Essays on International Trade and Development

Inaugural-Dissertation
zur Erlangung des Grades
Doctor oeconomiae publicae (Dr. oec. publ.)
an der Ludwig-Maximilians-Universität München

2015

vorgelegt von
Robert Grundke

Referent:	Prof. Gabriel Felbermayr, Ph.D.
Korreferent:	Prof. Alexander Danzer, Ph.D.
Promotionsabschlussberatung:	04. November 2015

Datum der mündlichen Prüfung:	23. Oktober 2015
Berichterstatter:	Prof. Gabriel Felbermayr, Ph.D.
	Prof. Alexander Danzer, Ph.D.
	Prof. Davide Cantoni, Ph.D.

Acknowledgements

First and foremost, I want to thank my supervisors Gabriel Felbermayr and Alexander Danzer for an excellent supervision of my doctoral thesis and their encouragement of my research projects. The field research I conducted in Tajikistan as part of my doctoral thesis would not have been possible without their strong support. Second, I thank my co-authors Christoph Moser and Alexander Danzer for an excellent working relationship and fruitful discussions. Moreover, I am deeply grateful to my parents and my sister for supporting me through the five years of my doctoral studies and giving me valuable advice on formatting issues in the final stage of my dissertation. Furthermore, I am deeply indebted to Raquel Artecona and Fernando Flores from the United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC), who during an internship gave me the opportunity to access and work with the raw data of the U.S. import refusal database, which I use in the first chapter of my dissertation.

I am also very grateful to Reinhard Woytek, Hartwig Ungethuem, Torsten Swoboda, Firuza Ganieva and Zara Makhmudova from the GIZ Office in Tajikistan for providing me with valuable advice and logistical support during the field research stay in Tajikistan in March and November 2014. In addition, I want to thank my language interpreter Muhammadali Nurov as well as the rural farmers and other interview partners that provided me with valuable insights in the institutional structures and living realities in Tajikistan. I am also very grateful to the German Academic Exchange Service (DAAD), the German National Academic Foundation (Studienstiftung des deutschen Volkes), the German Research Foundation (DFG), the Münchner Universitätsgesellschaft (MUG) as well as the Faculty of Economics of the University of Munich for providing me with financial support during my doctoral studies and during the internship at the UN-ECLAC. Last but not least, I want to thank my flat mates and friends as well as my colleagues and staff members at the Faculty of Economics of the University of Munich for the interesting and lively conversations and wonderful five years in Munich.

Contents

List of Figures

List of Tables

Preface

There is a broad consensus among economists that trade openness is beneficial for countries in the long run. This is also true for developing countries, whereby a strong integration into the world economy may significantly contribute to the development process (Winters et al. 2004). Furthermore, according to the Stolper-Samuelson-Theorem, the poor low-skilled workers that are the relatively abundant production factor in developing countries should especially gain from increased trade openness in terms of wage income. However, evidence from recent periods of trade liberalization in developing countries indicates that distributional changes went into the opposite direction leading to a rise in wage inequality (Goldberg and Pavcnik 2007). Poor low skilled populations in developing countries could reap much less of the income gains from trade than expected.

Thus far, the literature has offered several explanations for this paradox. The most prominent one is that trade liberalization caused an increase in the demand for skilled labor leading to a rise in the skill premium in developing countries. Among the explaining factors for this increase in the demand for skilled labor are trade-induced skill biased technological change (Wood 1995, Thoenig and Verdier 2003, Attanasio et al. 2004, Acemoglu 2003, Harrison and Hanson 1999, Aghion et al. 2005), capital inflows and complementarity of capital and skilled labor (Cragg and Epelbaum 1996, Behrman et al. 2000), outsourcing and trade in intermediate goods (Feenstra and Hanson 1997, 2003), firm heterogeneity (Bernard and Jensen 1997, Zhu 2005, Verhoegen 2008) as well as distortions in factor and product markets (Topalova 2010, Chiquear 2008, Wacziarg and Wallack 2004). Another explanation is that trade liberalization in developing countries disproportionally affected sectors with a higher share of unskilled labor leading to a relative decline of the industry wage premium or an increase of informal employment to the disfavor of poor unskilled workers (Goldberg and Pavcnik 2005, 2007).

In this dissertation, I present evidence on another type of explanation for why poor low-skilled workers in developing countries do not benefit as much from globalization as expected: political economy factors that influence the way how poor low-skilled workers in developing countries can participate in the global economy. Thereby, I focus on both sides of the international trade relationship. On the one side, I investigate how trade protectionism following an economic crisis in a developed country, namely the United States, affected imports from developing countries. Employing a newly constructed dataset on U.S. import refusals and a gravity estimation framework, I find that during the recent Subprime Crisis and its aftermath the U.S. has used the enforcement of product standards to disproportionally protect its domestic industries against imports

from developing countries. Because exports from many developing countries to the U.S. predominantly consist of food products, which are produced by poor unskilled rural populations, this recent episode of rising trade protectionism had adverse effects on poor and unskilled workers in developing countries.

On the other side of the trade relationship, I focus on a poor land-locked developing country in Central Asia, namely Tajikistan, and investigate how rent-seeking of local officials and authorities influences whether poor unskilled agricultural laborers in the cotton sector benefit from a global cotton price surge. Using a newly constructed household panel dataset and a difference-in-difference estimation framework, I find that rent appropriation mainly works through political interference in the labor market branch of the production process. Managers of large para-statal farms, local politicians and cotton gins collude and appropriate the rents from cotton exports by coercing employees of state-owned enterprises, hospitals and schools as well as students and school children to work in the cotton harvest for very low picking wages. On those large para-statal farms, the cotton price surge has led to a strong increase in the profits of managers, whereas wages of poor unskilled cotton pickers did not change. Interestingly, I find that on small private farms, which were created during the privatization process pushed by international donors and where incentive structures are more market-oriented, wages of cotton pickers positively responded to the cotton price surge. Those small private farms do not command the political connections necessary to access the pool of coerced labor and face competitive local labor markets, whereby labor supply consists of landless female laborers from local villages. The earnings of small holder farmers and wages of cotton pickers on small farms significantly increased in response to the cotton price surge.

In the first chapter which is co-authored by Christoph Moser, I present a newly gathered and constructed dataset that links disaggregated U.S. import flows with U.S. import refusals due to non-compliance with U.S. product standards. This novel dataset comprises U.S. import flows and import refusals for 93 food and non-food product groups, 164 trading partners of the U.S and the years 2002 to 2012. The main challenge for the construction of this novel dataset has been to match the unique product classification for import refusals from the U.S. Food and Drug Administration (FDA) to the Harmonized System (HS) product classification for international trade flows used by the U.S. International Trade Commission (ITC). I employ this dataset and a sectoral gravity equation to estimate the costs of non-compliance with U.S. product standards. The results indicate that import refusals significantly decrease exports to the United States. This trade reducing effect is driven by developing countries, whereas for developed countries there

are no negative effects. Even more important, the trade reducing effect of refusals is dominated by refusals without any product sample analysis, in particular during the Subprime Crisis and its aftermath. Because FDA officers inspecting imported shipments at the U.S. border have considerable legal leeway and are allowed to reject import shipments that only appear to violate U.S. product standards, this result is worrisome. It indicates that the U.S. might have used the enforcement of product standards to protect domestic industries during the Subprime Crisis and its aftermath. Especially worrisome is that this countercyclical, hidden protectionism mainly affected imports from developing countries. By focusing on a non-tariff barrier to trade (NTB) that has not been in the research focus thus far, this paper contributes to the literature on the effects of NTBs on trade flows taking into account the endogeneity of protectionism (Trefler 1993, Essaji 2008 and Bown and Crowley 2013).

The second chapter which is co-authored with Alexander Danzer, exploits a surge in the world market price of cotton in 2010/11 combined with Tajikistan's geographic variation in the suitability for cotton production to identify the causal effect of cotton prices on employment and wages of agricultural workers in the cotton sector. For this analysis, I constructed a novel household panel dataset that is based on data from the Tajikistan Living Standards Survey (TLSS) conducted by the World Bank in 2007 and 2009 and the Institute for East and Southeast European Studies (IOS) in 2011. To identify cotton communities, I use information on crops grown in the community from the TLSS 2007 as well as information on the suitability of areas for cotton production from the Food and Agricultural Organization (FAO) - Global Agricultural and Ecological Zones Database (GAEZ) that I matched with the geo-referenced communities in the TLSS. Because Tajikistan is only a small producer on the world market of cotton, the surge in the world market price of cotton in 2010/2011 can be treated as exogenous to Tajikistan. Employing a difference-in-difference estimator that exploits the geographic variation in the suitability for cotton production and the time variation of world cotton prices, I find that the cotton price surge led to substantially higher labor demand and wages for female cotton pickers, who form the most vulnerable part of the workforce. The price hike benefits only workers on small entrepreneurial family farms, whereas cotton pickers of big parastatal enterprises miss out.

Interviews and additional data collected in Tajikistan in March and November 2014 indicate that the pass-through of price fluctuations depends on the competitive structure of local labor markets. Managers of big para-statal farms exploit their political connections to access a pool of coerced labor that consists of employees of state-owned enterprises, hospitals and schools as well as students and school children that are forced to

work in the cotton harvest for very low picking wages. In contrast, small private farms face competitive local labor markets, whereby labor supply consists of landless female laborers from local villages. Hence, this paper shows that so far the privatization process in Tajikistan has succeeded in establishing a more competitive and entrepreneurial agricultural sub-sector that created new income opportunities for poor landless women in rural villages.

In the third chapter of my dissertation, I exploit the natural experiment of the cotton price surge to identify the effects of a positive transitory income shock on consumption and investment decisions of poor rural households in the cotton regions of Tajikistan. Analyzing how poor households in developing countries respond to short run income fluctuations due to trade openness is crucial for evaluating the overall effects of globalization and trade on poverty (Winters et al. 2004). Particularly in the short run, changes in trade openness cause adjustment processes and income fluctuations that might have strong impacts for poorer households, especially in developing countries (Goldberg and Pavcnik 2007). Although important parts of the population in developing countries are strongly exposed to income risk caused by world price fluctuations, the literature has, thus far, mainly focused on how households in developing countries deal with income risk induced by weather shocks or illness (Wolpin 1982, Paxson 1992, Gertler and Gruber 2002). This paper contributes to the literature by focusing on the impacts of a trade-induced positive income shock on household consumption and investments. Using a newly constructed household panel dataset and a difference-in-difference estimator that exploits the geographic variation in the suitability for cotton production and the exogenous time variation of world cotton prices, I find that the cotton price surge increased real monthly income of agricultural households in cotton regions by over 70 percent. This positive transitory income shock led to a significant increase in household consumption, which indicates that rural households in Tajikistan cannot fully insure against transitory income shocks (Morduch 1995). However, I find evidence that several types of consumption smoothing strategies exist. Potentially investment or savings related disbursements for non-food products increase much more than disbursements for simple consumption motives (Rosenzweig and Wolpin 1993, Attanasio and Szekely 2004). Furthermore, the results indicate that poor rural households in Tajikistan try to smooth future consumption by sending more migrants abroad (Yang and Choi 2007) or by investing in social relationships that might act as insurance device in lean times (Grimard 1997). I also find that the positive transitory income shock lead households to increase investments in human capital, i.e. spending for medical treatment of household members and education of children.

1 Hidden Protectionism? Evidence from Non-tariff Barriers to Trade in the United States[1]

1.1 Introduction

Non-tariff barriers to trade (NTBs) like product standards and technical regulations have increased in importance compared to tariffs that are at historical lows.[2] NTBs are characterized by two opposing trends. While some countries aim at harmonizing product standards to reap further gains from trade (e.g., trade talks between the United States and European Union), fear of protectionism has led to a close monitoring of NTBs worldwide during the Great Recession (e.g., Baldwin and Evenett, 2009).

Product standards are imposed to overcome market failures and protect the health and safety of domestic consumers. In the United States, the Food and Drug Administration (FDA) is responsible for ensuring the safety of domestic and foreign products. Those import shipments not complying with U.S. product standards are refused entry into the market by the FDA. In this study, we collect a new data set that combines disaggregated import data from the U.S. International Trade Commission (ITC) with import refusals from the FDA.

This paper provides estimates on the costs of non-compliance with U.S. product standards at different times of the business cycle. We show that the trade costs associated with non-compliance with U.S. product standards are substantial for poorer countries. While there is a negative impact of import refusals on imports to the United States for non-OECD countries, OECD countries are largely unaffected. Our estimates imply that a one standard deviation increase in refusals reduces short- and long-run exports from an average developing country by USD 6 to 11 billion. We gain further insights by examining the type of inspection that underlies a given import refusal. It turns out that the trade reducing effect is mainly triggered by refusals without any product sample analysis and the implied trade costs quadruple during the Subprime Crisis and its aftermath. We conclude that these results for the United States are consistent with the hypothesis that product standards are counter-cyclical protectionism in disguise.

[1] This chapter was co-authored by Christoph Moser. While we developed the empirical strategy and, more generally, the paper together, the original idea for this research project was mine. It was also mainly my task to investigate and summarize the institutional background of the FDA and, more importantly, to gather a novel dataset that allows us to link disaggregated U.S. import flows with disaggregated U.S. import refusals. The main challenge was to make the different classification systems of the ITC and FDA comparable and to carefully match the corresponding product groups.

[2] Similarly, Baldwin's famous quote says that "[t]he lowering of tariffs has, in effect, been like draining a swamp. The lower water level has revealed all the snags and stumps of non-tariff barriers that still have to be cleared away." (Baldwin, 1970, quoted in Baldwin, 2000).

We estimate a bilateral gravity model for 93 imported product-groups to the United States for the years 2002 to 2012. We proceed in three steps by reporting OLS estimates, standard fixed effect estimates and, then, dynamic panel estimates. The last and preferred specification does not only allow us to control for past import flows and use lagged import refusals as internal instruments for our non-compliance measure (as suggested by Essaji, 2008), but we can also extend the framework to include additional, external instruments drawn from the EU - Rapid Alert System for Food and Feed (RASFF) database. Since EU refusals and notifications are plausibly exogenous to U.S. import demand, but likely to be correlated with U.S. refusals, they constitute a valid instrument.

Why are thousands of shipments blocked from entering the U.S. market each year? The FDA names two main reasons for import refusals: adulteration and misbranding. Recent reports on blocked U.S. imports of toys containing lead fall in the first category with products being inferior and entailing substantial health risks.[3] But adulteration can also simply stem from differing product standards between trading countries. Second, a product might be denied entry into the United States due to misbranding, i.e., U.S. labelling standards are not met or necessary certificates for conformity assessment are not provided by the exporter.

The FDA might be also subject to lobbying and political pressures.[4] In one of its most controversial moves, the FDA issued an outright ban of all grapes from Chile in March 1989 due to a non-lethal contamination of two grapes with cyanide (Engel, 1999; Hawthorne, 2005). It remains unclear to date, whether the FDA simply overreacted or the U.S. government aimed for a weakening of the Pinochet regime. Similar to technical regulations (see Trefler, 1993 and Essaji, 2008), stricter product standards and border inspections may be imposed for protectionist motives in the United States. Lamb (2006) provides anecdotal evidence that political pressure from U.S. avocado producer associations has been driving the boycott of Mexican Hass avocados until 1997. More recently, U.S. catfish producers have lobbied for more frequent inspections of catfish imports to protect their industry.[5,6] According to Watson and James (2013) regulatory protection-

[3] Decker, Brett and William Triplett "China's Poisonous Exports: PRC Products Aren't just Cheap, They're Dangerous," The Washington Times, November 16th, 2011.

[4] After all, the FDA is a government agency, its commissioner a political appointee and the revolving door also spins at the FDA. For the U.S. Department of Defense, Luechinger and Moser (2014) show that conflicts of interest can arise due to the revolving door. The Government Accountability Office indeed acknowledges a staff turnover rate at the FDA above the federal government average in 2002 (cited in Hawthorne, 2005, p. 30).

[5] Nixon, Ron, "Number of Catfish Inspectors Drives a Debate on Spending," The New York Times, July 26th, 2013.

ism exists in the United States and Baldwin (2000) is especially concerned about its effect on developing countries.

Figure 1.1 sheds some first light on the enforcement of U.S. product standards. This figure shows that the total number of shipments inspected by the FDA increased hand in hand with the unemployment rate due to the Subprime Crisis from less than 140,000 in 2008 to close to 280,000 in 2011. These FDA-inspections include inspections with and without a product sample analysis. Even more striking, incidences of non-compliance with U.S. product standards rose sharply in the aftermath of the crisis, with import refusals without any product sample analysis being the main driver. Our regression analyses will further deal with this type of inspection that is arguably most prone to potential hidden protectionism.

Our paper contributes to the existing literature in several ways. First, we contribute to the recent empirical literature on protectionism (see Rose, 2013; Bown and Crowley, 2013; Kee et al., 2013) by highlighting another channel through which governments might temporarily seek import protection: a stricter enforcement of product standards. Most importantly, we are to the best of our knowledge the first to link the effect of import refusals to the business cycle and to consider the type of inspection leading to import refusals. Second, we add to the trade and development literature by quantifying the short- and long-run costs of forgone exports due to non-compliance with U.S. product standards. Most alternative measures of product standards, e.g., notifications to the WTO, are based on technical regulations that are most favoured nation (MFN) measures without variation across exporters. In contrast, our measure substantially varies across countries, product-groups and time. This allows us to factor in that any potential import protection is trading partner- and product-specific and to control for country-product-specific factors that are often omitted in other studies. Third, we contribute to the literature on import refusals by demonstrating how important it is to account for the endogenous nature of refusals.[7] Thereby, endogeneity can arise due to import protection or risk-guided inspections. Product-groups with increasing imports are more closely monitored and inspected by the FDA.

The remainder of the paper is organized as follows. Sections 2 and 3 discuss the related literature, the institutional background of the U.S. Food and Drug Administration

[6] Jouanjean (2012) provides evidence that U.S. producer associations influence U.S. market access regulation for imports of fresh fruits and vegetables. As exemplified for Russia, product standards and stricter inspections at the border might be even used for foreign policy purposes. See Kramer, Andrew, "Chocolate Factory, Trade War Victim," The New York Times, October 29th, 2013; Herszenhorn, David, "Russia Putting a Strong Arm on Neighbors," The New York Times, October 22th, 2013.

[7] In contrast to other studies, we quantify the impact of import refusals not only for food products, but also for pharmaceuticals, cosmetics and manufacturing products. This is a smaller contribution to the literature.

(FDA) and some descriptive statistics for the new import refusal database. Section 4 provides a description of our data set and an outline of the empirical strategy. Section 5 presents the empirical results and Section 6 offers concluding remarks.

1.2 Related Literature

Our paper is related to the literature on endogenous protectionism, the theory on product standards and the effect of non-tariff barriers to trade, in particular for developing countries.

In a seminal paper, Trefler (1993) argues that the level of trade protection is not exogenous but increasing in import competition and domestic lobbying efforts. Similarly, the paper closest to our study is Essaji (2008) who analyzes the effects of technical regulations for a cross-section of sectoral trade flows to the United States. To address potential endogeneity of technical measures, Essaji (2008) instruments U.S. technical regulations with such regulations of countries with similar regulatory processes, but different import patterns. Both important contributions clearly show that the effects of protectionism are economically large, once endogeneity is taken into account.

Several recent empirical papers investigate whether countries fall back into protectionism in bad economic times. The empirical evidence on this issue is mixed. While Rose (2013) argues forcefully that protectionism – as measured by a broad set of tariff and non-tariff barriers – has neither been counter-cycle in the United States nor worldwide after World War II, Bown and Crowley (2013) and Kee et al. (2013) offer a more nuanced picture. Kee et al. (2013) conclude that only few countries have markedly increased their tariffs from 2008 to 2009, but the relatively modest U.S. trade policy reaction has been an NTB, namely antidumping.[8] Bown and Crowley (2013) investigate the relationship between the business cycle and another NTB for five OECD countries. The most relevant result for our paper: Bown and Crowley (2013) provide evidence that the number of disaggregated product groups affected by temporary trade barriers increases with negative macroeconomic shocks in the United States. In particular, the domestic unemployment rate proves to be an important determinant of this NTB before and after the onset of the Subprime Crisis.

The theoretical literature mainly views differing product standards as protectionist, since higher quality standards increase the compliance costs for foreign firms relative to domestic ones. Fischer and Serra (2000) argue that standards chosen by a domestic social planner are always protectionist. In a similar framework, Marette and Beghin

[8] In another study, based on the Global Trade Alert (GTA), Boffa and Olarreaga (2012) conclude that countries have not retaliated during the Great Recession.

(2010) show that domestic standards are not necessarily protectionist, if domestic and foreign producers differ in meeting these costs. However, this only holds for foreign producers being more efficient, an unlikely assumption for developing countries exporting to the United States. Essaji (2010) is interested in the interplay between trade liberalization and the use of product standards. Sturm (2006) offers a political economy model, where uncertainty about the optimal safety level might open the door for hidden domestic transfers.

Our paper is obviously also related to and builds on the empirical literature on product standards.[9] Moenius (2004) provides an important early account on the effects of standards on trade between OECD countries at the industry-level. Several studies exploit the number of notifications of newly imposed product standards by importing countries under WTO's Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) agreements or counter-notifications under the SPS for a cross-section or panel of trade flows (see Disdier et al., 2008; Crivelli and Gröschl, 2012; Fontagne et al., 2013). Crivelli and Gröschl (2012) find for a disaggregated gravity model for agricultural and food products that SPS measures decrease the probability of market entry, but positively influence the intensive margin of exporters. For a rich panel data set of French exporting firms, Fontagne et al. (2013) show that restrictive SPS measures in the importing country negatively affect the extensive margin of firms and, in contrast to Crivelli and Gröschl (2012), also the intensive margin of trade.

1.3 Background

1.3.1 The U.S. Food and Drug Administration (FDA)

The U.S. Food and Drug Administration (FDA) is located within the U.S. Department of Health and Human Services.[10] The FDA is responsible for enforcing the Federal Food, Drug, and Cosmetic (FD&C) Act of 1938 and other laws designed to protect consumer health. The following product categories fall under FDA jurisdiction: food, drugs, cosmetics, medical devices, electronic items that emit radiation, vaccines, blood and biologics, animal feed and veterinary, and tobacco products. To ensure that products from these categories comply with U.S. product standards, the FDA has the authority to inspect domestically produced and imported products and eventually refuse entry

[9] We focus here on the most closely related papers. Other studies differ in their measurement of product standards, the sectors and time covered as well as their approach to the endogeneity issue. The earlier literature focuses on one particular standard in a given product-group (see for instance Otsuki et al., 2001, on African groundnut exports to Europe; Anders and Caswell, 2009, on U.S. seafood imports; Maertens and Swinnen, 2009, on vegetable exports from Senegal; Baylis et al., 2010, on seafood exports to the EU).

[10] For an excellent overview of the FDA, see for instance Buzby et al. (2008), Josling et al. (2004), Hawthorne (2005) and Liu (2010).

into U.S. markets. An inspected domestic product is refused entry if it violates U.S. product standards. However, an imported product can already be refused entry "if it [only] appears to violate" a certain U.S. product standard (Buzby et al., 2008; Liu, 2010). This formulation in Section 801(a) of the Federal Food, Drug, and Cosmetic (FD&C) Act leaves room for discriminatory action of FDA officials with respect to imports.[11] The FDA separates violations into two main categories: adulteration and misbranding. According to the FD&C Act, adulteration means that due to the addition of a substance a product is inferior, impure and not genuine. Most violations for adulteration deal with safety, packaging integrity or sanitation, but differing product standards between trading partners might also be the cause.[12] Besides adulteration, a product might also be denied entry in the United States due to misbranding. Misbranding includes untruthful or misleading statements on product labels or products missing appropriate labeling or packaging (Buzby et al., 2008). This category also comprises products that were rejected by the FDA due to the lack of necessary certificates for conformity assessment.

According to the FD&C Act, every importer of an FDA-regulated product has to file an entry notice with U.S. Customs and Border Protection (CBP), which then notifies the FDA of the entry. The import requests are collected and processed by the computer-based system "Operational and Administrative System for Import Support (OASIS)". The FDA uses OASIS to review the entry documents and to make admissibility decisions. If the FDA does not wish to inspect the entry, the product will proceed into U.S. commerce. If the FDA decides to examine the entry, the importer will not be allowed to further distribute the shipment until the result of the inspection is received. Two types of inspections exist: field exams and sample analysis involving a laboratory test of product samples. The overwhelming majority of inspections are field exams at the ports of entry, whereby FDA inspection officers mainly use organoleptic testing (e.g., appearance and smell) to decide whether a product complies with U.S. product standards.[13] If the product appears to violate these standards, the importer will be given the opportunity to submit a petition to recondition the product into compliance (Buzby et al., 2008; Liu, 2010; FDA, 2011a).[14]

[11] Imported products can be refused without any physical evidence, e.g. just on the basis of bad reputation due to past events of non-compliance at the firm or country-product level (see for instance Jouanjean et al., 2012).

[12] Non-food products can also be refused due to adulteration, i.e., if product-specific regulations are not met.

[13] Barrionuevo, Alexei "Food Imports Often Escape Scrutiny," The New York Times, May 1st, 2007.

[14] Many law firms in the U.S. are specialized on contesting FDA decision of detentions and refusals (e.g., FDAimports.com, LLC: http://www.fdaimports.com/). The services of these law firms are expensive and it is hard(er) for exporters from developing countries to cover such legal costs.

Based on OASIS, the FDA collects information on all ultimately refused shipments in the Import Refusals Report (IRR). The IRR database is available from the beginning of 2002 onwards and includes the exact date of the refusal, name, address and country of origin of the exporting firm, an FDA-specific product code and the product description, port of entry, reason for the refusal and the type of inspection. The database does not include information on the quantity, weight or value of refused shipments, but it is the best source of information on import refusals due to non-compliance with U.S. product standards.

It is important to bear in mind that the FDA´s decision to inspect an entry is not random. The FDA is only able to inspect about 1% of all imported products under its jurisdiction (Buzby et al., 2008; FDA, 2010). To economize its resources for inspections, the FDA employs risk-based criteria to guide its inspections. Using the OASIS database and past import refusals, the FDA identifies exporting countries, product-groups, products or certain firms that have a higher risk of violating U.S. product standards. To react to urgent risks, the FDA additionally issues import alerts that place a product from a certain country or a particular firm on detention without physical examination. Thus, subsequent shipments from this company or country-product-group will be refused automatically, unless the importer can present evidence to overcome this violation.[15] The FDA may also use external information to identify risk products such as the information from the EU-RASFF authorities (Jouanjean et al., 2012). Import surges in a given country-product-group can also trigger more inspections, since any non-compliance represents a higher risk for U.S. citizens. Another reason for an increase in inspections of country-product-groups with higher imports may be protectionism (Trefler, 1993; Essaji, 2008; Baylis et al., 2009).

The United States is an important export market for many countries and about 20% of the overall U.S. imports fall under the jurisdiction of the FDA.[16] 25 cents of every dollar spent on commodities by U.S. consumers are for products regulated by the FDA (FDA, 2011b). A growing share of these products comes from developing countries.[17] In 2010, 15% of food products, 28% of drugs and 52% of medical devices sold in the U.S. markets were imported. Import lines of FDA regulated products have grown from 6 million in 2001 to 24 million in 2011, corresponding to a 15% annual increase (FDA, 2011b).

[15] It can be quite costly, in particular for exporters from developing countries, to obtain the necessary documents for conformity assessment from accepted certification bodies (Jaffee and Henson, 2005).

[16] The FDA estimates this share to be over 10%, but only considers food, drugs and cosmetics (FDA, 2011b). Hence, our estimate of around 20% in the year 2011 also includes medical devices, electronic items emitting radiation, animal feed and animal drugs and biologics under the jurisdiction of the FDA.

[17] Emerging markets like China, India and Mexico have increased their exports in FDA regulated products to the U.S. significantly in the last years. Drugs, medical devices and electronic items emitting radiation are the product categories that have experienced the strongest rise in imports from developing countries (FDA, 2011b).

Note that the resources dedicated to the FDA and the funding provided for FDA officers in the field (who are responsible for product inspections) vary over time. In the aftermath of the September 11 terrorist attacks in 2001 and the Subprime crisis in 2008, the U.S. Congress granted more authority and additional resources to the FDA. The majority of the FDA investigators are assigned to inspect domestic products and facilities.[18] It is difficult to identify the number of FDA officers assigned to the border from official documents.

1.3.2 Descriptive Statistics on U.S. Imports and Import Refusals

Figure 1.2 shows total U.S. imports in FDA regulated products and the total number of refused shipments (total refusals) for the years 2002 to 2012. Except for the Great Recession, U.S. imports have been steadily increasing and the overall volume of imports in FDA regulated products more than doubled during the sample period.[19] In contrast to imports, import refusals exhibit more variation over time. Figures 1.3 and 1.4 allow for a comparison between OECD and non-OECD countries. There are two main takeaways. First, both country groups share a similar growth pattern in imports, but non-OECD countries account for on average USD 250 billion or about twice the overall import volume of OECD-countries. Second, while both groups had to face an increase in import refusals after the Subprime crisis, this increase is more pronounced for poorer countries and starts from a higher level of total refusals (around 10,000 vs. 4,000 refusals in the year 2009). Furthermore, non-OECD countries are responsible for the noticeable spike in import refusals in 2004/2005.

To shed more light on the distribution of U.S. import refusals across product-groups, Table A1.8 in the Appendix shows import refusals at a more disaggregated product level. Food products play a prominent role among those products most often refused during the sample period. Fish products, fruits and vegetables, sugar confectionary, bread and pastry as well as sauces, mixed dressings and condiments are among the top ten most refused product-groups. However, the two product categories with most import refusals are other drugs and medical devices. Table A1.9 in the Appendix includes the ten most frequent reasons for import refusals from 2002 until 2011, showing that import refusals due to adulteration are less frequent than refusals due to misbranding or missing certifications.

[18] Racino, Brad (2011), "Inspectors Struggle to Keep Up with Flood of Imports," News 21 (http://foodsafety.news21.com/2011/imports/border/; download on October 29th, 2014).

[19] Note that the shares for five aggregated product-groups have been quite stable over time (Fig. A1.6), i.e., the growth in imports is fairly spread over different sectors. Furthermore, the non-food product-groups pharmaceuticals, cosmetics and other manufacturing goods combine for about 75% of total imports in FDA regulated products and are responsible for an increase in total import refusals during the sample period (Fig. A1.7).

To emphasize the importance of FDA regulated products for countries exporting to the U.S., we compute the share of FDA regulated products in total exports to the U.S. for 2012. For most countries, FDA regulated products comprise more than 20% of total exports to the United States, whereby for some developed and developing countries like Ireland or Denmark and Ghana or Thailand this share rises above 50%. Tables A1.10 and A1.11 provide further descriptive statistics on OECD and non-OECD countries.

1.4 Data and Empirical Strategy

1.4.1 Data

This paper is based on a newly collected data set. We carefully gather detailed information from two main data sources. Since the FDA uses its own unique product classification system, the main challenge has been to combine the FDA's Import Refusals Report (IRR) database with disaggregated international trade data (c.i.f.) as provided by the U.S. International Trade Commission (ITC). The raw data provided by the FDA reports incidences of import refusals at the firm- and product-level. We aggregate import refusals to the most fine-grained product-group for which a consistent match between the FDA and the Harmonized System (HS) classification is possible. Our guiding principle for this careful matching procedure has been that any FDA product code uniquely falls into the assigned HS product categories. We have succeeded in matching all FDA regulated products to the corresponding HS categories. The exact mapping for our 93 food and non-food product-groups is documented in Table A1.17 in the Appendix.[20]

Our panel data set starts with the first year for which the IRR data is available, covering on a yearly basis all country-product-groups with at least one notified refusal during the sample period 2002 to 2012. For an important extension of our baseline regression model, we draw on an additional data source. We use EU notification data from the Rapid Alert System for Food and Feed (RASFF) database to instrument for U.S. refusals.[21] The RASFF database uses yet another own production classification system and covers only food products and animal feed. After another careful match, this leaves us with 17 aggregated product-groups that consistently combine our 78 food and animal

[20] In principle, we match FDA product codes to HS 4 digit codes and preserve as much detailed information as possible. For some matched groups, we have to use additional HS 5 or HS 6 digit information. We have succeeded in creating 93 matched product-groups. Note that for medical devices and radiation emitting products, the constructed product-groups may include more HS products than necessary for matching, because it was not possible to isolate FDA regulated products at the HS 6 digit or even at the HS 10 digit classification.

[21] We use all the information available in the RASFF notification database (i.e., import refusals and information on detentions, import alerts and firms own inspections) to construct our instrument, since all these types of information are relevant for inspection authorities at the U.S. FDA (Jouanjean et al., 2012).

feed product-groups with 35 broad product-groups by the RASFF. The exact mapping is presented in Table A1.18 in the Appendix.

1.4.2 Empirical Strategy

We proceed in three steps. We start with OLS and standard fixed effects estimates. Then, we follow Arellano and Bond (1991) and estimate a dynamic panel model, where variations within the country-product-group are used for identification. The Arellano-Bond estimator is a natural choice against the background of large N and small T, a dynamic data generating process and concerns about potential endogeneity. Our bilateral gravity model for disaggregated import flows to the United States covers up to 93 product-groups per country for the years 2002 to 2012, with 166 exporting countries entering our baseline regression. We estimate the following reduced form model:

$$\ln Imp_{i,k,t} = \sum_{s=1}^{S}\left(\alpha_s \ln Imp_{i,k,t-s}\right) + \beta\, Refusals_{i,k,t-1} + \mu_t + \gamma_{i,k} + u_{i,k,t}, \qquad (1.1)$$

whereby the dependent variable measures the real value of imports (in logarithm) from country *i*'s product-group *k* at time *t* to the United States. We control in all our main specifications for time fixed effects (μ_t) and for country-product-group fixed effects ($\gamma_{i,k}$).

Our coefficient of main interest is β, which captures the effect of import refusals on sectoral trade flows to the United States. Following the literature, we employ two different measures for import refusals in our empirical analysis. First, we use a dummy variable which takes the value of one, if in a given product-group *k* from country *i* at least one incidence of a refusal has been recorded at time *t*. Second, we use the log(1+refusals) in order to account for the intensity of import refusals, i.e., the total number of refusals in such a country-product-group in time *t*. The refusal indicator enters equation (1.1) with a lag for two main reasons. First, export contracts tend to be signed a few months in advance and cannot be cancelled short-term. Second, we measure imports to the United States as the import value (c.i.f.), i.e., cost, insurance and freight implies among other things that export shipments to the U.S. that have been refused by the FDA still enter the import statistics in a given year.

Note that the time fixed effects capture time-varying characteristics of the importing country, global macroeconomic conditions and factors affecting trade costs for all exporting countries to the United States alike. This time fixed effect also absorbs any

changes in FDA inspection capacity in the United States. Furthermore, the country-product-group fixed effects control for the time average of the multilateral resistance terms at the country-product-group level and time invariant country-product-group characteristics, like trade costs or production levels. Since the country-fixed effects are a linear combination of these country-product-group specific effects, we are not able to either include country dummies or distance to the United States (a classical gravity variable) separately in the regression.[22]

The Arellano-Bond GMM estimator allows for using internal and external instruments. On the one hand, we instrument endogenous refusals with lagged refusals as internal instruments. Essaji (2008) argues that in a panel data setting lagged values of technical regulations in the U.S. represent plausible instruments for these regulations. In our context, this strategy is even more sensible, since FDA inspections are inter alia guided by past incidences of refusals. To foresee two important specification tests of our dynamic panel estimates, the null hypothesis of the validity of the overidentifying restrictions of the Sargan and Hansen tests will indeed never be rejected. On the other hand, in an important extension, we additionally incorporate EU notifications from the RASFF database as external instruments. We generate our variables for non-compliance with EU product standards analogously to the U.S. ones.

EU notifications constitute a valid instrument for U.S. import refusals, since U.S. FDA agents are reported to also use external information to identify high-risk products to guide their inspections. It is reassuring for our empirical strategy that Baylis et al. (2009) show that EU import refusals are indeed one important determinant of U.S. import refusals. Furthermore, EU notifications in a certain exporting country-product-group should not be correlated with U.S. import demand in the same country-product-group. EU notifications are collected from individual EU member states with heterogeneous import demand structures. More generally, the United States and the European Union are quite different with respect to their overall openness to trade, their major trading partners and their import demand structure. Hence, EU refusals and notifications are plausibly exogenous to U.S. import demand and constitute a valid instrument in our context.

[22] Note that we will report below robustness checks including further fixed effects controlling for time-varying country dummies (multilateral resistance term) and time-varying aggregated sector dummies.

1.6 Empirical Results

1.6.1 Baseline Results

We now turn to our main results. Tables 1.1 and 1.2 present the estimates for a number of baseline regressions. In Table 1.1, we use the dummy refusal and in Table 1.2 the refusal intensity log(1+refusals) as our measures for non-compliance with U.S. product standards.

In both tables, we benchmark our preferred dynamic panel model in Column (4) with pooled OLS and simple fixed effects estimates in Columns (1) and (2), respectively. Compared to Column (4), Column (3) takes the allegedly wrong assumption of refusals being exogenous. Our preferred specification in Column (4) is based on the two-step Arellano-Bond estimator with the dependent variable entering with its first and second lag. These lagged dependent variables are instrumented with their first through third lags. Furthermore, for our refusal indicator variable, we also use its first through third lag as internal instruments. To avoid weak instrument problems, we reduce the number of instruments by collapsing the instrument matrix (Roodman, 2009). Furthermore, we follow Bazzi and Clemens (2013) and open the "black box" of GMM in order to assess the strength of our instruments for our preferred specifications in Column (4). It is reassuring that these (unreported) additional specification tests show that we can reject the null hypotheses of underidentification and weak instruments.[23] Finally, all our main results are robust to the exact lag length of our instruments (as shown in Tables A1.19 and A1.20 in the Appendix).

There are two main findings from Tables 1.1 and 1.2. First, the disaggregated U.S. import flows exhibit substantial persistence over time. Our estimates show that the first and the second lag of the dependent variable enter our regression significantly. This corroborates our decision to use a dynamic panel estimator. Furthermore, the null hypothesis of the validity of the overidentifying restrictions is rejected neither for the Sargan- nor the Hansen-test in any main regression, indicating that our preferred specification is well-specified.

Second, import refusals are indeed endogenous to import flows. When we control for lagged import flows and country-product-group fixed effects using the Arellano-Bond estimator in Column (3), the positive and significant impact of refusals on import flows of the simple OLS in Column (1) disappears. Once we additionally instrument our im-

[23] In particular, we employ the tests for underidentification and for weak instruments as proposed by Kleinbergen and Paap (2006) and Stock and Yogo (2005) as well as Yogo (2004), respectively. In the latter case, we follow Bazzi and Clemens (2013) and test for the null hypothesis that the bias is greater than 30 percent of the OLS bias.

port refusals indicator with lagged refusals, the point coefficients become negative and significantly different from zero at the 5% level (see Column (4) of Table 1.1 and 1.2). These results demonstrate that the endogeneity of trade barriers leads to a strong upward bias in the estimated coefficient and an underestimation of trade costs, if the empirical strategy does not address these endogeneity issues. Trefler (1993) finds that accounting for endogeneity of non-tariff barriers to trade (NTBs), the estimated negative impact of NTBs on U.S. imports is ten times larger than in estimations not addressing the endogeneity issue. Similar to our paper, Essaji (2008) shows that the effects of U.S. technical regulations on U.S. imports are significantly negative when accounting for endogeneity of technical regulations to import flows. In the case of not addressing the endogeneity issues, he reports positive effects of technical regulations on imports.

1.6.2 Developing vs. Developed Countries

In this section, we go beyond the overall impact of import refusals and present a more nuanced picture by distinguishing between different product-groups, types of refusals and - in particular - country groups.

We report our preferred specification of Table 1.2, Column (4), in the first column of Table 1.3 for comparability. We refer to this estimation as our baseline estimation. Column (2) allows the slope coefficient for import refusals to vary by product-group. We distinguish between food-products and non-food products. The point coefficients for both product-groups are negative, but (due to the large standard error for non-food products) only the coefficient for food-products is significantly different from zero.

We continue with an important part of our analysis. In Columns (3) and (4) of Table 1.3, we investigate, whether there is a differential effect of import refusals between developed and developing countries for food and non-food products. Thereby, we distinguish between OECD and non-OECD countries. While the first group of countries includes all industrialized countries with a very high standard of living, the second group encompasses developing and emerging markets with on average a lower GDP per capita.[24] Note that we apply the same specification as in Column (2) once to OECD countries and once to non-OECD countries in Columns (3) and (4), respectively. This sample split reveals that the negative impact of refusals on imports is driven by poorer countries. Similarly to the baseline, the point coefficients for food and non-food products are

[24] Note that we employ the "classical" definition of OECD countries from the beginning of the 1990s (before emerging markets like Mexico and Chile joined), since it provides a sharper distinction between rich and poor countries. None of our main results hinges on the exact definition.

negative for non-OECD countries and in the same ballpark, but only the former coefficient is also significantly different from zero.

Furthermore, we offer results for the type of refusals in Table 1.4. We group refusals according to the type of non-compliance into refusals due to adulteration and refusals due to misbranding and allow the slope coefficient for refusals to vary by refusal type. For all countries, both point coefficients are negative and not significant. For non-OECD countries, we find negative point coefficients of roughly similar size, with the coefficient on adulteration being significant at the 5% level.

1.6.3 Is there Evidence for Protectionism?

To recap our empirical results thus far: We find that import refusals negatively affect disaggregated trade flows to the United States, in particular for non-OECD countries. But our empirical analyses have not offered any indication for hidden protectionism yet.

We will argue in this section that the type of inspection can shed some light on hidden protectionism. Remember that an imported product can be refused entry, if it simply "appears to violate" U.S. product standards. Hence, there is considerable leeway for the FDA to enforce these standards, opening the door for less honorable motives than pure health or product quality concerns. It is reasonable to assume that this leeway is most pronounced, if a refusal is not based on any laboratory tests but solely on the judgment of an FDA officer. We will proceed in two steps in this section. First, we will distinguish between refusals with and without any product sample analysis. Second, we are interested in examining to what extent refusals and the negative trade effect of the inspection type varies over time.

Table 1.5 presents the results for different types of inspection that lead to import refusals. The results in Column (2) indicate that those refusals that are not based on any product sample analysis are driving the negative effect of (the total number of) refusals on imports for the overall sample. Even worse, when comparing the results in Column (3) and (4), it becomes evident that solely non-OECD countries suffer from this discretionary room for refusal decisions. To be clear, many of these refusal decisions might be well-grounded, for instance if a product is obviously rotten. But the room for discriminatory action is considerable in this category and it is worrisome that solely developing countries are suffering from these potentially arbitrary refusals.[25] It is exactly this type

[25] Various cases of discriminatory action of U.S. authorities against imports from developing countries are documented in the literature. For instance, U.S. authorities have banned Mexican Hass Avocados from entering the U.S. market for 79 years due to pest concerns, though officials from the U.S. Department of Agriculture have repeatedly certified Mexican growing areas as pest free during that time period (Lamb, 2006).

of non-tariff barrier to trade that might fly under the radar, since it is hard to identify and measure.

In an intermediate step, Table 1.6 sheds some light on the evolution of refusals over time. While the estimates of these simple regressions should not be interpreted causally, they clearly indicate a positive correlation between the number of refusals and the Subprime Crisis and its aftermath in the United States. This significant rise in refusals and (in unreported results) refusals without any product sample analysis provides further evidence consistent with hidden protectionism during crisis times.[26] This argument is further supported by Levchenko et al. (2011), who show that the product quality of U.S. imports did not decline during the Subprime Crisis and its aftermath.

Finally, we show in Table 1.7 how the results for both types of inspection for OECD and non-OECD countries vary over time. For comparability, Columns (1) and (4) report the baseline results for both country groups for refusals based on product sample analyses and refusals without such analyses. More importantly, we provide in Columns (2) and (3) as well as (5) and (6) a sample split along the time dimension, whereby the first period spans the years from 2004 to 2008 for a similar instrumentation length. The second period from 2008 to 2012 encompasses the Subprime Crisis and its aftermath in the United States.[27] Hence, both sample periods are directly comparable in sample size but differ in a crucial dimension. The average unemployment rate in the United States rose from 5.87 to 8.34%.

The results of Table 1.7 are striking. Non-OECD countries generally suffer from import refusals without any product sample analysis and they suffer all the more when unemployment rates in the U.S. are at historical highs. In stark contrast, import refusals do not have any statistically significant impact on export flows for OECD countries to the United States during any time period. In addition, Figure 1.5 offers another interesting insight. The share of FDA-inspections based on a product sample analysis (out of all FDA-inspections with and without product sample analysis) has decreased over the last few years, even though the total FDA budget for field activities (i.e., product inspections) and the number of FDA-officers in the field have increased. In our view, the re-

[26] The Subprime Crisis and its aftermath (2008-2012) also coincide with a rise in the unemployment rate and an increase in the number of inspections and of FDA field officers as well as the FDA budget more generally. Since all these variables are highly, positively correlated, it is not sensible to enter them simultaneously in such a regression. Note that these variables only vary over time but not across country-product groups and are captured in all our main regressions by the time fixed effects.

[27] While we feel that these two subsamples are well suited for such a comparison due to sample size and efficiency reasons, the results on the type of inspection hold more generally for 5-year rolling windows for OECD and non-OECD countries (see Appendix Tables A1.21 and A1.22).

gression results are consistent with the hypothesis that the enforcement of U.S. product standards is hidden protectionism in disguise at the cost of poor countries.

1.6.4 The Costs of Non-Compliance with U.S. Product Standards

The size of the negative effects of U.S. import refusals on U.S. imports is substantial. An increase of the refusal intensity by 10% reduces U.S. imports in a certain country-product-group by 3.2% (see Table 1.2, Column 4).[28] Trefler (1993) and Essaji (2008) also report large economic effects of U.S. non-tariff barriers to trade. For instance, Trefler (1993) found that NTBs in the manufacturing sector reduced manufacturing imports to the United States by 24% in 1983.

In our paper, the negative trade effects of import refusals are confined to emerging and developing countries. It seems intuitive that it is more difficult for poorer countries to comply with product standards in the United States. At the same time, it is important to note that our empirical exercise allows us to quantify the costs of non-compliance with U.S. product standards for poorer countries in the short- and long-term. An increase in the number of refusals by one standard deviation decreases imports to the United States from non-OECD countries by about real USD 385 million (in 2005 terms) per country and product-group (based on Column (4) of Table A1.12, which presents the preferred specification of Table 1.2 for non-OECD countries). Since for non-OECD countries on average about 15 product-groups underlie the identification of this effect, the short-run costs of non-compliance amount to around USD 6 billion per exporting country. Turning to the long-run effects, we find that developing countries lose over USD 11 billion in export flows to the United States.

Our empirical results confirm and qualify that product standards represent a challenge in particular to developing countries (Essaji, 2008). The fixed costs to enter a foreign market are higher for producers in developing countries and their production costs are more sensitive to a tightening of product standards.[29,30] Poorer countries often lack the public infrastructure, investment sources and human capital to meet the product standards and conformity assessment requirements of a developed importing country. Hence, product

[28] Note that an alternative measure for the intensity of import refusals, namely log(refusals), would reduce our main sample from about 23,000 to just over 7,000 observations. For this reduced sample and this alternative measure, our estimates on the implied trade costs are still in the same ballpark.

[29] For instance, Maskus et al. (1999), Jaffe and Henson (2005) and Jaud and Kukenova (2011).

[30] The literature stresses the costs incurred to meet the precise technical regulation (product re-design) and costs for verifying that regulations are met (conformity assessment). Maskus et al. (1999) claim that conformity assessment costs pose by far the larger technical barrier to trade for exporting firms in developing countries. They also state that the recognition of conformity assessment certificates leaves room for protectionism.

standards negatively affect import flows especially for developing countries (Henson and Loader, 2001; Disdier et al., 2008; Essaji, 2008).[31]

Returning to the key results of Table 1.7, we compare the negative trade effects for non-OECD countries' import refusals without a product sample analysis before and after the Subprime Crisis. For a change of one standard deviation in refusals, the negative short-term and long-term costs for non-OECD countries rise by more than four times, from 1.8 billion to 8.9 billion and 3.6 billion to 16.1 billion, respectively. Note that this jump in costs of foregone exports is driven by a doubling in the point coefficient and an increase in variation of import refusals in the later period.

1.6.5 Further Results

We conclude the discussion of our empirical results with some further robustness checks and an excursus on European Union member states. In Column (1) of Table A1.13 in the Appendix, we start by reporting our baseline results for all countries for comparability. In Column (2), we add EU refusals and other notifications within the same country-product-group as additional external instruments (on top of the internal instruments of the GMM estimator).[32] This specification is based on 78 food and animal feed product-groups for which we can construct the external instruments. The results in Column (2) indicate that our main results are robust to using additional external instruments for U.S. import refusals with the coefficients being significant and in the same ballpark as our benchmark results.

Turning to Columns (3) and (4) of Table A1.13, we check whether our main results are robust to the inclusion of further fixed effects. Note that these two specifications are based on those countries that export at least 20 (out of 93) product-groups to the United States. This restriction is necessary, because more cross-sectional variation within countries is required for these more demanding specifications. Column (3) adds sector-year fixed effects to the baseline specification in Column (1).[33] This specification is further extended by country-time fixed effects, whereby we consider two-year periods in each case. Column (4) of Table A1.13 presents the results for the most demanding specification, where time-, country-product-, sector-year and country-time-fixed effects are included at the same time. Hence, in the order of fixed effects, this specification controls

[31] For the shrimp industry in Bangladesh and Nicaragua, Jaffe and Henson (2005), Cato et al. (2000) and Cato and Lima dos Santos (2003) provide numerical examples for the sizable adjustment costs developing country exporters face due to non-compliance with U.S. product standards.

[32] We use the first and the second lag of the intensity of EU notifications to instrument for the first lag of our refusal intensity measure.

[33] We define 5 aggregated sectors for our 93 product-groups: fish products, fruits and vegetables, other food products and animal feed, pharmaceuticals and cosmetics and other manufacturing products.

for macroeconomic shocks in the United States, any time-invariant country-specific product characteristics, any time-varying global factors at a more aggregated product-level and any time-varying characteristics at the country of origin. We perform the same set of specifications for the main results for non-OECD countries, including the baseline results as well as the specifications for refusals with and without product sample analyses (as reported in Tables A1.14 and A1.15 in the Appendix). It is reassuring that all our main results are insensitive to these alternative specifications, with the point estimates being in the same ballpark and significant at the 5% level.

Finally, we provide further empirical results in light of the ongoing negotiations on a free trade agreement between the United States and the European Union. Since the reduction in and harmonization of product standards is a central part of these negotiations, it seems worthwhile to have a closer look at the effects of U.S. import refusals on European Union member countries (as opposed to non-European member countries). We estimate the main specifications in Columns (4) of Tables 1.2, 1.3, 1.4 and 1.5 for the 27 EU member states. Any negative and significant effects for EU member countries could be interpreted as evidence for potential gains from reforms in product standards between the United States and the European Union. The results presented in Table A1.16 do not give any such indication.

1.7 Conclusions

This paper assesses the impact of U.S. import refusals on U.S. sectoral import flows for a rich data set of 93 product-groups for over 160 trading partners from 2002 to 2012. Our estimates show that non-compliance with U.S. product standards can exhibit substantial trade costs. This trade reducing effect of enforced product standards is driven by non-OECD countries, whereby our empirical results indicate that a one standard deviation increase in refusals reduces short- and long-run exports from developing countries by USD 6 to 11 billion. Hence, non-compliance with product standards can be very costly for poorer countries and might hinder their economic development.

Furthermore, we find striking evidence that the intensity of FDA inspections and import refusals as well as the negative effect of import refusals on U.S. imports have increased in the aftermath of the Subprime Crisis. During this time period, the unemployment rates in the United States have also markedly increased, suggesting that there is a business cycle element to the non-compliance of imports with U.S. product standards.

Most importantly, we find that the sharp increase in import refusals is driven by those refusals that are not based on any product sample analysis. It is exactly this sort of inspection that offers most leeway for FDA officers. In many instances these refusals are

for sure warranted, but it is puzzling that these types of refusals are counter-cyclical, suggesting that the FDA, like any other U.S. agency, might not be immune to political pressures. We conclude that our empirical results are consistent with the existence of counter-cyclical, hidden protectionism due to non-tariff barriers to trade in the United States. Hence, this paper corroborates worries raised by Baldwin and Evenett (2009) about a rise of murky protectionism.

Tables and Figures

Table 1.1.: U.S. Imports and Refusals Dummy – Different Estimators

Variables	***OLS***	***Fixed effects***	***Arellano-Bond***	***Arellano-Bond***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.739**	0.410**	0.443**	0.470**
	(0.01)	(0.01)	(0.04)	(0.05)
Log Imports (t-2)	0.233**	0.030*	0.061**	0.070**
	(0.01)	(0.01)	(0.02)	(0.02)
Dummy refusal (t-1)	0.047**	0.023°	-0.005	-0.850*
	(0.01)	(0.01)	(0.01)	(0.42)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	No	Yes	Yes	Yes
Refusals endogenous	No	No	No	Yes
AR(1)			0.000	0.000
AR(2)			0.712	0.745
Sargan-test			0.231	0.794
Hansen-test			0.605	0.883
Number of instruments			13	15
Number of groups			3304	3304
Number of countries	166	166	164	164
Number of observations	26858	26858	23242	23242

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable dummy refusal takes the value of one, if in a given product-group k from country i at least one refusal incidence is recorded in year t. Robust standard errors are reported in parentheses. The estimates in Column (1) and (2) are based on pooled OLS and (country-product) fixed effects, with standard errors being clustered at the country-level. Columns (3) and (4) employ a two-step Arellano-Bond estimator with robust standard errors. The lagged dependent variable is instrumented with the first through third lag. In Column (3), we define dummy refusal as exogenous. In Column (4), we allow the dummy refusal to be endogenous and instrument it with its first through third lag. The instrument matrix is collapsed. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively

Table 1.2.: U.S. Imports and Refusals – Different Estimators

Variables	***OLS***	***Fixed effects***	***Arellano-Bond***	***Arellano-Bond***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.737**	0.410**	0.443**	0.448**
	(0.01)	(0.01)	(0.04)	(0.04)
Log Imports (t-2)	0.231**	0.030*	0.061**	0.064**
	(0.01)	(0.01)	(0.02)	(0.02)
Refusals (t-1)	0.035**	0.011	-0.004	-0.323*
	(0.00)	(0.01)	(0.01)	(0.13)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	No	Yes	Yes	Yes
Refusals endogenous	No	No	No	Yes
AR(1)			0.000	0.000
AR(2)			0.713	0.629
Sargan-test			0.230	0.656
Hansen-test			0.605	0.869
Number of instruments			13	15
Number of groups			3304	3304
Number of countries	166	166	164	164
Number of observations	26858	26858	23242	23242

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). Robust standard errors are reported in parentheses. The estimates in Column (1) and (2) are based on pooled OLS and (country-product) fixed effects, with standard errors being clustered at the country-level. Columns (3) and (4) employ a two-step Arellano-Bond estimator with robust standard errors. The lagged dependent variable is instrumented with the first through third lag. In Column (3), we define the variable refusals as exogenous. In Column (4), we allow the variable refusals to be endogenous and instrument it with its first through third lag. The instrument matrix is collapsed. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Table 1.3.: U.S. Imports and Refusals – Food vs. Non-Food Products

Variables	***Baseline***	***All countries***	***OECD-countries***	***Non-OECD-countries***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.448**	0.460**	0.480**	0.404**
	(0.04)	(0.04)	(0.09)	(0.05)
Log Imports (t-2)	0.064**	0.066**	0.019	0.073**
	(0.02)	(0.02)	(0.03)	(0.02)
Refusals (t-1)	-0.323*			
	(0.13)			
Refusals (non-Food) (t-1)		-0.449	0.159	-0.760
		(0.74)	(0.35)	(0.61)
Refusals (Food) (t-1)		-0.256*	-0.026	-0.457*
		(0.11)	(0.10)	(0.21)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.629	0.575	0.745	0.349
Sargan-test	0.656	0.653	0.775	0.902
Hansen-test	0.869	0.661	0.953	0.937
Number of instruments	15	18	18	18
Number of groups	3304	3304	929	2375
Number of countries	164	164	23	141
Number of observations	23242	23242	6980	16262

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1), we report the baseline estimates for all refusals from Table 2, Column (4), for comparability. Column (2) allows for different slope coefficients for refusals for food and non-food product-groups. Columns (3) and (4) report the same specification for OECD-countries and non-OECD-countries, separately. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Table 1.4.: U.S. Imports and Refusals – Type of Refusal

Variables	***Baseline***	***All countries***	***OECD-countries***	***Non-OECD-countries***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.448**	0.454**	0.525**	0.409**
	(0.04)	(0.04)	(0.10)	(0.05)
Log Imports (t-2)	0.064**	0.063**	0.029	0.070**
	(0.02)	(0.02)	(0.03)	(0.02)
Refusals (t-1)	-0.323*			
	(0.13)			
Refusals (Misbranding) (t-1)		-0.324	0.144	-0.468
		(0.30)	(0.55)	(0.33)
Refusals (Adulteration) (t-1)		-0.190	-0.086	-0.341*
		(0.12)	(0.32)	(0.15)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.629	0.552	0.769	0.368
Sargan-test	0.656	0.573	0.763	0.371
Hansen-test	0.869	0.561	0.972	0.398
Number of instruments	15	18	18	18
Number of groups	3304	3304	929	2375
Number of countries	164	164	23	141
Number of observations	23242	23242	6980	16262

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1), we report the baseline estimates for all refusals from Table 2, Column (4), for comparability. Column (2) allows for different slope coefficients for refusal types adulteration and misbranding. Columns (3) and (4) report the same specification for OECD-countries and non-OECD-countries, separately. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Table 1.5.: U.S. Imports and Refusals – Type of Inspection

Variables	***Baseline***	***All countries***	***OECD-countries***	***Non-OECD-countries***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.448**	0.460**	0.522**	0.425**
	(0.04)	(0.04)	(0.11)	(0.05)
Log Imports (t-2)	0.064**	0.065**	0.029	0.072**
	(0.02)	(0.02)	(0.03)	(0.02)
Refusals (t-1)	-0.323*			
	(0.13)			
Refusals (Sample) (t-1)		0.349	-0.170	0.427
		(0.23)	(0.35)	(0.28)
Refusals (no Sample) (t-1)		-0.310*	0.082	-0.546**
		(0.12)	(0.14)	(0.19)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.629	0.463	0.708	0.230
Sargan-test	0.656	0.641	0.683	0.812
Hansen-test	0.869	0.651	0.924	0.819
Number of instruments	15	18	18	18
Number of groups	3304	3304	929	2375
Number of countries	164	164	23	141
Number of observations	23242	23242	6980	16262

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1), we report the baseline estimates for all refusals from Table 2, Column (4), for comparability. Column (2) allows for different slope coefficients for the type of inspection leading to a given refusal. We distinguish between refusals without any product sample analysis and refusals after an FDA or private product sample analysis has been provided. Columns (3) and (4) report the same specification for OECD-countries and non-OECD-countries, separately. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Table 1.6.: U.S. Refusals and the Subrime Crisis – A First View

Variables	***OLS***	***Fixed effects***	***Fixed effects***	***Fixed effects***
	(1)	***(2)***	***(3)***	***(4)***
Crisis	0.026*	0.039**	0.036**	0.037**
	(0.01)	(0.01)	(0.01)	(0.01)
Log Imports			0.028**	0.027**
			(0.01)	(0.01)
Refusals (t-1)				0.050**
				(0.01)
Time FE	No	No	No	No
Country-Product FE	No	Yes	Yes	Yes
Refusals endogenous	No	No	No	No
Number of groups	3304	3304	3304	3304
Number of countries	164	164	164	164
Number of observations	23242	23242	23242	23242

Notes: Dependent variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). The variable Crisis is a dummy variable taking the value of one for the years 2008 to 2012 and zero otherwise. Log imports of 93 product-groups to the United States from 2002-2012. Standard errors are clustered at the country-product-level are reported in parentheses. The estimates in Column (1) and Columns (2), (3) and (4) are based on pooled OLS and country-product fixed effects, respectively. All estimates are based on the same sample as the main sample (see Table 2). **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Table 1.7.: U.S. Imports and Refusals – Evidence for Hidden Protectionism?

Variables	***OECD-countries***			***Non-OECD-countries***		
	Baseline	***2004-2008***	***2008-2012***	***Baseline***	***2004-2008***	***2008-2012***
	(1)	***(2)***	***(3)***	***(4)***	***(4)***	***(4)***
Log Imports (t-1)	0.522**	0.451**	0.445**	0.425**	0.432**	0.385**
	(0.11)	(0.19)	(0.13)	(0.05)	(0.08)	(0.07)
Log Imports (t-2)	0.029	0.049	-0.017	0.072**	0.056°	0.064**
	(0.03)	(0.05)	(0.04)	(0.02)	(0.03)	(0.03)
Refusals (Sample) (t-1)	-0.170	0.042	-0.383	0.427	0.252	0.354
	(0.35)	(0.14)	(0.53)	(0.28)	(0.27)	(0.26)
Refusals (no Sample) (t-1)	0.082	0.017	-0.086	-0.546**	-0.243°	-0.549*
	(0.15)	(0.14)	(0.17)	(0.19)	(0.14)	(0.26)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.708	0.586	0.503	0.230	0.189	0.225
Sargan-test	0.683	0.558	0.015	0.812	0.322	0.863
Hansen-test	0.924	0.288	0.797	0.819	0.134	0.923
Number of instruments	18	15	15	18	14	15
Number of groups	929	914	908	2375	2183	2281
Number of countries	23	23	23	141	141	141
Number of observations	6980	4358	4371	16262	8033	10272

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1) and Column (4), we report the estimates for the whole time period from Table 5, Columns (3) and (4) for comparability. Columns (2) and (3) and Columns (5) and (6) split the OECD and non-OECD sample into two time periods of comparable size, whereby the later sample period encompasses the Subprime Crisis and rising unemployment rates in the United States. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

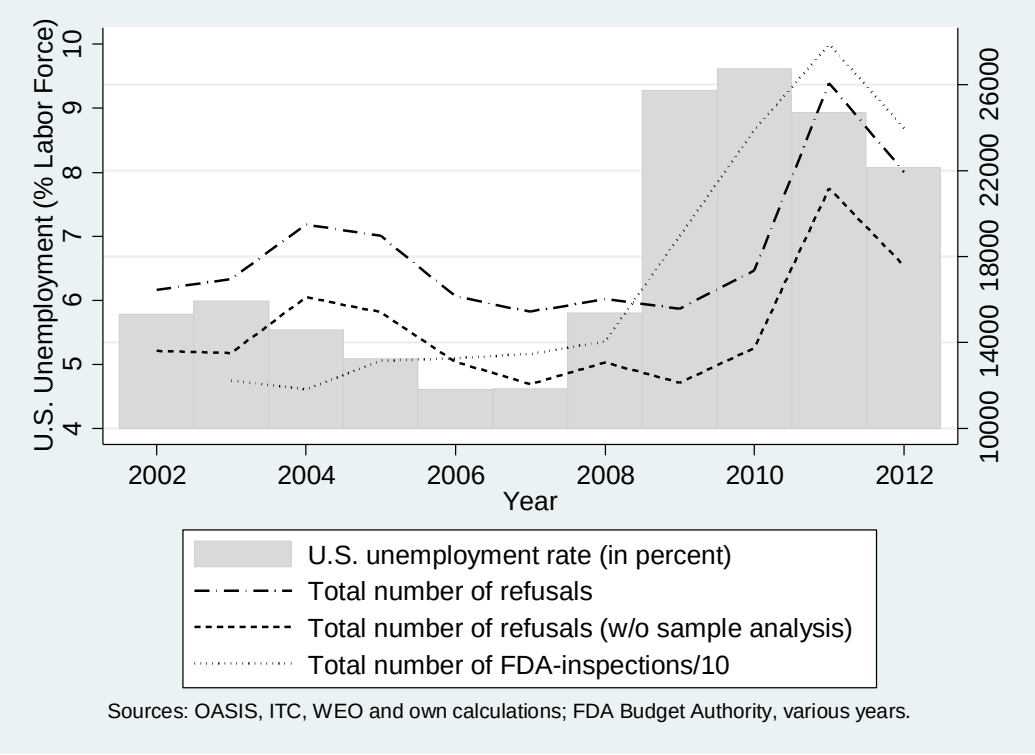


Figure 1.1.: U.S. Unemployment Rate and Hidden Protectionism?

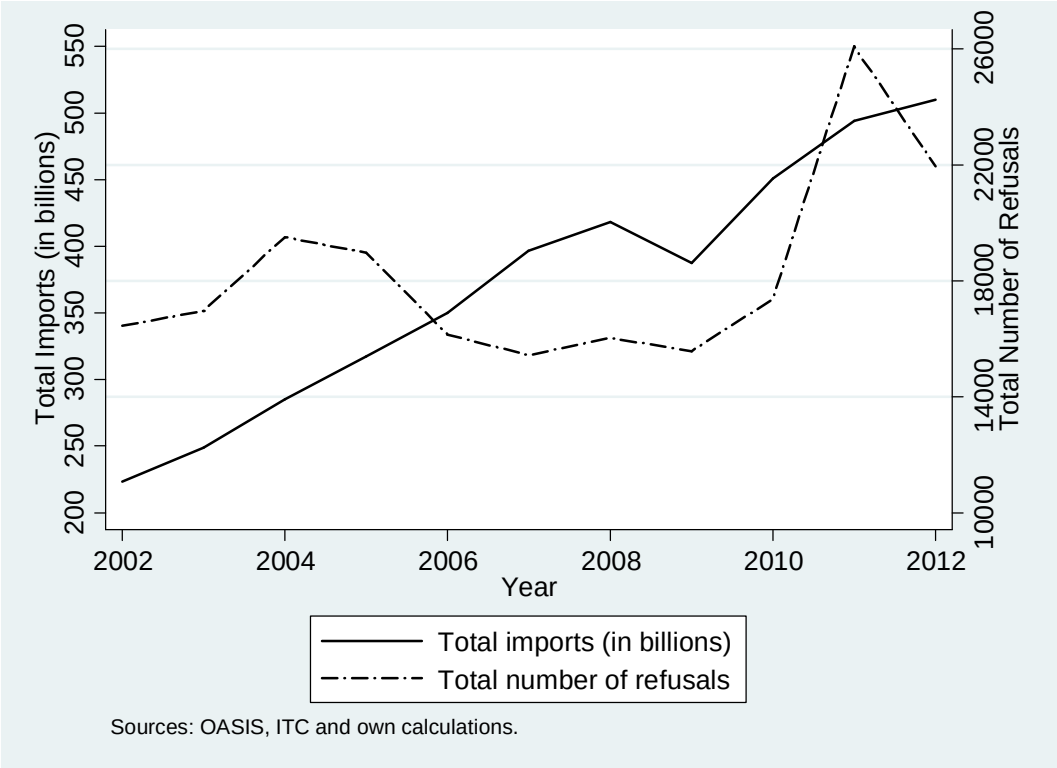


Figure 1.2.: Total U.S. Imports and Refusals of FDA Regulated Products

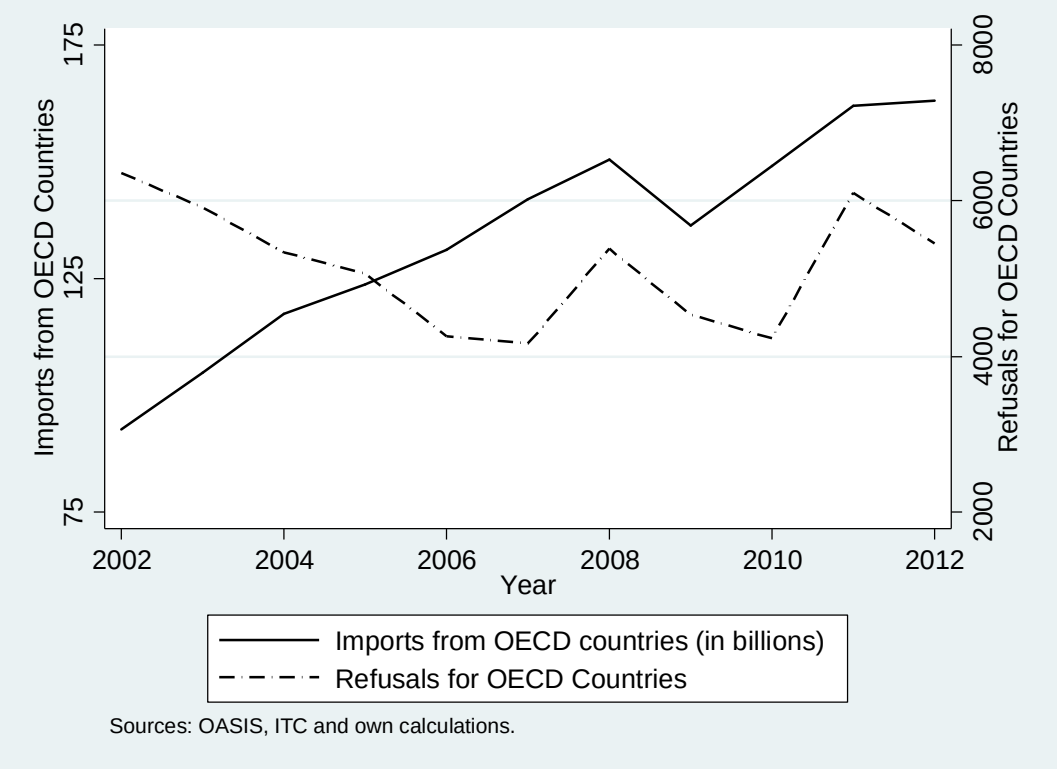


Figure 1.3.: U.S. Imports and Refusals for OECD Countries

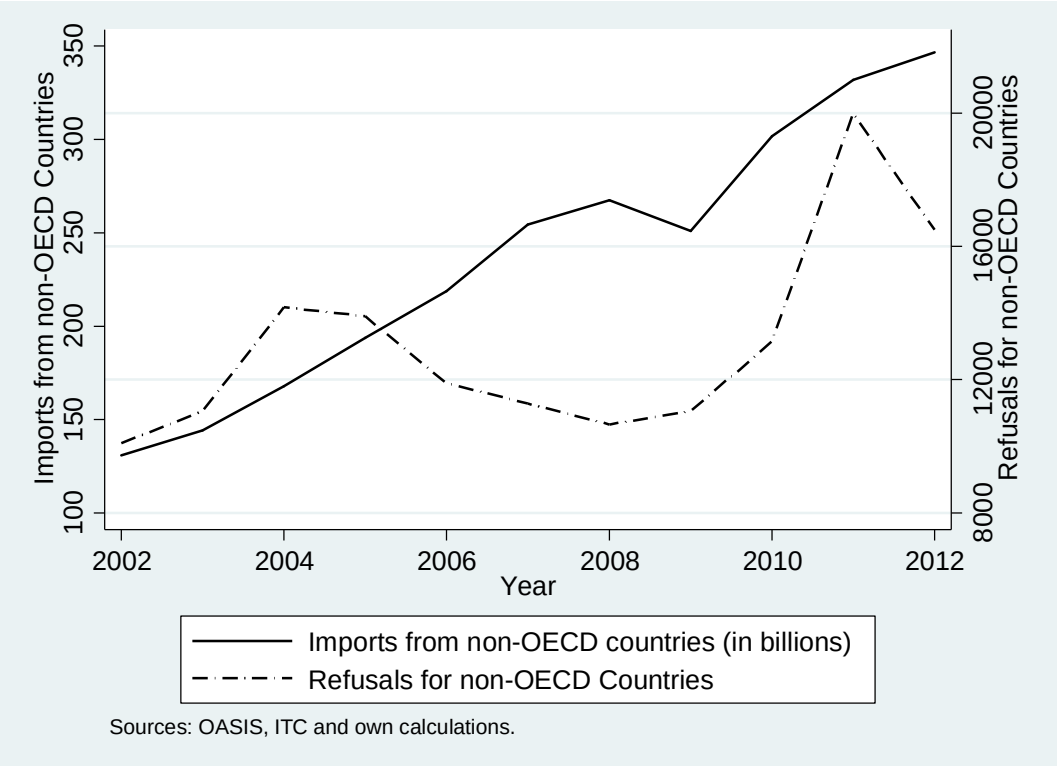


Figure 1.4.: U.S. Imports and Refusals for non-OECD Countries

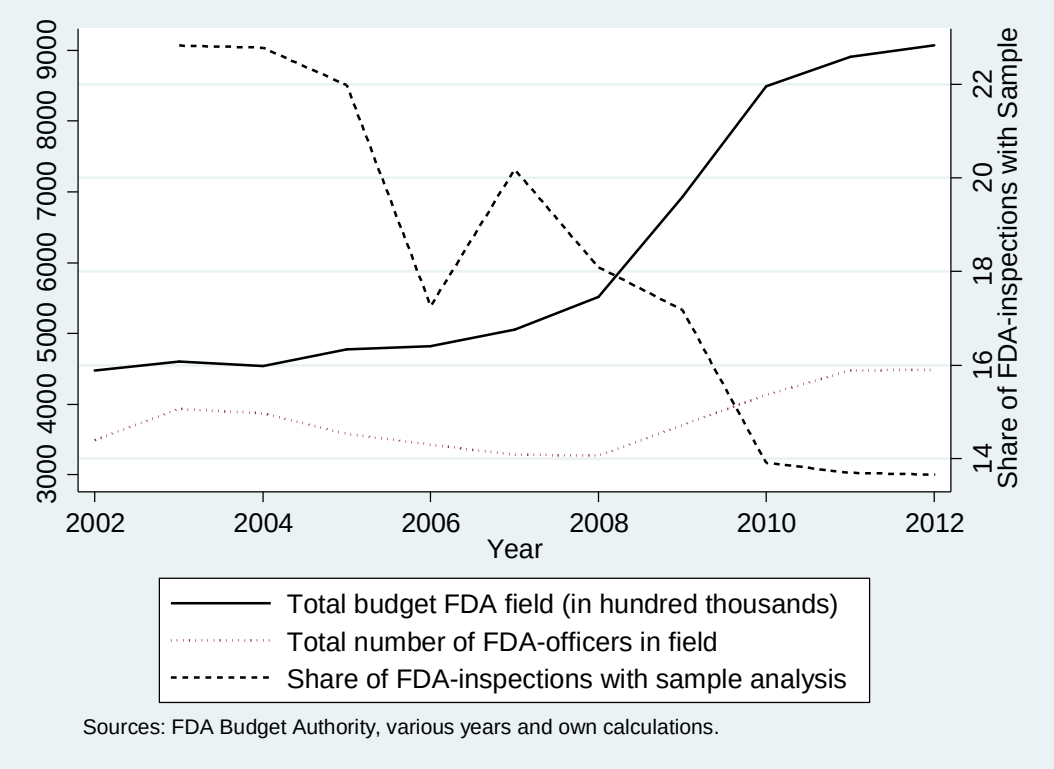


Figure 1.5.: FDA-budget for Field Activities, FDA-officers in the Field and FDA-inspections with Product Sample Analysis

Appendix 1 A Tables and Figures

Appendix Table A 1.8.: Number of U.S. Import Refusals per Matched Product-group 2002 – 2012 (Top Ten out of 93 Product-groups)

Product-group Number	***Description***	***Number of Import Refusals***
84	Other medicaments, except antibiotics and hormones	32623
90	Medical instruments, machines and other medical devices	27889
74	Skin care and make up	8197
36	Bread and pastry, pudding, other baker ware	7998
2	Fish, dried, salted, smoked or in brine	7467
46	Sugar confectionary without cacao	6781
3	Crustaceans, fresh, chilled, frozen, dried, smoked or in brine	6323
60	Sauces, mixed dressings and condiments	5986
8	Fruits used as vegetables, fresh or chilled	5352
1	Fish, fresh, chilled or frozen	5247

Appendix Table A 1.9.: Reasons of U.S. Import Refusals (Top Ten Reasons from 2002 - 2011)

FDA Reason Code	***FDA Reason Description***	***Number of Import Refusals***
NOT LISTED	It appears the drug or device is not included in a list required by Section 510(j), or a notice or other information respecting it was not provided as required by section 510(j) or 510(k).	27113
UNAPPROVED	The article appears to be a new drug without an approved new drug application.	26699
FILTHY	The article appears to consist in whole or in part of a filthy, putrid, or decomposed substance or be otherwise unfit for food.	18743
NUTRIT LBL	The article appears to be misbranded in that the label or labeling fails to bear the required nutrition information.	16119
NO PROCESS	It appears that the manufacturer has not filed information on its scheduled process as required by 21 CFR 108.25(c)(2) or 108.35(c)(2).	14637
UNSAFE COL	The article appears to be a color additive for the purposes of coloring only in or on drugs or devices, and is unsafe within the meaning of Section 721(a).	12500
SALMONELLA	The article appears to contain Salmonella, a poisonous and deleterious substance which may render it injurious to health.	11073
NEEDS FCE	It appears the manufacturer is not registered as a low acid canned food or acidified food manufacturer pursuant to 21 CFR 108.25(c)(1) or 108.35(c)(1).	10015
LIST INGRE	It appears the food is fabricated from two or more ingredients and the label does not list the common or usual name of each ingredient.	9857
PESTICIDES	The article is subject to refusal of admission pursuant to section 801(a)(3) in that it appears to be adulterated because it contains a pesticide chemical, which is in violation of section 402(a)(2)(B).	9510

Appendix Table A 1.10.: Share of FDA Regulated Products in Total Exports to the U.S. for OECD Countries (Year 2012)

Country	***Total exports to the US (in Mill. USD)***	***Total exports of FDA products (in Mill. USD)***	***Share of FDA products in total exports***	***Share of FDA food products in total exports***	***Share of FDA non-food products in total exports***
Canada	328719.27	34057.84	10.36%	5.88%	4.48%
Germany	110612.00	23195.66	20.97%	1.40%	19.57%
Ireland	33436.44	19309.24	57.75%	2.47%	55.28%
Japan	150401.18	13811.87	9.18%	0.51%	8.67%
Switzerland	25955.55	12031.50	46.35%	3.38%	42.97%
France	42339.07	11962.74	28.25%	9.90%	18.36%
United Kingdom	55975.68	10941.81	19.55%	4.24%	15.31%
Italy	38145.46	8789.33	23.04%	10.12%	12.92%
Netherlands	22937.61	5115.52	22.30%	8.80%	13.51%
Denmark	6894.37	4065.58	58.97%	3.32%	55.65%
Belgium	17701.04	3408.08	19.25%	3.51%	15.75%
Spain	12221.53	2940.42	24.06%	11.97%	12.09%
Austria	9695.12	2751.44	28.38%	6.58%	21.79%
Sweden	10490.75	2572.59	24.52%	4.97%	19.55%
Australia	9851.58	2474.72	25.12%	11.65%	13.47%
New Zealand	3623.29	1620.19	44.72%	29.65%	15.06%
Finland	5317.83	1185.18	22.29%	1.35%	20.94%
Norway	6754.39	880.99	13.04%	5.14%	7.90%
Turkey	6605.28	833.31	12.62%	9.33%	3.29%
Greece	1051.89	382.30	36.34%	25.79%	10.55%
Portugal	2706.28	300.29	11.10%	4.64%	6.45%
Iceland	299.94	214.86	71.63%	51.82%	19.81%
Luxembourg	579.99	151.79	2.87%	0.02%	2.86%

Appendix Table A 1.11.: Share of FDA Regulated Products in Total Exports to the U.S. for non-OECD Countries (Year 2012, Top 10 by Region)

Country Group	Country	*Total exports to the US (in Mill. USD)*	*Total exports of FDA products (in Mill. USD)*	*Share of FDA products in total exports*	*Share of FDA food products in total exports*	*Share of FDA non-food products in total exports*
Africa	Cote d`Ivoire	1138.81	778.28	68.34%	68.20%	0.14%
	South Africa	8861.26	404.37	4.56%	3.23%	1.34%
	Ghana	304.87	199.83	65.55%	65.08%	0.47%
	Morocco	995.25	169.41	17.02%	14.83%	2.19%
	Tunisia	759.33	140.18	18.46%	15.74%	2.72%
	Kenya	404.57	110.90	27.41%	26.17%	1.24%
	Egypt	3104.64	109.71	3.53%	2.39%	1.14%
	Ethiopia	189.43	101.39	53.52%	53.34%	0.18%
	Nigeria	19523.41	83.25	0.43%	0.41%	0.02%
	Malawi	69.30	63.11	91.07%	91.03%	0.04%
Asia and Oceania	China	444469.15	161000.61	36.22%	1.52%	34.70%
	Thailand	27051.56	13972.76	51.65%	14.68%	36.97%
	Japan	150401.18	13811.87	9.18%	0.51%	8.67%
	India	41910.57	12166.13	29.03%	5.30%	23.73%
	Malaysia	26651.97	11074.61	41.55%	7.04%	34.51%
	Korea	60979.15	9630.99	15.79%	0.92%	14.87%
	Taiwan	40215.10	9037.19	22.47%	1.06%	21.41%
	Israel	22344.66	7628.57	34.14%	1.23%	32.91%
	Singapore	20455.01	5018.75	24.54%	0.60%	23.94%
	Indonesia	18839.70	3749.06	19.90%	13.70%	6.20%
Americas	Mexico	280024.55	71343.35	25.48%	5.81%	19.67%
	Canada	328719.27	34057.84	10.36%	5.88%	4.48%
	Brazil	33227.22	4155.34	12.51%	10.62%	1.89%
	Chile	10096.59	4101.42	40.62%	39.74%	0.88%
	Costa Rica	12303.03	2873.76	23.36%	13.87%	9.49%
	Guatemala	4843.69	2200.18	45.42%	44.69%	0.74%
	Argentina	4577.60	1975.51	43.16%	39.11%	4.04%
	Dom. Rep.	4481.03	1920.90	42.87%	20.96%	21.91%
	Colombia	25224.60	1867.75	7.40%	6.72%	0.68%
	Ecuador	9896.24	1788.58	18.07%	17.93%	0.15%

Appendix Table A 1.12: U.S. Imports and Refusals – Different Estimators, Non-OECD Countries

Variables	***OLS***	***Fixed effects***	***Arellano-Bond***	***Arellano-Bond***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.725**	0.396**	0.412**	0.400**
	(0.01)	(0.02)	(0.05)	(0.05)
Log Imports (t-2)	0.240**	0.040**	0.068**	0.072**
	(0.01)	(0.01)	(0.02)	(0.02)
Refusals (t-1)	0.039**	0.006	-0.005	-0.514**
	(0.00)	(0.01)	(0.01)	(0.19)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	No	Yes	Yes	Yes
Refusals endogenous	No	No	No	Yes
AR(1)			0.000	0.000
AR(2)			0.525	0.427
Sargan-test			0.341	0.822
Hansen-test			0.648	0.915
Number of instruments			13	15
Number of groups			2375	2375
Number of countries	143	143	141	141
Number of observations	18898	18898	16262	16262

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). Robust standard errors are reported in parentheses. The estimates in Column (1) and (2) are based on pooled OLS and (country-product) fixed effects, with standard errors being clustered at the country-level. Columns (3) and (4) employ a two-step Arellano-Bond estimator with robust standard errors. The lagged dependent variable is instrumented with the first through third lag. In Column (3), we define the variable refusals as exogenous. In Column (4), we allow the variable refusals to be endogenous and instrument it with its first through third lag. The instrument matrix is collapsed. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Appendix Table A 1.13.: U.S. Imports and Refusals – Further Fixed Effects

Variables	***Baseline***	***External Instrument***	***Further Fixed Effects I***	***Further Fixed Effects II***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.448**	0.490**	0.399**	0.365**
	(0.04)	(0.05)	(0.06)	(0.06)
Log Imports (t-2)	0.064**	0.065**	0.048*	0.038°
	(0.02)	(0.02)	(0.02)	(0.02)
Refusals (t-1)	-0.323*	-0.235*	-0.359*	-0.362*
	(0.13)	(0.10)	(0.14)	(0.16)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes
Sector-year FE	No	No	Yes	Yes
Country-time FE	No	No	No	Yes
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.629	0.558	0.673	0.564
Sargan-test	0.656	0.844	0.758	0.626
Hansen-test	0.869	0.936	0.781	0.716
Number of instruments	15	17	47	239
Number of groups	3304	2588	2761	2761
Number of countries	164	149	65	65
Number of observations	23242	18109	19987	19987

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1), we report the baseline results from Table 2, Column (4), for comparability. Column (2) reports the results for the baseline specification, where we additionally use EU refusals as external instruments (which are available for 78 out 93 product-groups). Columns (3) and (4) allow for further fixed effects. Since these specifications require more cross-sectional variation within countries, we restrict the sample to countries with export flows to the United States in at least 20 product-groups. Column (3) extends the baseline with sector-year fixed effects, where all product-groups are classified into five more aggregated sectors. Column (4) also includes these sector-year fixed effects and additionally country-time fixed effects, with time being defined as two-year spells. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Appendix Table A 1.14.: U.S. Imports and Refusals – Further Fixed Effects, Non-OECD Countries

Variables	***Baseline***	***External Instrument***	***Further Fixed Effects I***	***Further Fixed Effects II***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.400**	0.467**	0.328**	0.309**
	(0.05)	(0.05)	(0.07)	(0.08)
Log Imports (t-2)	0.072**	0.079**	0.054*	0.046°
	(0.15)	(0.02)	(0.03)	(0.03)
Refusals (t-1)	-0.514**	-0.435**	-0.547**	-0.512*
	(0.19)	(0.16)	(0.20)	(0.22)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes
Sector-year FE	No	No	Yes	Yes
Country-time FE	No	No	No	Yes
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.427	0.859	0.446	0.366
Sargan-test	0.822	0.651	0.864	0.794
Hansen-test	0.915	0.834	0.854	0.799
Number of instruments	15	17	47	179
Number of groups	2375	1899	1858	1858
Number of countries	141	127	45	45
Number of observations	16262	12974	13186	13186

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1), we report the baseline results from Table 4, Column (1), for comparability. Column (2) reports the results for the baseline specification, where we additionally use EU refusals as external instruments (which are available for 78 out 93 product-groups). Columns (3) and (4) allow for further fixed effects. Since these specifications require more cross-sectional variation within countries, we restrict the sample to countries with export flows to the United States in at least 20 product-groups. Column (3) extends the baseline with sector-year fixed effects, where all product-groups are classified into five more aggregated sectors. Column (4) also includes these sector-year fixed effects and additionally country-time fixed effects, with time being defined as two-year spells. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Appendix Table A 1.15.: U.S. Imports and Refusals – Further Fixed Effects, Non-OECD Countries, Evidence for Hidden Protectionism?

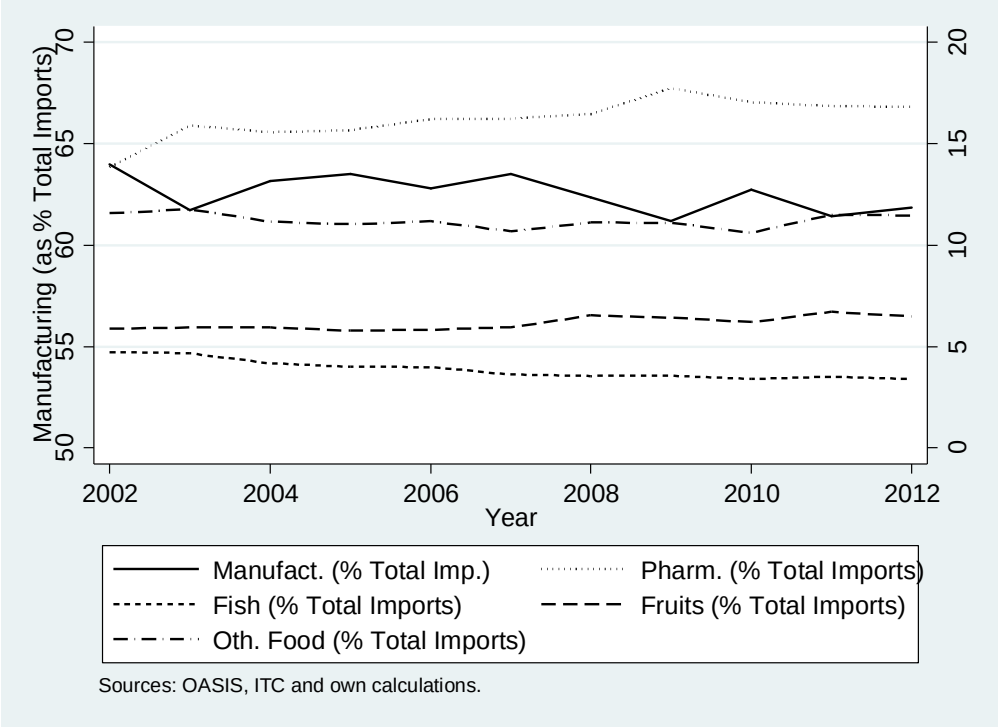
Variables	***Baseline***	***External Instrument***	***Further Fixed Effects I***	***Further Fixed Effects II***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.425**	0.488**	0.357**	0.344**
	(0.05)	(0.06)	(0.07)	(0.07)
Log Imports (t-2)	0.072**	0.073**	0.053*	0.048°
	(0.15)	(0.03)	(0.03)	(0.03)
Refusals (Sample) (t-1)	0.427	0.746°	0.236	0.224
	(0.28)	(0.39)	(0.25)	(0.24)
Refusals (no Sample) (t-1)	-0.546**	-0.668**	-0.507**	-0.437*
	(0.19)	(0.22)	(0.18)	(0.19)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes
Sector-year FE	No	No	Yes	Yes
Country-time FE	No	No	No	Yes
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.230	0.547	0.289	0.256
Sargan-test	0.812	0.944	0.820	0.785
Hansen-test	0.819	0.977	0.776	0.743
Number of instruments	18	20	50	182
Number of groups	2375	1899	1858	1858
Number of countries	141	127	45	45
Number of observations	16262	12974	13186	13186

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1), we report the baseline results from Table 4, Column (1), for comparability. Column (2) reports the results for the baseline specification, where we additionally use EU refusals as external instruments (which are available for 78 out 93 product-groups). Columns (3) and (4) allow for further fixed effects. Since these specifications require more cross-sectional variation within countries, we restrict the sample to countries with export flows to the United States in at least 20 product-groups. Column (3) extends the baseline with sector-year fixed effects, where all product-groups are classified into five more aggregated sectors. Column (4) also includes these sector-year fixed effects and additionally country-time fixed effects, with time being defined as two-year spells. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

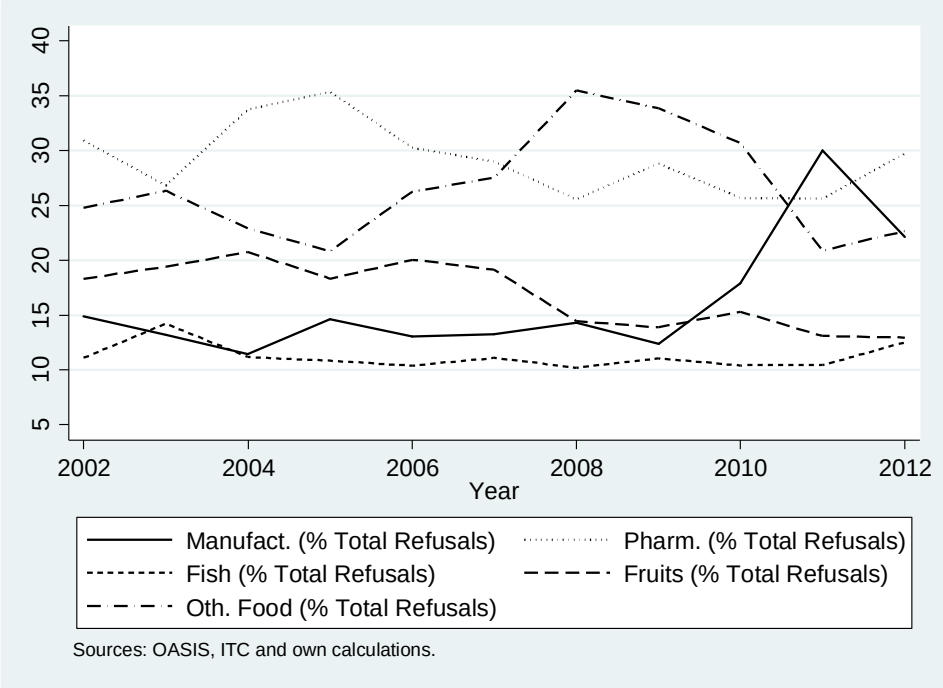
Appendix Table A 1.16.: U.S. Imports and Refusals – European Union (EU 27)

Variables	***Baseline***	***Food vs. non-Food***	***Refusal Type I***	***Refusal Type II***
	(1)	***(2)***	***(3)***	***(4)***
Log Imports (t-1)	0.453**	0.491**	0.484**	0.412**
	(0.11)	(0.09)	(0.11)	(0.13)
Log Imports (t-2)	0.038	0.047	0.061	0.015
	(0.03)	(0.03)	(0.04)	(0.04)
Refusals (t-1)	-0.125			
	(0.33)			
Refusals (non-Food) (t-1)		0.564		
		(0.57)		
Refusals (Food) (t-1)		0.041		
		(0.17)		
Refusals (Misbranding) (t-1)			0.714	
			(0.96)	
Refusals (Adulteration) (t-1)			-0.276	
			(0.36)	
Refusals (Sample) (t-1)				1.216°
				(0.66)
Refusals (no Sample) (t-1)				-0.317
				(0.48)
Time FE	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.748	0.964	0.512	0.737
Sargan-test	0.056	0.288	0.547	0.669
Hansen-test	0.580	0.824	0.880	0.948
Number of instruments	15	18	18	18
Number of groups	696	696	696	696
Number of countries	27	27	27	27
Number of observations	5055	5055	5055	5055

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1), we report the baseline results from Table 4, Column (1), for comparability. Column (2) allows for different slope coefficients for refusals between food and non-food product-groups imported from EU27-countries. Column (3) allows for different slope coefficients for refusal types adulteration and misbranding. Finally, Column (4) distinguishes between refusals without any product sample analysis and refusals after an FDA or private product sample analysis has been provided. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.



Appendix Figure A 1.6.: U.S. Imports by FDA Product-groups (as % Total Imports)



Appendix Figure A 1.7.: U.S. Import Refusals by FDA Product-group (as % Total Refusals)

Appendix Table A 1.17.: Mapping of 93 Product-groups

	Description	*FDA codes*	*HS product codes*
1	Fish, fresh, chilled or frozen	16A (except 32, 99, 21, 35, 01, 45, 22, 33, 15), 16X (except 30, 20, 40, 42, 31, 32, 33, 21, 41).	301, 302, 303, 304

Note that this table currently only displays the first and last line. The exact matching code for all 93 product-groups (including food and non-food FDA regulated products) will be made available at a later stage.

93	Microwave heaters	96.	851650, 851660, 851420, 851430, 851440, 851490, 84193, 84198.

Notes: Parentheses after two or three digit FDA codes specify subgroups (third digit or fourth and fifth digit, respectively). FDA codes are comprised of a two digit numerical industry code, a one digit subgroup code (capital letter) and a further two digit numerical product index. Note that the FDA product group 54Y99 is excluded from the analysis, since it was not possible to match it.

Appendix Table A 1.18.: Mapping of EU-RASFF Product-groups and Our 93 Product-groups

	Description	*RASFF product categories*	*Product- groups used in this paper*
1	Alcoholic Beverages	Alcoholic Beverages	66, 67, 68, 69
		Wine	

Note that this table currently only displays the first and last line. The exact matching code for all 72 product-groups for which corresponding EU-RASFF categories exist will be made available at a later stage.

17	Animal Feed	Animal by-products Feed additives Feed premixtures Feed materials Compound feeds	86, 87, 88, 89

Notes: Note that this external instrument, which is used on top of the internal instruments, only exists for product-groups in the food and animal feed sectors.

Appendix Table A 1.19.: U.S. Imports and Refusals – Robustness of IV lag Structure (Dummy Refusal)

Variables	***Baseline***	***Additional Lag I***	***Additional Lag II***	***Additional Lag III***	***Additional Lag IV***	***Baseline without Collapse***
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
Log Imports (t-1)	0.470**	0.469**	0.470**	0.464**	0.455**	0.398**
	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)
Log Imports (t-2)	0.070**	0.068**	0.068**	0.066*	0.063**	0.048**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Dummy refusal (t-1)	-0.850*	-0.773*	-0.815*	-0.747*	-0.685*	-0.594*
	(0.42)	(0.37)	(0.35)	(0.34)	(0.32)	(0.24)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.607	0.550	0.547	0.514	0.454	0.303
Sargan-test	0.794	0.159	0.301	0.375	0.274	0.000
Hansen-test	0.883	0.565	0.763	0.823	0.754	0.178
Number of instruments	15	17	19	21	23	58
Number of groups	3304	3304	3304	3304	3304	3304
Number of countries	164	164	164	164	164	164
Number of observations	23242	23242	23242	23242	23242	23242

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable dummy refusal takes the value of one, if in a given product-group k from country i at least one refusal incidence is recorded in year t. All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1) of Online Appendix 5, we report the baseline estimates for all refusals from Table 1, Column (4), for comparability. In Columns (2) to (5), we allow step by step for an additional lag of our instruments. Finally, Column (6) is based on the full set of potential instruments. It is important to note that the point coefficients are quite stable over the different sets of instruments and that the specification tests clearly favor our more parsimonious specification of instruments. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Appendix Table A 1.20.: U.S. Imports and Refusals – Robustness of IV lag Structure (Refusals)

Variables	***Baseline***	***Additional Lag I***	***Additional Lag II***	***Additional Lag III***	***Additional Lag IV***	***Baseline without Collapse***
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
Log Imports (t-1)	0.448**	0.458**	0.463**	0.457**	0.452**	0.396**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Log Imports (t-2)	0.064**	0.065**	0.066**	0.065**	0.063**	0.049**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Refusals (t-1)	-0.323*	-0.237*	-0.145	-0.184*	-0.215*	-0.167*
	(0.13)	(0.11)	(0.10)	(0.09)	(0.09)	(0.07)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.629	0.582	0.658	0.619	0.582	0.443
Sargan-test	0.656	0.023	0.025	0.054	0.055	0.000
Hansen-test	0.869	0.152	0.136	0.204	0.238	0.087
Number of instruments	15	17	19	21	23	58
Number of groups	3304	3304	3304	3304	3304	3304
Number of countries	164	164	164	164	164	164
Number of observations	23242	23242	23242	23242	23242	23242

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1) of Online Appendix 6, we report the baseline estimates for all refusals from Table 2, Column (4), for comparability. In Columns (2) to (5), we allow step by step for an additional lag of our instruments. Finally, Column (6) is based on the full set of potential instruments. It is important to note that the point coefficients are quite stable over the different sets of instruments and that the specification tests clearly favor our more parsimonious specification of instruments. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Appendix Table A 1.21.: U.S. Imports and Refusals – Evidence for Hidden Protectionism? OECD Countries (5-year Rolling Windows)

Variables	***Baseline***	***2002-2006***	***2003-2007***	***2004-2008***	***2005-2009***	***2006-2010***	***2007-2011***	***2008-2012***
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***	***(8)***
Log Imports (t-1)	0.522**	0.715	0.512*	0.451*	0.439**	0.602**	0.359**	0.445**
	(0.11)	(0.44)	(0.21)	(0.19)	(0.13)	(0.12)	(0.09)	(0.13)
Log Imports (t-2)	0.029	0.063	0.078	0.049	0.030	0.067	0.025	-0.017
	(0.03)	(0.09)	(0.06)	(0.05)	(0.04)	(0.04)	(0.03)	(0.04)
Refusals (Sample) (t-1)	-0.170	0.282	0.125	0.042	-0.001	0.088	0.131	-0.383
	(0.35)	(0.69)	(0.38)	(0.14)	(0.17)	(0.34)	(0.27)	(0.53)
Refusals (no Sample) (t-1)	0.082	-0.249	-0.017	0.017	-0.087	0.143	0.145	-0.086
	(0.14)	(0.39)	(0.19)	(0.14)	(0.21)	(0.15)	(0.12)	(0.17)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.708	---	0.813	0.776	0.586	0.758	0.497	0.503
Sargan-test	0.683	0.880	0.763	0.431	0.558	0.950	0.080	0.015
Hansen-test	0.924	0.874	0.804	0.495	0.288	0.943	0.881	0.797
Number of instruments	18	9	13	14	15	15	15	15
Number of groups	929	883	891	904	914	915	908	908
Number of countries	23	23	23	23	23	23	23	23
Number of observations	6980	1742	2609	3484	4358	4365	4369	4371

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1) we report the baseline estimates for OECD countries from Table 7, Column (1). In Columns (2) to (8), we report the results for the same specification for different 5-year windows. It is important to note that the number of instruments and observations is comparable for the last four columns, whereby Columns (5) and (8) of Online Appendix 7 are reported in the Table 7. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Appendix Table A 1.22.: U.S. Imports and Refusals – Evidence for Hidden Protectionism? Non-OECD Countries(5-year Rolling Windows)

Variables	***Baseline***	***2002-2006***	***2003-2007***	***2004-2008***	***2005-2009***	***2006-2010***	***2007-2011***	***2008-2012***
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***	***(8)***
Log Imports (t-1)	0.425**	0.308*	0.430**	0.432**	0.449**	0.406**	0.458**	0.385**
	(0.05)	(0.12)	(0.09)	(0.08)	(0.06)	(0.06)	(0.06)	(0.07)
Log Imports (t-2)	0.072**	-0.002	0.064°	0.056°	0.062*	0.077**	0.094**	0.064*
	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Refusals (Sample) (t-1)	0.427	0.269	0.084	0.252	0.198	0.173	0.253	0.354
	(0.28)	(0.83)	(0.30)	(0.27)	(0.18)	(0.23)	(0.22)	(0.26)
Refusals (no Sample) (t-1)	-0.546**	-0.152	-0.296	-0.243°	-0.220°	-0.374**	-0.251°	-0.549*
	(0.28)	(0.79)	(0.38)	(0.14)	(0.18)	(0.14)	(0.13)	(0.26)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Refusals endogenous	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.230	---	0.087	0.189	0.377	0.729	0.583	0.225
Sargan-test	0.812	0.752	0.271	0.322	0.191	0.585	0.719	0.863
Hansen-test	0.819	0.691	0.441	0.134	0.489	0.416	0.661	0.923
Number of instruments	18	9	13	14	15	15	15	15
Number of groups	2375	2041	2114	2183	2256	2267	2267	2281
Number of countries	141	141	141	141	141	141	141	141
Number of observations	16262	3964	5990	8033	10099	10194	10243	10272

Notes: Dependent variable: Log imports of 93 product-groups to the United States from 2002-2012. The variable refusals refers to the total number of refusals in a given product-group k from country i in year t and enters as the log(1+refusals). All estimations are based on the two-step Arellano-Bond estimator with robust standard errors reported in parentheses. The lagged dependent variable is instrumented with the first through third lag. The variable refusals is allowed to be endogenous and is instrumented with its first through third lag. The instrument matrix is collapsed. In Column (1) we report the baseline estimates for non-OECD countries from Table 7, Column (4). In Columns (2) to (8), we report the results for the same specification for different 5-year windows. It is important to note that the number of instruments and observations is comparable for the last four columns, whereby Columns (5) and (8) of Online Appendix 8 are reported in the Table 7. **, * and ° denotes significant at the 1%, 5% and 10% level, respectively.

Appendix 1 B Data Cleaning and Matching

For the empirical analysis described in the main part of this chapter, I constructed a new dataset on U.S. import refusals and import flows at the product group level. For this dataset, I had to match the unique product classification of import refusals from the U.S. Food and Drug Administration (FDA) with the Harmonized System (HS) product classification of import flows from the U.S. International Trade Commission (ITC). This task was not trivial, because both product classifications follow completely different classification principles. As far as I know, there has not been any researcher yet trying to undertake the task I completed during my dissertation. In this Appendix, I give an overview on the matching procedure I applied to merge both datasets.

During my Ph.D., Christoph Moser from the ETH Zürich and I decided to work together to estimate the trade effects of U.S. import refusals on U.S. imports from all countries of the world with a special focus on potential protectionist motives of U.S. authorities. At the beginning of this project in fall of 2011, the Import Refusals Report (IRR) database from the U.S. FDA was not publicly available and we were allowed to use the data the UN-ECLAC Washington Office had requested and received from the U.S. FDA through a special information request (Artecona and Flores 2009). However, in July 2012, the U.S. FDA started to publish the historical IRR data from 2002 until 2011 on its website and has regularly updated the database with recent refusal incidences since then. We decided to use this data from the FDA website, because it included an additional variable on the type of sample that underlies a given refusal, which was not included in the data the UN-ECLAC had received. As described in the paper, this variable is very important for our empirical analysis. The detailed data on sectoral U.S. import flows at the 6 and 10 digit level of the HS product classification we obtained from the website of the U.S. ITC. The main challenge for the project has been to match the unique product classification of the U.S. FDA to the HS product classification used by the U.S. ITC at a sufficiently disaggregated level. This task proved to be non-routine and the necessary careful matching procedure by hand took me more than 8 month. I succeeded in mapping the FDA and HS product classification into 93 new product groups. In the following, I will describe the matching procedure as well as the necessary cleaning procedures for the raw data in detail.

I am highly indebted to United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC) Washington Office and their staff members Fernando Flores and Raquel Artecona, who gave me the opportunity to work with the Import Refusals Report (IRR) Database of the U.S. FDA during an internship in 2009/2010. During

the internship, I started to use this data to investigate the trade effects of U.S. product standards on my own initiative. Joint with Raquel Artecona from the UN-ECLAC Washington Office, we wrote a working paper on the effects of United States food safety and agricultural health standards on agro-food exports from Latin America and the Caribbean using the FDA import refusals database (Artecona and Grundke 2010). For this project, I had matched the unique product classification of the U.S. FDA to the Harmonized System (HS) product classification used by the U.S. International Trade Commission (ITC) at a very aggregate level resulting in 8 matched product sectors (Artecona and Grundke 2010).

Matching procedure combining product classifications from the FDA and the Harmonized System (HS)

As described in the data section of the chapter, I tried to aggregate import refusals to the most fine-grained product-group for which a consistent match between the FDA and the Harmonized System (HS) classification is possible. The guiding principle for this careful matching procedure has been that any FDA product code uniquely falls into the assigned HS product categories. In general, I tried to match FDA product codes to HS 4 digit codes and preserve as much detailed information as possible. For some matched groups, I had to use additional HS 5 or HS 6 digit information. I succeeded in matching all FDA regulated products to the corresponding HS categories. For medical devices and radiation emitting products, the constructed product-groups may include more HS products than necessary for matching, because it was not possible to isolate FDA regulated products at the HS 6 digit or even at the HS 10 digit classification. The exact mapping for our 93 food and non-food product groups is documented in Table A1.17.

For the matching procedure, I used the Harmonized (HS) Tariff Schedule of the United States (U.S. ITC 2012) and information on FDA product codes from the FDA product code builder (FDA 2012a, FDA 2012b). The FDA product code consists of five elements. The first element is a two digit industry code that ranges from 02 (whole and milled grain and starch) to 98 (tobacco products). The range of products included in the FDA product classification is smaller than in the HS classification because the FDA regulated products only comprise food, drugs, cosmetics, medical devices, electronic items that emit radiation, vaccines, blood and biologics, animal feed and veterinary, and tobacco products (see the background section in the chapter). The second element of the FDA product code is the product class, an alpha character describing a sub-group of products that is specific to each industry code. For example, the seafood products industry (industry code 16) comprises the product classes fresh, smoked and breaded fish

among others. The third element of the FDA product code defines the product sub-class that again is an alpha character and specific to each industry and product class. For most products, the sub-class describes the material the container or the packaging of the product consists of. The fourth element of the product code is the Process Indicator Code (PIC) that describes the manufacturing process of the product or the storage type. This PIC is also specific to each product industry and class. Finally, the fifth element of the FDA product code consists of two characters that may contain numeric or alpha values and indicate the detailed product. For example, in the fishery products industry and the product class smoked fish one specific product could be swordfish, tuna or tilapia among others. The HS product classification system is a classification system commonly used in international economics and I will not describe this product classification system in detail (see U.S. ITC 2012).

In principle, I tried to match the first two elements of the FDA product codes, which comprise 2 digits and on alpha character, to HS 4 digit product categories. However, due to the fundamentally different classification system of the FDA, for many products it was impossible to establish this correspondence. For example, although the industry code 16 (seafood products) includes product classes like C (Fish, Cakes, Balls, etc.) and D (Smoked fish) that could easily be allocated to HS 4 digit categories 1604 and 0305, respectively, it also includes product classes like A (fish), W (Mixed Fishery/Seafood Products), X (Aquaculture Harvested Fishery/Seafood Products) and Y (Fishery Prod, n.e.c.) that include all kinds of fresh and prepared seafood products (indicated by the fifth element of the FDA product code). For example, 16A includes fresh swordfish (16A42) but also Korean dried fish seasoned with spices (16A99). 16X includes all kinds of different seafood like shrimps, alligators, salmon, catfish etc. Thus, to be able to maintain a sufficient level of disaggregation for the product classification mapping, I had to use the fifth element of the FDA product group code (in addition to the first and second element) for matching the product classes 16A, 16W, 16X and 16Y to corresponding HS categories. This was quite time consuming because every product class contained over 200 single products. I had to look at every single product in the FDA classification to decide to which HS 4 or 6 digit category it corresponds. In many cases, I had to look up product names and descriptions in the internet to gather sufficient information for this decision. For vegetables and fruits, I even had to use the third and fourth element of the FDA product code (in addition to the first, second and fifth element) to be able to match the products to HS 4 or 6 digit categories.

It was also very complicated and in some cases impossible to locate single products within the HS classification even at the 10 digit level (especially for medical devices

and electronic items emitting radiation). Thus, I often had to choose more aggregated HS categories as correspondence (mostly at the 4 and 6 digit level), where I could be sure that the respective FDA listed product is inside this HS category with certainty. The consequence of this procedure is that some of our newly constructed product groups may include more HS products (and thus more trade flows) than necessary for matching. However, we think that this is the better alternative compared to a matching procedure where FDA product categories from one newly constructed product group may partly correspond to trade flows in another newly constructed product group. In our matching procedure all newly constructed product groups include all corresponding trade flows for the assigned FDA product categories with certainty. The detailed mapping of FDA and HS product classification for two of our newly constructed product groups can be found in Table A1.17. My Co-Author and I decided not to publish the complete mapping table before the article is published in a scientific journal. Currently, we are working on the revision of the article because we received an invitation for a revise and resubmit at the Journal of International Economics.

Data cleaning and other matching procedures

After having established the detailed mapping between the FDA and the HS product classification, I still had to clean the FDA import refusals data, construct several new variables and match the data with the U.S. sectoral import flows from the U.S. ITC by country, year and newly constructed product group.[34] In addition, I matched the constructed database that combines U.S. import refusals and import flows at the product-group-level with several other databases. Most of these additional databases we used for earlier empirical specifications are not shown in the current paper, because the fixed effects in our specification already control for all those variables. However, the European Union Rapid Alert System for Food and Feed (EU-RASFF) database, which includes import refusals and notifications for food and animal feed products for all EU member countries, comprises an important part of our empirical strategy. The EU-RASFF database uses yet another unique product classification and I had to match this classification to our newly constructed product groups (Tab. A1.18). These procedures together took another six months, especially due to many coding errors in the refusals database, differing country codes across datasets and the time consuming cleaning and matching

[34] Furthermore, I matched U.S. import refusals with U.S. import flows by port of entry (in addition to country, year and newly constructed product group), which required an exact mapping of U.S. ports of entry from the FDA classification with ports of entries reported by the U.S. ITC. I also prepared a dataset that matches U.S. import refusals and import flows on a monthly basis, which was possible because the U.S. ITC reports U.S. trade flows on a monthly and a yearly basis. This matching was not straight forward due to many products not appearing every month in the FDA database and I had to change the matching do-files. However, in the current paper we decided to use neither the information at the port level nor the monthly data, but we plan to do so in future projects.

procedures. In the following, I will describe the data cleaning for the import refusals data and the different matching procedures.

The raw data of the Import Refusals Report (IRR) from the FDA website does not include an exact definition of a refused shipment regarding the quantity of the shipment. One inspected and refused physical shipment of goods may result in different entries in the IRR database, because each item with a different tariff description has to be listed in a separate line in the entry documents at the U.S. border (the import line or "entry line"). We follow Buzby et al. (2008) in defining each entry line in the IRR database as a refused shipment. As stated in the paper, there is no information on the quantity or the value of the refused item in the IRR database. The raw data I obtained from the UN-ECLAC in 2011 included several hundred observation pairs with the same entry line but different dates as well as observations that were absolutely identical. I had to apply a cleaning procedure to correct that. In addition, if an imported item was refused due to several charges, each charge appeared as a separate entry in the database from the UN-ECLAC. Thus, I reshaped the database defining each item with a unique entry line as one shipment independent from the number of charges that led to the border rejection. This reshaping and the data cleaning procedure were not necessary for the data we obtained from the FDA website in 2012 because this data was already consolidated. However, one problem still existed in the data from the FDA website. In 2011, twenty incidences were reported for the same firm from Mexico exporting medical devices to the U.S. that recorded several thousand different refused entry lines (imported items) at the same date due to the same refusal charge of "No notification to FDA" for the same product (surgery tray). On 10 August 2011, there were 20684 refused items and on the other 19 dates around 2000 to 3000 refused items were recorded. Because the average number of refusals for Mexico per year across all product categories is around 2000, we had to exclude those cases from the analysis. I had contacted the responsible person for the IRR database at the FDA and he could not explain those cases. A possible explanation could be that FDA officers at the border changed their approach for registering the items of surgery trays during those 20 incidents for this special company from Mexico and opened the surgery trays to register each single item separately. After excluding those cases, the raw data from the IRR database from 2002 to 2012 was reduced from 268212 to 209334 refused entry lines.

After finishing the data cleaning, I constructed new variables that include the sum of refused items per exporting country and year for different levels of aggregation of the FDA product code. Using those variables, I applied the matching code described above and presented in Table A.1.17 to aggregate refusals into our newly constructed product

groups. The next step was to download the U.S. import flows for several levels of aggregation of the HS classification system from the U.S. ITC website and aggregate the trade flows of single HS categories to our newly constructed product groups. To match import refusals with import flows by country, year and newly constructed product group, I still head to deal with the issues of differing country codes and countries not appearing in one or the other dataset. Country codes for countries from Ex-Yugoslavia, for Burma, South-Sudan, Palestine, North Korea, Taiwan and several island states differed between the datasets. I could also retrieve missing country information for around 200 observations in the FDA dataset from other string variables in the FDA dataset. Furthermore, in the FDA dataset, overseas territories from Great Britain, France, the Netherlands or the U.S. appeared that were subsumed under the former colonial power in the U.S. ITC trade flow dataset. I assigned import refusals of those overseas territories to the former colonial power to be able to consistently match refusals with U.S. import flows.

For the empirical specification, we decided to additionally distinguish between refusals due to different groups of charges as well as between refusals based on a product sample analysis and refusals without such sample analysis. We used two classifications for groups of charges. The first one is included in the FDA dataset and categorizes charges into adulteration and misbranding. Because many refused items report several charges for the refusal decision, we decided to assign a refusal into the adulteration group, if at least one charge was an adulteration charge. Thus, refusals fall into the misbranding group, if no adulteration charge was reported. For the second classification, I looked closely at the description of every single charge of the 230 different charges reported in the FDA dataset and created a third category (next to adulteration and misbranding) that includes charges due to missing certificates of conformity assessment. However, due to insufficient descriptive information on some single charges in the dataset, we opted for the classification provided by the FDA to avoid introducing measurement error. To distinguish between refusals based on a product sample analysis and refusals without such sample analysis, we used a variable included in the dataset that indicates whether a private sample analysis, an FDA sample analysis or no sample analysis had been conducted to inform the refusal decision. We aggregated refusals based on a private and on an FDA product sample analysis into one group. To construct the dataset for those different types of refusals, I used the same procedure as described in the last paragraph summing refusals per exporting country, year, FDA product code and additional classification variable for refusal charges or for product sample analysis. It was not trivial to apply the programmed matching code for these subsets of refusals, because not all FDA

products were included in each subset of the data and I had to adjust the programmed matching code accordingly.

Another important task was to match the constructed database with additional information from external databases. The most important one was, as already mentioned above, the EU-RASFF database, which includes import refusals and notifications for food and animal feed products for all EU member countries. The EU-RASFF database does not use any product classification and only includes the product description within a longer text, which also describes the reason for the refusal, the corresponding legislation, the reporting country and the source country of the refused product (EU-RASFF 2012). Due to time constraints for my Ph.D., it was impossible to isolate the product description from the text and match every single product to our newly constructed product groups. Instead, I matched the classification of products into 36 aggregated product groups in the RASFF database with our 93 newly constructed product groups into 17 new aggregated product groups (Tab. A1.18). In addition, I matched the constructed database to several other external databases. The main issue for matching was that country codes differed between databases and I had to match different country classifications. I matched our database with data on variables commonly used in gravity equations from the French research institute CEPII, with data on trade cost and country variables from the World Development Indicators of the World Bank, with macro data at the country level from the World Economic Outlook database of the International Monetary Fund, with trade data on total exports for all countries of the world from UN-COMTRADE and the World Integrated Trade Solution (WITS) from the World Bank, with variables for institutional quality from a dataset used in La Porta et al. (1999) and with data on typical gravity equation variables used in Helpman et al. (2008). Because we decided to use country-product, country-time, sector-time and country-group-sector-time fixed effects in our final empirical specifications, we could not include all those additional variables in the specification because they are picked up by the fixed effects.

2 Export price shocks and rural labor markets: The case of cotton in Tajikistan[35]

2.1 Introduction

Much of today's consumption relies on a global supply chains that link consumers to producers worldwide. Occasional media attention reminds consumers in industrialized countries of the weakest link in this supply chain: Workers in the labor-intensive manufacturing, agriculture and mining sectors of developing countries who toil for little pay under harsh working conditions. Workers (and firms) are especially vulnerable in sectors such as staple food, cotton and mining where global commodity prices are fluctuating.

The welfare enhancing effect of trade is among the fundamentals of economics. A growing literature has analysed the wage effects of openness, especially with respect to shifts in skill requirements (Costinot, Vogel and Wang 2012). This literature has documented ambiguous wage effects across skill groups (Wood 1997; Attanasio, Goldberg and Pavcnik 2004; Krishna, Poole and Zeynep Senses 2012), production stages (Costinot, Vogel and Wang 2012) and gender (Juhn, Ujhelyi and Villegas-Sánchez 2013). The largest part of the literature has focused on structural changes in manufacturing following waves of trade liberalization. Recent papers have taken a closer look at the effect of trade liberalization on local labor markets (Kovak 2013) and the role of exporting firms. Firms have been thought to contribute to wage inequality either through export premiums (Krishna, Poole and Zeynep Senes 2012) or through heterogenous wage setting mechanisms (Amiti and Davis 2011). Another strand of the literature has exploited exchange rate and world market price fluctuations to study short-run shocks to trade. World market prices in agriculture have become especially volatile owing to weather shocks and misguided trade policies, often with ambiguous effects on the poor (Ivanic and Martin 2008; Anderson et al. 2013). In this paper we demonstrate how short-run world market price fluctuations affect the lives of the poor at the bottom of a global supply chain. Our focus on cotton sheds light on the agricultural sector, which has received disproportional attention in trade studies (Costinot, Vogel and Wang 2012) while providing the major source of income for three quarters of the world's poorest (World Bank 2007). Our focus on non-food agriculture allows identifying the effect of price changes on workers welfare, because fluctuating prices have unambiguous effects on

[35] This chapter was co-authored by Alexander Danzer. While we wrote the introduction, the background and the results section together, it was my task to write the remaining sections and to design the theoretical model. The idea of the research project and the empirical strategy were developed jointly. Alexander Danzer accessed the TLSS 2011 dataset, while I collected all additional datasets. It was my task to clean and construct the panel dataset, to perform the regressions and to organize and conduct the field research stay in Tajikistan.

the poor. Hence, our research circumvents some of the problems of analyzing staple food production in which many households in the developing world are involved both as producers and consumers (Barrett and Dorosh 1996; Swinnen and Squicciarini 2012). Our use of labor force and household data complements a literature that has mostly relied on industry level data. And finally, our focus on short-run effects of cotton world-market price fluctuations fills a gap in the literature concerning the shock exposure of the weakest link in global production. The history of price hikes in the global cotton market goes back to the American Civil War and has experienced several ups and downs since then (Deaton 1999). The last cotton price surge took place during the 2010/2011 season, when China (the largest cotton producer and consumer) had to double its cotton imports after a severe crop failure (Table 1).

Our paper exploits this last price episode to investigate the following questions: First, how do market fluctuations for internationally traded commodities affect the weakest link of the global production chain in the garment and textile industry: the cotton pickers? Second, how do market distortions in export oriented sectors in developing countries affect the pass through of world market price fluctuations? We will particularly focus on the heterogeneity between big and small firms, because large (parastatal) cotton farms are strongly controlled by local political elites and face perfectly elastic labor supply (relying on political connections to recruit workers, students and children during harvest time). Small private farms hire cotton pickers in local labor markets which are characterized by upward sloping supply curves. They tend to act more entrepreneurial on the productive side and have clearly defined individual land titles. The Stolper-Samuelson theorem suggests that a relative rise in the price of cotton increases the relative remuneration of the factor intensively used in the production of cotton (labor). We want to relate this important implication to the heterogeneity in local labor market conditions. Since cotton is mostly produced by women, distributional effects are given special consideration. Our paper illustrates how political interference in the labor market branch of the *production* process of export commodities inhibits the economic empowerment of poor farmers and landless agricultural laborers, and hence adds to a huge literature that has so far predominantly focused on political influences in the *export* process.

To answer the questions empirically we exploit regional differences in cotton production in Tajikistan. We combine this variation with a nationally-representative longitudinal household survey from 2007-11 that contains harvest labor earnings and wages of agricultural workers over time. The analysis is based on a difference-in-differences approach. The 2010/2011 world market price surge for cotton implied an exogenous shock

to the Tajik economy in which cotton is the most important export sector (next to aluminum) and generates roughly one third of total exports (FAO 2011). Owing to this price shock, the Tajik cotton production increased by 34 percent between 2010 and 2011 (FAO 2011, Fig. A2.6). Since Tajikistan is at the same time a small exporter of cotton (accounting for only 1 percent of total world exports), global price fluctuations are truly exogenous to the country.

Our paper contributes to the literature focusing on the link between trade exposure and poverty (Winters et al. 2004). While trade openness, trade liberalization and price fluctuations seem to have strong distributional consequences, the micro-level evidence regarding household farms and local labor markets is scarce (Goldberg and Pavcnik 2007). Notable exceptions are the studies of the impact of rice price fluctuations on child labor and household labor supply in Vietnam by Edmonds and Pavcnik (2005; 2006) which, however, feature households as joint producers and consumers of the exported commodity. By focusing on cotton, our paper can more directly disentangle pure price effects on income and employment. Our research further adds to the literature employing exogenous price variation and regional differences in the production structure of countries to identify exogenous labor demand shocks (Acemoglu et al. 2013; Angrist and Kugler 2008; Black et al. 2005; Chiqiar 2008; Kovak 2013; Topalova 2010). Unlike ours, none of the aforementioned recent papers has focused on a low income country despite the fact that these economies have been long known to suffer from especially narrow economic export structures (Massell 1964) that have made them highly vulnerable to commodity price fluctuations (Jacks, O'Rourke and Williamson 2011). At the same time it addresses the recently emerging empirical literature that exploits exogenous labor demand shocks to investigate local labor and production markets (Autor, Dorn and Hanson 2013; Kaur 2012; Greenstone and Moretti 2003; 2011). Another strand of literature that we contribute to focuses on the gender dimension of the labor market in developing countries. Our paper shares an important feature with the study by Qian (2008) who analyses the effect of increases in the price of tea on the sex imbalances in China: Similar to tea, cotton is predominantly picked by women, allowing us to focus on the economic fortunes of the most vulnerable group on the labor and production market. Finally, there exists a literature on export prices and their effects on households, which mostly employs CGE modeling to evaluate the effects of export taxes (e.g. Warr 2001, Warr 2002; for an econometric study see Hudson and Ethridge, 1999). Interestingly, Tajik authorities discussed the implementation of an export tax in 2011 to mitigate the effects of rising cotton prices for the small domestic cotton processing industry.

Our results indicate that the cotton world price hike benefitted workers in the cotton sector, but not in other agricultural production. In line with the predominant employment of women in cotton picking, we find that women benefit strongly from the price shock, while men gained close to nothing. At the same time, we observe an expansion of employment in the cotton sector at the extensive margin. While more women entered the labor force and paid employment, working hours at the intensive margin only slightly decreased. These findings suggest that the substitution effect dominated the income effect at the household level—which is in line with previous evidence for other developing countries (Edmonds and Pavcnik 2006).[36] The results of our falsification exercise indicate no relative changes in the remuneration of non-agricultural workers in cotton compared to non-cotton regions, suggesting that there are no unobserved omitted regional wage trends. A Placebo-Test for the pre-shock period 2007-2009 shows no differential effects in agricultural wages between cotton and non-cotton regions and lends further credibility to our results.

Interestingly, our findings are dominated by workers on small private family farms. Workers on big cotton farms do not gain from the price shock, although harvest labor demand increased on both farm types. This indicates that the effect of the price shock operates through the heterogeneity in local labor markets. In order to attract more workers for the increased cotton production, small family farms use economic incentives. This translates very directly into higher wages of cotton pickers on these farms. Thus, the cotton price hike does not only benefit smallholders and their families, but also the poor landless females from local villages, who work in the cotton harvest as daily laborers. Workers on big cotton farms, to the contrary, do not gain from the export price hike because they emanate from perfectly elastic labor pools or from coerced labor. Furthermore, we find that monthly earnings of managers of big cotton farms increase strongly in response to the price shock, whereas earnings of small farm managers do only slightly increase. The results of our quantitative analysis are supported and complemented by qualitative interviews with farmers and other public and private agents in the Tajik cotton sector, which we conducted in Tajikistan in March and November 2014.

The remainder of the paper is structured as follows: Section 2 gives an overview over the case study, Tajikistan and its cotton sector. Section 3 presents the empirical methodology and the new panel data set. Section 4 describes and discusses the preliminary results, while Section 5 concludes.

[36] In one sub-section of the next chapter, I will analyze this issue in more detail.

2.2 Tajikistan and the cotton sector

Tajikistan is a landlocked lower income country in Central Asia, located between Afghanistan, China, Kyrgyzstan and Uzbekistan. In the year 2011, the country ranked 150 out of 185 in terms of GDP per capita PPP according to the IMF. Hence, Tajikistan's GDP per capita PPP is less than one fourth of China's and only one twenty-fourth of the USA. Tajikistan is populated by 7.6 million inhabitants. Around 67 percent of its working population is employed in agriculture, the least paying sector of the economy (van Atta 2009). In rural areas, where the economically active population mainly consists of women this share comes close to 100 percent (FAO 2011). Male labor is missing due to large-scale labor emigration (Danzer and Ivaschenko 2010). Most of Tajikistan's territory is hilly or mountainous, making cotton production only feasible in some sharply defined regions. Cotton relies on specific climatic and geographic preconditions leading to a concentration of growing areas in the few flat regions below 1000m above sea level which command irrigation as well as transport infrastructure (Fig. 2.1). In 2007, 29 percent of the total cultivated area of 891126 ha was cropped with cotton (TajStat 2012). Apart from cotton, wheat, fruits and vegetables are important crops in Tajikistan that grow on all parts of the cultivated land (FAO 2009). Nevertheless, Tajikistan is highly dependent on wheat imports from Kazakhstan and other neighboring countries and the world price for wheat strongly affects domestic prices (USAID 2011). Production of vegetables (mainly potatoes) and fruits takes predominantly place at household plots and for local consumption (FAO 2011).

In the world market for cotton lint, Tajikistan is a small player exporting only around 1 percent of total world exports (Table 2.1). Given Tajikistan's minor role on the global stage, we treat the export price for cotton as exogenous to Tajikistan. In the agricultural season 2010/2011 the world market for cotton was disturbed by a serious drought in China: The global leader in cotton production (around 30 percent) and consumption (around 40 percent) doubled its cotton imports from 2010 until 2011. From July 2010 until March 2011 the world cotton price more than doubled (Fig. 2.2). This led to an increase in cotton production in Tajikistan in 2011 by almost 40 percent (Fig. A2.6), reversing the decade long declining trend that was owing to the country's lack in investments to modernize irrigation and infrastructure and the shift towards food production (Akramov and Shreedhar 2012). The cotton area harvested increased by almost 30 percent in 2011 (Fig. A2.6), whereas the area harvested with wheat and other crops decreased by the same amount (FAO 2011, Fig. A2.8, TajStat 2012).

Tajikistan's most important export commodity (next to aluminum) is cotton which is produced in a 'contract farming' relationship between strong futurists, farm managers,

political decision makers and weak small private farmers as well as agricultural laborers.[37] The structure and deficiencies of cotton production in Tajikistan share many similarities to the sector worldwide (Brambilla and Porto 2011; Kranton and Swamy 2008). Although the country generates around 30 percent of yearly export revenues from cotton, it remains a small producer globally (FAO 2011). During the Soviet era the cotton industry comprised big state-owned farms (*kolkhozes* and *sovkhozes*) which recruited additional agricultural laborers during harvest time. Forced labor of students and child labor were widespread (ILRF 2007). Five years after independence in the year 1991, the privatization of cultivated farmlands was officially initiated for all 832 state-owned farms. Until 2007, the central government had turned 77 percent of the cultivated area of Tajikistan into private ownership. 23 percent were still cultivated by big state owned collective farms, which are officially registered as agricultural enterprises. They predominantly grow cotton and accounted for 37 percent of the total cotton production in 2007 (Sattar and Mohib 2006, FAO 2009, Fig. A2.20).

The privatized farmland comprises small household plots as well as bigger peasant farms (in Tajik *dehkan* farms), whereby 22 percent of the cultivated area was distributed to household plots and 55 percent to dehkan farms in 2007 (Fig. A2.9-A2.11). Household plots, which had already existed before 1991 cultivating around 10 percent of farmlands, have an average size of 0.3 hectare and exclusively produce food crops for subsistence consumption and local domestic markets (Lerman 2012; FAO 2009). In contrast, dehkan farms are larger entities created during the privatization process that produce, besides wheat and other crops, 63 percent of the total cotton production in Tajikistan (FAO 2009). Regarding farm size and organizational structures, a strong heterogeneity exists within dehkan farms that can be categorized into two main types: individual/family dehkan and collective dehkan farms (Lerman 2012, FAO 2009).

Collective dehkan farms are large (generally > 20 hectares) private (or parastatal) cooperatives created by the state farm restructuring method: The land was officially transferred to the cooperative of farmers which had previously formed a brigade. Farming decisions are taken by a farm manager who in most cases had already headed the brigade of the state-owned farm and who is *de facto* authorized by the local government for life. In effect, these farms experienced little change in their incentive structures and strongly resemble the state owned agricultural enterprises. Individual farmers and workers receive a low wage that is mostly paid on a daily basis for specific activities. Thus,

[37] Futurists are intermediate cotton traders that pre-finance cotton production by supplying inputs in kind to farmers and taking the future cotton harvest as collateral. Mostly, those futurists collude with local cotton gins and in kind credits have to be repaid in raw cotton (Sattar and Mohib, 2006, van Atta 2009).

monthly wages are not fixed and vary according to seasonal farm activities. In addition, individual farmers are allowed to use a small share of the collective land to grow food crops for subsistence consumption. The farm manager decides on the procurement of crop inputs, marketing of outputs and financial management, e.g. on how to share profits within the collective dehkan farm (Sattar and Mohib 2006). In addition, strong reciprocal relationships exist between the farm manager and local governments. In many sub-districts, collective dehkan farms still support social services like hospitals, schools and kindergartens, for which the state owned collective farms had been responsible in Soviet times. During the privatization process, these social services have officially been transferred to local governments, but without compensating them with sufficient financial resources (Sattar and Mohib 2006, Kassam 2011). In exchange, local governments support the cotton harvesting activities on collective dehkan farms and state owned enterprises by sending state employees, students and school children to the cotton fields (van Atta 2009, ILRF 2007, Appendix 2 D). Furthermore, strong rent seeking networks exist between farm managers of big farms, local governments, cotton ginneries and trading firms that are explained in more detail below.

Officially, the individual farmers of the collective dehkan farm are shareholders of the farm and have the right to opt out of the collective using their respective land shares. However, individual property rights on land do not exist in Tajikistan. The State Committee for Land and Geodesy (SCLG) issues a collective land using certificate in the name of the farm manager with a list of the shareholder names. This collective land using right is valid for a period of 5 up to 20 years and only specifies the size of the plot for each shareholder (on average around 0.6 hectares), but no precisely defined land claim. Thus, if shareholders want to opt out of the collective dehkan farm, the farm manager has a strong incentive to only hand out marginal plots with low soil quality and bad irrigation infrastructure (van Atta 2009, Appendix 2 D). Other factors impeding shareholders to opt out of the collective dehkan farms are credit constraints, lack of agricultural and entrepreneurial knowledge, social norms and political pressure. In reality, shareholders and their families are strongly tied to the collective dehkan farm and are exploited to increase the rents from cotton exports appropriated by their managers, local governments, futurists and cotton gins (Sattar and Mohib 2006, van Atta 2009). The situation on state owned agricultural enterprises strongly resembles the one on collective dehkan farms and we will classify those two farm types as one farm type of big farms (>20 ha) throughout this paper.[38]

[38] Interviews with GIZ officials in Tajikistan as well as World Bank (2012) suggest that the only reliable criterion to identify collective dehkan farms and agricultural enterprises (with their specific organizational and incentive structure) is farm size, specifically a farm size bigger than 20 hectares or a number of shareholders bigger than 25.

In contrast, private individual and family dehkan farms have sizes ranging between 2 and 20 hectares and command well defined and inheritable land using rights for 99 years. During the privatization process, international donors have pressured the Tajik government to further split up collective dehkan farms into smaller entities with better defined land titles to reduce the government influence in growing decisions and to increase the market orientation of agricultural production (Sattar and Mohib 2006, World Bank 2012). Alongside efforts of other institutions, the World Bank has implemented a Farm Privatization Support Project (FPSP) in several pilot districts, where 10 state owned collective farms covering around 17 000 hectares were split up. Equal per-capita acreage (on average about 0.6 hectares) was distributed to all members of a brigade of the privatized state-owned farm by lottery and inheritable but not tradeable land use certificates were allocated to individual farmers (Sattar and Mohib 2006). Farmers also received training on the entire set of farming tasks on demonstration plots, because in Soviet times farming was highly specialized and individual farmers had very little general agricultural knowledge. Mostly, members of the same family pooled their land shares and founded a family dehkan farm that ranges between 2 and 20 hectares. Shareholders of these small private individual and family dehkan farms command much more freedom over production and investment decisions on their land than shareholders on bigger collective dehkan farms (Sattar and Mohib 2006, World Bank 2012). Unlike in big farms, there is a direct pass-through of cotton proceeds to the farmers. Hence, due to less political interference and well-defined land using rights, they act more entrepreneurial and this may explain why there are no productivity differences between the farm types, in spite of possibly larger effects of scale on bigger collective dehkan farms and state owned agricultural enterprises (Tab. 2.2, World Bank 2012).[39] Throughout this paper, we will classify private individual and family dehkan farms as small private farms (<20 ha).

Regarding the division of the cultivated area into state owned agricultural enterprises, dehkan farms and household plots, the privatization process came basically to a halt since 2007. The share of the area cultivated by big state owned agricultural enterprises has only slightly decreased from 23 percent in 2007 to around 18 percent in 2011 (Fig. A2.10). The share of land cultivated by private and collective dehkan farms increased from 55 percent in 2007 to 60 percent in 2011 and the share cultivated by household plots remained around 22 percent during that time period (Fig. A2.9, A2.11). Unfortunately, the Tajik Statistics Agency does not report any statistics for sub-categories with-

[39] Importantly, changes in productivity which are typical for post-privatization periods will not influence our estimates of the price shock which took place in 2011 (Pavnik 2002).

in the dehkan farm category. However, the Food and Agricultural Organization (FAO) reports that in 2006 and 2010 two thirds of the area under dehkan farms was cultivated by small private dehkan farms and one third by collective dehkan farms (FAO 2009, 2011; Tab. 2.16). This indicates that the privatization process with respect to further splitting up the collective dehkan farms has not progressed much from 2007 until 2011. Furthermore, during a research stay in Tajikistan we obtained statistics from the Tajik State Committee for Land and Geodesy (SCLG) on the number of SCGL-certificates handed out to new private farms with less than 25 shareholders at the sub-district level for the years 2007 until 2011. From 2007 until 2011, the SCLG project was the biggest project trying to further split up collective dehkan farms into smaller private family dehkan farms (Lerman 2012).[40] Measured by the number of newly issued certificates, the privatization process decelerated from 2009 until 2011 compared to 2007 until 2009 (Fig. A2.12). We use these statistics at the sub-district level to control for the heterogeneity of the privatization process across sub-districts in our regressions. Furthermore, we control for all institutional changes at the province level by including province-year dummies and for all time-invariant institutional characteristics at the district level using district dummy variables.

Effectively, the cotton growing sector fragmented into two types of farms (small private vs. big para-statal farms) which use comparable production techniques and land qualities. Cotton yields and efficiency are comparable between small and large farms (World Bank 2012, Tab. 2.2). This is also reflected in the output shares: From 2007 until 2011, the share of Tajikistan's cotton production originating from dehkan farms and state-owned enterprises closely tracks their respective share in area devoted to cotton production (Fig. A2.19, A2.20).[41] In most sub-districts, both farm types exist (Kassam 2011, Fig. A2.14). During the harvest season, all types of farms require additional wage workers for cotton picking, which is the most labor intensive production step. It is predominantly performed by women (and children) because male labor is missing (due to the

[40] Although we do not dispose of statistics from other privatization projects like the World Bank Land Registration and Cadastre System for Sustainable Agriculture Project (LRCSP), we think that the SCLG statistics are the best ones to describe the privatization on the ground in terms of real changes in the organizational and incentive structure of farms. In contrast to the LRCSP certificates that were handed out for free, farmers had to pay half of a monthly average wage of around 300 Somoni for a SCLG certificate for around 2 hectares. Because those certificates are only prerequisites for founding a new farm, farmers that obtained the SCLG certificate are more likely to really start their own family farm. In an interview with the former head of the commission responsible for the LRCSP, it became obvious that in most cases handed out LRCSP certificates did not actually lead to founding a new farm. Organizational structures of the collective dehkan farm did not change, although individual farmers had obtained the LRCSP certificates (also see van Atta 2009).

[41] Unfortunately, official statistics do not report figures for small vs. big collective dehkan farms. In Figures A2.19 and A2.20, the province around the Tajik capital Dushanbe (RRP) has a much higher share of cotton production and area on state owned enterprises. This is mainly due to the fact that still around 30 percent of the cultivated area is under state owned enterprises that mainly produce cotton. In addition, as far as allowed by local authorities, dehkan farms in this province produce other crops like fruits and vegetables because of the low transportation costs to the Dushanbe market.

Civil War 1992-97 and due to labor migration to Russia) and because of women's allegedly higher degree of dexterity. With a monthly pay of around 38 USD, cotton picking is among the worst paid economic activities in Tajikistan.[42] To the firms, wages make up between 3 and 10 percent of cotton proceeds within the production and marketing chain (Sattar and Mohib 2006). Integrated labor markets do barely exist in rural Tajikistan because managers on collective dehkan and state-owned farms exploit their own shareholders and their families as well as political connections to recruit cotton pickers. In effect, farm managers have access to an unlimited (sometimes involuntary) pool of workers from other parastatal and state-owned enterprises, universities and schools (ICG 2005, ICLG 2007).[43] Family *dehkan* farms hire at the local labor market and in the extended family. Mobility across local labor markets is extremely untypical as women in rural Tajikistan command a severely limited geographic action space and are often not allowed to work outside the local community. This is mainly due to the Islamic revival that prevents women from travelling without males from their family, who mostly migrated to Russia for work.

We will now describe the remaining facts on the institutional context of the Tajik cotton sector. Official cotton quotas which had existed since Soviet times were somewhat relaxed in 2007 (Akramov and Shreedhar 2012). Together with rising international wheat prices and a severe domestic shortage due to a drought in 2008, this lead to an immediate shift towards wheat production across all cotton growing regions and farm types in 2009 (FAO 2009, TajStat 2012, Fig. A2.8). Although private family farms have officially been granted free crop choice (not least to support the country's precarious food situation), local authorities, cotton future companies and cotton ginneries still try to push private farmers into cotton production through political pressure and the control of input supplies and credit (ICG 2005; van Atta 2009).[44] The system continues to resemble a futurist- and state-financed quasi-command agriculture (van Atta 2009) in which district authorities generate the largest fraction of their tax revenues from local monopsonistic

[42] In many cases, cotton pickers also receive the cotton stalks as in kind payments, which they use for heating (van Atta 2009). We also run regressions using wages in cash and in kind as the dependent variable and our results do not change. Results are not shown, but can be requested from the author.

[43] "Local officials do use coercive methods on teachers and children." "The kids have problems getting their books if they don't go pick cotton," Babadjanova said. "During exams and finals, they might have problems with their grades. Or there have been some cases, very rare, when the students [were] expelled from school for not going to pick cotton." (van Atta 2009) "Some adult government employees, including doctors and teachers, were required by Tajik authorities to pick cotton." (Department of State 2010)

[44] Another argument put forward is that farmers 'voluntarily' grow cotton because this is the only way to get access to loans for purchasing inputs (Kassam 2011).However, our interviews and collected data from farm head surveys in Tajikistan show that unofficially cotton quotas still exist in Tajikistan and are enforced by local authorities to ensure a steady supply of raw cotton for rent extraction (Tab. A2.17, A2.25).

ginneries.[45] Local futurist companies and cotton gins collude and provide credit and inputs for cotton growing at inflated prices while forcing farmers to enter future contracts with often unrealistically high production targets and low output prices. This futurist system of cotton financing resulted in increasing indebtedness of farmers over the last decade (van Atta 2009). Although these debts were written off in 2008, credit constraints still force farmers to grow cotton and use the crop as collateral for credit (van Atta 2009, Kassam 2011). For the period under consideration in this paper (2007-11), private family and collective dehkan farms as well as state-owned agricultural enterprises did not differ with respect to market power: All of them faced regional monopsony power of cotton ginneries.[46] Accordingly, farm profits and wages were suppressed at the expenses of ginning and loan costs, whereby managers of big collective dehkan and state-owned farms participated in the rent extraction system (Sattar and Mohib 2006).[47]

Cotton yields in Tajikistan are low by international standards, mostly due to aged or destroyed irrigation infrastructure. Somewhat simplified, the raw cotton is harvested, sold to the local cotton gin, processed and then paid according to the spot rate for cotton at the Liverpool Stock Exchange minus transportation costs (ILRF 2007; Kassam 2011). In 2006, there were 38 cotton gins in Tajikistan; every gin has a local monopsony for the surrounding district due to political pressure and quality constraints in transportation.[48] Most of the previously state owned ginneries were privatized in the year 2000, but are intertwined with cotton future companies and collude with local authorities to extract rents from cotton farmers (van Atta 2009). Tajik cotton ginneries are also quite inefficient compared to international standards. The turnover rate of raw to ginned cotton is about 30 percent at maximum (Kassam 2011). The ginneries exert their monopsonistic market power often by evaluating the quality of the cotton as too low

[45] The tax on ginned cotton is collected and can be exclusively spent by district authorities. Furthermore, many district authorities are heavily intertwined with the cotton sector (stakeholders of cotton gins or trading companies). Thus, district authorities have a strong incentive to prevent that farmers sell the raw cotton to gins in other districts. In 2011, district authorities were still closing the borders to neighbouring districts in harvest time (Kassam 2011, World Bank 2012, Interviews conducted in Tajikistan).

[46] Note a crucial difference to the market structure of the US: While the organization in collectives with horizontal market structures helped overcome the monopsonistic exploitation in the cotton sector of the Southern States, collectives in Tajikistan operate in vertically organized markets. Hence, farmers and collectives remain fully dependent on ginneries and trade intermediaries.

[47] As of 2014, small holders can now more freely make growing decision because credit constraints have been relaxed and local officials interfere less in the growing decision; nowadays ginneries and future companies provide incentives to small farmers to continue growing cotton. However, our interviews conducted in early 2014 in Tajikistan suggest that the internal market 'liberalization' started only in 2012/2013, hence after our observation period.

[48] As described above, local authorities force farmers to sell to the local cotton ginnery because they generate most of their tax revenues from ginneries and are often involved in the local cotton business. In addition, during transportation the quality of the raw cotton deteriorates decreasing the price paid by the ginnery. Selling the raw cotton to the ginnery of the neighboring district is very costly for the farmers (Kassam 2011).

and thus paying inadequate prices per ton of raw cotton. Finally, the processed cotton is exported.[49,50]

2.3 Theory

Based on the insights from the background section, we present a simple model in Appendix 2 C that captures the main features of the Tajik cotton sector and describes the pass through of the world cotton price surge to wages of cotton pickers. In this section, we will briefly introduce the model and discuss its implications that we test in our empirical analysis. We assume that there are two representative types of farms (small private vs. big para-statal farms) that produce cotton or wheat.[51] Both farms command the same constant returns to scale Cobb-Douglas production technology using the production factors land and labor.[52] The total land endowment per farm is fixed, because land markets do not exist in Tajikistan and farmers cannot increase land endowments in the short and medium run (van Atta 2009, Lerman 2012). Thus, the fixed amount of land is allocated between cotton and wheat production (Shumway et al. 1984). The second production factor labor is mobile between cotton and wheat production within the same farm type, whereby cotton is more labor intensive than wheat, particularly during harvest time. However, both farm types differ with respect to the characteristics of their labor supply curves. Small private dehkan farms face a competitive local labor market that comprises landless females from local villages, who are often not allowed to work outside the local community. In harvest time, small private dehkan farms in local labor markets compete for those female agricultural workers and, thus, their labor supply curve is upward sloping. In contrast, big para-statal farms are still heavily intertwined with local governments and receive harvest workers sent by the local government, which comprise workers employed in the public administration, schools, hospitals and other para-statal enterprises as well as students and school children (van Atta 2009, Interviews in Tajikistan). Those workers and the shareholders of the big farms are forced to work at the cotton harvest for minimum picking wages that are announced by district

[49] Tajikistan is only now trying to establish a textile industry. Major international customers of Tajik cotton are Russia, China, Latvia, Iran, and Switzerland. Tajikistan does impose a sales tax on cotton lint of 10 percent for exports and domestic sales, but non-tariff barriers do not exist. On March 2, 2013, the country has become the 159th WTO member and will gradually reduce tariffs on cotton and cotton fabrics (bound rate to decline from 25 to 20 until 2017) as well as on cotton yarn (bound rate to decline from 20 to 15 until 2016).

[50] The domestic freight traffic is operated by small private firms in a competitive environment (based on medium-sized trucks) (WFP 2005). Tajikistan is landlocked and its integration in international transport systems is inefficient due to a lack of investment. In the early 2000s, more than 80 percent of exports were exported by Tajik Railways through Uzbekistan which controls export routes and charges high tariffs (WFP 2005).

[51] Wheat is the main alternative crop grown by farms in cotton regions of Tajikistan (FAO 2009, 2011). In the model, we could also interpret wheat as an aggregate of other alternative crops.

[52] For simplicity reasons, we exclude other inputs like seeds or fertilizer. However, it is straightforward to include these additional inputs and the results of the comparative statics do not change.

authorities for each harvest season.[53] Hence, we assume that big para-statal farms face a completely elastic labor supply curve at the level of the official district-specific minimum wage.

As described above, cotton gins are regional monopsonists that do not discriminate between farm types. They collude with futurists to obtain the raw cotton from local farmers paying the same farm gate price for raw cotton to all farm types. After processing the raw cotton into ginned cotton, ginneries export the ginned cotton and receive the FOB export price, which basically equals the spot rate for cotton at the Liverpool Stock Exchange minus transportation costs (Kassam 2011, Fig 2.2).[54] Although ginneries apply several strategies to exert their market power, we think that the traditional mechanism of reducing the purchased quantity to lower input prices is the dominant strategy (van Atta 2009, Kassam 2011).[55] Thus, both farm types are price takers of the farm gate price for raw cotton offered by the local gin. Wheat and other crops are exclusively supplied to the domestic market, whereby both farm types are also price takers. They maximize their profits by deciding over the optimal share of land allocated to wheat and cotton production as well as the optimal use of labor given the production technology, output prices for cotton and wheat as well as the interest rate. Both farm types need to pre-finance the payments for the use of the production factor labor with the help of futurists and gins, because they solely receive the revenue from crop production several months after the harvest (Kassam 2011). As explained above, we simplify the model assuming that ginneries colluding with futurists do not exert their market power by influencing the interest rate, but through reducing the farm gate price for raw cotton. For aggregation and computation of the comparative statics, we further simplify the model by assuming that the area controlled by the local cotton gin equals the area of the local labor market, whereby both representative farms are active in this area and the total farmland is shared between both. Thus, both representative farms are aggregates of all single farms of their type within the local labor market and their labor demand equals the total labor demand of farms of that type in the local labor market.[56]

[53] Shareholders on big collective dehkan farms comprise the other part of the coerced labor pool big farms are able to exploit. Those mostly female shareholders are bound to the big farm by strong social and traditional norms, a lack of human capital and conscience about the agricultural reforms and their shareholder rights as well as missing economic resources (van Atta 2009).

[54] There are not more than ten big futurist companies operating in Tajikistan that also own or collude with the vast majority of gins (van Atta 2009, Interviews in Tajikistan). These futurist companies organize the export of the ginned cotton through their connections to international cotton traders.

[55] Kassam (2011) assumes that ginneries colluding with futurists additionally exert their market power through increasing the costs of credit for inputs or increasing input prices. However, this makes the model considerably more complex and does not provide additional insights on the labor market mechanism we focus on.

[56] This simple aggregation is possible, because we assume constant returns to scale.

It is straightforward to show that in this simple setting the monopsonist increases the farm gate price in response to a surge in the cotton export price to increase its profits by securing a rising supply of raw cotton (Appendix 2 C). The relative increase of farm gate prices for cotton relative to wheat leads farmers to enlarge the area sown with cotton and to reduce the area sown with wheat. Due to cotton being more labor intensive than wheat, this increases the labor demand for harvest workers on both farm types. Because small private family farms compete for picking workers at local labor markets, wages for picking workers on these farms rise in reaction to the cotton price surge. Big para-statal farms face a completely elastic labor supply curve and wages do not rise on those farms. This simple comparative static result is presented in Fig. 2.3 (for details see Appendix 2 C).

Thus far, descriptive statistics and qualitative evidence collected during a research stay in Tajikistan support important parts of this pass through mechanism. As argued above, the surge in the world market price of cotton from August 2010 until March 2011 by over 100 percent can be treated as exogenous to Tajikistan (Tab. 2.1, Fig. 2.2). The model predicts that this rise in the cotton export price should lead gins to increase the farm gate price for raw cotton. Indeed, during interviews conducted in Tajikistan in 2014, farmers and ginnery managers told us that the farm gate price had strongly increased in the harvest of 2010 as well as in future contracts offered by futurists and gins in the sowing period of 2011. Domestic prices for wheat and other crops did not show such increases (FAO 2011, Fig. A2.7). As predicted by the model, the relative increase of cotton farm gate prices led farmers to enlarge the area cropped with cotton in exchange for area cropped with wheat and other crops in 2011 (FAO 2011, Fig. A2.6, A2.8). In fact, Figures A2.15-A2.18, A2.21 and A2.22 show that small private as well as big collective dehkan farms and state owned agricultural enterprises increased the area cropped with cotton (FAO 2011).[57] Thus, farm managers of big farms as well as small private farmers seem to closely follow the world prices of cotton and base their growing decisions in early spring time on this information. This is further corroborated by Table A2.17 that shows that 71 percent of small farmers and 75 percent of managers

[57] As already mentioned above, the Tajik Statistics Agency does not report statistics for sub-categories of the dehkan farm category. However, in interviews with officials of the Tajik Statistics Agency, we obtained the presented data in Figures A2.21 and A2.22 on area cropped with cotton for dehkan farms smaller and larger than 20 ha at the province level. Unfortunately, we did not receive data on the number of small vs. big farms (or area cultivated by this farm types) at the province level and, hence, had to weight the data on cotton area harvested by some measure indicating the percentage of cotton area cultivated by small and big farms. We decided to use the share of agricultural workers on small farms per province computed from the TLSS dataset. Figures A2.21 and A2.22 corroborate the findings from Figures A2.15-A2.18 showing that agricultural enterprises as well as dehkan farms had increased area under cotton in 2011.

on big farms closely follow the world price of cotton.[58] Because harvesting cotton is much more labor intensive than harvesting wheat or other crops grown in Tajikistan (FAO 2009, 2011), the model predicts that the relative rise in area cropped with cotton should strongly increase the harvest labor demand on both farm types. However, due to both farm types facing different labor supply curves, this should only increase wages on small private farms, but not on big para-statal farms. Because cotton picking is mainly done by female, the wage increases on small farms should be mainly due to female agricultural workers. Furthermore, we expect that profits of managers on big para-statal farms should strongly increase in response to the export price shock. In the remaining part of this paper, we will test these predictions empirically using the dataset and identification strategy described in the following section.

2.4 Empirical methodology and data

Our data basis comprises the Tajikistan Living Standards Survey (TLSS) conducted by the World Bank and UNICEF in 2007 and 2009 and a follow up survey for 2011 conducted by the Institute for East and Southeast European Studies (IOS). All three waves were collected during the cotton harvest season so that we have comparable measures of labor market participation in cotton picking. In addition, the survey contains an array of household and individual level characteristics. The first wave in 2007 comprises a representative sample of 4,860 households living in 270 primary sampling units (PSUs). In the second and third wave, the sample consists of a representative sub-set of 167 PSUs and 1,503 households (Danzer, Dietz and Gatskova 2013). For the empirical analysis, we only use the households living in the 167 PSUs that are included in all three waves.[59] Unfortunately, the three waves of this potential panel household survey had not been matched at the individual level so far. During the matching procedure, we found many inconsistencies and errors in the identifiers at the individual, household and PSU level as well as in many other variables. The applied cleaning and matching procedures are described in Appendix 2 E. Using the corrected identifiers, I was able to match 6,097 individuals across all three waves, 1987 individuals across 2007 and 2009, 1,052 individuals across 2009 and 2011 and 769 individuals across 2007 and 2011. 10,088 individuals only appear in 2007, because the number of households per PSU was reduced

[58] In addition, during interviews in Tajikistan in 2014, many farmers told us that they base their growing decision in the sowing period (January until March) on the prices that prevailed during the last harvest period and until the sowing period. Farmers that do not have access to this price information mostly base their growing decisions on the profits made by themselves or by neighbors planting different crops during the last agricultural season.

[59] As a robustness check, we run regressions including the households living in the 103 PSUs excluded after 2007 and our results do not change. The results of this robustness check can be requested from the author.

from 18 to 9 in the TLSS 2009 and 2011 (Danzer et al. 2013).[60] Thus, our panel dataset includes 22,616 individuals and 38,618 individual-year observations, whereby 10,202 individual-year observations reported working.

We define cotton regions based on information about primary sampling units (PSUs/ communities) in the 2007 community survey that was conducted alongside the TLSS. PSUs in which cotton was reported as the first or second most important crop, are defined as cotton PSUs. Non-cotton PSUs are all remaining PSUs which are predominantly characterized by agricultural production (see Fig. 2.4 and Tab. A2.18 and A2.19).

As expected, cotton PSUs are characterized by lower altitude, better connectivity to federal or district capitals and by better infrastructure (roads, irrigation) than non-cotton PSUs while population size and school enrolment do not differ significantly (Tab. A.20).[61] Workers employed in agriculture in cotton PSUs comprise the treatment group. The control group contains agricultural workers in non-cotton PSUs. Table A2.21 presents summary statistics for the treatment and the control group in the year 2007. Building on the heterogeneity in labor supply faced by different farm types, we further refine our treatment and control group to agricultural workers in cotton PSUs at small private family vs. big para-statal farms, respectively. Summary statistics for this second definition of treatment and control group are presented in Table A2.22 for the year 2007. As robustness check, we use two additional definitions for cotton PSUs using external GIS data from the FAO GAEZ data base (FAO 2013) as well as a definition based on altitudes below 1000m sea level. The GIS data employ different criteria for soil quality, climate and other geographic characteristics to determine the suitability of arable land for cotton production (for details of these definitions see Appendix 2 B). We merge the GIS data with the geo-referenced PSUs in the TLSS 2007 survey.[62] As additional robustness check, we define treatment at the district level, whereby any PSU in a cotton district is defined as cotton PSU. We classify a district as a cotton district, if more than a certain percentage of PSUs in that district are defined as cotton PSUs. As thresholds we use 30, 50, or 70 percent.

Because of the cotton price spike in 2010/2011 and the increased cotton production in 2011, labor demand for cotton pickers should have increased strongly in cotton growing

[60] For more details see the Appendix 2 E. The selection procedure for selecting 9 out of the 18 households in the revisited 167 PSUs for the TLSS 2009 and 2011 was based on random sampling and should not influence our results (Danzer et al. 2013). However, we run regressions excluding the households that only appear in 2007 and our results do not change. These results can be requested from the author.

[61] In robustness checks, we control for these community level variables as well as control variables at the sub-district level for the year 2007 and our results do not change.

[62] The geo coordinates for PSUs in the TLSS 2007 were highly erroneous and we had to retrieve the correct information from Tajik websites and other open source websites (see the Appendix 2 E for more details).

regions in 2011. We expect wages of the treatment group (agricultural workers in cotton PSUs) to increase from 2009 until 2011 relative to the control group (agricultural workers in non-cotton PSUs). From 2007 to 2009, cotton prices slightly decreased and we expect a negative or no effect on wages of the treatment group relative to the control group (Fig. 2.2). Our empirical analysis uses two main specifications. We estimate the following model by OLS using only the sample of agricultural workers:

$$\ln(\text{realwageph})_{it} = \alpha + \beta_1(\text{cottonPSU} \times \text{year09}) + \beta_2(\text{cottonPSU} \times \text{year11}) + \beta_3\text{cottonPSU} + \beta_4\text{year09} + \beta_5\text{year11} + X_{it}'\gamma + \tau + u_{it} \quad (2.1)$$

for individual *i* at time *t*.

The dependent variable is the contemporary log real net wage per hour for individual *i* in year *t*.[63] As regional CPIs are unavailable, we deflate wages by national CPI and control for province-year dummies in the model (which also pick up other differential time trend across provinces). We interact the year dummy for 2011 with a dummy for cotton PSUs to capture the effect of the rising cotton price on the treatment group β_2 in the year 2011. The coefficient β_1 tests whether the wage growth between cotton and other agricultural workers differed already in the pre-price hike period from 2007 to 2009. In addition, the dummies for the years 2009 and 2011 and the cotton PSU dummy are included separately. The vector of control variables *X* includes gender, age, two dummies for middle and higher education (*secondaryedu* and *tertiaryedu*), three dummy variables for occupational group (*occhigh* stands for one-digit occupational codes 1-3, *occ4578* stands for one-digit occupational codes 4, 5, 7 and 8, *occagriskilled* stands for skilled agricultural occupations), a dummy for firm size indicating whether a firm has more than 50 employees (*firmbig*), and a dummy for state owned enterprises (*statefirm*). In addition, we include district fixed effects τ that control for all time invariant district specific characteristics, e.g. institutional characteristics that differ between districts but do not change in time.[64] The included province-year dummies control for time varying characteristics at the province level like economic activity, institutional changes and differing weather conditions. We also control for dummies of the interview month to

[63] In the survey, the variable wage is reported for the past month and hours worked for the last two weeks. As cotton pickers are paid daily wages, we use this information to compute the average hourly wage for the last month. Other information on labor market participation is measured for the last two weeks. However, wage payments in kind are reported for the last year. In a robustness check, we include average monthly in kind payments in the dependent variable wage and the results do not change. The results can be requested from the author.

[64] Tajikistan comprises 5 provinces (Oblasts), 58 districts (Hukumats/Raions) and 406 sub-districts (Jamoats).

capture seasonal effects.[65] In addition to the OLS estimation, we estimate each specification with individual fixed effects to control for unobserved heterogeneity at the individual level. Standard errors are clustered at the PSU/community level throughout all specifications.

The second specification is based on the full sample of agricultural and non-agricultural workers:

$$\begin{aligned}\ln(\text{realwageph})_{it} &= \alpha + \beta_1(\text{cottonPSU} \times \text{year09}) + \beta_2(\text{cottonPSU} \times \text{year11}) \\ &+ \beta_3\text{cottonPSU} + \beta_4\text{year09} + \beta_5\text{year11} + \beta_6(\text{agri} \times \text{year09}) \\ &+ \beta_7(\text{agri} \times \text{year11}) + \beta_8(\text{agri} \times \text{cottonPSU}) + \beta_9\text{agri} \\ &+ \beta_{10}(\text{cottonPSU} \times \text{year09} \times \text{agri}) \\ &+ \beta_{11}(\text{cottonPSU} \times \text{year11} \times \text{agri}) + X_{it}'\gamma + \tau \\ &+ u_{it} \qquad (2.2)\end{aligned}$$

The treatment effect is now captured by β_{11}, which reports the effect of the cotton price shock on agricultural workers (agri) in cotton PSUs compared to agricultural workers in non-cotton PSUs. The coefficient β_{10} tests whether there was a differential effect on agricultural wages in cotton PSUs compared to non-cotton PSUs in the pre-shock period. To investigate differences between small family vs. big para-statal farms, we will split the sample of all workers into workers at small (<25 employees) vs. big firms (>25 employees).[66] For an additional robustness check, we enrich the second specification by interactions with a dummy for working at a firm with less than 25 employees (*small*). To analyze labor supply adjustments to the price shock, we employ probit and linear probability specifications with a dummy indicating work in agriculture as dependent variable. In these specifications, we use the same explanatory variables as before and additionally include individual and household level characteristics that influence the labor supply decision.[67] The estimation uses the full sample of working age adults to

[65] The interviews in all three waves were conducted from September until November, whereby in 2011 a higher share of interviews was collected towards the end of the harvest season. Depending on the province, the cotton harvest starts at the end of August and lasts until mid of November. Because at the start of the harvest season a higher quantity and quality of cotton can be picked per day, daily wages are higher. Weather conditions in terms of rain also influence the quality of the picked cotton and, thus, daily wages earned. Because wages in the survey are reported for the last month, we control for seasonal variation in cotton picking wages by including dummies for the month of the interview in all specifications. Excluding those month dummies does not change the size of the coefficients and gives even smaller standard errors.

[66] As mentioned above, the only reliable criterion to identify collective dehkan farms and agricultural enterprises (with their specific organizational and incentive structure) is farm size, specifically a farm size bigger than 20 hectares or a number of shareholders bigger than 25 (World Bank 2012, Interviews with GIZ officials in Tajikistan).

[67] We exclude occupation dummies that are highly endogenous to the dependent variable working in agriculture. We additionally control for PSU and sub-district level characteristics in 2007 that may influence the labor supply decision. For robustness checks, we estimate the participation equation using only control variables appearing in the wage regressions and results do not change. The results of the wage regressions are also highly robust to including additional controls at the individual, household, PSU and sub-district level.

test whether new workers entered agriculture following the labor demand shock induced by the price shock.

Furthermore, we conduct various robustness checks for our main specification using additional datasets obtained during a field research stay in Tajikistan (see Appendix 2 B). We control for additional characteristics at the PSU and sub-district level before the price shock in 2007. We also test whether the privatization process may explain our results by controlling for the number of newly issued certificates for small farms at the sub-district level. Furthermore, we check whether our results may be explained by monopsony power of big para-statal farms in specific local labor markets by controlling for the share of agricultural workers on small farms per PSU. Further regressions address possible selection issues, look at profits of managers and try to identify the exact channel of the labor market mechanism by controlling for the area cropped with cotton per district. In addition, we estimate a measure of the price pass-through as the elasticity of wages with respect to the cotton price in an OLS framework:

$$\begin{aligned}\ln(\text{realwageph})_{it} &= \alpha + \beta_1 \ln(p_t) + \beta_2(\text{cottonPSU} \times \ln(p_t)) + \beta_3(\text{agri} \times \ln(p_t)) \\ &+ \beta_4(\text{cottonPSU} \times \text{agri} \times \ln(p_t)) + \beta_5(\text{agri} \times \text{cottonPSU}) + \beta_6 \text{agri} \\ &+ \beta_7 \text{cottonPSU} + X_{it}'\gamma + \tau + u_{it} \qquad (2.3)\end{aligned}$$

For cotton PSUs, we define the price p_t as the average cotton FOB export price in year t. For non-cotton PSUs, we define p_t as the average wheat CIF import price in year t, because wheat is the main crop grown in non-cotton regions of Tajikistan and domestic wheat prices closely follow international prices (USAID 2011). Thus, β_4 measures the pass-through of cotton prices to agricultural wages in cotton PSUs compared to the pass-through of wheat prices to agricultural wages in non-cotton PSUs. In this specification, we use the same explanatory variables as before. Instead of average yearly prices, we also run these regressions using average prices during the sowing period (January until March) as well as the average harvest price that prevailed two weeks before the respective interview. For robustness checks, we use world market prices for cotton and wheat instead of Tajik export and import prices.

2.5 Results

The world cotton price hike had profound consequences both for labor force participation as well as workers' incomes.

2.5.1 Results I: Participation in cotton harvesting

According to our theoretical considerations, high cotton prices during the sowing period of 2011 let many farmers shift their agricultural production from other crops (predominantly wheat) to cotton. This implies an expansion of agricultural area devoted to cotton and hence larger areas to be harvested in late 2011. Since the cotton harvest is much more labor-intensive than the harvest of other crops, farmers have to adjust their workforce in order to account for the larger crop areas. Based on these considerations we have predicted a relative expansion of the agricultural workforce.

Indeed, participation in the agricultural sector has substantially increased in areas which are suitable for cotton production (Table 2.3). Compared to the base year, the probability that an individual of working age was working in agriculture (note we have no particular information regarding the actual crops workers are dealing with) in cotton areas went up by 8 percentage points. This effect was concentrated among women whose attachment to agricultural employment increased by 10 percentage points (or 53 percent).[68] This is unsurprising as women form the vast majority of cotton pickers. These effects remain identical irrespective of whether we include individual fixed effects or whether we control for the district share of workers on small farms (in the total agricultural workforce). The unaffected result after including the latter control suggests that the workforce expansion took place across all cotton areas, no matter whether they were predominantly characterized by smallholder or parastatal farming structures.[69]

2.5.2 Results II: Effects on agricultural wages

Our main question of interest is whether cotton pickers actually benefitted from the global cotton price hike of 2011. Female agricultural workers in cotton PSUs experienced significant hourly wage growth at the times of high cotton prices, hence, capitalizing on the improved conditions for producers in the global production chain. Estimating specification (2.1) for the sample of agricultural workers, we find that the hourly wage rates of women in the agricultural sector increased by significant 44 log points due to the cotton price shock (Tab. 2.4 col. 3). Including all workers in the sample and estimating specification (2.2), we find that wage rates even increased by highly significant 61 log points (col. 9). The effect for male agricultural workers during the cotton price hike period is basically zero, again reflecting the fact that almost only women en-

[68] Table A2.23 shows that 19 percent of working age female in cotton PSUs were working in agriculture in 2007.

[69] For robustness checks, we also used the share of workers on small farms (in the total agricultural workforce) at the PSU level. The results are the same and can be requested from the author. Table A2.26 shows that the results hold, if we only use the control variables that are also included in the main wage regressions (gender, age and education dummies).

gage in cotton picking. Also note that there are no wage effects for the wave prior to the treatment year (2009) and for non-agricultural workers (col. 4-6), similar to the employment regressions. This supports our identification strategy which crucially relies on the common trend assumption between cotton and non-cotton PSUs. Once we account for potentially confounding unobserved heterogeneity by including individual fixed effects, the wage effects from the cotton price hike become even more pronounced in size and significance (Tab. 2.5). This result is important as our OLS estimates might potentially suffer from composition effects: If newcomers to cotton-picking were significantly more productive than the previous workforce, the positive wage rates could reflect productivity effects; however, all qualitative evidence from our focus group discussions suggests that famers tend to pay the same (hourly) wage rate to all of their pickers.

We now focus on the separate response between cotton pickers on small vs. big farms. To accomplish this we split the sample by farm size, defining small farms as those with less than 25 employees. As mentioned above, we chose this cut-off based on results from our focus group discussions and evidence from GIZ data, but also experiment with other cut-offs such as 16, 25 or 50 employees.[70] First, we estimate specification (2.2) separately for the subsample of small (<25 employees) and big firms (>25 employees) (Tab. 2.6). Second, we split the sample of agricultural workers into workers on small vs. big farms using the same cut-off and estimate specification (2.1) for each subsample separately (Table A2.27). Irrespective of the cut-off, we find wage gains for hourly and monthly wages exclusively for women on small farms while agricultural laborers on large farms and men do not benefit (Tab. 2.6, A2.28, A2.29).[71] The wage response appears quite substantial. Given that labor costs make up only 10-15% of total production cost in the cotton sector (Sattar and Mohib 2006), there is plenty of scope for other winners from the cotton price hike, and we will turn to other effects in subsection 3.

Elasticities

In order to quantify the effect of the cotton price shock in a more intuitive manner, we estimate the cotton price elasticity of agricultural wages using specification (2.3). We

[70] The TLSS dataset does not include information on the area cultivated by farms. The only available variable is the number of employees per firm, whereby we know whether the firm is an agricultural or a non-agricultural firm. As mentioned above, the only criteria to categorize farms into small private and big para-statal farms is farm size with the common thresholds being 20 hectares or 25 employees.

[71] Table A2.28 presents the results from Table 2.6 including individual fixed effects. The coefficient sizes are in the same ballpark, but standard errors increase. In addition, we also included a dummy for working at a small firm and its interactions with the cotton PSU, agri and year dummies in specification (2.2) and estimated this quadruple difference estimation with OLS. The results are very similar to the sample split results and can be requested from the author. Furthermore, we defined a small private farm using another question in the survey indicating whether an individual worked at a household enterprise. Using this definition gives similar results that can also be requested from the author.

construct a price measure that equals the average cotton FOB export price for cotton PSUs and the average wheat CIF import price for non-cotton PSUs during the year of the interview (alternatively, we also use average sowing and harvest prices) and regress real hourly log-wages on this measure.[72] The results show a slightly inelastic wage response for the average yearly and sowing price respectively, while during harvest time the response of female agricultural wages to changes in the cotton export price is slightly above unit-elastic (Tab. 2.7). According to our theoretical considerations, the sowing price elasticity should be the most relevant one, because wages in cotton PSUs rise due to an increase in area cropped with cotton and subsequent higher harvest labor demand. Using this elasticity, we can rationalize the results from Table 2.4 column 9, since

$$\Delta p \times \epsilon_{wp} \times \theta = 250\% \times 0.42 \approx \exp(0.61) - 1,$$

where Δp is the cotton price change between the sowing periods of 2007 and 2011, ϵ_{wp} is the cotton price elasticity of agricultural wages and the expression behind the approximately equal sign is the result from Table 2.4 column 9 expressed in percent.[73]

Income generation

Finally, we turn to the effect of the cotton price hike on income generation more broadly. By analyzing monthly earnings, we can shed light at intramarginal responses to increased wages (Tab. 2.8, 2.9). For instance, cotton pickers might well use their increased wage rates to afford more leisure, i.e. reduce monthly working hours. In essence, the tremendous changes to wage rates may not fully translate into income gains. We find some evidence on such a behavioral response: While monthly earnings increase for female cotton pickers in the fixed effects model (Tab. 2.9), the OLS results show only moderate increases which are not significantly different from zero at conventional levels (Tab. 2.8). This indicates that workers already working before the cotton price shock do only slightly reduce working hours. However, workers entering the labor force due to the cotton price hike work fewer hours than workers already on the labor market in 2007 and 2009.

2.5.3 Effects on other labor market subgroups

Besides female agricultural laborers, other labor market subgroups might have been directly affected by the price changes of cotton. Child labor in cotton picking has a long tradition in Tajikistan and beyond. During harvest time, entire schools were temporarily

[72] Results using the world prices of cotton and wheat yield basically identical results.

[73] As farmers and workers are predominantly paid on spot markets, using the elasticity w.r.t. the harvest price may be also reasonable. In this case, the estimated pass through would indicate a wage increase of around 150%, which seems to be too high compared to the estimates in Table 2.4.

closed in order to send school children to the fields (van Atta 2009, ILRF 2007). While this phenomenon has been on decline for several years, reports of involuntary child labor in cotton picking have not fully disappeared. We define child labor for youth below 18. Table 2.10 indicates a significant expansion in the incidence of child labor in cotton PSUs in the year of the cotton price hike. Across both sexes, the probability that adolescents work during the reference week in the harvest period is roughly ten percentage points higher. This effect becomes slightly larger once we control for the structure of farms in the district (i.e., by controlling for the share of small farm workers per district).

But were cotton pickers the only beneficiaries of the cotton price hike? In fact, if large parastatals were exploiting their political connections in order to attract cheap labor, where would the sharply rising revenues go? Our qualitative interviews suggest that farms increased their profits and that farm managers were benefitting from this. Just to illustrate this point, several small private farmers explained that managers of big farms purchased big cars as a consequence of higher revenues.[74] Here, we want to test this more formally by analyzing managers' earnings. Fortunately, we can additionally identify farm managers by combining individual occupation (e.g., manager or farm owner) with sector of operation (e.g., agriculture). We adjust our previous estimation strategy in a way to distinguish between employees and farm owners/managers. We estimate a quintuple difference estimator by enriching specification (2.2) with a dummy for working in a small firm and a dummy for being a manager (or the owner) as well as all interactions between these two dummies and the dummies for cotton PSU, working in agriculture and the year dummies.[75] We present the estimates for managers and employees separately for small vs. large farms in Table 2.11.

The earnings of farm managers increased disproportionally during the cotton price hike on both farm types, no matter whether we condition on individual fixed effects or not. In effect, while on small farms workers *and* managers see an increase in earnings, the only beneficiaries on large farms are managers.[76] Yet, the effect is fully concentrated in the male subsample. For women, who hold little management/ownership positions in our sample (only 37 percent of farms are run by a women), the estimate is imprecisely

[74] In general, profits of managers on big farms are much higher than for small holders (Sattar and Mohib 2006). The FAO farm dataset illustrates this point by showing that in 2005 the net profits on big farms were disproportionally higher than on small farm (Tab. A2.24)

[75] We could not estimate the regression for the subsample of managers/owners, because there are too few managers/owners in the dataset.

[76] In Table A2.30 and A2.31, we present results for the estimation of our main wage regressions from Table 2.4, 2.5 and 2.6 using the sub-sample of employees defined by the occupation question. The results show strong wage increases for female employees on small farms due to the cotton price shock. Wages for female employees on big farms and male employees do not increase. We did not use these regressions as our main regressions, because the reported answers for the occupation question were not always consistent with other information on activities on the job. Thus, we opted for estimating the main regressions for all individuals that indicated having a job.

estimated for small farms.[77] On large farms, we observe no single women in a management position, resulting in missing estimates for this category. On first sight, male managers on small farms seem to earn disproportionally more than managers on large farms; however, this effect reverses once we account for potential labor supply adjustments by analyzing monthly earnings rather than hourly wages. On a monthly basis, only managers of large farms reap substantial benefits from the cotton price hike. This may even be understated due to likely underreporting of profits by big farm mangers involved in the rent seeking networks of the cotton sector.

2.5.4 Analysis of political connections on large parastatal farms

So far we have simply assumed differences in political connections between managers of small vs. large farms. Now, we illustrate the differences more formally. We use the GIZ Survey of Political Leaders data set of 2011 and compare answers of 672 district (*Hukumat*) and sub-district (*Jamoat*) politicians regarding the political influence on farming decisions. Naturally, politicians' answers to such delicate questions might not correctly reflect the true extent of political influence; however, finding differences between regions in which more or less large parastatal farms operate should be indicative of actual differences in political interference. Figure 2.5 shows that politicians in districts which predominantly contain large farms are much more likely to favor political intervention in production planning and to report politically prescribed production targets.[78] In general, there is mounting evidence that production targets for cotton are especially attractive for district leaders (van Atta 2009, Kassam 2011, Tab. A2.25).

2.5.5 Robustness checks

The following section rules out three potential alternative explanations: The first hypothesis suggests that the privatization process might be responsible for the observed pass-through patterns; the second explains the wage effects by productivity differences between small and big farms; and, the third suggests that the absence of wage gains after the cotton price hike can be explained by monopsony power rather than by political connections.

One potential threat to our identification could stem from disproportionate privatization of land between the survey years 2009 and 2011. As discussed in the background section, we use data from the Tajik State Committee for Land and Geodesy (SCLG) on

[77] Another explanation may be that many women on small farms report being the farm head, because their husbands seasonally migrated to Russia. Those women may not be fully responsible for handling the profits of the farm.

[78] Small farm districts are districts with more than 50 percent of agricultural workers working on small farms. Most of the presented differences between small and large farm districts are significant at the 5 percent level (Tab. A2.25).

newly issued land use certificates for farms with less than 25 shareholders to investigate the privatization process over the period between 2007 and 2011. As Figure A2.12 illustrates, there was a substantial expansion in the number of newly issued SCLG land use certificates before the year 2009, but not after that year.[79] To lend further robustness to our results we repeat our main analysis and include a control variable that reflects the number of newly issued SCLG land use certificates per municipality (*Jamoat*). As expected, this does not change our finding of significantly higher wages for female cotton pickers (col. 7-12 in Tab. 2.13 and 2.14). This indicates that the privatization process is not driving our results.

If wages fully reflected labor productivity, wage differences between farm types may simply reflect a selection of more productive workers in small private farms. To test this potential explanation, we compare labor productivity differences in the GIZ farm survey for the year 2013 (Tab. 2.2). For this we relate a measure of cotton yield per hectare to a measure of worker per hectare, resulting in cotton output per unit of labor input. It turns out that the average worker on large and small farms produces 968 kg and 964 kg of cotton, respectively.[80]

A monopsony power explanation of the missing wage effects in large farms would require that large farms artificially suppress the labor intensity (per hectare) on its farms in order to put pressure on wages. We use data from the farm survey conducted by the GIZ to study differences in labor intensity in the cotton sector. Table 2.2 reveals that the number of workers per hectare (i.e., the labor intensity of production) on big and small farms is almost identical; this is also true for female workers per hectare, the most relevant group once it comes to cotton picking. Similarly, the cotton yield in 100 kg cotton per hectare is very similar. In fact, small and big farms use as input very similar labor-to-land ratios, making the use of monopsony power on big farms a very unlikely explanation (Tab. 2.2). Furthermore, we test the monopsony power explanation by including the share of agricultural workers working on small private farms per district (and per PSU) as control variable in our main wage regressions (col. 1-6 in Tab. 2.13 and 2.14).[81] A higher share of workers on small farms should indicate a higher degree of competition between farms in local labor markets and vice versa. The results show that the degree of competition in local labor markets does not explain our findings of in-

[79] Computing the share of agricultural workers on small farms per province using the TLSS, we also find that the privatization process mainly happened from 2007 until 2009 (Fig. A2.13).

[80] Given a total net harvest period of roughly four weeks the total daily productivity in Tajikistan is similar to Antebellum productivity per worker in America, where one person picked around 100 pounds per day.

[81] The results for the share of small farm workers per PSU are not shown here, but can be requested from the author. The results are very similar to the ones presented in Table 2.13 and 2.14.

creased agricultural wages in cotton PSUs compared to non-cotton PSUs from 2007 until 2011.

However, according to our theoretical considerations, the pass-through of the cotton price shock to agricultural wages in cotton regions should not be completely independent of the degree of competition in local labor markets. A higher degree of competition leads to a steeper labor supply curve for small private farms and, thus, the exogenous increase in harvest labor demand due to the cotton price surge should translate into higher wage increases. In Table 2.12 (col. 7-9), we test this hypothesis by including the area cropped with cotton per district, the share of agricultural workers working on small farms per district and the interaction between both variables in specification (2.1), which we estimate for the sub-sample of agricultural workers (excluding the interaction terms between cotton PSU and the year dummies). The results show that for female agricultural workers the wage increases due to a rise in the area cropped with cotton are significantly larger when the degree of competition in local labor markets is higher. For area sown with wheat, we do not find such effects (col. 10-12). These results provide further support for our hypothesis that the cotton price surge affected wages of cotton pickers on small private farms through competitive local labor markets.

A related question is whether local labor market conditions are reflected in wage responses: In more responsive (i.e., functional) labor markets faced by small private farms we would expect a negative correlation between the level of unemployment and wage levels. On big parastatal farms that command a pool of coerced labor, wages should not react to local labor market conditions. Indeed, we find that wages on smaller and more market-oriented farms decrease with rising unemployment rates while the correlation is zero for wages on large farms (Tab. 2.15 col. 7-12). This is another indication of structural differences between labor markets faced by small private vs. big parastatal farms.

Furthermore, we test the robustness of our results with a number of alternative specifications. Specifically, we exploit different definitions of cotton-suitable areas (according to production capacity in the FAO GAEZ data or according to altitude based measures; see Appendix 2 B for details) as well as different aggregation methods for cotton areas (at district rather than PSU level). Employing these alternative treatment definitions leads to the same strong results as in the main regressions (Tab. A2.32, A2.33). Furthermore, we include additional control variables at the individual, household, PSU and sub-district level (Tab. 2.15) and we restrict our estimation sample only to laborers who were working on small private and big parastatal farms before and after the cotton price

hike, respectively. None of these alternative approaches casts doubt on our main results.[82]

2.6 Conclusion

Exploiting the unexpected doubling of the world market price of cotton in 2010/2011 this paper has identified the commodity price effect on wages of cotton pickers. Using a new household panel from Tajikistan, we employed a difference-in-differences strategy based on variation in geographic suitability for cotton production as well as price variation over time. The wage increase following the expansion of the cotton production is substantial. While women, who form the largest part of the cotton workforce, gain from the price hike (real hourly wages increase by 84 percent), no comparable benefits can be detected for men. The increase in wages also led to a substantial take-up of agricultural work by women who were previously out of the labor force.

These changes in employment and wages have substantial social implications: While women who work in the cotton sector are normally considered the most deprived part of the workforce without social benefits (International Crisis Group 2005), the cotton price hike clearly benefitted them. Moreover, the growth in paid labor market participation of women will most likely have benefitted their absolute and relative economic standing and bargaining power within households and within the society as a whole.

Our findings suggest that the positive effect of the price shock operates through the labor market: While female workers on private family (*dehkan*) farms gain from the cotton price shock, their peers on big cotton farms gain close to nothing. Workers on family farms have to be recruited for the harvest season on the local labor market while big farms exploit their political connections to coerce workers of other state-owned enterprises, university students and school children into cotton picking. The fact that only workers on small family farms gain from the price shock indicates that the pass-through of cotton proceeds depends on the market structure. Perfectly elastic labor supply for big para-statal farms let the wages of their workers stagnate during the cotton price surge in 2011. Our regression results as well as interviews which we conducted in early 2014 in Tajikistan suggest that the higher cotton proceeds and farm profits on big farms were appropriated by farm managers rather than distributed to workers.

This paper sheds light on the link between international trade and the labor market conditions of some of the most disadvantaged workers in basic tradable commodity markets in developing countries. While working conditions in the cotton sector of Tajikistan are

[82] The results on the estimation for the sub-samples of workers who were working on small private and big parastatal farms before and after the cotton price hike can be requested from the author.

generally harsh, we observe strong wage adjustments following increased demand in the market oriented branch of the cotton production sector. This result is not confounded by changing skill requirements or compositions of the workforce as illustrated by our model that controls for individual heterogeneity. Our results are short-run estimates of the pass-through of world-market price fluctuations on labor inputs. In the long run, firms might in theory adjust their capital stock, which however is less likely for credit-constrained small-holders who are found to behave in correspondence with market incentives. Big cotton farms seem to be severely plagued by rent-seeking behavior of managers, cotton ginneries and local politicians. This leads to the surprising situation that big farms are not more efficient in cotton production than small-holders. According to our results, the global hunger for basic commodities benefitted some of the poorest workers as long as basic market rules are respected. Hence, this paper shows that so far the privatization process in Tajikistan has succeeded in establishing a more competitive and entrepreneurial agricultural sub-sector that created new income opportunities for poor landless women in rural villages.

The presented case study clearly shows how a strong external dependence on exports results in labor market risks for a substantial fraction of the local workforce and potentially pushes the boundaries of national social security institutions. While this time, the rise in the world market price of cotton benefitted the population, an equally likely drop in the world market price might produce massive social costs in Tajikistan. At this stage, it remains an open question whether export taxes or subsidies on cotton (as currently discussed in Tajikistan) are useful policy instruments to stabilize producer prices at the farm gate. However, decreasing cotton prices would probably push small private farmers to substitute from cotton to wheat and other crops thus mitigating the negative impacts of a potential cotton price slump. Therefore, an adequate strategy to mitigate the risk of cotton price fluctuations is to effectively secure free crop choice for farmers.

Tables and Figures

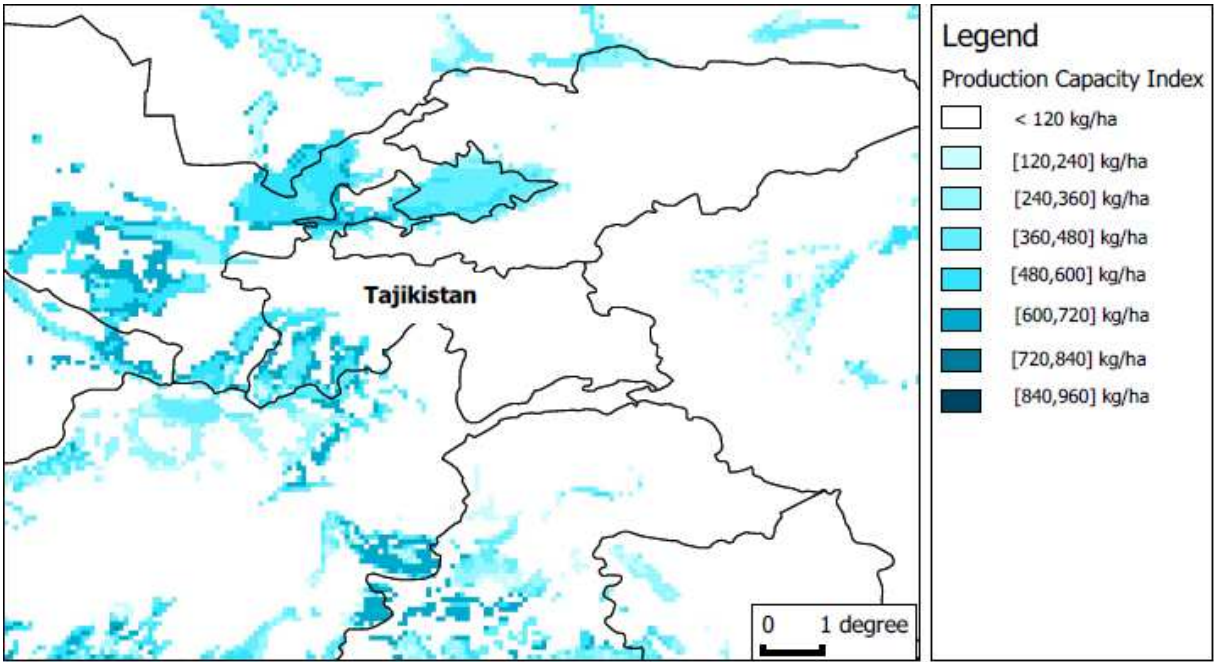


Figure 2.1.: Regional variation of cotton production in Central Asia and Tajikistan

Source: FAO - GAEZ – Production capacity index for cotton (for current cultivated land and intermediate input level irrigated cotton)

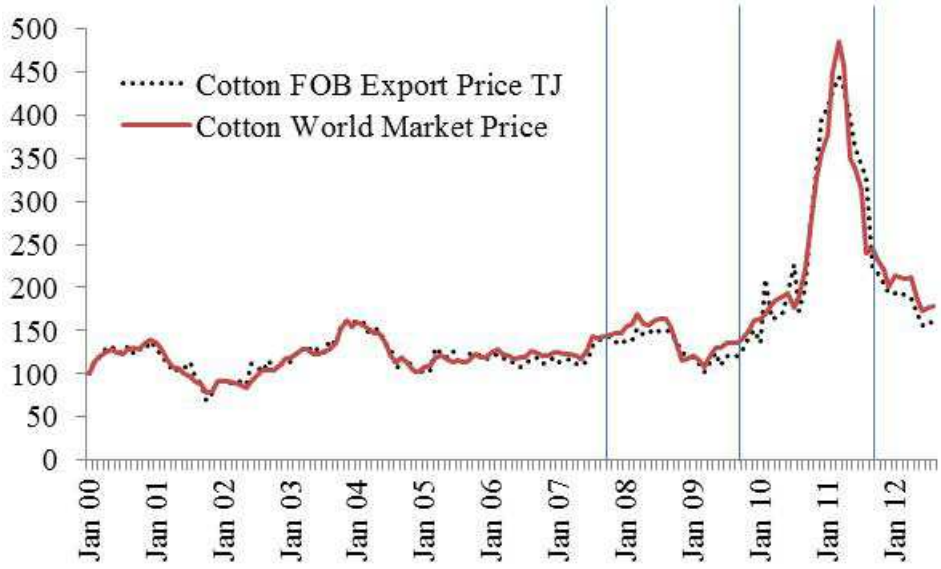


Figure 2.2.: Cotton world market price (100=2000)

Note: The vertical lines mark survey dates. Source: IMF Primary Commodity Prices (Cotton Outlook 'A Index', Middling 1-3/32 inch staple, CIF Liverpool, US cents per pound) and Statistical Agency of Tajikistan.

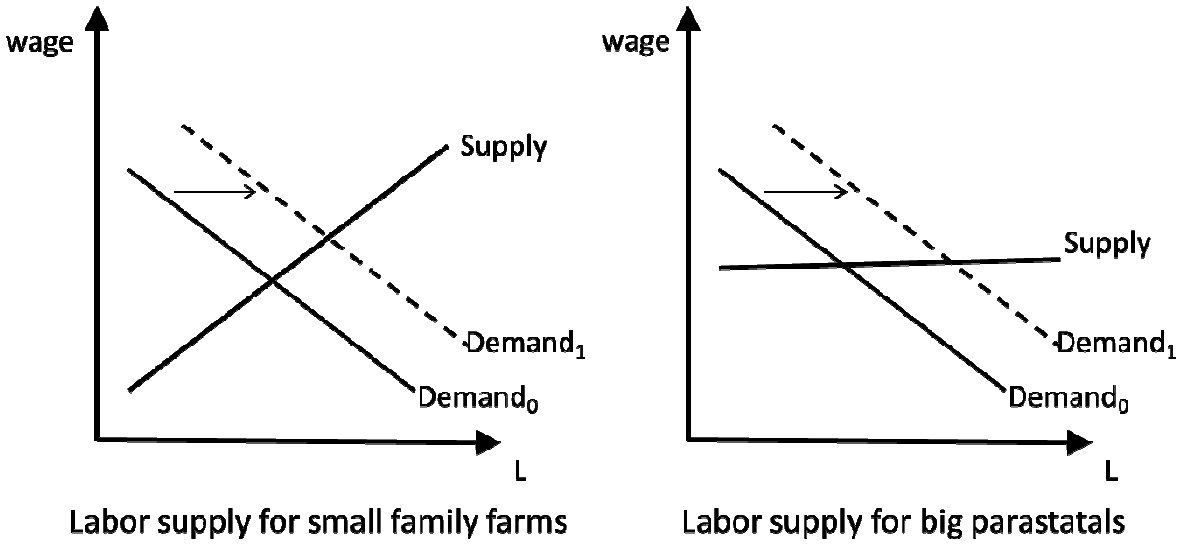


Figure 2.3.: Labor market equilibriums for small private and big para-statal farms

The figure shows the stylized comparative statics of the model in response to an increase in the world market price of cotton. For more details see Appendix 2 C.

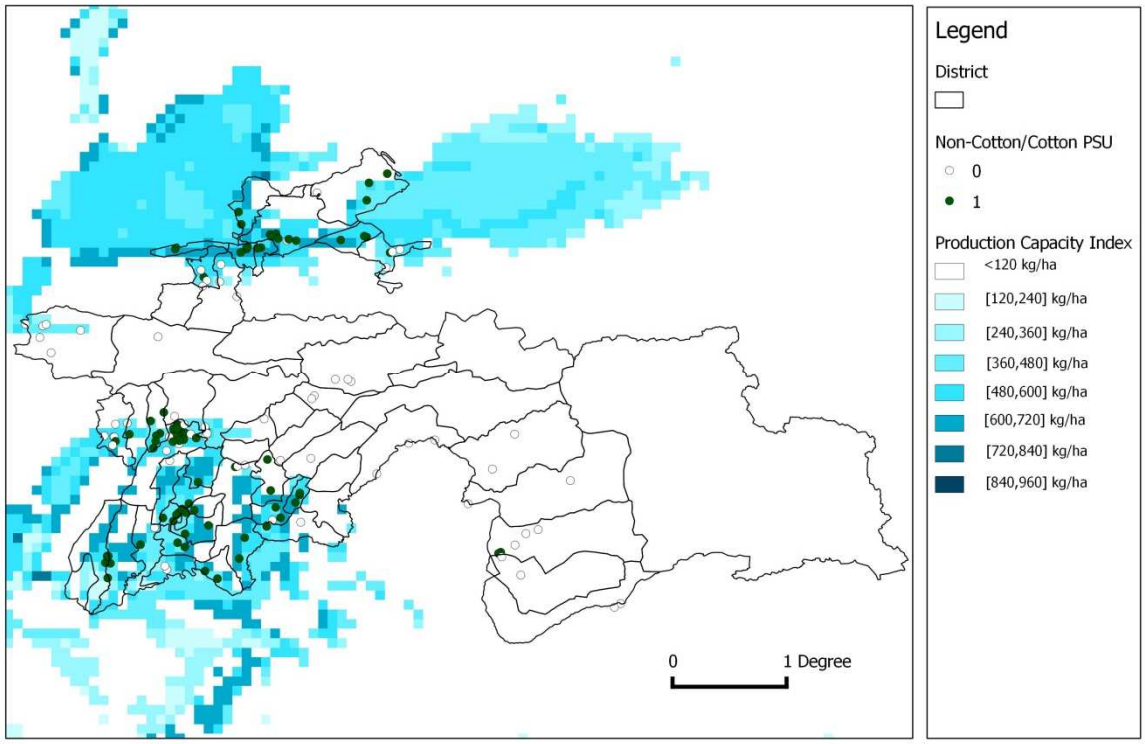


Figure 2.4.: Regional variation of cotton production in Tajikistan (cotton/non-cotton communities in the TLSS 2007)

Note: Cotton/non-cotton communities (PSUs) from TLSS 2007 (in green/white), cotton communities are communities that grow cotton as first or second most important crop. FAO - GAEZ – Production capacity

index for cotton (for current cultivated land and intermediate input level irrigated cotton). Administrative units are districts (*hukumats* or *raions*); there are 58 districts in Tajikistan.

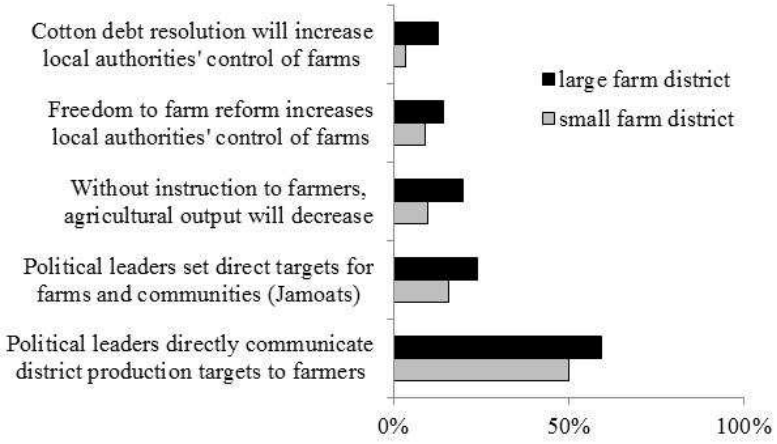


Figure 2.5.: Indicators for political influence on farming decisions (GIZ Political Leader Survey 2011)

Table 2.1.: Cotton exports and imports by country

Share of world export for ginned cotton (lint) Ranking according to 2011				Cotton imports (in 1'000 480 lb. Bales) Ranking according to 2011			
	Country	**2010**	**2011**		**Country**	**2009**	**2010**	**2011**
1	United States	40.5%	25.5%	1	China	10,903	11,979	24,533
2	India	14.1%	24.1%	2	Bangladesh	3,900	3,700	3,200
3	Brazil	5.6%	10.4%	3	Turkey	4,394	3,350	2,382
4	Australia	7.1%	10.1%	4	Indonesia	2,500	2,400	2,300
5	Uzbekistan	7.5%	5.4%	5	Vietnam	1,695	1,569	1,625
6	Pakistan	1.9%	2.7%	6	Thailand	1,806	1,752	1,263
7	Malaysia	n.a.	2.2%	7	South Korea	1,010	1,038	1,170
8	Greece	2.1%	2.2%	8	Malaysia	271	290	1,125
9	Turkmenistan	3.1%	1.6%	9	Mexico	1,393	1,196	1,000
10	Mali	1.3%	1.4%	10	Pakistan	1,574	1,443	900
12	Tajikistan	1.1%	1.1%					

Source: United States Department of Agriculture (USDA) - Foreign Agricultural Service (FAS)

Table 2.2.: Farm Characteristics from the GIZ 2013 farm head survey

	Group Means		**Difference (Big-Small)**	**p-value of the twosided T-Test**
	Small Farms (<20 ha)	**Big Farms (>20 ha)**		
Shareholder per ha under cotton	2.417886	2.439044	0.0211579	0.84
	(0.055328)	(0.092848)	(0.0211579)	
Female share-holders per ha under cotton	1.437603	1.531426	0.0938234	0.195
	(0.0328423)	(0.0644221)	(0.0723106)	
% of farm area cropped with cotton (in 2013)	0.469952	0.5105713	0.0406193	0.008
	(0.0085186)	(0.0129321)	(0.0154856)	
Cotton yield in 100 kg per ha (in 2011)	23.32	23.62	0.3014078	0.25
	(0.1198784)	(0.2317064)	(0.2608806)	
Number of observations	**3384**	**869**		

Source: GIZ Survey of farm heads 2013

Table 2.3.: Participation in agriculture (working age population)

VARIABLES	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female	(10) Full sample	(11) Male	(12) Female
	Dependent variable: Working in agriculture											
District share of agri. workers on small farms				0.03	0.05	0.02				0.04	0.07°	0.02
				(0.04)	(0.03)	(0.05)				(0.05)	(0.04)	(0.06)
cottonPSU*year2009	0.02	0.01	0.04	0.02	0.00	0.03	0.02	0.01	0.02	0.02	0.01	0.02
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)
cottonPSU*year2011	0.08*	0.05	0.10*	0.08*	0.05	0.11*	0.07°	0.05	0.09*	0.08°	0.05	0.11*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
sex	-0.00			-0.00								
	(0.01)			(0.01)								
age	0.00**	0.00**	0.00**	0.00**	0.00**	0.00**	0.01*	0.01	0.01	0.01°	0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)
secondaryedu	0.02*	0.03*	0.02*	0.02*	0.03*	0.03**	-0.01	0.02	-0.03	-0.00	0.03	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
tertiaryedu	-0.06**	-0.06**	-0.05**	-0.07**	-0.08**	-0.07**	-0.01	0.03	-0.06*	-0.01	0.03	-0.10*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.04)	(0.04)
Constant	-0.13	-0.08	-0.13	-0.15	-0.68**	-0.45*	-0.07	-0.03	-0.14	-0.10	-0.12	-0.13
	(0.12)	(0.12)	(0.16)	(0.13)	(0.19)	(0.22)	(0.12)	(0.20)	(0.15)	(0.16)	(0.26)	(0.20)
Individual and household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PSU and sub-district controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,856	9,505	10,351	17,016	8,182	8,834	19,856	9,505	10,351	17,016	8,182	8,834
R-squared	0.19	0.21	0.22	0.17	0.19	0.19	0.01	0.02	0.02	0.02	0.03	0.02
Adjusted R2	0.19	0.20	0.21	0.16	0.18	0.18	0.01	0.02	0.02	0.01	0.02	0.02
Number of panelid							12,044	5,686	6,358	10,836	5,134	5,702

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is an indicator whether the person works in agriculture or not, whereby we use the full sample of the working age population. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU and the year of the interview. Individual and household level controls include dummies for the ethnicity and the marital status of the individual as well as household size. PSU and sub-district level controls are for the year 2007 and include the distance of the PSU to the province capital, a dummy for urban location, measures for the importance of agriculture and male unemployment in the PSU as well as the unemployment rate, the dependency ratio, the share of economically active population and the share of households living below the poverty line at the sub-district level. Columns 1-6 show OLS estimates and columns 7-12 individual FE estimates. Columns 4-6 and 10-12 additionally include the district share of agricultural workers working on small private farms (out of all agricultural workers).

Table 2.4.: OLS wage regressions for hourly wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Agricultural workers			**Non-agricultural workers**			**All workers**		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**Dependent variable: Log of the real wage per hour**								
cottonPSU*year2009	-0.10	-0.27	-0.04	0.07	0.06	0.07	0.14	0.08	0.14
	(0.21)	(0.26)	(0.24)	(0.10)	(0.11)	(0.16)	(0.11)	(0.11)	(0.17)
cottonPSU*year2011	0.22	-0.02	0.44*	-0.01	-0.00	-0.09	-0.02	-0.03	-0.09
	(0.20)	(0.24)	(0.20)	(0.10)	(0.10)	(0.16)	(0.10)	(0.10)	(0.16)
cottonPSU*agri*year2009							-0.27	-0.42	-0.18
							(0.24)	(0.28)	(0.29)
cottonPSU*agri*year2011							0.27	0.01	0.61*
							(0.21)	(0.23)	(0.24)
sex	-0.16**			-0.39**			-0.35**		
	(0.04)			(0.03)			(0.02)		
age	0.01**	0.00	0.01**	0.00	-0.00	0.00	0.00*	0.00	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.03	0.06	0.00	0.17**	0.23**	0.00	0.11**	0.18**	-0.00
	(0.05)	(0.08)	(0.06)	(0.04)	(0.06)	(0.07)	(0.04)	(0.05)	(0.05)
tertiaryedu	0.15	0.23°	-0.19	0.41**	0.38**	0.44**	0.34**	0.33**	0.40**
	(0.12)	(0.13)	(0.24)	(0.05)	(0.06)	(0.10)	(0.05)	(0.06)	(0.07)
firmbig	-0.22*	-0.21*	-0.20*	0.19**	0.23**	0.09	0.03	0.11**	-0.10
	(0.08)	(0.10)	(0.10)	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)
statefirm	-0.21**	-0.15°	-0.27**	-0.55**	-0.51**	-0.53**	-0.43**	-0.42**	-0.41**
	(0.07)	(0.09)	(0.09)	(0.04)	(0.04)	(0.08)	(0.04)	(0.04)	(0.06)
occhigh	0.26*	0.22	0.04	0.17**	0.13*	0.27**	0.19**	0.14*	0.32**
	(0.11)	(0.14)	(0.30)	(0.05)	(0.06)	(0.09)	(0.04)	(0.05)	(0.09)
occ4578	0.35*	0.29	0.15	0.20**	0.13**	0.36**	0.26**	0.17**	0.42**
	(0.15)	(0.18)	(0.34)	(0.04)	(0.05)	(0.10)	(0.04)	(0.04)	(0.09)
occagriskilled	-0.06	-0.16	-0.05	-0.41*	-0.41*	-0.34	-0.11	-0.25**	0.02
	(0.08)	(0.12)	(0.12)	(0.19)	(0.18)	(0.51)	(0.07)	(0.08)	(0.10)
Constant	0.20	0.91	0.57	0.53**	0.08	-0.19	0.43**	0.04	-0.34°
	(0.17)	(0.93)	(0.46)	(0.11)	(0.12)	(0.22)	(0.11)	(0.12)	(0.20)
Observations	2,371	1,137	1,234	5,758	4,270	1,488	8,129	5,407	2,722
R-squared	0.38	0.34	0.43	0.25	0.19	0.29	0.39	0.32	0.42
Adjusted R2	0.357	0.299	0.402	0.238	0.173	0.250	0.386	0.307	0.396

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU and the year of the interview. Columns 7-9 additionally include a dummy for working in agriculture (agri) and its interactions with cotton PSU and the year dummies. Columns 1-6 show OLS estimates for the Dif-in-Dif of specification (1) for agricultural workers (col. 1-3) and non-agricultural workers (col. 4-6). Col. 7-9 show OLS estimates for the Dif-in-Dif-in-Dif from specification (2) for the sample of all workers.

Table 2.5.: Individual FE - wage regressions for hourly wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Agricultural workers			**Non-agricultural workers**			**All workers**		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**Dependent variable: Log of the real wage per hour**								
cottonPSU*year2009	-0.09	-0.50	0.34	0.10	0.11	0.05	0.14	0.15	0.07
	(0.35)	(0.43)	(0.32)	(0.12)	(0.14)	(0.16)	(0.13)	(0.15)	(0.16)
cottonPSU*year2011	0.24	-0.21	0.72**	-0.13	-0.12	-0.19	-0.11	-0.11	-0.20
	(0.30)	(0.39)	(0.25)	(0.11)	(0.12)	(0.20)	(0.12)	(0.12)	(0.22)
cottonPSU*agri*year2009							-0.60	-0.94°	0.21
							(0.43)	(0.49)	(0.35)
cottonPSU*agri*year2011							0.16	-0.25	0.98**
							(0.36)	(0.42)	(0.30)
age	-0.04	-0.20*	0.03	-0.03	-0.03	-0.03	-0.03°	-0.04°	0.00
	(0.05)	(0.10)	(0.04)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
secondaryedu	-0.13	-0.18	-0.13	0.16°	0.17	0.13	0.02	0.05	-0.07
	(0.11)	(0.25)	(0.14)	(0.09)	(0.11)	(0.14)	(0.07)	(0.09)	(0.09)
tertiaryedu	-0.59*	-0.62°	0.06	0.13	0.13	0.16	-0.04	-0.01	-0.06
	(0.28)	(0.35)	(0.39)	(0.10)	(0.12)	(0.17)	(0.09)	(0.10)	(0.15)
firmbig	-0.09	-0.10	-0.09	0.01	0.04	-0.04	-0.00	0.03	-0.05
	(0.12)	(0.16)	(0.14)	(0.05)	(0.06)	(0.08)	(0.05)	(0.05)	(0.07)
statefirm	-0.11	-0.02	-0.21	-0.27**	-0.29**	-0.18	-0.18**	-0.18**	-0.19°
	(0.11)	(0.16)	(0.17)	(0.06)	(0.08)	(0.12)	(0.06)	(0.07)	(0.10)
occhigh	0.47	0.29	0.54	0.15	0.09	0.27	0.17°	0.10	0.35°
	(0.39)	(0.42)	(0.43)	(0.10)	(0.12)	(0.20)	(0.09)	(0.10)	(0.18)
occ4578	0.61*	0.34	0.76	0.16°	0.16°	0.12	0.21**	0.18*	0.24°
	(0.28)	(0.34)	(0.52)	(0.08)	(0.09)	(0.15)	(0.07)	(0.08)	(0.14)
occagriskilled	-0.13	-0.46°	0.19	-0.42	-0.26	-1.08	-0.15	-0.31*	0.10
	(0.18)	(0.27)	(0.21)	(0.31)	(0.29)	(0.91)	(0.11)	(0.14)	(0.16)
Constant	0.70	7.15°	-2.05	1.17°	1.23	0.85	1.03°	1.74*	-0.42
	(1.52)	(3.69)	(1.30)	(0.70)	(0.94)	(1.05)	(0.56)	(0.77)	(0.80)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,371	1,137	1,234	5,758	4,270	1,488	8,129	5,407	2,722
Number of panelid	1,978	956	1,022	4,114	3,030	1,084	5,773	3,706	2,067
R-squared	0.32	0.38	0.36	0.17	0.16	0.29	0.23	0.23	0.29
Adjusted R2	0.310	0.367	0.354	0.167	0.152	0.279	0.225	0.229	0.281

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU and the year of the interview. Columns 7-9 additionally include a dummy for working in agriculture (agri) and its interactions with cotton PSU and the year dummies. Columns 1-6 show FE estimates for the Dif-in-Dif of specification (1) for agricultural workers (col. 1-3) and non-agricultural workers (col. 4-6). Col. 7-9 show FE estimates for the Dif-in-Dif-in-Dif from specification (2) for the sample of all workers.

Table 2.6.: OLS hourly and monthly wages for sample split small vs. big firms (all workers)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Big firms (>25 employees)			**Small firms (<25 employees)**			**Big firms (>25 employees)**			**Small firms (<25 employees)**		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**log of the real wage per hour**						**log of the real monthly wage**					
cottonPSU*agri*year2009	-0.39	-0.42	-0.21	-0.20	-0.48	0.07	-0.39	-0.25	-0.34	-0.15	-0.37	0.08
	(0.30)	(0.34)	(0.34)	(0.28)	(0.34)	(0.34)	(0.25)	(0.31)	(0.26)	(0.24)	(0.29)	(0.30)
cottonPSU*agri*year2011	-0.31	-0.34	-0.10	0.25	-0.06	0.90**	-0.20	-0.18	-0.06	0.00	-0.16	0.55°
	(0.27)	(0.36)	(0.33)	(0.25)	(0.28)	(0.31)	(0.20)	(0.28)	(0.27)	(0.22)	(0.26)	(0.30)
sex	-0.36**			-0.29**			-0.46**			-0.46**		
	(0.04)			(0.03)			(0.03)			(0.03)		
age	-0.00	-0.00*	0.00	0.00**	0.00	0.01**	-0.00	-0.00*	0.00	0.00	-0.00	0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.01	-0.01	0.00	0.15**	0.25**	-0.03	0.05	0.03	0.05	0.17**	0.24**	0.05
	(0.05)	(0.08)	(0.05)	(0.05)	(0.06)	(0.07)	(0.04)	(0.07)	(0.05)	(0.04)	(0.05)	(0.06)
tertiaryedu	0.19**	0.03	0.43**	0.41**	0.46**	0.33**	0.21**	0.07	0.40**	0.41**	0.45**	0.32**
	(0.07)	(0.09)	(0.10)	(0.06)	(0.07)	(0.10)	(0.06)	(0.09)	(0.09)	(0.05)	(0.06)	(0.09)
firmbig	0.04	0.07°	0.01				0.06°	0.11**	0.01			
	(0.04)	(0.04)	(0.05)				(0.03)	(0.04)	(0.05)			
statefirm	-0.36**	-0.36**	-0.27**	-0.53**	-0.50**	-0.51**	-0.42**	-0.42**	-0.32**	-0.53**	-0.48**	-0.54**
	(0.05)	(0.06)	(0.08)	(0.05)	(0.06)	(0.10)	(0.05)	(0.05)	(0.07)	(0.04)	(0.05)	(0.08)
occhigh	0.20**	0.16°	0.30**	0.23**	0.17**	0.36**	0.14*	0.04	0.32**	0.18**	0.10°	0.38**
	(0.07)	(0.09)	(0.12)	(0.06)	(0.06)	(0.12)	(0.06)	(0.07)	(0.11)	(0.05)	(0.06)	(0.09)
occ4578	0.33**	0.17*	0.50**	0.24**	0.17**	0.32*	0.40**	0.21**	0.53**	0.27**	0.22**	0.39**
	(0.07)	(0.09)	(0.13)	(0.04)	(0.05)	(0.12)	(0.06)	(0.08)	(0.12)	(0.04)	(0.04)	(0.10)
occagriskilled	-0.25*	-0.39**	-0.19	0.03	-0.14	0.19	-0.19*	-0.38**	-0.07	-0.02	-0.20*	0.16
	(0.11)	(0.12)	(0.15)	(0.08)	(0.11)	(0.12)	(0.09)	(0.10)	(0.13)	(0.07)	(0.09)	(0.12)
Constant	0.88**	0.54**	-0.10	0.15	-0.15	-0.57°	6.19**	5.77**	4.93**	5.61**	5.23**	4.35**
	(0.14)	(0.18)	(0.24)	(0.15)	(0.13)	(0.32)	(0.13)	(0.15)	(0.23)	(0.13)	(0.13)	(0.25)
Observations	3,111	1,788	1,323	5,018	3,619	1,399	3,137	1,806	1,331	5,060	3,645	1,415
R-squared	0.53	0.48	0.52	0.30	0.25	0.36	0.55	0.49	0.51	0.38	0.30	0.38
Adjusted R2	0.519	0.452	0.492	0.287	0.233	0.316	0.534	0.461	0.479	0.373	0.282	0.337

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month (col. 1-6) and the log of the wage in the last month (col. 7-12). All specifications are estimated for the sample of all workers and include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton PSU and the year dummies.

Table 2.7.: Output price elasticities of wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Yearly prices			**Sowing period prices**			**Harvest period prices**	
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**Dependent variable: Log of the real wage per hour**								
lnprice	0.28*	0.17	0.71**	0.12	0.05	0.37**	0.22	0.13	0.66**
	(0.14)	(0.15)	(0.18)	(0.09)	(0.10)	(0.11)	(0.18)	(0.21)	(0.21)
lnprice*cottonPSU	-0.00	0.09	-0.37*	0.09	0.14	-0.11	0.28	0.34	-0.07
	(0.14)	(0.15)	(0.18)	(0.09)	(0.10)	(0.12)	(0.19)	(0.22)	(0.25)
lnprice*agri	0.39°	0.78**	-0.29	0.27°	0.50**	-0.10	0.46	0.93*	-0.36
	(0.20)	(0.23)	(0.33)	(0.15)	(0.17)	(0.24)	(0.31)	(0.36)	(0.43)
lnprice*agri*cottonPSU	0.05	-0.33	0.72*	0.06	-0.17	0.42°	0.41	0.01	1.14*
	(0.24)	(0.29)	(0.34)	(0.18)	(0.21)	(0.24)	(0.42)	(0.50)	(0.49)
sex	-0.35**			-0.35**			-0.34**		
	(0.02)			(0.02)			(0.02)		
age	0.00*	0.00	0.01**	0.00*	0.00	0.01**	0.00*	0.00	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.12**	0.21**	-0.00	0.12**	0.21**	-0.00	0.12**	0.21**	-0.00
	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)
tertiaryedu	0.35**	0.35**	0.39**	0.35**	0.36**	0.40**	0.36**	0.36**	0.40**
	(0.05)	(0.06)	(0.07)	(0.05)	(0.06)	(0.07)	(0.05)	(0.06)	(0.07)
firmbig	0.03	0.11**	-0.11°	0.03	0.11**	-0.11°	0.03	0.11**	-0.12°
	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)
statefirm	-0.44**	-0.42**	-0.42**	-0.44**	-0.42**	-0.42**	-0.44**	-0.42**	-0.42**
	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)
occhigh	0.19**	0.14**	0.33**	0.19**	0.14**	0.33**	0.19**	0.14**	0.32**
	(0.04)	(0.05)	(0.09)	(0.04)	(0.05)	(0.09)	(0.04)	(0.05)	(0.09)
occ4578	0.27**	0.18**	0.41**	0.27**	0.18**	0.41**	0.26**	0.18**	0.41**
	(0.04)	(0.04)	(0.09)	(0.04)	(0.04)	(0.09)	(0.04)	(0.04)	(0.09)
occagriskilled	-0.12°	-0.25**	-0.00	-0.12°	-0.25**	-0.00	-0.14*	-0.25**	-0.05
	(0.07)	(0.08)	(0.10)	(0.07)	(0.08)	(0.09)	(0.07)	(0.08)	(0.09)
Constant	1.00**	0.42	0.98**	0.71**	0.21	0.40	0.87*	0.33	0.90*
	(0.28)	(0.31)	(0.36)	(0.21)	(0.24)	(0.28)	(0.35)	(0.41)	(0.43)
Observations	8,129	5,407	2,722	8,129	5,407	2,722	8,129	5,407	2,722
R-squared	0.38	0.30	0.41	0.38	0.30	0.40	0.38	0.30	0.40
Adjusted R2	0.379	0.293	0.389	0.378	0.292	0.388	0.376	0.291	0.384

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, a dummy for working in agriculture (agri) and the interaction between agri and cotton PSU.

Table 2.8.: OLS wage regression for monthly wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Agricultural workers			**Non-agricultural workers**			**All workers**		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**Dependent variable: Log of the real wage per hour**								
cottonPSU*year2009	-0.08	-0.15	-0.11	0.07	0.06	0.06	0.13	0.07	0.12
	(0.19)	(0.21)	(0.24)	(0.09)	(0.10)	(0.16)	(0.10)	(0.11)	(0.14)
cottonPSU*year2011	0.10	0.04	0.17	-0.03	0.01	-0.22	-0.04	-0.03	-0.18
	(0.19)	(0.20)	(0.25)	(0.09)	(0.09)	(0.17)	(0.09)	(0.09)	(0.17)
cottonPSU*agri*year2009							-0.25	-0.30	-0.20
							(0.21)	(0.24)	(0.27)
cottonPSU*agri*year2011							0.12	-0.00	0.39
							(0.19)	(0.21)	(0.29)
sex	-0.26**			-0.54**			-0.48**		
	(0.03)			(0.03)			(0.02)		
age	0.01**	0.00°	0.01**	-0.00	-0.00*	0.00	0.00	-0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.05	0.04	0.04	0.20**	0.23**	0.08	0.14**	0.18**	0.07
	(0.05)	(0.08)	(0.05)	(0.04)	(0.05)	(0.06)	(0.03)	(0.04)	(0.04)
tertiaryedu	0.20*	0.28*	-0.43*	0.41**	0.38**	0.45**	0.35**	0.33**	0.39**
	(0.10)	(0.12)	(0.22)	(0.05)	(0.05)	(0.07)	(0.04)	(0.05)	(0.06)
firmbig	-0.09	-0.11	-0.08	0.26**	0.29**	0.17**	0.12**	0.19**	0.01
	(0.07)	(0.09)	(0.09)	(0.03)	(0.04)	(0.05)	(0.03)	(0.04)	(0.06)
statefirm	-0.19**	-0.14°	-0.23**	-0.55**	-0.49**	-0.57**	-0.44**	-0.42**	-0.40**
	(0.07)	(0.08)	(0.08)	(0.03)	(0.04)	(0.06)	(0.03)	(0.04)	(0.05)
occhigh	0.31**	0.22°	0.55*	0.12**	0.02	0.32**	0.13**	0.05	0.35**
	(0.11)	(0.13)	(0.24)	(0.04)	(0.05)	(0.07)	(0.04)	(0.05)	(0.08)
occ4578	0.31*	0.29°	-0.13	0.24**	0.16**	0.43**	0.30**	0.21**	0.48**
	(0.13)	(0.15)	(0.31)	(0.04)	(0.04)	(0.08)	(0.03)	(0.04)	(0.08)
occagriskilled	-0.05	-0.15°	-0.00	-0.36*	-0.47**	0.08	-0.11°	-0.27**	0.06
	(0.07)	(0.09)	(0.11)	(0.14)	(0.15)	(0.31)	(0.05)	(0.07)	(0.09)
Constant	5.11**	5.57**	4.35**	5.95**	5.44**	4.66**	5.81**	5.36**	4.54**
	(0.16)	(1.20)	(0.24)	(0.11)	(0.11)	(0.21)	(0.10)	(0.11)	(0.18)
Observations	2,372	1,137	1,235	5,825	4,314	1,511	8,197	5,451	2,746
R-squared	0.30	0.28	0.29	0.33	0.23	0.37	0.44	0.35	0.40
Adjusted R2	0.274	0.235	0.246	0.325	0.216	0.336	0.431	0.336	0.378

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU and the year of the interview. Columns 7-9 additionally include a dummy for working in agriculture (agri) and its interactions with cotton PSU and the year dummies. Columns 1-6 show OLS estimates for the Dif-in-Dif of specification (1) for agricultural workers (col. 1-3) and non-agricultural workers (col. 4-6). Col. 7-9 show OLS estimates for the Dif-in-Dif-in-Dif from specification (2) for the sample of all workers.

Table 2.9.: Individual FE - wage regressions for monthly wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Agricultural workers			**Non-agricultural workers**			**All workers**		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**Dependent variable: Log of the real wage per hour**								
cottonPSU*year2009	-0.04	-0.27	0.17	0.08	0.08	0.06	0.13	0.11	0.10
	(0.28)	(0.32)	(0.35)	(0.11)	(0.13)	(0.14)	(0.12)	(0.13)	(0.14)
cottonPSU*year2011	0.30	0.02	0.72**	-0.12	-0.12	-0.19	-0.11	-0.14	-0.12
	(0.27)	(0.31)	(0.27)	(0.10)	(0.10)	(0.16)	(0.10)	(0.10)	(0.17)
cottonPSU*agri*year2009							-0.50	-0.69°	0.02
							(0.36)	(0.40)	(0.39)
cottonPSU*agri*year2011							0.20	-0.07	0.80*
							(0.32)	(0.36)	(0.32)
age	-0.02	-0.12	0.00	-0.03	-0.02	-0.04	-0.02°	-0.03	-0.02
	(0.04)	(0.09)	(0.04)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
secondaryedu	-0.12	-0.19	-0.07	0.15*	0.15°	0.16	0.03	0.04	0.02
	(0.10)	(0.22)	(0.10)	(0.07)	(0.08)	(0.12)	(0.06)	(0.08)	(0.07)
tertiaryedu	-0.71**	-0.60*	-0.98**	0.15°	0.17°	0.10	0.01	0.03	-0.07
	(0.27)	(0.30)	(0.36)	(0.08)	(0.10)	(0.12)	(0.07)	(0.09)	(0.11)
firmbig	0.11	0.08	0.10	0.08°	0.10°	0.05	0.10*	0.13**	0.07
	(0.10)	(0.16)	(0.11)	(0.04)	(0.05)	(0.06)	(0.04)	(0.05)	(0.06)
statefirm	-0.06	-0.00	-0.18	-0.29**	-0.30**	-0.26**	-0.22**	-0.22**	-0.24**
	(0.11)	(0.15)	(0.16)	(0.05)	(0.06)	(0.10)	(0.05)	(0.06)	(0.08)
occhigh	0.47	0.22	1.45**	0.04	-0.04	0.26°	0.10	0.01	0.34*
	(0.32)	(0.33)	(0.41)	(0.08)	(0.10)	(0.16)	(0.07)	(0.09)	(0.14)
occ4578	0.47*	0.18	1.22**	0.17*	0.14	0.22	0.24**	0.19**	0.36**
	(0.21)	(0.23)	(0.24)	(0.08)	(0.09)	(0.13)	(0.06)	(0.07)	(0.12)
occagriskilled	-0.12	-0.40*	0.08	-0.03	0.00	-0.06	-0.12	-0.27*	0.09
	(0.14)	(0.20)	(0.18)	(0.17)	(0.19)	(0.33)	(0.09)	(0.11)	(0.15)
Constant	5.23**	9.27**	3.97**	6.14**	6.22**	5.98**	6.03**	6.46**	5.24**
	(1.23)	(3.21)	(1.23)	(0.60)	(0.77)	(0.83)	(0.47)	(0.65)	(0.64)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,372	1,137	1,235	5,825	4,314	1,511	8,197	5,451	2,746
Number of panelid	1,979	956	1,023	4,152	3,053	1,099	5,807	3,726	2,081
R-squared	0.16	0.26	0.19	0.20	0.18	0.37	0.24	0.26	0.29
Adjusted R2	0.156	0.247	0.176	0.192	0.172	0.363	0.235	0.251	0.286

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU and the year of the interview. Columns 7-9 additionally include a dummy for working in agriculture (agri) and its interactions with cotton PSU and the year dummies. Columns 1-6 show FE estimates for the Dif-in-Dif of specification (1) for agricultural workers (col. 1-3) and non-agricultural workers (col. 4-6). Col. 7-9 show FE estimates for the Dif-in-Dif-in-Dif from specification (2) for the sample of all workers.

Table 2.10.: Participation of children (below 18) in agriculture

	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female	(10) Full sample	(11) Male	(12) Female
VARIABLES	**Dependent variable: Working in agriculture**											
District share of agri. workers on small farms				0.01	0.02	-0.02				-0.01	0.12	-0.13
				(0.04)	(0.05)	(0.07)				(0.08)	(0.09)	(0.15)
cottonPSU*year2009	0.03	0.00	0.05	0.03	0.01	0.05	0.02	0.03	0.03	0.02	0.02	0.04
	(0.05)	(0.07)	(0.06)	(0.06)	(0.08)	(0.06)	(0.09)	(0.13)	(0.08)	(0.09)	(0.13)	(0.08)
cottonPSU*year2011	0.09*	0.10°	0.10*	0.10*	0.11°	0.11*	0.10	0.17	0.08	0.12	0.24	0.09
	(0.04)	(0.06)	(0.05)	(0.05)	(0.06)	(0.05)	(0.11)	(0.15)	(0.10)	(0.11)	(0.15)	(0.11)
sex	0.03**			0.04**								
	(0.01)			(0.01)								
age	0.04**	0.04**	0.03**	0.05**	0.05**	0.04**	0.02	0.02	0.01	0.03	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)	(0.04)
secondaryedu	0.04*	0.01	0.07*	0.04°	0.00	0.09*	0.06	0.08	0.04	0.07	0.10	0.05
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.04)	(0.05)	(0.08)	(0.07)	(0.06)	(0.10)	(0.09)
tertiaryedu	0.00	0.00	-0.03	0.00	0.00	0.00						
	(0.02)	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)						
Constant	-0.78**	-0.62**	-0.72*	-1.19**	-0.87**	-0.95*	-0.28	-0.22	-0.36	-0.33	-0.30	-0.39
	(0.20)	(0.18)	(0.32)	(0.27)	(0.20)	(0.39)	(0.42)	(0.67)	(0.48)	(0.50)	(0.76)	(0.65)
Individual and household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PSU and sub-district controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,445	1,253	1,192	2,102	1,089	1,013	2,445	1,253	1,192	2,102	1,089	1,013
R-squared	0.15	0.15	0.22	0.14	0.15	0.22	0.10	0.21	0.12	0.11	0.24	0.13
Adjusted R2	0.115	0.0913	0.160	0.109	0.0828	0.149	0.0939	0.194	0.105	0.105	0.229	0.118
Number of panelid							2,113	1,078	1,035	1,840	948	892

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is an indicator whether the person younger than 18 works in agriculture or not, whereby we use the sample of all under 18 year old individuals. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU and the year of the interview. Individual and household level controls include dummies for the ethnicity and the marital status of the individual as well as household size. PSU and sub-district level controls are for the year 2007 and include the distance of the PSU to the province capital, a dummy for urban location, measures for the importance of agriculture and male unemployment in the PSU as well as the unemployment rate, the dependency ratio, the share of economically active population and the share of households living below the poverty line at the sub-district level. Columns 1-6 show OLS estimates and columns 7-12 individual FE estimates. Columns 4-6 and 10-12 additionally include the district share of agricultural workers working on small private farms (out of all agricultural workers).

Table 2.11.: 5 DIF wage regressions for employees vs. manager/owners

	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female	(10) Full sample	(11) Male	(12) Female
VARIABLES	**Log of hourly real earnings**						**Log of real earnings per month**					
CottonPSU*2011*agri*big*employee	-0.00	0.02	0.25	0.04	0.06	0.29	-0.01	-0.07	0.37	0.05	0.01	0.38
	(0.18)	(0.18)	(0.26)	(0.18)	(0.19)	(0.26)	(0.15)	(0.16)	(0.23)	(0.16)	(0.17)	(0.24)
CottonPSU*2011*agri*big*owner	0.58**	0.54**		0.39*	0.43**		0.89**	0.82**		0.55**	0.55**	
	(0.15)	(0.15)		(0.16)	(0.16)		(0.13)	(0.14)		(0.14)	(0.16)	
CottonPSU*2011*agri*small*employee	0.06	0.02	0.38	0.07	0.03	0.39	-0.47**	-0.43*	-0.10	-0.46**	-0.41*	-0.12
	(0.19)	(0.19)	(0.27)	(0.19)	(0.19)	(0.27)	(0.14)	(0.17)	(0.22)	(0.15)	(0.17)	(0.22)
CottonPSU*2011*agri*small*owner	0.68**	0.86**	0.59	0.72**	0.88**	0.56	0.15	0.26	0.18	0.17	0.28	0.08
	(0.20)	(0.27)	(0.36)	(0.19)	(0.27)	(0.35)	(0.19)	(0.19)	(0.49)	(0.20)	(0.20)	(0.46)
sex	-0.34**						-0.47**					
	(0.02)						(0.02)					
age	0.00	-0.00	0.00**	0.00	-0.00	0.01**	0.00	-0.00	0.00*	0.00	-0.00°	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.11**	0.18**	-0.00	0.10**	0.18**	-0.01	0.13**	0.18**	0.06	0.12**	0.17**	0.06
	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)
tertiaryedu	0.33**	0.32**	0.41**	0.31**	0.31**	0.35**	0.33**	0.32**	0.39**	0.30**	0.30**	0.33**
	(0.05)	(0.06)	(0.07)	(0.05)	(0.06)	(0.07)	(0.04)	(0.05)	(0.06)	(0.04)	(0.05)	(0.06)
firmbig	0.06	0.11*	0.01	0.05	0.11*	0.01	0.08*	0.14**	0.01	0.07*	0.13**	0.01
	(0.04)	(0.05)	(0.06)	(0.04)	(0.04)	(0.06)	(0.03)	(0.04)	(0.05)	(0.03)	(0.04)	(0.05)
statefirm	-0.45**	-0.45**	-0.37**	-0.44**	-0.44**	-0.35**	-0.49**	-0.46**	-0.43**	-0.47**	-0.44**	-0.41**
	(0.04)	(0.05)	(0.06)	(0.04)	(0.05)	(0.06)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)
occhigh	0.17**	0.12*	0.32**	0.17**	0.12*	0.32**	0.12**	0.03	0.34**	0.11*	0.02	0.34**
	(0.04)	(0.05)	(0.09)	(0.04)	(0.05)	(0.10)	(0.04)	(0.05)	(0.08)	(0.04)	(0.05)	(0.08)
occ4578	0.26**	0.17**	0.38**	0.26**	0.17**	0.37**	0.30**	0.21**	0.45**	0.29**	0.21**	0.42**
	(0.04)	(0.04)	(0.09)	(0.04)	(0.04)	(0.09)	(0.03)	(0.04)	(0.08)	(0.03)	(0.04)	(0.08)
occagriskilled	-0.10	-0.26**	0.05	-0.10	-0.27**	0.07	-0.11*	-0.28**	0.06	-0.12*	-0.29**	0.06
	(0.07)	(0.08)	(0.10)	(0.07)	(0.09)	(0.10)	(0.05)	(0.07)	(0.09)	(0.05)	(0.07)	(0.09)
Constant	0.45**	0.09	-0.40°	0.45**	0.09	-0.21°	5.84**	5.39**	4.56**	5.85**	5.39**	2.29**
	(0.13)	(0.14)	(0.23)	(0.13)	(0.14)	(0.11)	(0.11)	(0.13)	(0.20)	(0.11)	(0.12)	(0.10)
Individual FE	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Observations	8,069	5,365	2,704	8,069	5,365	2,704	8,137	5,409	2,728	8,137	5,409	2,728
R-squared	0.41	0.34	0.43				0.45	0.36	0.41			
Adjusted R2	0.400	0.323	0.409	.	.	.	0.443	0.350	0.387	.	.	.
Number of panelid				5,745	3,689	2,056				5,780	3,709	2,071

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1
The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri), a dummy for working in a small firm, a dummy for being the owner (or the manager) of the firm and all interactions between agri, cotton PSU, the year dummies, the small and the owner dummy. Columns 1-3 and 7-9 show OLS estimates and columns 4-6 and 10-12 individual FE estimates.

Table 2.12.: OLS including area cropped with cotton and wheat per district (sub-sample of agricultural workers)

VARIABLES	(1) Big farms (>25 employees) Full sample	(2) Male	(3) Female	(4) Small farms (<25 employees) Full sample	(5) Male	(6) Female	(7) All agricultural workers Full sample	(8) Male	(9) Female	(10) All agricultural workers Full sample	(11) Male	(12) Female
	Dependent variable: Log of the real wage per hour											
Cotton area per district	0.01	0.03	0.00	0.01	-0.03	0.05	-0.01	-0.01	-0.00			
	(0.02)	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)	(0.02)	(0.02)	(0.02)			
District share of agri. workers on small farms							-0.10	0.39	-1.10*	0.14	0.39	-0.32
							(0.38)	(0.43)	(0.49)	(0.36)	(0.53)	(0.36)
Cotton area*Dist. share of small farm work.							0.02	-0.01	0.07*			
							(0.03)	(0.04)	(0.03)			
sex	-0.14**			-0.07			-0.16**			-0.15**		
	(0.05)			(0.06)			(0.04)			(0.04)		
age	0.00**	0.00	0.01**	0.01**	0.00	0.01*	0.01**	0.00	0.01**	0.01**	0.00	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	-0.01	-0.03	-0.03	0.06	0.16	-0.05	0.02	0.05	-0.00	0.03	0.06	0.00
	(0.05)	(0.10)	(0.06)	(0.09)	(0.13)	(0.12)	(0.05)	(0.08)	(0.06)	(0.05)	(0.08)	(0.06)
tertiaryedu	0.17	0.20	-0.01	0.23	0.42*	-0.43	0.15	0.23°	-0.15	0.18	0.24°	-0.19
	(0.15)	(0.18)	(0.26)	(0.17)	(0.20)	(0.43)	(0.12)	(0.14)	(0.25)	(0.11)	(0.13)	(0.25)
firmbig	-0.15*	-0.20°	-0.12				-0.20*	-0.17°	-0.21*	-0.20*	-0.18°	-0.22*
	(0.07)	(0.11)	(0.08)				(0.08)	(0.10)	(0.09)	(0.08)	(0.10)	(0.09)
statefirm	0.03	0.20	-0.12	-0.31*	-0.22	-0.40	-0.20**	-0.14°	-0.25**	-0.19**	-0.13	-0.24**
	(0.09)	(0.12)	(0.12)	(0.15)	(0.17)	(0.27)	(0.07)	(0.09)	(0.09)	(0.07)	(0.09)	(0.09)
occhigh	0.36*	0.33°	0.40	0.33°	0.32	-0.11	0.27*	0.23	0.07	0.27*	0.22	0.02
	(0.15)	(0.19)	(0.41)	(0.19)	(0.21)	(0.42)	(0.11)	(0.15)	(0.31)	(0.12)	(0.15)	(0.30)
occ4578	0.44*	0.34	0.07	0.30°	0.22	-0.11	0.36*	0.31°	0.16	0.36*	0.30°	0.14
	(0.22)	(0.23)	(0.25)	(0.17)	(0.23)	(0.44)	(0.14)	(0.18)	(0.34)	(0.14)	(0.18)	(0.35)
occagriskilled	-0.17	-0.20	-0.17	-0.03	-0.13	-0.06	-0.06	-0.13	-0.05	-0.07	-0.15	-0.04
	(0.14)	(0.15)	(0.18)	(0.10)	(0.14)	(0.15)	(0.08)	(0.11)	(0.12)	(0.08)	(0.12)	(0.11)
Wheat area per district										0.03	0.03	0.03°
										(0.02)	(0.02)	(0.02)
Wheat area*Dist. share of small farm work										-0.00	-0.02	0.01
										(0.02)	(0.02)	(0.02)
Constant	-1.09**	-1.54**	0.48	0.85	0.12	0.82	0.28	0.42	2.28**	0.04	0.43	2.10**
	(0.38)	(0.31)	(0.34)	(0.97)	(1.62)	(0.64)	(0.40)	(1.04)	(0.50)	(0.39)	(1.15)	(0.47)
Observations	1,142	459	683	1,229	678	551	2,371	1,137	1,234	2,371	1,137	1,234
R-squared	0.37	0.40	0.39	0.37	0.33	0.50	0.38	0.34	0.44	0.38	0.34	0.44
Adjusted R2	0.337	0.308	0.336	0.326	0.255	0.437	0.356	0.298	0.405	0.360	0.299	0.410

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications are estimated for the sub-sample of agricultural workers and include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU and the year of the interview. Area under cotton and wheat is measured in 1000 hectares.

Table 2.13.: OLS wage regressions controlling for the privatization process and monopsony power

	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female	(10) Full sample	(11) Male	(12) Female
VARIABLES	**log of the real wage per hour**			**log of the real monthly wage**			**log of the real wage per hour**			**log of the real monthly wage**		
District share of agri. workers on small farms	0.18	0.16	0.19	-0.02	0.05	-0.19						
	(0.15)	(0.16)	(0.17)	(0.11)	(0.13)	(0.15)						
cottonPSU*agri*year2009	-0.31	-0.45	-0.27	-0.29	-0.33	-0.30	-0.28	-0.43	-0.18	-0.25	-0.31	-0.20
	(0.24)	(0.28)	(0.30)	(0.21)	(0.24)	(0.26)	(0.24)	(0.28)	(0.29)	(0.21)	(0.23)	(0.27)
cottonPSU*agri*year2011	0.25	0.01	0.53*	0.08	-0.01	0.27	0.28	0.01	0.63*	0.12	0.00	0.39
	(0.21)	(0.23)	(0.25)	(0.19)	(0.21)	(0.28)	(0.21)	(0.23)	(0.25)	(0.20)	(0.21)	(0.28)
sex	-0.35**			-0.49**			-0.35**			-0.48**		
	(0.03)			(0.02)			(0.02)			(0.02)		
age	0.00*	-0.00	0.01**	0.00	-0.00	0.01**	0.00*	0.00	0.01**	0.00	-0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.10**	0.17**	-0.00	0.13**	0.17**	0.06	0.11**	0.18**	0.00	0.14**	0.18**	0.06
	(0.04)	(0.05)	(0.05)	(0.03)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)	(0.03)	(0.04)	(0.04)
tertiaryedu	0.35**	0.35**	0.41**	0.35**	0.33**	0.39**	0.34**	0.34**	0.40**	0.35**	0.33**	0.39**
	(0.05)	(0.07)	(0.08)	(0.05)	(0.06)	(0.07)	(0.05)	(0.06)	(0.07)	(0.04)	(0.05)	(0.06)
firmbig	0.02	0.12**	-0.12°	0.11**	0.20**	-0.04	0.03	0.11**	-0.09	0.12**	0.19**	0.01
	(0.04)	(0.04)	(0.07)	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)	(0.03)	(0.04)	(0.06)
statefirm	-0.41**	-0.40**	-0.38**	-0.41**	-0.39**	-0.38**	-0.43**	-0.42**	-0.41**	-0.44**	-0.42**	-0.41**
	(0.04)	(0.05)	(0.07)	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)	(0.03)	(0.04)	(0.05)
occhigh	0.17**	0.09	0.40**	0.11*	0.02	0.37**	0.18**	0.13*	0.32**	0.13**	0.05	0.35**
	(0.05)	(0.06)	(0.11)	(0.05)	(0.05)	(0.09)	(0.04)	(0.05)	(0.09)	(0.04)	(0.05)	(0.08)
occ4578	0.29**	0.18**	0.50**	0.32**	0.23**	0.48**	0.26**	0.17**	0.42**	0.30**	0.21**	0.48**
	(0.04)	(0.04)	(0.11)	(0.04)	(0.04)	(0.10)	(0.04)	(0.04)	(0.09)	(0.03)	(0.04)	(0.08)
occagriskilled	-0.10	-0.26**	0.04	-0.11°	-0.28**	0.07	-0.11	-0.25**	0.02	-0.11°	-0.27**	0.06
	(0.07)	(0.08)	(0.10)	(0.05)	(0.07)	(0.09)	(0.07)	(0.08)	(0.10)	(0.05)	(0.07)	(0.09)
Nr. of issued SCLG certificates per sub-district							0.09	0.08	0.13	0.01	0.03	-0.03
							(0.08)	(0.08)	(0.15)	(0.06)	(0.05)	(0.13)
Constant	-0.22	-0.64*	-0.60*	5.84**	5.35**	4.04**	0.43**	0.04	-0.34°	5.81**	5.36**	4.54**
	(0.26)	(0.31)	(0.23)	(0.12)	(0.14)	(0.24)	(0.11)	(0.12)	(0.20)	(0.10)	(0.11)	(0.18)
Observations	7,011	4,693	2,318	7,071	4,734	2,337	8,129	5,407	2,722	8,197	5,451	2,746
R-squared	0.40	0.33	0.42	0.44	0.36	0.38	0.39	0.32	0.42	0.44	0.35	0.40
Adjusted R2	0.397	0.320	0.404	0.436	0.346	0.362	0.386	0.307	0.397	0.431	0.336	0.377

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1
The dependent variable is the log of the real wage per hour in the last month (col. 1-3 and 7-9) and the log of the monthly real wage (col. 4-6 and 10-12). All specifications are estimated by OLS and include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton PSU and the year dummies. Columns 1-6 additionally include the share of small farm workers per district and columns 7-12 the number of newly issued SCLG land use certificates per sub-district.

Table 2.14.: FE wage regressions controlling for the privatization process and monopsony power

	(1) Full sam-ple	(2) Male	(3) Female	(4) Full sam-ple	(5) Male	(6) Female	(7) Full sam-ple	(8) Male	(9) Female	(10) Full samp-le	(11) Male	(12) Female
VARIABLES	**log of the real wage per hour**			**log of the real monthly wage**			**log of the real wage per hour**			**log of the real monthly wage**		
District share of agri. workers on small farms	0.10	0.02	0.34*	-0.14	-0.12	-0.17						
	(0.15)	(0.16)	(0.17)	(0.10)	(0.12)	(0.14)						
cottonPSU*agri*year2009	-0.64	-0.97°	0.09	-0.58	-0.76°	-0.18	-0.61	-0.95°	0.22	-0.49	-0.68°	0.02
	(0.43)	(0.49)	(0.39)	(0.36)	(0.40)	(0.36)	(0.44)	(0.49)	(0.37)	(0.36)	(0.40)	(0.38)
cottonPSU*agri*year2011	0.17	-0.21	0.94**	0.16	-0.09	0.65°	0.16	-0.24	0.99**	0.19	-0.07	0.79*
	(0.36)	(0.42)	(0.34)	(0.32)	(0.36)	(0.34)	(0.36)	(0.42)	(0.31)	(0.32)	(0.36)	(0.32)
age	-0.02	-0.04	0.02	-0.01	-0.02	-0.00	-0.03°	-0.04°	0.00	-0.02°	-0.03	-0.02
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
secondaryedu	-0.02	0.03	-0.16	-0.00	0.03	-0.05	0.02	0.05	-0.06	0.03	0.04	0.02
	(0.08)	(0.11)	(0.11)	(0.06)	(0.09)	(0.08)	(0.07)	(0.09)	(0.09)	(0.06)	(0.08)	(0.07)
tertiaryedu	-0.10	-0.03	-0.29	-0.05	0.01	-0.25°	-0.04	-0.01	-0.06	0.00	0.03	-0.07
	(0.10)	(0.12)	(0.18)	(0.09)	(0.11)	(0.14)	(0.09)	(0.10)	(0.15)	(0.07)	(0.09)	(0.11)
firmbig	-0.02	0.01	0.00	0.09°	0.14*	0.04	-0.00	0.03	-0.05	0.10*	0.13**	0.07
	(0.05)	(0.06)	(0.09)	(0.05)	(0.06)	(0.07)	(0.05)	(0.05)	(0.07)	(0.04)	(0.05)	(0.06)
statefirm	-0.16*	-0.17*	-0.13	-0.21**	-0.21**	-0.23*	-0.18**	-0.18**	-0.17°	-0.23**	-0.22**	-0.24**
	(0.07)	(0.08)	(0.13)	(0.07)	(0.08)	(0.10)	(0.06)	(0.07)	(0.10)	(0.05)	(0.06)	(0.08)
occhigh	0.19°	0.11	0.38°	0.12	0.04	0.35*	0.17°	0.10	0.35°	0.10	0.01	0.34*
	(0.10)	(0.12)	(0.22)	(0.08)	(0.10)	(0.16)	(0.09)	(0.10)	(0.18)	(0.07)	(0.08)	(0.14)
occ4578	0.31**	0.25**	0.48**	0.30**	0.25**	0.44**	0.21**	0.18*	0.25°	0.24**	0.19**	0.35**
	(0.08)	(0.09)	(0.15)	(0.07)	(0.07)	(0.15)	(0.07)	(0.08)	(0.14)	(0.06)	(0.07)	(0.12)
occagriskilled	-0.13	-0.31*	0.11	-0.11	-0.26*	0.10	-0.14	-0.31*	0.11	-0.12	-0.27*	0.08
	(0.11)	(0.15)	(0.16)	(0.09)	(0.11)	(0.15)	(0.11)	(0.14)	(0.16)	(0.09)	(0.11)	(0.15)
Nr. of issued SCLG certificates per sub-district							0.06	0.06	0.20	-0.07	-0.05	-0.02
							(0.09)	(0.11)	(0.21)	(0.07)	(0.07)	(0.16)
Constant	0.61	1.63	-1.39°	5.74**	6.26**	4.83**	1.02°	1.73*	-0.48	6.04**	6.46**	5.25**
	(0.73)	(1.07)	(0.82)	(0.56)	(0.87)	(0.73)	(0.56)	(0.76)	(0.80)	(0.47)	(0.65)	(0.64)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,011	4,693	2,318	7,071	4,734	2,337	8,129	5,407	2,722	8,197	5,451	2,746
Number of panelid	5,161	3,336	1,825	5,193	3,356	1,837	5,773	3,706	2,067	5,807	3,726	2,081
R-squared	0.22	0.23	0.29	0.23	0.25	0.27	0.23	0.23	0.29	0.24	0.26	0.29
Adjusted R2	0.216	0.224	0.281	0.223	0.247	0.259	0.225	0.229	0.283	0.236	0.252	0.286

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1
The dependent variable is the log of the real wage per hour in the last month (col. 1-3 and 7-9) and the log of the monthly real wage (col. 4-6 and 10-12). All specifications include individual fixed effects, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton PSU and the year dummies. Columns 1-6 additionally include the share of small farm workers per district and columns 7-12 the number of newly issued SCLG land use certificates per sub-district.

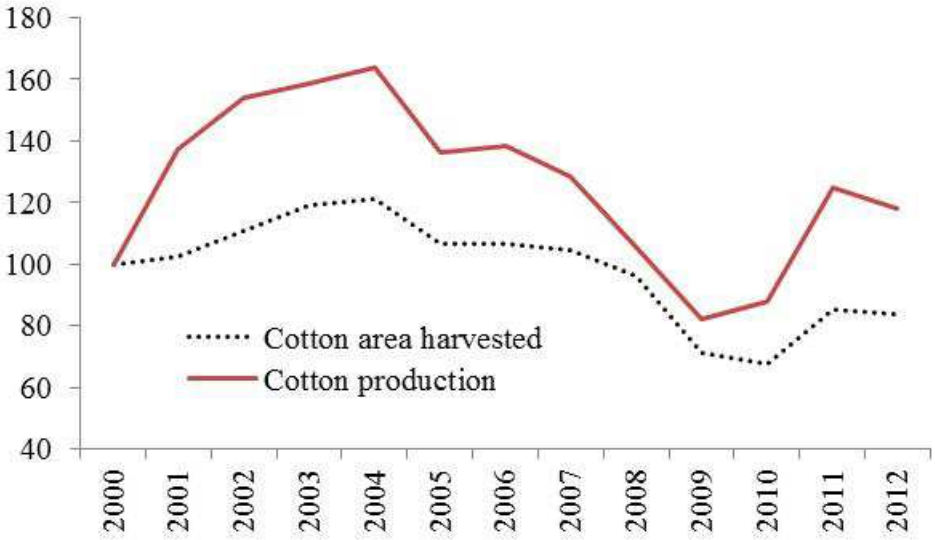
Table 2.15.: Wage regressions including additional control variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All workers						**Big firms (>25 employees)**			**Small firms (<25 employees)**		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**log of the real wage per hour**			**log of the real monthly wage**			**log of the real wage per hour**			**log of the real wage per hour**		
Share of pop. economic. active in sub-district	0.02°	0.01	0.05**	0.01°	0.01	0.03*	0.01	0.02	-0.01	0.02	0.00	0.07**
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
Share of fem. pop. econo. active in sub-district	-0.01*	-0.01	-0.04**	-0.01°	-0.00	-0.03*	-0.01	-0.02	0.01	-0.02	-0.00	-0.07**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Unemployment rate in the sub-district	-0.02**	-0.02**	-0.04**	-0.01**	-0.01*	-0.03**	-0.02*	-0.03*	-0.01	-0.02*	-0.01	-0.05**
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
cottonPSU*agri*year2009	-0.12	-0.19	-0.15	-0.10	-0.09	-0.22	-0.47	-0.48	-0.24	0.13	-0.11	0.44
	(0.28)	(0.32)	(0.39)	(0.24)	(0.25)	(0.33)	(0.36)	(0.40)	(0.48)	(0.32)	(0.39)	(0.41)
cottonPSU*agri*year2011	0.42°	0.15	0.65*	0.14	-0.06	0.48	-0.72*	-0.69*	0.10	0.54°	0.17	0.99*
	(0.23)	(0.27)	(0.28)	(0.23)	(0.25)	(0.30)	(0.30)	(0.34)	(0.24)	(0.28)	(0.32)	(0.38)
sex	-0.31**	0.00	0.00	-0.44**	0.00	0.00	-0.30**	0.00	0.00	-0.27**	0.00	0.00
	(0.03)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)	(0.04)	(0.00)	(0.00)	(0.04)	(0.00)	(0.00)
age	-0.00	-0.00	-0.00	-0.00°	-0.00**	0.00	-0.00	-0.00	0.00	-0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.06	0.09	-0.00	0.09*	0.11*	0.07	-0.01	-0.03	0.02	0.08	0.14°	-0.03
	(0.04)	(0.06)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.10)	(0.06)	(0.06)	(0.08)	(0.08)
tertiaryedu	0.26**	0.24**	0.32**	0.29**	0.26**	0.34**	0.20*	0.06	0.44**	0.27**	0.32**	0.20
	(0.06)	(0.07)	(0.09)	(0.05)	(0.06)	(0.07)	(0.08)	(0.12)	(0.11)	(0.07)	(0.09)	(0.12)
firmbig	0.05	0.10*	-0.03	0.12**	0.16**	0.05	0.07	0.11*	0.04	0.00	0.00	0.00
	(0.04)	(0.05)	(0.07)	(0.04)	(0.04)	(0.06)	(0.04)	(0.05)	(0.06)	(0.00)	(0.00)	(0.00)
statefirm	-0.43**	-0.41**	-0.45**	-0.45**	-0.42**	-0.45**	-0.30**	-0.30**	-0.25*	-0.55**	-0.54**	-0.58**
	(0.05)	(0.06)	(0.07)	(0.04)	(0.05)	(0.07)	(0.06)	(0.07)	(0.10)	(0.07)	(0.08)	(0.13)
occhigh	0.18**	0.14*	0.30**	0.12*	0.05	0.34**	0.07	0.02	0.21	0.32**	0.29**	0.39**
	(0.05)	(0.07)	(0.11)	(0.05)	(0.06)	(0.09)	(0.08)	(0.11)	(0.14)	(0.07)	(0.08)	(0.13)
occ4578	0.26**	0.20**	0.31*	0.30**	0.23**	0.39**	0.24**	0.10	0.32°	0.28**	0.23**	0.30°
	(0.04)	(0.05)	(0.12)	(0.04)	(0.04)	(0.10)	(0.09)	(0.12)	(0.17)	(0.05)	(0.06)	(0.15)
occagriskilled	-0.15°	-0.28**	0.00	-0.12°	-0.30**	0.09	-0.25°	-0.32*	-0.21	-0.04	-0.21°	0.19
	(0.08)	(0.09)	(0.12)	(0.07)	(0.08)	(0.11)	(0.14)	(0.14)	(0.20)	(0.10)	(0.13)	(0.13)
Constant	0.69	-0.25	0.22	4.16**	4.55**	3.96*	-0.00	-0.62	-0.13	0.88	-0.66	4.47°
	(1.01)	(1.00)	(2.28)	(1.28)	(0.99)	(1.74)	(1.61)	(2.72)	(2.14)	(1.53)	(1.37)	(2.68)
Individual and household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PSU and sub-district controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,856	9,505	10,351	17,016	8,182	8,834	19,856	9,505	10,351	17,016	8,182	8,834
R-squared	0.19	0.21	0.22	0.17	0.19	0.19	0.01	0.02	0.02	0.02	0.03	0.02
Adjusted R2	0.19	0.20	0.21	0.16	0.18	0.18	0.01	0.02	0.02	0.01	0.02	0.02

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

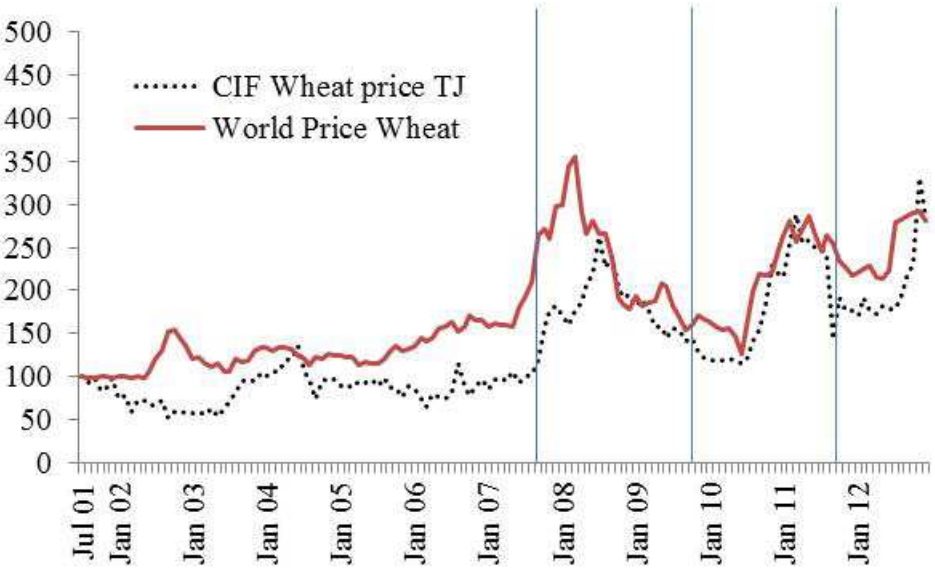
The dependent variable is the log of the real wage per hour in the last month (col. 1-3 and 7-12) and the log of the monthly real wage (col. 4-6). All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton PSU and the year dummies. Individual and household level controls include dummies for the ethnicity and the marital status of the individual as well as household size. PSU and sub-district level controls are for the year 2007 and include the distance of the PSU to the province capital, a dummy for urban location, measures for the importance of agriculture and male unemployment in the PSU as well as the unemployment rate, the dependency ratio, the share of economically active population and the share of households living below the poverty line at the sub-district level.

Appendix 2 A Tables and Figures



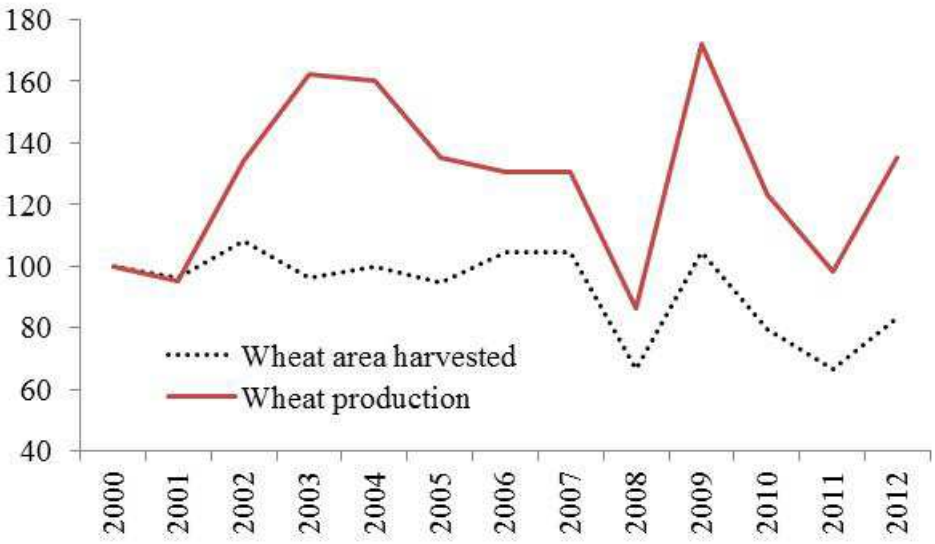
Appendix Figure A 2.6.: Cotton production and land area harvested (100=2000)

Source: United States Department of Agriculture (USDA) - Foreign Agricultural Service (FAS)

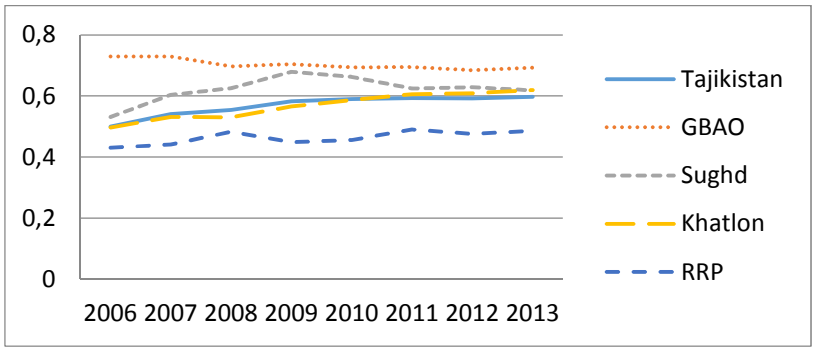


Appendix Figure A 2.7.: Wheat world market price (100=2001)

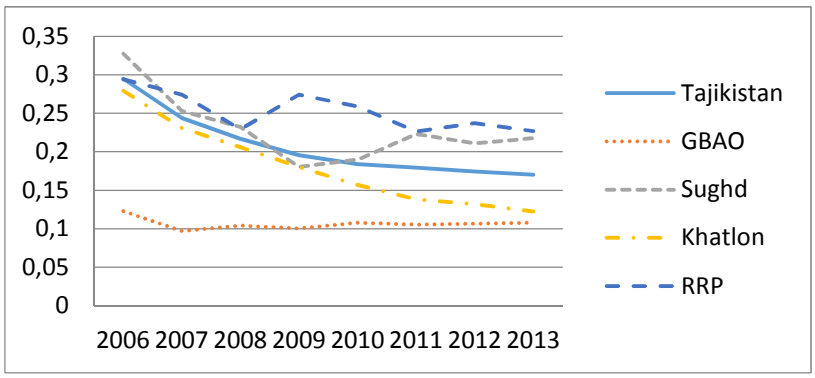
Note: Vertical lines mark survey dates. Source: IMF Primary Commodity Prices (Wheat, No.1 Hard Red Winter, ordinary protein, FOB Gulf of Mexico, US$ per metric ton) and Statistical Agency of Tajikistan



Appendix Figure A 2.8.: Wheat production and land area harvested (100=2000)
Source: United States Department of Agriculture (USDA) - Foreign Agricultural Service (FAS)

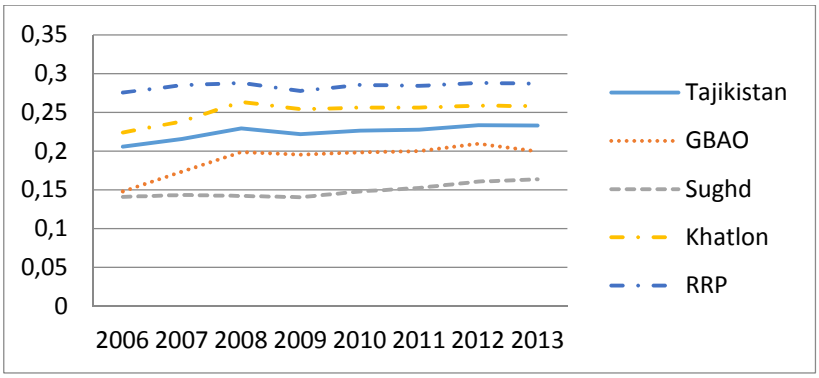


Appendix Figure A 2.9.: Share of cultivated area under dehkan farms per province
Source: TajStat 2012



Appendix Figure A 2.10.: Share of cultivated area under state owned enterprises per province

Source: TajStat 2012

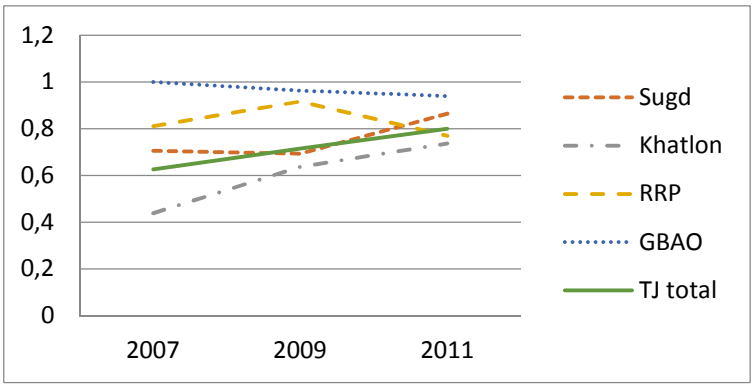


Appendix Figure A 2.11.: Share of cultivated area under household plots per province

Source: TajStat 2012

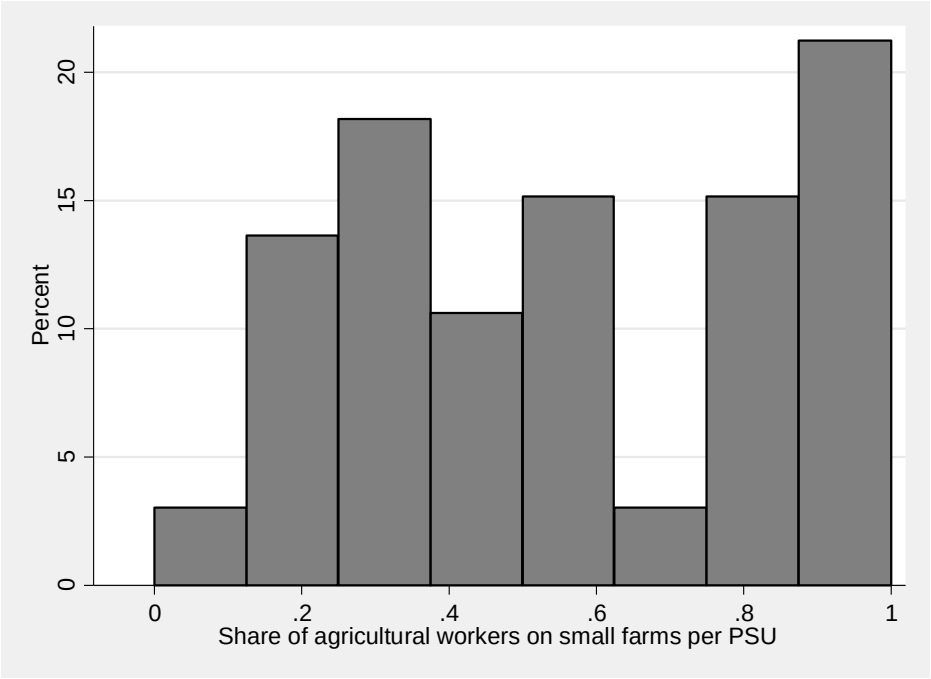
Appendix Figure A 2.12.: Number of newly issued SCLG land use certificates per province (2007=100)

Source: Tajik State Committee for Land and Geodesy (SCLG)

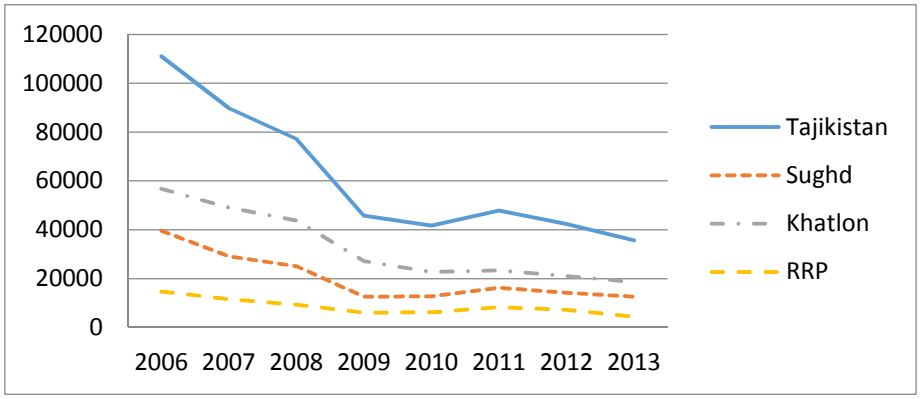


Appendix Figure A 2.13.: Share of small farm workers (out of all agricultural workers) by province

Source: TLSS 2007-2011

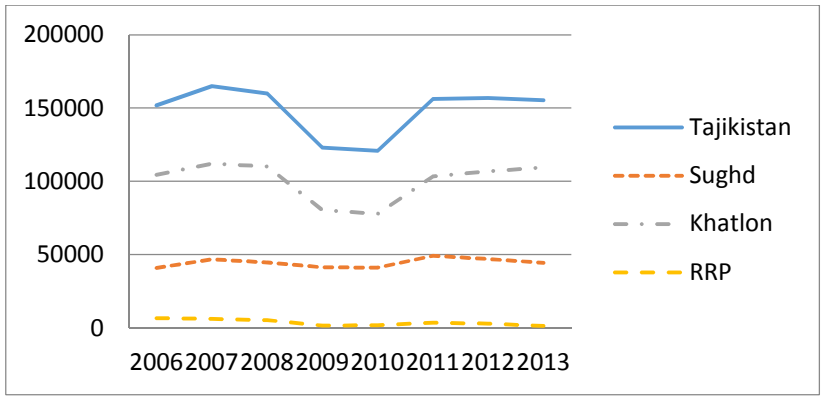


Appendix Figure A 2.14.: Histogram for the share of small farm workers (out of all agricultural workers) per PSU (for all cotton PSUs in 2007); TLSS 2007



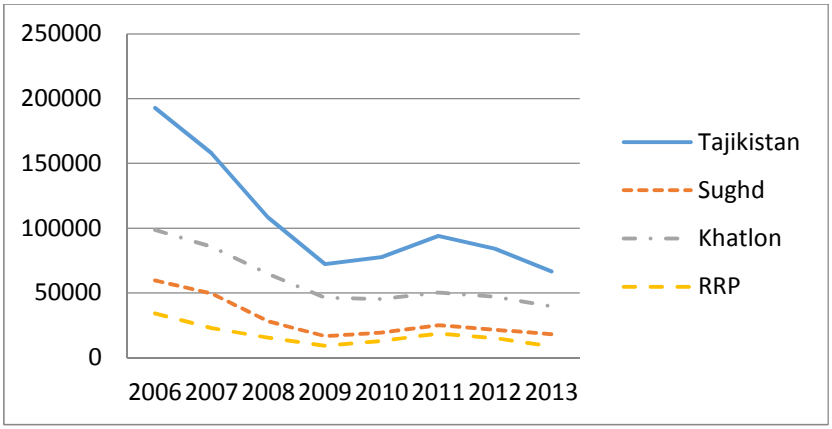
Appendix Figure A 2.15.: Area cropped with cotton on state owned enterprises per province (in ha)

Source: TajStat 2012



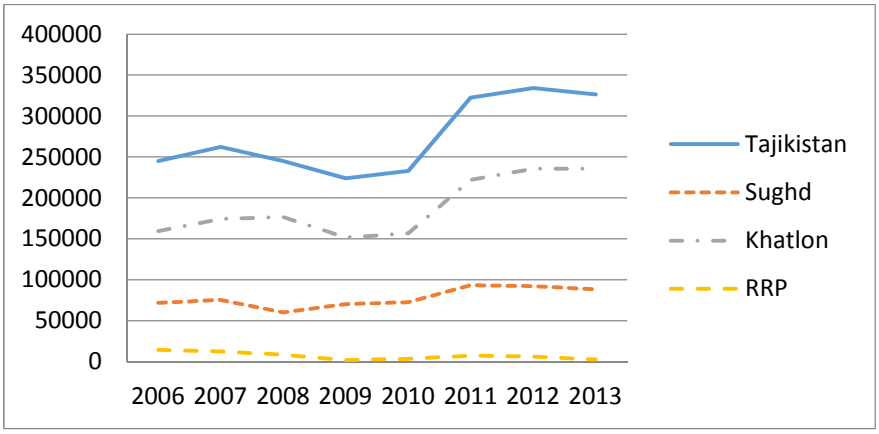
Appendix Figure A 2.16.: Area cropped with cotton on dehkan farms per province (in ha)

Source: TajStat 2012



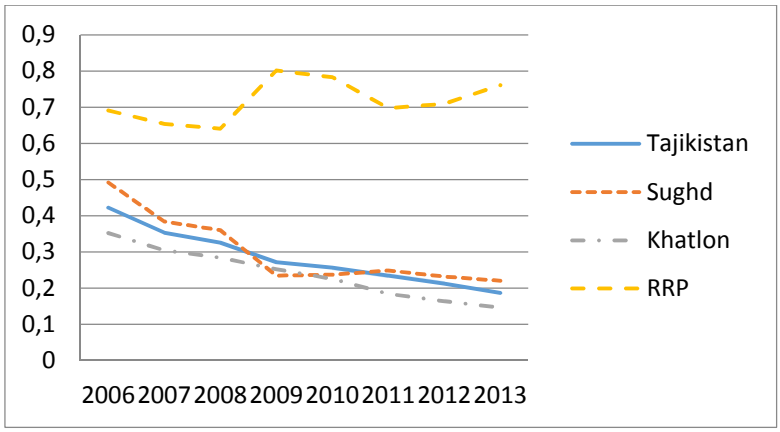
Appendix Figure A 2.17.: Cotton production on state owned enterprises per province (in tons)

Source: TajStat 2012



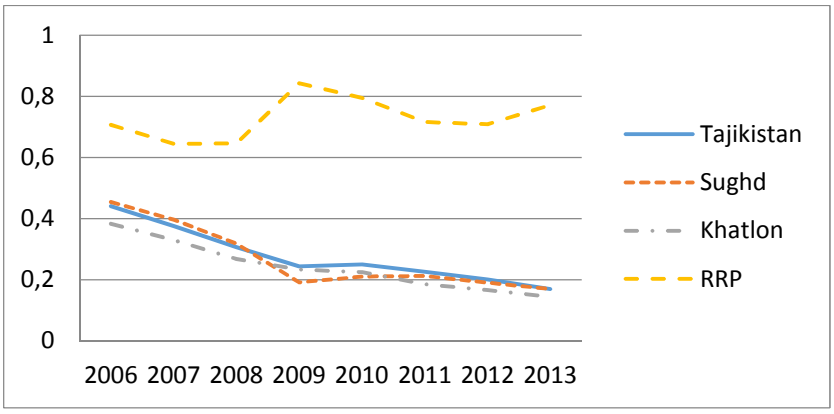
Appendix Figure A 2.18.: Cotton production on dehkan farms per province (in tons)

Source: TajStat 2012



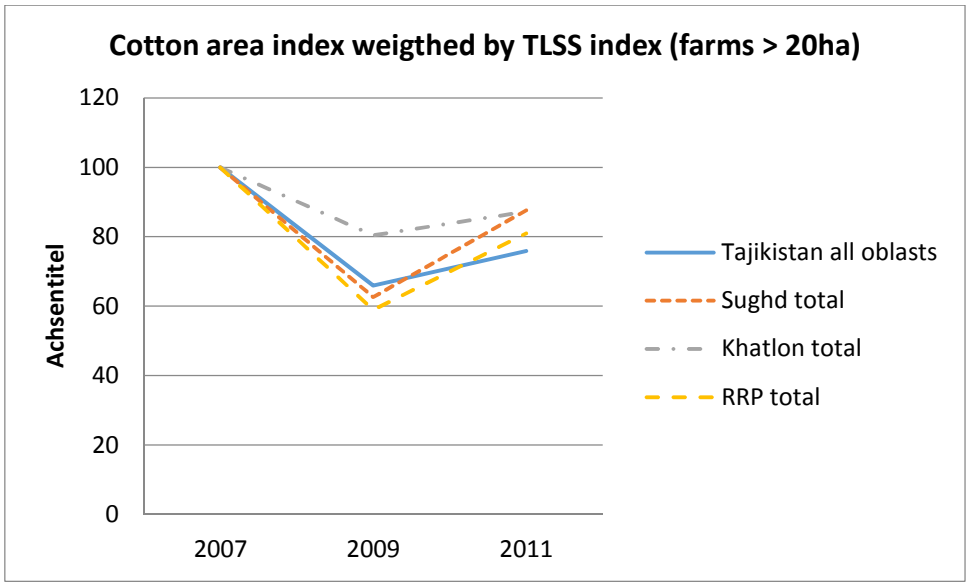
Appendix Figure A 2.19.: Share of area cropped with cotton on state owned enterprises (out of total area under cotton) per province

Source: TajStat 2012



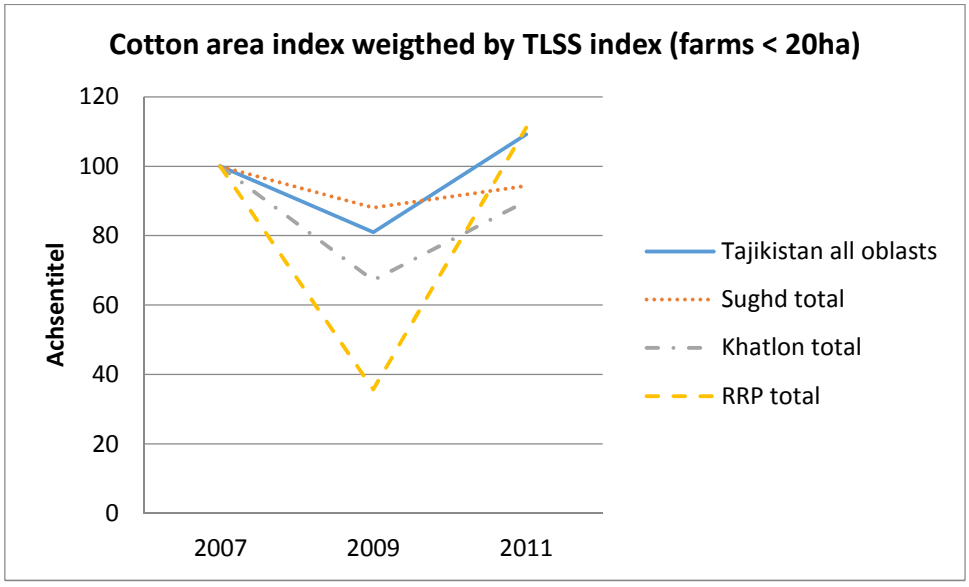
Appendix Figure A 2.20.: Share of cotton production on state owned enterprises (out of total cotton production) per province

Source: TajStat 2012



Appendix Figure A 2.21.: Area cropped with cotton on big farms (>20 ha) per province (2007=100)

Source: Statistical Agency of Tajikistan (Interview); Note: The index is weighted by the share of big farm workers (out of all agricultural workers) per province to account for varying cultivated area on big farms.



Appendix Figure A 2.22.: Area cropped with cotton on small farms (<20 ha) per province (2007=100)

Source: Statistical Agency of Tajikistan (Interview); Note: The index is weighted by the share of small farm workers (out of all agricultural workers) per province to account for varying cultivated area on small farms.

Appendix Table A 2.16.: Data on number of private vs. collective dehkan farms for whole Tajikistan

	Number of entities		**Arable land cultivated in ha**	
	2006	**2010**	**2006**	**2010**
Private Dehkan Farms	18040	18300	324724	320000
Collective Dehkan Farms	9000	8300	162000	165000
HH and Presidential Plots	1115400		274908	
State enterprises	193		62146	

Note: HH plots and Presidential plots grow mainly crops for subsistence consumption and do not grow cotton (average size is 0.2 ha). Source: FAO Mission reports 2009 and 2011

Appendix Table A 2.17.: Farm Head Survey GIZ 2011

Indicators and variables	**Group Means**		**Difference (Big-Small)**	**p-value of the twosided T-Test**
	Small Farms (<20 ha)	**Big Farms (>20 ha)**		
% of family heads working abroad (of total families being shareholders)	0.6504386	0.4636383	-0.1868003	0.001
	(0.0484872)	(0.0284314)	(0.0561239)	
Losses are added to farm debts, farm manager does not take on the debts	0.2619048	0.4094488	0.1475441	0.01
	(0.0393254)	(0.043807)	(0.0588688)	
Farm head is regularly receiving information about world price of cotton	0.7063492	0.7480315	0.0416823	0.46
	(0.0407352)	(0.0386766)	(0.0561715)	
Jamoat, hukumat or futurists influence decisions on the farm	0	0.039	0.039	0.02
	(0)	(0.017)	(0.017)	
Fear of consecuences if I reduce cotton area	0.3333333	0.3385827	0.0052493	0.93
	(0.0421637)	(0.0421585)	(0.0596248)	
Spending for social responsibili-ties from income of Manager	1418.294	3803.787	2898.389	0
	(250.3035)	(498.2477)	(626.1253)	
Farm Manager elected by hukumat	0.00	0.02	0.02	0.16
	(0)	(0.0110913)	(0.011)	
Number of observations	**126**	**127**		

Source: GIZ farm head survey 2011; Note: Standard errors in parenthesis

Appendix Table A 2.18.: Two most important agricultural crops in cotton and non-cotton communities (communities included in the TLSS)

	First crop in PSU		**Second crop in PSU**	
	Non-cotton PSUs	Cotton PSUs	Non-cotton PSUs	Cotton PSUs
Cotton-growing	0	**44**	0	**60**
Gardening	5	1	**20**	2
Grain crops	**32**	6	8	**26**
Plant growing	3	1	0	0
Vegetable growing	**21**	**51**	**33**	**16**
Vineyard	2	1	0	0
Legumes	0	0	2	0
Total	**63**	**104**	**63**	**104**

Source: TLSS 2007

Appendix TableA 2.19.: Two most important economic activities in cotton and non-cotton communities (PSUs)

	First economic activity in PSU		**Second economic activity in PSU**	
	Non-cotton PSUs	Cotton PSUs	Non-cotton PSUs	Cotton PSUs
Agriculture	**55**	**56**	1	2
Mining	**5**	**6**	**2**	**5**
Manufacturing	0	5	2	5
Energy, Gas and Water	0	1	1	1
Construction	1	1	3	9
Retail Trade, Restaurants and Hotels	1	**30**	**13**	**21**
Transport	0	1	3	5
Finance, Real Estate and Insurance	0	0	0	2
Public Administration and Defense	0	0	2	2
Education	0	3	**29**	**14**
Health and Social Services	0	0	0	8
Other Services	0	0	0	11
Other	1	1	3	1
Total	**63**	**104**	**59**	**86**

Source: TLSS 2007

Appendix Table A 2.20.: Comparison of Cotton and Non-Cotton communities (Double T-tests or Rank-sum-tests)

Variable	Cotton PSUs	Non-Cotton PSUs	P-Value for group comparison test (H0: no difference)
Population	6600	7210	68%
Altitude	684m	1301m	0%
Distance to Dushanbe	152km	257km	0%
Hours to drive to Dushanbe	5.9h	9.8h	1%
Distance to District Capital	13km	25km	0%
Hours to drive to District Capital	0.24h	1h	4%
School enrolment	same median	same median	97%
Weeks school close because of agriculture	0.4	0.2	15%
Share of population working in agriculture	lower than median	higher than median	0%
Quality of Roads	better	worse	1.6%
Part of crops planted on irrigated fields	higher than median	lower than median	2%

Source: TLSS 2007

Appendix Table A 2.21.: Agricultural workers in cotton regions (treated) vs. agricultural workers in non-cotton regions (control) in 2007

Variable	Mean Control Group	Mean Treated Group	Difference	SE of Difference	P-value	N Control	N Treated
Wage	159.58	133.81	25.77	23.92	0.28	302	1005
Dummy for being female	0.46	0.56	-0.10	0.02	0.00	880	1229
age	35.65	33.29	2.36	0.61	0.00	880	1229
Dummy for primary or no education	0.34	0.28	0.06	0.02	0.00	880	1229
Dummy for secondary educ.	0.61	0.69	-0.07	0.02	0.00	880	1229
Dummy for tertiary educ.	0.04	0.03	0.01	0.01	0.27	880	1229
Dummy for working in a small firm (<25 employees)	0.86	0.46	0.40	0.02	0.00	880	1229
Dummy for working in a very big firm (>50 employees)	0.07	0.29	-0.21	0.02	0.00	880	1229
Dummy for working in a state owned firm	0.07	0.17	-0.10	0.01	0.00	880	1229
Dummy for high occupation	0.02	0.02	0.00	0.01	0.50	880	1229
Dummy for occ. group 4,5,7 and 8	0.01	0.04	-0.03	0.01	0.00	880	1229
Dummy for skilled agricultural occupation	0.84	0.89	-0.05	0.02	0.00	880	1229
Dummy for unskilled occup.	0.12	0.05	0.08	0.01	0.00	880	1229
Hours worked per week	40.45	46.45	-6.01	0.75	0.00	880	1229

Source: TLSS 2007

Appendix Table A 2.22.: Agricultural workers in cotton regions on small farms (treated) vs. agricultural workers in cotton regions on big farms (control) in 2007

Variable	Mean Control Group	Mean Treated Group	Difference	SE of Difference	P-value	N Control	N Treated
Wage	94.78	201.09	-106.32	28.79	0.00	636	369
Dummy for being female	0.60	0.51	0.09	0.03	0.00	0.60	0.51
age	32.39	34.35	-1.95	0.75	0.01	32.39	34.35
Dummy for primary or no education	0.29	0.27	0.02	0.03	0.54	0.29	0.27
Dummy for secondary educ.	0.69	0.69	-0.01	0.03	0.84	0.69	0.69
Dummy for tertiary educ.	0.03	0.04	-0.01	0.01	0.31	0.03	0.04
Dummy for working in a small firm (<25 employees)	0.00	1.00	-1.00	0.00		0.00	1.00
Dummy for working in a very big firm (>50 employees)	0.53	0.00	0.53	0.02	0.00	0.53	0.00
Dummy for working in a state owned firm	0.23	0.10	0.14	0.02	0.00	0.23	0.10
Dummy for high occupation	0.01	0.03	-0.01	0.01	0.11	0.01	0.03
Dummy for occ. group 4,5,7 and 8	0.03	0.05	-0.02	0.01	0.08	0.03	0.05
Dummy for skilled agricultural occupation	0.92	0.86	0.06	0.02	0.00	0.92	0.86
Dummy for unskilled occup.	0.03	0.06	-0.03	0.01	0.02	0.03	0.06
Hours worked per week	50.87	41.22	9.65	0.87	0.00	50.87	41.22

Source: TLSS 2007

Appendix Table A 2.23.: All female individuals in cotton (treated) vs. female in non-cotton regions (control) in 2007

Variable	Mean Control Group	Mean Treated Group	Difference	SE of Difference	P-value	N Control	N Treated
wage	127.87	154.02	-26.16	14.24	0.07	356	1099
Dummy working in agriculture (working age population)	0.17	0.19	-0.02	0.01	0.12	2313	3617
age	26.23	25.52	0.71	0.39	0.07	3786	6029
Dummy for primary or no education	0.60	0.58	0.02	0.01	0.03	3786	6029
Dummy for secondary educ.	0.37	0.37	0.00	0.01	0.87	3786	6029
Dummy for tertiary educ.	0.02	0.05	-0.02	0.00	0.00	3786	6029
Dummy for working in a small firm (<25 employees)	0.13	0.10	0.03	0.01	0.00	3786	6029
Dummy for working in a very big firm (>50 employees)	0.02	0.06	-0.04	0.00	0.00	3786	6029
Dummy for working in a state owned firm	0.05	0.08	-0.03	0.01	0.00	3786	6029
Dummy for high occupation	0.03	0.05	-0.01	0.00	0.00	3786	6029
Dummy for occ. group 4,5,7 and 8	0.02	0.04	-0.02	0.00	0.00	3786	6029
Dummy for skilled agricultural occupation	0.10	0.11	-0.01	0.01	0.03	3786	6029
Dummy for unskilled occup.	0.02	0.02	0.00	0.00	0.73	3786	6029
Hours worked per week	38.15	42.74	-4.58	0.81	0.00	642	1284

Source: TLSS 2007

Appendix Table A 2.24.: Net profits on small vs. big farms in Tajik Somoni

	Group Means (SE in parenthesis)		**Difference (Big-Small)**	**p-value of the T-Test (Diff>0)**
	Small Farms (<20 ha)	**Big Farms (>20 ha)**		
Netprofits per farm in USD	1765.872 (336.3672)	60732.93 (29978.71)	58967.05 (39665.08)	0.07
Number of observations	**47**	**82**		

Source: FAO Farm data set (Caccavale 2005)

Appendix Table A 2.25.: GIZ Survey of Political Leaders 2011

Indicators for political repression and coerced labor	**Group Means**		**Difference (Big-Small)**	**p-value of the twosided T-Test**
	Respondents in small farm districts (TLSS district share of small farm workers > 50%)	**Respondents in big farm districts (TLSS district share of small farm workers < 50%)**		
District target for area cropped with cotton (% of total cultivatable area)	0.5655857	0.5352559	-0.0303298	0.03
	(0.0115419)	(0.0073749)	(0.0136969)	
To fulfill district production targets, I directly communicate with farmers and agro-processors, procure and distribute farm inputs and charge Jamoat officials to support farmers	0.5008319	0.5915493	0.0907173	0.15
	(0.0204124)	(0.0587511)	(0.0621962)	
To implement freedom to farm we set specific targets for Jamoats and farms	0.1547421	0.2394366	0.0846945	0.12
	(0 .0147647)	(0.0510051)	(0.0530991)	
Freedom to farm reform will decrease agricultural production due to lack of instructions to farmers by district officials	0.0965058	0.1971831	0.1006773	0.04
	(0.0120549)	(0.0475548)	(0.0490589)	
Cotton debt resolution will only increase work load for local governments to control cotton farm activities	0.0266223	0.1126761	0.0860538	0.03
	(0.0065719)	(0.0377927)	(0.0383598)	
Freedom to farm reform will increase local authorities control of farms and the involvement in farm decisions	0.0898502	0.1408451	0.0509948	0.24
	(0.0116746)	(0.0415774)	(0.0431854)	
Cotton debt resolution will increase local authorities control of farms and the involvement in farm decisions	0.0332779	0.1267606	0.0934827	0.02
	(0.0073224)	(0.0397658)	(0.0404343)	
Number of observations	**601**	**71**		

Appendix Table A 2.26.: Participation in agriculture without additional control variables

	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female	(10) Full sample	(11) Male	(12) Female
VARIABLES	**Dependent variable: Working in agriculture**											
District share of agri. workers on small farms				0.06	0.08*	0.04				0.07	0.09*	0.04
				(0.04)	(0.03)	(0.05)				(0.04)	(0.04)	(0.06)
cottonPSU*year2009	0.05	0.02	0.07°	0.04	0.02	0.07°	0.04	0.02	0.06	0.04	0.02	0.06
	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)
cottonPSU*year2011	0.08*	0.06°	0.09*	0.08*	0.06	0.10*	0.07*	0.05	0.10**	0.08*	0.05	0.11**
	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
sex	-0.01			-0.01								
	(0.01)			(0.01)								
age	0.00**	0.00**	0.00**	0.00**	0.01**	0.00**	0.01	0.00	0.01	0.01	0.00	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
secondaryedu	0.01	0.02	0.01	0.01	0.02°	0.01	-0.01	0.01	-0.03°	-0.01	0.01	-0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
tertiaryedu	-0.07**	-0.07**	-0.07**	-0.09**	-0.08**	-0.09**	-0.01	0.02	-0.05*	-0.01	0.02	-0.07*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Constant	-0.00	-0.04	0.02	0.03	-0.16*	-0.03	0.02	0.07	-0.01	-0.01	-0.00	-0.00
	(0.04)	(0.04)	(0.03)	(0.05)	(0.07)	(0.09)	(0.11)	(0.18)	(0.14)	(0.14)	(0.23)	(0.18)
Individual FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,398	11,205	12,193	20,534	9,868	10,666	23,398	11,205	12,193	20,534	9,868	10,666
R-squared	0.16	0.18	0.18	0.14	0.16	0.16	0.01	0.02	0.02	0.01	0.02	0.02
Adjusted R2	0.16	0.17	0.18	0.14	0.15	0.16	0.01	0.02	0.01	0.01	0.02	0.01
Number of panelid							14,113	6,653	7,460	12,896	6,097	6,799

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is an indicator whether the person works in agriculture or not, whereby we use the full sample of the working age population. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU and the year of the interview. Columns 1-6 show OLS estimates and columns 7-12 individual FE estimates. Columns 4-6 and 10-12 additionally include the district share of agricultural workers working on small private farms.

Appendix Table A 2.27.: OLS Small vs. big firms (sub-samples firms in agriculture and non-agriculture)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Agricultural workers						**Workers in non-agricultural enterprises**					
	Small farms (<25 employees)			**Big farms (>25 employees)**			**Small firms (<25 employees)**			**Big firms (>25 employees)**		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**Dependent variable: Log of the real wage per hour**											
cottonPSU*year2009	-0.19	-0.41	0.03	-0.09	-0.07	-0.08	0.04	0.05	0.05	0.06	0.08	-0.10
	(0.27)	(0.33)	(0.28)	(0.20)	(0.24)	(0.23)	(0.12)	(0.13)	(0.23)	(0.15)	(0.18)	(0.24)
cottonPSU*year2011	0.15	-0.09	0.49°	-0.13	-0.11	-0.10	0.01	0.03	-0.14	-0.06	-0.03	-0.14
	(0.24)	(0.30)	(0.26)	(0.17)	(0.19)	(0.30)	(0.11)	(0.11)	(0.27)	(0.12)	(0.14)	(0.20)
sex	-0.08			-0.14**			-0.33**			-0.46**		
	(0.06)			(0.05)			(0.04)			(0.04)		
age	0.01**	0.00	0.01*	0.00**	0.00	0.01**	0.00*	0.00	0.00	-0.00°	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.08	0.16	-0.04	-0.01	-0.03	-0.03	0.20**	0.28**	-0.00	0.04	0.04	-0.12
	(0.09)	(0.13)	(0.12)	(0.05)	(0.10)	(0.06)	(0.05)	(0.06)	(0.09)	(0.09)	(0.11)	(0.13)
tertiaryedu	0.22	0.40°	-0.44	0.17	0.21	-0.01	0.47**	0.48**	0.41**	0.23*	0.06	0.39**
	(0.17)	(0.20)	(0.42)	(0.15)	(0.18)	(0.26)	(0.06)	(0.07)	(0.12)	(0.09)	(0.12)	(0.14)
firmbig				-0.15*	-0.21°	-0.12				0.12**	0.14**	0.13*
				(0.07)	(0.11)	(0.08)				(0.04)	(0.05)	(0.07)
statefirm	-0.31*	-0.21	-0.46°	0.02	0.18	-0.13	-0.61**	-0.56**	-0.57**	-0.53**	-0.50**	-0.49**
	(0.15)	(0.18)	(0.26)	(0.09)	(0.12)	(0.11)	(0.05)	(0.06)	(0.11)	(0.06)	(0.07)	(0.09)
occhigh	0.33°	0.31	-0.03	0.36*	0.32°	0.41	0.21**	0.16*	0.30**	0.17*	0.13	0.21°
	(0.19)	(0.21)	(0.40)	(0.15)	(0.19)	(0.41)	(0.06)	(0.08)	(0.11)	(0.08)	(0.10)	(0.12)
occ4578	0.29	0.18	-0.10	0.44*	0.33	0.07	0.18**	0.15**	0.30*	0.21**	0.08	0.35*
	(0.18)	(0.24)	(0.45)	(0.22)	(0.22)	(0.25)	(0.04)	(0.05)	(0.12)	(0.07)	(0.10)	(0.14)
occagriskilled	-0.03	-0.15	-0.07	-0.17	-0.19	-0.16	-0.32	-0.36°	-0.07	-0.62*	-0.60*	-0.95*
	(0.10)	(0.15)	(0.15)	(0.14)	(0.16)	(0.18)	(0.26)	(0.22)	(0.71)	(0.24)	(0.27)	(0.47)
Constant	0.84	-1.20**	0.88	-1.06**	-1.52**	0.45	0.24	-0.10	-0.48	1.14**	0.66**	0.28
	(0.97)	(0.16)	(0.64)	(0.37)	(0.33)	(0.35)	(0.15)	(0.14)	(0.34)	(0.17)	(0.22)	(0.27)
Observations	1,229	678	551	1,142	459	683	3,789	2,941	848	1,969	1,329	640
R-squared	0.37	0.33	0.50	0.37	0.39	0.39	0.24	0.19	0.31	0.33	0.27	0.38
Adjusted R2	0.33	0.26	0.44	0.34	0.31	0.34	0.22	0.16	0.24	0.30	0.23	0.30

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU and the year of the interview.

Appendix Table A 2.28.: Individual FE hourly and monthly wages for the sample split in small vs. big firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Big firms (>25 employees)			**Small firms (<25 employees)**			**Big firms (>25 employees)**			**Small firms (<25 employees)**		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**log of the real wage per hour**						**log of the real monthly wage**					
cottonPSU*agri*year2009	-0.19	-0.52	0.14	-1.07	-1.58*	0.59	-0.21	-0.31	0.05	-0.87	-1.23*	0.07
	(0.35)	(0.48)	(0.28)	(0.67)	(0.77)	(0.60)	(0.32)	(0.44)	(0.26)	(0.53)	(0.62)	(0.51)
cottonPSU*agri*year2011	-0.05	-0.15	-0.68	-0.14	-0.60	0.96	0.07	0.09	-0.94*	-0.18	-0.54	0.75
	(0.39)	(0.47)	(0.46)	(0.54)	(0.61)	(0.68)	(0.41)	(0.49)	(0.43)	(0.44)	(0.50)	(0.56)
age	-0.04°	-0.04	-0.01	-0.02	-0.01	-0.05	-0.03	-0.05	0.01	-0.02	-0.01	-0.05
	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)	(0.07)	(0.03)	(0.04)	(0.04)	(0.02)	(0.02)	(0.05)
secondaryedu	-0.11	-0.27	-0.08	0.07	0.10	-0.17	-0.04	-0.19	0.01	0.09	0.08	0.09
	(0.13)	(0.24)	(0.13)	(0.11)	(0.13)	(0.19)	(0.11)	(0.20)	(0.13)	(0.09)	(0.10)	(0.15)
tertiaryedu	-0.00	-0.12	0.09	-0.07	0.01	-0.57	0.07	-0.01	0.06	-0.04	0.00	-0.29
	(0.16)	(0.26)	(0.19)	(0.14)	(0.15)	(0.35)	(0.13)	(0.21)	(0.16)	(0.11)	(0.12)	(0.24)
firmbig	-0.04	0.02	-0.11				0.03	0.12	-0.06			
	(0.06)	(0.08)	(0.08)				(0.06)	(0.07)	(0.07)			
statefirm	-0.10	0.05	-0.28°	-0.21°	-0.26*	0.05	-0.13	-0.02	-0.28*	-0.28**	-0.28**	-0.23
	(0.11)	(0.12)	(0.15)	(0.11)	(0.12)	(0.24)	(0.09)	(0.10)	(0.14)	(0.09)	(0.10)	(0.17)
occhigh	0.17	0.15	0.09	-0.07	-0.08	0.08	0.07	0.03	0.16	-0.02	-0.02	0.10
	(0.17)	(0.21)	(0.25)	(0.12)	(0.13)	(0.31)	(0.13)	(0.16)	(0.20)	(0.10)	(0.11)	(0.25)
occ4578	0.06	0.11	-0.12	0.21*	0.20*	0.50*	0.07	0.07	0.10	0.18*	0.16°	0.47*
	(0.17)	(0.22)	(0.20)	(0.09)	(0.10)	(0.24)	(0.13)	(0.16)	(0.16)	(0.08)	(0.08)	(0.20)
occagriskilled	-0.06	-0.30	0.22	-0.12	-0.18	0.10	-0.08	-0.23	0.25	-0.16	-0.17	-0.17
	(0.14)	(0.24)	(0.14)	(0.19)	(0.22)	(0.29)	(0.15)	(0.21)	(0.19)	(0.13)	(0.15)	(0.14)
Constant	1.72°	1.86	0.30	0.89	0.57	1.55	6.43**	7.23**	4.12**	5.93**	5.67**	6.52**
	(0.93)	(1.37)	(1.47)	(0.87)	(0.95)	(2.44)	(1.01)	(1.37)	(1.47)	(0.66)	(0.74)	(1.71)
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,111	1,788	1,323	5,018	3,619	1,399	3,137	1,806	1,331	5,060	3,645	1,415
Number of panelid	2,552	1,449	1,103	3,956	2,752	1,204	2,572	1,465	1,107	3,978	2,762	1,216
R-squared	0.38	0.44	0.39	0.19	0.19	0.31	0.37	0.44	0.38	0.21	0.21	0.39
Adjusted R2	0.373	0.429	0.380	0.181	0.183	0.297	0.362	0.433	0.371	0.206	0.208	0.377

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month (col. 1-6) and the log of the wage in the last month (col. 7-12). All specifications include individual fixed effects, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton PSU and the year dummies.

Appendix Table A 2.29.: Different thresholds for the sample split in small vs. big firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Big firms			**Small firms**		**Big firms**			**Small firms**	
	>25 employees	>50 employees	<16 employees	<25 employees	<50 employees	>25 employees	>50 employees	<16 employees	<25 employees	<50 employees
VARIABLES	**log of the real wage per hour**									
cottonPSU*agri*year2009	-0.21	-0.13	0.05	0.07	-0.07	0.14	0.11	-0.25	0.59	0.62
	(0.34)	(0.46)	(0.45)	(0.34)	(0.34)	(0.28)	(0.65)	(0.62)	(0.60)	(0.47)
cottonPSU*agri*year2011	-0.10	0.35	0.96*	0.90**	0.70*	-0.68	-0.68	0.16	0.96	1.19**
	(0.33)	(0.38)	(0.42)	(0.31)	(0.27)	(0.46)	(0.80)	(1.19)	(0.68)	(0.43)
age	0.00	0.00	0.01*	0.01**	0.01**	-0.01	-0.01	-0.03	-0.05	-0.04
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	(0.06)	(0.12)	(0.07)	(0.03)
secondaryedu	0.00	-0.03	-0.02	-0.03	-0.02	-0.08	0.04	-0.15	-0.17	-0.13
	(0.05)	(0.08)	(0.09)	(0.07)	(0.06)	(0.13)	(0.25)	(0.23)	(0.19)	(0.11)
tertiaryedu	0.43**	0.40*	0.27*	0.33**	0.36**	0.09	-0.04	-0.80°	-0.57	-0.29
	(0.10)	(0.15)	(0.12)	(0.10)	(0.08)	(0.19)	(0.23)	(0.47)	(0.35)	(0.24)
firmbig	0.01					-0.11				
	(0.05)					(0.08)				
statefirm	-0.27**	-0.19°	-0.50**	-0.51**	-0.51**	-0.28°	-0.12	0.04	0.05	-0.22°
	(0.08)	(0.10)	(0.13)	(0.10)	(0.08)	(0.15)	(0.24)	(0.29)	(0.24)	(0.13)
occhigh	0.30**	0.26	0.32*	0.36**	0.34**	0.09	1.05°	-0.03	0.08	0.15
	(0.12)	(0.16)	(0.14)	(0.12)	(0.10)	(0.25)	(0.55)	(0.44)	(0.31)	(0.21)
occ4578	0.50**	0.46**	0.34*	0.32*	0.37**	-0.12	1.14*	0.42	0.50*	0.30
	(0.13)	(0.17)	(0.14)	(0.12)	(0.11)	(0.20)	(0.56)	(0.28)	(0.24)	(0.20)
occagriskilled	-0.19	-0.00	0.20	0.19	0.05	0.22	-0.03	-0.06	0.10	0.02
	(0.15)	(0.23)	(0.16)	(0.12)	(0.10)	(0.14)	(0.28)	(0.43)	(0.29)	(0.22)
Constant	-0.10	-0.23	-0.42	-0.57°	-0.46°	0.30	0.47	1.10	1.55	1.15
	(0.24)	(0.28)	(0.35)	(0.32)	(0.26)	(1.47)	(2.03)	(4.50)	(2.44)	(1.18)
Individual FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Observations	1,323	731	974	1,399	1,991	1,323	731	974	1,399	1,991
Number of panelid						1,103	651	850	1,204	1,613
R-squared	0.52	0.56	0.31	0.36	0.39	0.39	0.62	0.32	0.31	0.31
Adjusted R2	0.492	0.511	0.244	0.316	0.359	0.380	0.607	0.299	0.297	0.298

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications are estimated for the sample of all female workers and include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton PSU and the year dummies. Columns 1-6 show OLS estimates and columns 7-12 individual FE estimates.

Appendix Table A 2.30.: OLS wage regressions for employees

VARIABLES	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female	(10) Full sample	(11) Male	(12) Female
	log of the real wage per hour						**log of the real monthly wage**					
cottonPSU*agri*year2009	-0.21	-0.26	-0.31	-0.39	-0.61	0.17	-0.21	-0.23	-0.23	-0.34	-0.47	0.06
	(0.27)	(0.32)	(0.33)	(0.46)	(0.53)	(0.37)	(0.24)	(0.26)	(0.32)	(0.37)	(0.40)	(0.41)
cottonPSU*agri*year2011	0.34	0.05	0.62*	0.29	-0.15	0.97**	0.15	0.01	0.42	0.32	0.02	0.88**
	(0.22)	(0.25)	(0.26)	(0.35)	(0.44)	(0.29)	(0.21)	(0.22)	(0.30)	(0.32)	(0.36)	(0.33)
sex	-0.35**						-0.48**					
	(0.03)						(0.02)					
age	0.00	-0.00	0.01**	-0.02	-0.04	-0.01	-0.00	-0.00**	0.00**	-0.01	-0.01	-0.02
	(0.00)	(0.00)	(0.00)	(0.02)	(0.02)	(0.03)	(0.00)	(0.00)	(0.00)	(0.02)	(0.02)	(0.02)
secondaryedu	0.10**	0.16**	0.02	-0.00	0.04	-0.09	0.12**	0.14**	0.07°	0.01	0.02	0.01
	(0.04)	(0.05)	(0.05)	(0.08)	(0.12)	(0.10)	(0.03)	(0.05)	(0.04)	(0.06)	(0.09)	(0.08)
tertiaryedu	0.35**	0.32**	0.43**	-0.06	-0.03	-0.02	0.34**	0.30**	0.41**	-0.05	-0.02	-0.06
	(0.05)	(0.06)	(0.08)	(0.10)	(0.13)	(0.15)	(0.04)	(0.05)	(0.07)	(0.08)	(0.11)	(0.12)
firmbig	0.05	0.13**	-0.07	-0.01	0.04	-0.06	0.14**	0.21**	0.02	0.10*	0.14*	0.06
	(0.04)	(0.04)	(0.06)	(0.05)	(0.06)	(0.07)	(0.04)	(0.04)	(0.06)	(0.05)	(0.05)	(0.06)
statefirm	-0.43**	-0.41**	-0.39**	-0.13*	-0.12	-0.18	-0.44**	-0.41**	-0.39**	-0.17**	-0.15*	-0.22*
	(0.04)	(0.05)	(0.06)	(0.06)	(0.08)	(0.11)	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)	(0.09)
occhigh	0.15**	0.07	0.31**	0.16	0.05	0.32	0.10*	-0.01	0.37**	0.08	-0.04	0.36*
	(0.05)	(0.06)	(0.10)	(0.10)	(0.12)	(0.20)	(0.05)	(0.05)	(0.08)	(0.09)	(0.10)	(0.15)
occ4578	0.23**	0.12*	0.40**	0.20*	0.16	0.15	0.29**	0.16**	0.53**	0.22**	0.14°	0.37*
	(0.04)	(0.05)	(0.10)	(0.09)	(0.10)	(0.17)	(0.04)	(0.04)	(0.09)	(0.08)	(0.08)	(0.14)
occagriskilled	-0.11	-0.31**	0.07	-0.18	-0.42**	0.23	-0.11°	-0.32**	0.08	-0.17°	-0.36**	0.10
	(0.07)	(0.09)	(0.11)	(0.11)	(0.15)	(0.14)	(0.06)	(0.07)	(0.10)	(0.10)	(0.11)	(0.16)
Constant	0.52**	0.09	-0.25	0.94	1.56°	-0.16	5.91**	5.47**	4.57**	5.68**	5.96**	5.30**
	(0.12)	(0.14)	(0.20)	(0.67)	(0.86)	(0.87)	(0.11)	(0.12)	(0.17)	(0.56)	(0.72)	(0.65)
Individual FE	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Observations	6,802	4,408	2,394	6,802	4,408	2,394	6,859	4,444	2,415	6,859	4,444	2,415
R-squared	0.40	0.34	0.41	0.24	0.25	0.32	0.44	0.36	0.39	0.25	0.27	0.31
Adjusted R2	0.394	0.328	0.390	0.239	0.244	0.309	0.437	0.351	0.371	0.247	0.268	0.300
Number of panelid				5,045	3,209	1,836				5,076	3,227	1,849

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month (col. 1-6) and the log of the wage in the last month (col. 7-12). All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton PSU and the year dummies. Col. 1-3 and 7-9 are estimated by OLS and 4-6 and 10-12 using individual fixed effects.

Appendix Table A 2.31.: Wage regressions for employees on small vs. big farms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Big firms (>25 employees)			**Small firms (<25 employees)**			**Big firms (>25 employees)**			**Small firms (<25 employees)**		
	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
VARIABLES	**log of the real wage per hour**											
cottonPSU*agri*year2009	-0.44	-0.49	-0.30	-0.08	-0.23	-0.01	-0.20	-0.54	0.13	-0.66	-1.11	0.94
	(0.30)	(0.35)	(0.31)	(0.34)	(0.41)	(0.38)	(0.35)	(0.48)	(0.28)	(0.80)	(0.89)	(0.73)
cottonPSU*agri*year2011	-0.30	-0.36	-0.10	0.31	-0.06	1.10**	-0.03	-0.17	-0.64	-0.02	-0.67	1.90**
	(0.27)	(0.37)	(0.35)	(0.27)	(0.29)	(0.35)	(0.38)	(0.46)	(0.46)	(0.65)	(0.78)	(0.65)
sex	-0.37**			-0.29**								
	(0.04)			(0.04)								
age	-0.00	-0.00°	0.00	0.00	-0.00	0.01*	-0.04°	-0.04	-0.01	0.00	0.02	-0.13
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.15)
secondaryedu	0.02	-0.01	0.03	0.15*	0.25**	-0.01	-0.11	-0.26	-0.10	0.07	0.17	-0.31
	(0.05)	(0.08)	(0.06)	(0.06)	(0.07)	(0.08)	(0.13)	(0.25)	(0.13)	(0.17)	(0.21)	(0.29)
tertiaryedu	0.23**	0.07	0.46**	0.43**	0.47**	0.38**	0.02	-0.05	0.08	-0.17	-0.07	-0.54
	(0.07)	(0.10)	(0.10)	(0.07)	(0.08)	(0.10)	(0.17)	(0.26)	(0.20)	(0.21)	(0.24)	(0.44)
firmbig	0.06	0.09*	0.03				-0.02	0.04	-0.10			
	(0.04)	(0.05)	(0.06)				(0.06)	(0.08)	(0.09)			
statefirm	-0.37**	-0.39**	-0.26**	-0.52**	-0.48**	-0.46**	-0.08	0.05	-0.25	-0.14	-0.19	-0.03
	(0.05)	(0.06)	(0.08)	(0.05)	(0.06)	(0.11)	(0.11)	(0.12)	(0.15)	(0.11)	(0.14)	(0.26)
occhigh	0.18*	0.14	0.28*	0.18**	0.09	0.32*	0.22	0.21	0.14	-0.25	-0.28	0.13
	(0.08)	(0.09)	(0.12)	(0.06)	(0.07)	(0.13)	(0.17)	(0.21)	(0.25)	(0.16)	(0.19)	(0.32)
occ4578	0.32**	0.17°	0.40**	0.19**	0.10°	0.31*	0.12	0.23	-0.15	0.08	0.05	0.54
	(0.08)	(0.09)	(0.13)	(0.05)	(0.05)	(0.14)	(0.17)	(0.21)	(0.20)	(0.13)	(0.14)	(0.42)
occagriskilled	-0.22*	-0.37**	-0.14	0.01	-0.22°	0.29*	-0.04	-0.23	0.22	-0.29	-0.42°	0.09
	(0.11)	(0.12)	(0.15)	(0.09)	(0.12)	(0.14)	(0.14)	(0.23)	(0.14)	(0.21)	(0.24)	(0.37)
Constant	0.90**	0.55**	-0.01	0.16	-0.15	-0.55	1.62°	1.82	0.31	0.25	-0.17	4.37
	(0.14)	(0.19)	(0.25)	(0.17)	(0.17)	(0.34)	(0.94)	(1.41)	(1.49)	(1.19)	(1.20)	(5.21)
Individual FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,984	1,706	1,278	3,818	2,702	1,116	2,984	1,706	1,278	3,818	2,702	1,116
R-squared	0.52	0.47	0.51	0.32	0.28	0.38	0.38	0.45	0.39	0.20	0.20	0.34
Adjusted R2	0.504	0.442	0.473	0.308	0.260	0.335	0.375	0.435	0.376	0.192	0.193	0.323
Number of panelid							2,439	1,376	1,063	3,211	2,229	982

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton PSU and the year dummies. Col. 1-6 are estimated by OLS and 7-12 using individual fixed effects.

Appendix Table A 2.32.: District level treatment (30% of PSUs within district treated, 50%, and 70%)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		30% Threshold			**50% Threshold**			**70% Threshold**	
VARIABLES	Full sample	Male	Female	Full sample	Male	Female	Full sample	Male	Female
					log of the real wage per hour				
cottonDistrict*agri*year2009	-0.23	-0.44	-0.07	-0.34	-0.42	-0.21	-0.15	-0.34	-0.01
	(0.29)	(0.31)	(0.38)	(0.24)	(0.28)	(0.31)	(0.22)	(0.27)	(0.25)
cottonDistrict*agri*year2011	0.27	0.03	0.45°	0.21	-0.03	0.56*	0.40*	0.12	0.71**
	(0.22)	(0.24)	(0.26)	(0.21)	(0.24)	(0.25)	(0.20)	(0.23)	(0.24)
sex	-0.35**			-0.35**			-0.35**		
	(0.02)			(0.02)			(0.02)		
age	0.00*	0.00	0.01**	0.00*	0.00	0.01**	0.00*	0.00	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.10**	0.17**	-0.00	0.10**	0.18**	-0.00	0.10**	0.18**	-0.00
	(0.03)	(0.05)	(0.05)	(0.03)	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)
tertiaryedu	0.33**	0.33**	0.40**	0.34**	0.33**	0.40**	0.34**	0.33**	0.40**
	(0.05)	(0.06)	(0.07)	(0.05)	(0.06)	(0.07)	(0.05)	(0.06)	(0.07)
firmbig	0.02	0.11**	-0.10	0.03	0.12**	-0.09	0.03	0.11**	-0.10
	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)
statefirm	-0.43**	-0.42**	-0.41**	-0.43**	-0.42**	-0.41**	-0.43**	-0.42**	-0.42**
	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.06)
occhigh	0.19**	0.13*	0.32**	0.19**	0.14**	0.32**	0.18**	0.13*	0.32**
	(0.04)	(0.05)	(0.09)	(0.04)	(0.05)	(0.09)	(0.04)	(0.05)	(0.09)
occ4578	0.26**	0.17**	0.41**	0.26**	0.17**	0.42**	0.26**	0.17**	0.41**
	(0.04)	(0.04)	(0.09)	(0.04)	(0.04)	(0.09)	(0.04)	(0.04)	(0.09)
occagriskilled	-0.11°	-0.26**	0.02	-0.10	-0.24**	0.02	-0.12°	-0.25**	-0.01
	(0.07)	(0.08)	(0.10)	(0.06)	(0.08)	(0.10)	(0.07)	(0.08)	(0.10)
Constant	0.26**	0.21*	0.54**	0.28**	0.28**	0.93**	0.07	-0.26**	0.96**
	(0.10)	(0.10)	(0.18)	(0.09)	(0.09)	(0.16)	(0.08)	(0.10)	(0.15)
Observations	8,129	5,407	2,722	8,129	5,407	2,722	8,129	5,407	2,722
R-squared	0.39	0.32	0.41	0.39	0.32	0.41	0.39	0.32	0.42
Adjusted R2	0.386	0.310	0.395	0.387	0.309	0.395	0.386	0.308	0.397

The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies (for each district), province-year dummies, dummies for the month of the interview as well as a dummy for cotton district, dummies for the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton district dummy and the year dummies. A district is classified as a cotton district, if 30% (50% or 70%) of the PSUs within the district are classified as cotton PSUs according to our main treatment definition.

Appendix Table A 2.33.: Other treatment definitions

	(1) **Low level dummy** Full Sample	(2) **Low level dummy** Female	(3) **FAO PP1** Full Sample	(4) **FAO PP1** Female	(5) **FAO PP2** Full Sample	(6) **FAO PP2** Female
VARIABLES	**log of the real wage per hour**					
cottonPSU*agri*year2009	0.03	-0.16	0.03	-0.16	0.03	-0.16
	(0.24)	(0.41)	(0.24)	(0.41)	(0.24)	(0.41)
cottonPSU*agri*year2011	0.74**	0.94**	0.74**	0.94**	0.74**	0.94**
	(0.23)	(0.24)	(0.23)	(0.24)	(0.23)	(0.24)
sex	-0.34**		-0.34**		-0.34**	
	(0.02)		(0.02)		(0.02)	
age	0.00*	0.01**	0.00*	0.01**	0.00*	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
secondaryedu	0.10**	-0.01	0.10**	-0.01	0.10**	-0.01
	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)
tertiaryedu	0.34**	0.39**	0.34**	0.39**	0.34**	0.39**
	(0.05)	(0.07)	(0.05)	(0.07)	(0.05)	(0.07)
firmbig	0.03	-0.10	0.03	-0.10	0.03	-0.10
	(0.04)	(0.06)	(0.04)	(0.06)	(0.04)	(0.06)
statefirm	-0.44**	-0.41**	-0.44**	-0.41**	-0.44**	-0.41**
	(0.04)	(0.06)	(0.04)	(0.06)	(0.04)	(0.06)
occhigh	0.18**	0.32**	0.18**	0.32**	0.18**	0.32**
	(0.04)	(0.09)	(0.04)	(0.09)	(0.04)	(0.09)
occ4578	0.26**	0.42**	0.26**	0.42**	0.26**	0.42**
	(0.04)	(0.09)	(0.04)	(0.09)	(0.04)	(0.09)
occagriskilled	-0.11	0.02	-0.11	0.02	-0.11	0.02
	(0.07)	(0.10)	(0.07)	(0.10)	(0.07)	(0.10)
Constant	0.45**	-0.33	0.45**	-0.33	0.45**	-0.33
	(0.12)	(0.22)	(0.12)	(0.22)	(0.12)	(0.22)
Observations	8,129	2,722	8,129	2,722	8,129	2,722
R-squared	0.40	0.42	0.40	0.42	0.40	0.42
Adjusted R2	0.389	0.399	0.389	0.399	0.389	0.399

Robust standard errors (clustered at the PSU level) in parentheses ** p<0.01, * p<0.05, ° p<0.1

The dependent variable is the log of the real wage per hour in the last month. All specifications include district dummies, province-year dummies, dummies for the month of the interview as well as dummies for cotton PSU, the year of the interview, a dummy for working in agriculture (agri) and all interactions between agri, cotton PSU and the year dummies. We define a cotton PSU as a PSU located below 1000m in col. 1 and 2. Using GIS data from the FAO-GAEZ data base we classify PSUs as cotton PSUs, if the Production Capacity Index for intermediate (col. 3-4) or low (col. 5-6) input level irrigated cotton is >0 for the PSU.

Appendix 2 B List of datasets

Dataset	Source	Year the data was collected	Respondents/Content	Number of Individual Observations
Household Panel Survey				
Tajikistan Living Standards Measurement Survey (TLSS) 2007	The World Bank website (publicly available)	2007 (harvest season)	Representative Sample of 4860 Tajik Households in 270 Primary Sampling Units (PSU); Additional detailed PSU level information on socio-economic, demographic, geographic and agricultural characteristics	30318 individuals
Tajikistan Living Standards Measurement Survey (TLSS) 2009	The World Bank website (publicly available)	2009 (harvest season)	1503 Households out of the 4860 Households from TLSS 2007 (Panel data), 167 PSUs	10069 individuals
Tajikistan Living Standards Measurement Survey (TLSS) 2011	The Institute for East and Southeast European Studies (IOS) in Regensburg, Germany	2011 (harvest season)	1503 Households from TLSS 2007 and 2009 (Panel data), 167 PSUs	9608 individuals
Detailed statistical information on Tajikistan matched with the TLSS panel data				
Global Agro-Ecological Zones Database (GAEZ) from the Food and Agricultural Organization (FAO)	FAO – GAEZ website (publicly available)	1961-1990 (data published 2012)	Production suitability indices for cotton for the territory of Tajikistan (GIS data)	Data matched with all 270 PSUs in the TLSS through GIS GEO-coordinates of the PSUs (which were retrieved from various sources, see Appendix 2 E)
Socio-Economic Atlas of Tajikistan 2005	The World Bank and GeoData Institute at the University of Southampton; data obtained from Cem Mete (World Bank), Craig Hutton and Andy Murdoch (GeoData Institute)	2000 (poverty variables are for the year 2003)	Socio-economic variables at the sub-district (Jamoat) level for Tajikistan for the year 2000; GIS information on borders of districts and oblasts of Tajikistan	Jamoat data matched with all 270 PSUs in the TLSS at the sub-district level (Jamoats) by hand; GIS information on district borders matched with PSU coordinates using Quantum GIS
Number of land use certificates for small farms (<25 employees) by sub-district	Land use certificates handed out by the Tajik State Committee for Land and Geodesy (SCLG); Data obtained during an interview with staff of World Bank Tajikistan in November 2014	January 2007 until July 2011 (project ended in July 2011)	Number of land use certificates for small farms (<25 employees) handed out by the SCLG at the sub-district level (Jamoat)	Data matched with all 270 PSUs in the TLSS at the sub-district level (Jamoats) by hand
Cotton Sector Statistics for Tajikistan	National Statistics Institute of Tajikistan (TajStat), Year Book for the Cotton Sector (purchased in Dushanbe in March 2014)	2007-2011	Cotton sector statistics by district (raion or hukumat); Cotton production and area planted with cotton by district	Data matched with all 270 PSUs in the TLSS at the district level by hand
FAO Crop Statistics for Tajikistan	FAO Office in Tajikistan; Data obtained during an interview with a staff member in November 2014	2000-2012	Statistics on crop production, area harvested and yields for various crops by district (hukumat)	Data matched with all 270 PSUs in the TLSS at the district level by hand
Price Statistics for Tajikistan	National Statistics Agency of Tajikistan (website)	2000-2012	FOB cotton export prices, CIF wheat import price and consumer price	CPI matched by year; FOB export price for cotton matched to PSUs

			index (CPI) for Tajikistan	in cotton regions, CIF import price for wheat matched to PSUs in non-cotton regions
IMF Commodity Price Index	International Monetary Fund (IMF) website	2000-2012	Cotton and wheat world market price indices	World market price for cotton matched to PSUs in cotton regions, CIF world market price for wheat matched to PSUs in non-cotton regions
Micro datasets collected in Tajikistan in March and November 2014				
GIZ - Political Leader Survey 2011	German Federal Enterprise for International Cooperation (GIZ), Office Tajikistan	End of 2011	District and Jamoat Leaders from all 58 districts of Tajikistan; Questions about the agricultural reform process in Tajikistan	672 heads of districts and sub-districts
GIZ Farm Head Survey 2011	GIZ Office Tajikistan; Survey conducted by Mattes Scheftelowitz	November 2011 until March 2012	Heads of small private and large collective dehkan farms from 13 cotton growing districts in Tajikistan	253 farm heads
GIZ Farm Survey 2013	GIZ Office Tajikistan	End of 2013	Heads of all types of farms from 51 districts in Tajikistan; Information on farm characteristics	4253 farms
FAO Farm Survey 2005	FAO Publication Caccavale (2005)	2005	Small holder farmers and heads of collective dehkan farms from all districts of Tajikistan	135 farms
Statistical data on Tajikistan used for descriptive statistics				
Statistical Year Books for Agriculture in Tajikistan	National Statistics Agency of Tajikistan; Books purchased in Dushanbe in March 2014	1995-2013 (some data only available from 2006 on)	Agricultural statistics by district	
District level data on cotton production by farm size	National Statistics Agency of Tajikistan; Data obtained during an interview with a staff member in November 2014	2007-2011	Cotton production and area harvested with cotton for small vs. big farms (20 ha as threshold) for all districts in the provinces Sughd and RRP as well as for Khatlon province and the Republic of Tajikistan	
FAO data on the privatization process	FAO Mission Reports for Tajikistan 2009 and 2011	2006, 2010	Number and area cultivated by private vs. collective dehkan farms	
FAO Agricultural Statistics	FAO website (publicly available)	2000-2012	Production statistics for Tajikistan for various crops	
USDA Foreign Agricultural Service (FAS) Database	US Department of Agriculture (USDA) website (publicly available)	2000-2012	Production, harvested area, exports and imports for various crops and all countries	

Comparison of different treatment definitions

Treatment Definition	Data Source	Level of Aggregation of the treatment definition	Description
1. Baseline	TLSS 2007 community questionnaire	Community (PSU) level	Cotton is the first or second most important crop in the community
2. FAO PP1	FAO GAEZ data base	Community (PSU) level	Production Capacity Index for intermediate input level irrigated cotton is >0 for the community
3. FAO PP2	FAO GAEZ data base	Community (PSU) level	Production Capacity Index for low input level irrigated cotton is >0 for the community
4. Lowland Definition	TLSS 2007 community questionnaire	Community (PSU) level	Altitude of the community is <1000m
5. District Baseline	TLSS 2007 community questionnaire	District level	The district is treated, if more than 30% (50%, 70%) of the communities in the sample are treated according to the baseline treatment definition 1

Appendix 2 C Theoretical Model

Theoretical Model for the Labor Market Mechanism

Based on the insights from the background section, we present a simple model that captures the main features of the Tajik cotton sector and describes the pass through of the world cotton price surge to wages of cotton pickers.

We assume that there is a representative farm that describes the basic decision problem on small private dehkan farms as well as on bigger collective dehkan farms in cotton growing areas of Tajikistan. Both farm types only differ in the characteristics of their labor supply curves. Both use the same constant returns to scale Cobb-Douglas production technology to produce cotton or wheat.[83] The total land endowment per farm is fixed ($\bar{Z}$), because land markets do not exist in Tajikistan and farmers cannot increase land endowments in the short and medium run. Thus, the fixed amount of land $\bar{Z}$ is allocated between cotton and wheat production (a common assumption in agricultural economics, see Shumway et al. 1984).[84] The second production factor is labor (L), whereby cotton is more labor intensive than wheat, especially during harvest time.[85]

1. Model for the representative farm

Cotton production (X)

$$X = Z_x^{1-\alpha} L_x^{\alpha}$$

Wheat production (Y)

$$Y = Z_y^{1-\beta} L_y^{\beta}$$

$\alpha > \beta$ Cotton is more labor intensive than wheat (for all relative factor prices)

[83] For farms in Tajikistan that produce cotton, wheat is the main crop alternative (FAO 2009, 2011). Wheat can also be grown outside of cotton growing areas (without irrigation infrastructure).

[84] From the interviews and GIZ farm head survey (Tab. A2.17), we know that farm heads of small and big farms in Tajikistan follow world prices of cotton and use this information for their production decisions. They can freely allocate land between production of cotton and production of wheat as long as a minimum amount of land is placed under cotton (around 40-50%, cotton quotas vary between districts). The fact that wheat area and supply increased dramatically in 2009 (in exchange for cotton) as a reaction to the high wheat prices in 2008/2009 further supports the hypothesis that farms can freely reallocate land between crops (FAO 2009). For simplicity reasons, we will not include a minimum share of land to be cropped with cotton in the model. However, it is straightforward to include this cotton quota in the model.

[85] For simplicity reasons, other inputs (N) (like fertilizer, insecticides, fuel and machinery) are left out in this version of the model. They can easily be included in the equations.

Profit Maximization of the representative farm (decision variables are Z_x, Z_y, L_x, L_y):

$$\pi_f = p_x X + p_y Y - (1+r)w\left(L_x + L_y\right)$$

s. t. production functions for X and Y and the resource constraint $\bar{Z} \geq Z_x + Z_y$

p_x is the farm gate price for raw cotton, p_y is the farm gate price for wheat, r is the interest rate and w is the wage for agricultural labor that is mobile between cotton and wheat production. The farm manager has to pre-finance input costs through loans with interest rate r. The representative farm is a price taker on product and factor markets. We follow Shumway et al. (1984) and do not include costs for the fixed but allocatable input land (because it is fixed in the short and medium run at the farm level).

Solutions to the constraint maximization problem:

Defining:

$$A = \frac{(1-\alpha)p_x^{\frac{1}{1-\alpha}}\alpha^{\frac{\alpha}{1-\alpha}}}{(1-\beta)p_y^{\frac{1}{1-\beta}}\beta^{\frac{\beta}{1-\beta}}}(w(1+r))^{\frac{\beta}{1-\beta}-\frac{\alpha}{1-\alpha}}$$

$Z_x^*(p_x, p_y, w, r, \bar{Z}) = \frac{A\bar{Z}}{1+A}$ Demand for land in cotton production

$Z_y^*(p_x, p_y, w, r, \bar{Z}) = \frac{\bar{Z}}{1+A}$ Demand for land in wheat production

$L_x^*(p_x, p_y, w, r, \bar{Z}) = \left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}}\frac{A\bar{Z}}{1+A}$ Demand for labor in cotton production

$L_y^*(p_x, p_y, w, r, \bar{Z}) = \left(\frac{p_y\beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\frac{\bar{Z}}{1+A}$ Demand for labor in wheat production

$X^*(p_x, p_y, w, r, \bar{Z}) = \left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{\alpha}{1-\alpha}}\frac{A\bar{Z}}{1+A}$ Optimal output in cotton production

$Y^*(p_x, p_y, w, r, \bar{Z}) = \left(\frac{p_y\beta}{(1+r)w}\right)^{\frac{\beta}{1-\beta}}\frac{\bar{Z}}{1+A}$ Optimal output in wheat production

Comparative statistics:

1.) Reaction of the labor demand of the farm to an increase in p_x:

It is straightforward to show that:

$$\frac{dL_x^*(p_x,p_y,w,r,\bar{Z})}{dp_x} = \frac{A\bar{Z}}{1+A}\left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}}\frac{1}{(1-\alpha)p_x}\left(\frac{2+A}{1+A}\right) > 0$$

$$\frac{dL_y^*(p_x,p_y,w,r,\bar{Z})}{dp_x} = -\frac{A\bar{Z}}{1+A}\left(\frac{p_y\beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\frac{1}{(1-\alpha)p_x}\left(\frac{1}{1+A}\right) < 0$$

And the change in total labor demand of the farm:

$$\frac{d(L_x^*(p_x,p_y,w,r,\bar{Z}) + L_y^*(p_x,p_y,w,r,\bar{Z}))}{dp_x} = \frac{A\bar{Z}}{(1+A)}\frac{1}{(1-\alpha)p_x}\left(\left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}}\left(\frac{2+A}{1+A}\right) - \left(\frac{p_y\beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\left(\frac{1}{1+A}\right)\right)$$

If $\alpha > \beta$ (cotton is more labor intensive than wheat, this is the main assumption) and $\frac{p_x}{p_y} > \frac{\beta}{\alpha}$ total labor demand on the farm increases in p_x at all values of the independent variables (for other cases it is not trivial to show that). This inequality should hold almost surely, because the price for a ton of cotton has been higher than for a ton of wheat over the last decades.

Elasticities of labor demand w.r.t. a change in p_x:

$$\varepsilon_{L_x^*(p_x,p_y,w,r,\bar{Z}),p_x} = \frac{1}{(1-\alpha)}\left(1+\frac{1}{1+A}\right) > 0$$

$$\varepsilon_{L_Y^*(p_x,p_y,w,r,\bar{Z}),p_x} = -\frac{1}{(1-\alpha)}\frac{A}{1+A} < 0$$

And the difference between the elasticities:

$$\varepsilon_{L_x^*(p_x,p_y,w,r,\bar{Z}),p_x} - \varepsilon_{L_Y^*(p_x,p_y,w,r,\bar{Z}),p_x} = \frac{1}{(1-\alpha)}\left(\frac{2}{1+A}\right) > 0$$

Elasticity of the total labor demand of the farm:

$$\varepsilon_{L^*_{Total}(p_x,p_y,w,r,\bar{Z}),p_x} = \frac{\frac{A}{(1-\alpha)}\left(\left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}}\left(\frac{2+A}{1+A}\right) - \left(\frac{p_y\beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\left(\frac{1}{1+A}\right)\right)}{\left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}} A + \left(\frac{p_y\beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}}$$

The denominator is always positive. The numerator is positive if $\alpha > \beta$ and $\frac{p_x}{p_y} > \frac{\beta}{\alpha}$. Thus, in those cases the elasticity of total labor demand w.r.t. p_x increases at all values of the independent variables.

2.) Reaction of the labor demand of the farm to an increase in w:

It is straightforward to show that for $\alpha > \beta$

$$\frac{dL^*_x(p_x,p_y,w,r,\bar{Z})}{dw} = \frac{A\bar{Z}}{(1+A)w}\left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}}\left(\frac{\frac{\beta}{1-\beta}-\frac{\alpha}{1-\alpha}}{1+A} - \frac{1}{(1-\alpha)}\right) < 0$$

And:

$$\frac{dL^*_y(p_x,p_y,w,r,\bar{Z})}{dw} = -\frac{\bar{Z}}{(1+A)w}\left(\frac{p_y\beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\left(\frac{1}{(1-\beta)} + \frac{A}{1+A}\left(\frac{\beta}{1-\beta}-\frac{\alpha}{1-\alpha}\right)\right)$$

If $1 < \alpha + (\alpha-\beta)\frac{A}{1+A}$ with $\frac{A}{1+A} \epsilon (0,1)$ then $\frac{dL^*_y(p_x,p_y,w,r,\bar{Z})}{dw} > 0$

And the change in total labor demand of the farm:

$$\frac{d(L^*_x(p_x,p_y,w,r,\bar{Z}) + L^*_y(p_x,p_y,w,r,\bar{Z}))}{dw} = \frac{A\bar{Z}}{(1+A)w}\left(\frac{\frac{\beta}{1-\beta}-\frac{\alpha}{1-\alpha}}{1+A}\right)\left(\left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}} - \left(\frac{p_y\beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\right) - \frac{\bar{Z}}{(1+A)w}\left(\frac{A}{(1-\alpha)}\left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}} + \frac{1}{(1-\beta)}\left(\frac{p_y\beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\right)$$

If $\alpha > \beta$ and $\frac{p_x}{p_y} > \frac{\beta}{\alpha}$ then $\frac{d(L^*_x(p_x,p_y,w,r,\bar{Z})+L^*_y(p_x,p_y,w,r,\bar{Z}))}{dw} < 0$

If those conditions hold, total labor demand on the farm decreases in w at all values of the independent variables (for other cases it is not trivial to show that).

3.) Reaction of cotton production to an increase in p_x for the representative farm:

$$\frac{dX^*(p_x, p_y, w, r, \bar{Z})}{dp_x} = \frac{A\bar{Z}}{1+A}\left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{\alpha}{1-\alpha}} \frac{1}{(1-\alpha)p_x}\left(\alpha + \frac{1}{1+A}\right) > 0$$

Elasticity of cotton production with respect to a change in px:

$$\varepsilon_{X^*(p_x,p_y,w,r,\bar{Z}),p_x} = \frac{1}{(1-\alpha)}\left(\alpha + \frac{1}{1+A}\right) > 0$$

2. The ginnery as an intermediate monopsonistic trader

Because the production decisions on both farm types are well described by the representative farm, one can assume that the ginnery with a local monopsony for the region R faces the supply of raw cotton from a representative farm with the endowment of cultivatable land $\bar{Z}_R$ in the region R.

From the interviews, we know that private and collective dehkan farms face the same output prices for raw cotton. There is no price discrimination between private and collective dehkan farms. Thus, we can model the supply of raw cotton in the region R assuming a representative farm with endowment of land $\bar{Z}_R$.

In this model, we assume that the ginnery only has monopsony power in the market for raw cotton (due to transport costs and pressure from local politicians and elites). This assumption is supported by our interview results. After reforms in 2007/2008, gins have less monopoly power in the markets for credit and for inputs. Farmers can get inputs and credit from other sources (like microfinance institutions and banks, other retail input suppliers). Gins finance their operations with credit from national banks and are price takers regarding the interest rate r.[86]

Total supply of raw cotton in the region R:

$$X_R^*(p_x, p_y, w, r, \bar{Z}_R) = \left(\frac{p_x\alpha}{(1+r)w}\right)^{\frac{\alpha}{1-\alpha}} \frac{A\bar{Z}_R}{1+A}$$

Profit maximization of the ginnery:

The ginnery buys raw cotton X_R^* and has to gin this cotton to get θX_R^* ginned cotton which it can sell on the world market for price p_w. In Tajikistan, the efficiency parameter θ is typically around 0.3 (see Kassam, 2011). The gin pays p_x for the raw cotton it purchases from farmers. There is no price discrimination between farm types.

[86] However, one could add monopoly power for credit and input markets in the profit maximization of the ginnery and investigate the reaction of optimal interest rates, the optimal amount of credit given out to farms and optimal input prices of the monopoly to a change in the world price of cotton.

$$\pi_g = p_w \theta X_R^*(p_x, p_y, w, r, \bar{Z}_R) - p_x X_R^*(p_x, p_y, w, r, \bar{Z}_R)$$

Maximazation w.r.t. p_x gives:

$$p_x^* = \frac{p_w \theta \varepsilon_{X_R^*(p_x,p_y,w,r,\bar{Z}_R),p_x}}{1 + \varepsilon_{X_R^*(p_x,p_y,w,r,\bar{Z}_R),p_x}}$$

Where: $\varepsilon_{X_R^*(p_x,p_y,w,r,\bar{Z}_R),p_x} = \frac{1}{(1-\alpha)}\left(\alpha + \frac{1}{1+A}\right)$

1.) Fixed degree of market power (supply elasticity $\varepsilon_{X_R^*(p_x,p_y,w,r,\bar{Z}_R),p_x}$ is constant):

$$\frac{dp_x^*(p_y, w, r, \bar{Z}_R, p_w)}{dp_w} = \frac{\theta \varepsilon_{X_R^*(p_x,p_y,w,r,\bar{Z}_R),p_x}}{1 + \varepsilon_{X_R^*(p_x,p_y,w,r,\bar{Z}_R),p_x}}$$

Then it is trivial to see that $\varepsilon_{p_x^*(p_y,w,r,\bar{Z}_R,p_w),p_w} = 1$

A 100% increase in the world market price would lead to a 100% increase in the farm gate price.

2.) Solution with flexible supply elasticity $\varepsilon_{X_R^*(p_x,p_y,w,r,\bar{Z}_R),p_x}$

Defining:

$$A = B p_x^{\frac{1}{1-\alpha}}$$

$$B = \frac{(1-\alpha)\alpha^{\frac{\alpha}{1-\alpha}}}{(1-\beta)p_y^{\frac{1}{1-\beta}}\beta^{\frac{\beta}{1-\beta}}}(w(1+r))^{\frac{\beta}{1-\beta}-\frac{\alpha}{1-\alpha}}$$

Simple algebra leads to the following first order condition for $p_x^*(p_y, w, r, \bar{Z}_R, p_w)$:

$$2p_x^* + B p_x^{*\frac{1}{1-\alpha}}(p_x^* - p_w \theta \alpha) = p_w \theta(\alpha + 1)$$

An explicit solution for p_x^* does not exist. Applying the implicit function theorem:

$$\frac{dp_x^*(p_y, w, r, \bar{Z}_R, p_w)}{dp_w} = \frac{\theta \alpha B p_x^{*\frac{1}{1-\alpha}} + \theta(\alpha + 1)}{2 + \frac{B p_x^{*\frac{1}{1-\alpha}}}{1-\alpha}\left(2 - \alpha - \frac{p_w \theta \alpha}{p_x^*}\right)}$$

The numerator is always positive.

1.) The denominator and thus $\frac{dp_x^*(p_y,w,r,\bar{Z}_R,p_w)}{dp_w}$ is positive, if $\frac{2-\alpha}{\alpha} > \frac{p_w \theta}{p_x^*}$ (which should be the case for reasonable values of α)

2.) If $\frac{2-\alpha}{\alpha} < \frac{p_w \theta}{p_x^*}$ the denominator and thus $\frac{dp_x^*(p_y,w,r,\bar{Z}_R,p_w)}{dp_w}$ is positive, if $\frac{B p_x^{*\frac{1}{1-\alpha}}}{1-\alpha}\left(2 - \alpha - p_w \theta \alpha p x * > -2\right.$

Thus, for reasonable values of the model parameters, the monopsonistic ginnery would always increase the farm gate price for raw cotton in reaction to an increase in the world market price for ginned cotton.

3. Partial equilibrium in local labor markets

Due to extensive labor migration of male to Russia as well as the civil war in the 1990s, the agricultural labor force in rural areas of Tajikistan comprises mostly female workers (FAO 2009, 2011). Because of strong traditional norms and the Islamic revival, those female agricultural workers are not mobile across sub-districts. That is why rural labor markets in Tajikistan are best described as local labor markets that are defined by villages and their neighboring communities (see Interviews in March and November 2014). For simplicity reasons, we will assume that the region R the gin faces as a monopoly equals the area of the local labor market. This assumption is realistic, because most sub-districts in Tajikistan are controlled by one ginnery.

Because production on both farm types is well described by the representative farm, one can assume that the supply of raw cotton in region R can be described by a representative farm with endowment of land $\bar{Z}_R$ in the region R.

$$X_R^*(p_x, p_y, w, r, \bar{Z}_R) = \left(\frac{p_x \alpha}{(1+r)w}\right)^{\frac{\alpha}{1-\alpha}} \frac{A\bar{Z}_R}{1+A}$$

Total labor demand in the region R is:

$$L^*_{Total\ Demand,R}(p_x, p_y, w, r, \bar{Z}_R) = \frac{\bar{Z}_R}{1+A}\left(\left(\frac{p_x \alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}} A + \left(\frac{p_y \beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\right)$$

Total labor demand in region R decreases with rising wage w, if $\alpha > \beta$ and $\frac{p_x}{p_y} > \frac{\beta}{\alpha}$:

$$\frac{d\left(L^*_{Total\ Demand,R}(p_x, p_y, w, r, \bar{Z}_R)\right)}{dw}$$

$$= \frac{A\bar{Z}_R}{(1+A)w}\left(\frac{\frac{\beta}{1-\beta} - \frac{\alpha}{1-\alpha}}{1+A}\right)\left(\left(\frac{p_x \alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}} - \left(\frac{p_y \beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\right)$$

$$- \frac{\bar{Z}_R}{(1+A)w}\left(\frac{A}{(1-\alpha)}\left(\frac{p_x \alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}} + \frac{1}{(1-\beta)}\left(\frac{p_y \beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\right) < 0$$

Now solve for the partial equilibrium in the local labor market:

The important difference between private dehkan and collective dehkan farms is that both farm types face different local labor supplies. Small private dehkan farms face a competitive local labor market that comprises landless females from local villages

whose male family members have migrated to Russia for work. In the harvest time, private dehkan farms in local labor markets compete for those female agricultural workers. In contrast, big collective dehkan farms are still heavily intertwined with local governments and receive harvest workers sent by the local government. Those workers are employed in the public administration, schools, hospitals and other para-statal enterprises and are forced to work at the cotton harvest for minimum picking wages.[87] For further details please see the Appendix 2 D on the qualitative interviews in Tajikistan.

We define $\overline{Z_{R,PF}}$ as the land under private dehkan farms (PF) in region R and $\overline{Z_{R,CF}}$ as the land under collective dehkan farms (CF) in region R. From Kassam (2011) and FAO (2009, 2011) we know that the share of cultivated land under collective dehkan farms and state owned enterprises, which have similar organizational structures than collective dehkan farms, is about 40% for the whole Republic of Tajikistan.

$$\overline{Z_{R,PF}} + \overline{Z_{R,CF}} = \bar{Z}_R$$

1.) Partial equilibrium for small private dehkan farms

Private dehkan farms face a efficiency wage curve, the elasticity of labor supply w.r.t. the wage is positive ($\gamma > 0$). Those farms have to increase wages to attract further picking workers from local village labor markets. Workers from local villages have a reservation wage that mainly depends on household remittances and the level of subsistence production on household plots.

$$L_{S,PF}(w) = \gamma w - k$$

Where k>0 and the reservation wage $w_r = \frac{k}{\gamma}$

Local labor market partial equilibrium:

$$L^*_{Total\ Demand,R,PF}\left(p_x, p_y, w^*, r, \overline{Z_{R,PF}}\right) = L_{S,PF}(w^*)$$

Leads to:

$$0 = \frac{\bar{Z}_{R,PF}}{1+A}\left(\left(\frac{p_x \alpha}{(1+r)w}\right)^{\frac{1}{1-\alpha}} A + \left(\frac{p_y \beta}{(1+r)w}\right)^{\frac{1}{1-\beta}}\right) - \gamma w^* + k$$

An explicit solution for w does not exist. Applying the implicit function theorem leads to:

[87] Shareholders on big collective dehkan farms comprise the other part of the coerced labor pool big farms are able to exploit. Those mostly female shareholders are bound to the big farm by strong social and traditional norms, a lack of human capital and conscience about the agricultural reforms and their shareholder rights as well as missing economic resources.

$$\frac{dw^*(p_x, p_y, w^*, r, \overline{Z_{R,PF}})}{dp_x} = -\frac{E}{F}$$

$$E = \frac{A\overline{Z_{R,PF}}}{(1+A)} \frac{1}{(1-\alpha)p_x} \left(\left(\frac{p_x \alpha}{(1+r)w} \right)^{\frac{1}{1-\alpha}} \left(\frac{2+A}{1+A} \right) - \left(\frac{p_y \beta}{(1+r)w} \right)^{\frac{1}{1-\beta}} \left(\frac{1}{1+A} \right) \right)$$

$$F = \frac{A\bar{Z}_R}{(1+A)w} \left(\frac{\frac{\beta}{1-\beta} - \frac{\alpha}{1-\alpha}}{1+A} \right) \left(\left(\frac{p_x \alpha}{(1+r)w} \right)^{\frac{1}{1-\alpha}} - \left(\frac{p_y \beta}{(1+r)w} \right)^{\frac{1}{1-\beta}} \right)$$

$$- \frac{\bar{Z}_R}{(1+A)w} \left(\frac{A}{(1-\alpha)} \left(\frac{p_x \alpha}{(1+r)w} \right)^{\frac{1}{1-\alpha}} + \frac{1}{(1-\beta)} \left(\frac{p_y \beta}{(1+r)w} \right)^{\frac{1}{1-\beta}} \right) - \gamma < 0$$

If $\alpha > \beta$ and $\frac{p_x}{p_y} > \frac{\beta}{\alpha}$ the denominator F is negative. Other cases are not trivial to solve.

If $\alpha > \beta$ and $\frac{p_x}{p_y} > \frac{\beta}{\alpha}$ the nominator is positive (total labor demand on private dehkan farms increases in p_x; for other cases it is not trivial to show that).

Thus for $\alpha > \beta$ and $\frac{p_x}{p_y} > \frac{\beta}{\alpha}$ it follows that:

$$\frac{dw^*(p_x, p_y, w^*, r, \overline{Z_{R,PF}})}{dp_x} > 0$$

For reasonable values of the model parameters, the wages on small private dehkan farms increase if the farm gate price for raw cotton increases (cet. par.).

2.) Partial equilibrium for collective dehkan farms and state owned agricultural enterprises

Collective dehkan farms face an infinitely elastic labor supply due to political connections and coerced labor. Managers of the collective dehkan farms can dispose of a pool of coerced labor and do not have to raise wages to increase labor supply. They pay the minimum picking wage ($\overline{w}$) that is announced by the district government (hukumat) each year before the cotton harvest starts.

Labor supply for collective dehkan farms is completely elastic until a certain maximum amount:

$$L_{S,CF} = \bar{L}_{CF}$$

Local labor market partial equilibrium:

$$L^*_{Total\ Demand,R,CF}\left(p_x, p_y, \overline{w}, r, \overline{Z_{R,CF}}\right) = L_{S,CF}$$

Leads to:

$$0 = \frac{\bar{Z}_{R,CF}}{1+A}\left(\left(\frac{p_x\alpha}{(1+r)\overline{w}}\right)^{\frac{1}{1-\alpha}} A + \left(\frac{p_y\beta}{(1+r)\overline{w}}\right)^{\frac{1}{1-\beta}}\right) - \bar{L}_{CF}$$

Thus, increasing labor demand on collective dehkan farms is met by the respective labor supply at the minimum picking wage ($\overline{w}$) until labor demand reaches the value $\bar{L}_{CF}$. At this point, the pool of coerced labor is exhausted and collective dehkan farms cannot further increase labor demand and cotton production. An increase in the farm gate price of cotton p_x would lead to increased cotton production on collective dehkan farms until the pool of coerced labor is exhausted, but wages for picking workers on collective dehkan farms would stay constant.

From the evaluation of the interviews, we know that collective dehkan farms always paid the minimum picking wage announced by the hukumat. Those farms did not participate in local labor markets to attract further workers by rising picking wages. In most cases, collective dehkan farms did not exhaust the pool of coerced labor and were able to match their labor demand with sufficient picking workers. However, in many cases the cotton harvest at collective dehkan farms lasted longer and some collective dehkan farms seemed to have problems in meeting their picking labor demand. Statistics on cotton production and area under cotton for small vs. big farms show that in some districts big collective dehkan farms did increase cotton area and production not as strongly as the small private dehkan farms in 2011 (Fig. A2.15-A2.18). This might be partly explained by the labor supply restrictions for collective dehkan farms in those districts.

Appendix 2 D Interviews in Tajikistan

Qualitative Research in Tajikistan

As part of my dissertation project, I spent eight weeks in March and November 2014 in Tajikistan to conduct qualitative interviews and organize additional statistical data on the market structure of the Tajik cotton sector and the Tajik agricultural sector in general.

The main motivation for this field research was to better understand the labor market channels of global price fluctuations. In our quantitative analysis, we had used the TLSS household panel survey in 2007, 2009 and 2011 to investigate the impacts of the substantial cotton price hike in the year 2010/2011 on rural employment and wages in Tajikistan. Employing a Difference-in-Differences framework to exploit variation in the cotton price over time and in the suitability for cotton production across regions, we found that due to the price shock real wages per hour for agricultural workers increased by over 90% in cotton regions from 2009 until 2011 (compared to non-cotton regions). Interestingly, the effect was dominated by workers on small household owned farms. Workers on larger cotton farms did not gain from the positive world price shock. At this stage of the research project, the exact labor market channel of these found effects could not be determined due to the lack of detailed data on the Tajik agricultural sector and the cotton sector in particular. The main competing hypotheses for the findings were that farms of different size face vastly different labor supplies, or that recent reforms in the cotton sector had increased the relative negotiation power of smallholders with cotton ginneries.

To collect additional data and better understand the institutional structure of the cotton sector in Tajikistan, I organized a field research in March and November 2014 in Tajikistan. I applied for financial support at various institutions and finally received a Ph.D. scholarship from the German Academic Exchange Service (DAAD) as well as an additional grant from the Münchner Universitätsgesellschaft (MUG). I initiated the research cooperation with the German Federal Enterprise for International Cooperation (GIZ) in Tajikistan that supported me in logistical matters. Through an agricultural consultancy firm (SAROB) that is supported by the GIZ in Tajikistan, I could establish many valuable contacts with national and local administration officials, ginnery managers as well as many farmers in various regions of Tajikistan. During the field research and with the help of a local language interpreter, I was also able to establish contacts to many local farmers on my own. I also initiated various contacts to international cotton trading companies (e.g. Reinhart AG, ECOM Agroindustrial Corp. Ltd), NGOs and International

Organizations (e.g. the World Bank, the Asian Development Bank, the Food and Agricultural Organization of the UN) involved in or monitoring the cotton sector in Tajikistan. The organizational work involved in this field research project was quite intense and took about two months before the first stay in March 2014.

In total, I conducted 57 qualitative interviews with private and public agents in the cotton sector in Tajikistan, e.g. small holder farmers, workers and managers of larger cotton farms, ginnery managers, staff members of international and Tajik cotton trading companies, agricultural finance consultancies and cotton investors, local public administration officials, officials from the Ministry of Agriculture and the National Statistics Agency, International Organizations and NGOs. A complete list of the conducted interviews can be found below. The main result of the qualitative interviews is that differences in the world market price pass-through to farm wages were mainly due to farms of different size facing different labor supplies. Big collective dehkan farms are still heavily intertwined with local governments and receive harvest workers sent by the local government. Those workers are employed in the public administration, schools, hospitals and other para-statal enterprises and are forced to work at the cotton harvest for minimum picking wages. Even school children are still sent to the cotton fields during the harvest season. In exchange, the managers of big collective dehkan farms still support the local governments in maintaining the public and social infrastructure (e.g. funding and sending workers for the construction of schools and hospitals). It also appeared from some interviews that the managers of big collective dehkan farms are still colluding with local ginneries and politicians to reap the rents from the cotton sector (see Sattar and Mohib, 2006, for a description of this clientelistic system).[88]

In contrast, small private dehkan farms lack the strong political connections of big farms and have to hire additional harvest workers at the local village labor markets. The local labor supply is mostly comprised of landless female workers whose working age male family members have migrated to Russia for work. Due to traditional norms and the Islamic revival, those landless females are not allowed to travel alone and, thus, local labor markets are confined to local villages. The emergence of small private dehkan farms due to the agricultural reforms has not only benefitted the households owning those farms but has also created new opportunities for landless females bound to the villages through the emergence of competitive local labor markets. The cotton price hike in 2010/2011 has increased labor demand for cotton pickers in the harvest of 2011

[88] Shareholders on big collective dehkan farms comprise the other part of the coerced labor pool big farms are able to exploit. Those mostly female shareholders are bound to the big farm by strong social and traditional norms, a lack of human capital and conscience about the agricultural reforms and their shareholder rights as well as missing economic resources.

on both farm types, but only on small farms picking wages increased because those farms faced a competitive local labor market.

A more detailed overview of the results of the qualitative interviews can be found in subsection 2 and 3. The data requests I initiated with various private and public institutions in Tajikistan resulted in obtaining various additional data sets that are presented in Appendix 2 B.

Content

1. Lists of conducted interviews

Overview of interviews conducted in Tajikistan in March and April 2014

Interview Number	Date, Time	Location	Interview Partners
1.	5 March 2014, 11 am	National Academy of Sciences, Dushanbe	Prof. Dr. Mustafar Olimov, Director Research Institute SHARQ
2.	5 March 2014, 3 pm	Office of the German Federal Enterprise for International Cooperation (GIZ), Dushanbe	Muhammadi Muminow, Director of the agricultural consultancy firm SAROB that is supported and funded by the GIZ Tajikistan
3.	6 March 2014, 2 pm	GIZ Office, Dushanbe	Hartwig Ungethuem, Team Leader of the GIZ Divisions "Business Enabling Environment" und "Value Chains", GIZ Tajikistan
4.	12 March 2014, 11 am	Restaurant, Dushanbe	Staff member of the Ministry of Agriculture of the Republic of Tajikistan and owner of a family farm in Hissar district; another colleague of him that also owns a family farm in Hissar district (both requested anonymous citation)
5.	12 March 2014, 1.30	Restaurant „Traktor“,	Staff members of the Tajik cotton trading companies Eurotex Ventures Inc.

	pm	Dushanbe	and Golden Lion LLC (business partners of the international cotton trading company Reinhart AG) (requested anonymous citation)
6.	12 March 2014, 5.30 pm	Café of the National Library of Tajikistan, Dushanbe	Dr. Hafiz Boboyorov, Research Associate at the National Academy of Sciences of Tajikistan and Research Fellow of the German research institute "Zentrums für Entwicklungsforschung (ZEF)" in Bonn, expert for social and political power structures in cotton areas of Tajikistan
7.	13 March 2014, 9 am	Hissar district (RRP province), courtyard of the big collective farm	Two shareholders of a big collective farm (1500 ha), one driver and another shareholder
8.	13 March 2014, 10 am	Hissar district, courtyard of the big collective farm	Vice-Manager of the same big collective farm (from interview 7), the agronomist of the farm
9.	13 March 2014, 2 pm	Hissar district, fields of the farm	Manager of a collective dehkan farm (59 ha), Agronomist for Hissar district at the agricultural consultancy firm SAROB
10.	13 March 2014, 3 pm	Hissar district, fields of the farm	Manager of a collective dehkan farm (128 ha)
11.	14 March 2014, 9 am	Hissar district, courtyard of the big collective farm	Director of a big collective farm (605 ha)
12.	14 March 2014, 11 am	Sharinav district (RRP province), fields of the farm	Farm head and one shareholder of a family dehkan farm (2 ha)
13.	14 March 2014, 12 pm	Sharinav district, fields of the farm	Farm head of a family dehkan farm (3,2 ha)
14.	14 March 2014, 1 pm	Sharinav district, fields of the farm	Farm head of a family dehkan farm (2 ha)

15.	14 March 2014, 3 pm	GIZ Office, Dushanbe	Sanginboy Sanginow, former staff member of the Food and Agricultural Organization (FAO) in Tajikistan, senior expert on the agricultural sector in Tajikistan
16.	17 March 2014, 2 pm	Kurgonteppa City (Khatlon province), hotel lobby	Leading Agronomist for three districts at the agricultural consultancy firm SAROB (Firuz) and another agronomist
17.	17 March 2014, 3 pm	Bohtar district (Khatlon province), sub-district Navbahor, courtyard of the collective dehkan farm	Manager of a collective dehkan farm (230 ha)
18.	17 March 2014, 4.30 pm	Bohtar district, sub-district Navbahor, office of the cotton ginnery	Manager of the cotton ginnery and of a collective dehkan farm (120 ha)
19.	17 March 2014, 6 pm	Bohtar district, sub-district Navbahor, courtyard of the farm	Farm head of a family dehkan farm (10 ha)
20.	18 March 2014, 10.30 am	Bohtar district, sub-district Sargar, house of the family	Farm head of a family dehkan farm (7,5 ha)
21.	18 March 2014, 12 pm	Bohtar district, sub-district Sargar, hospital of the sub-district	Former futurist and cotton trader and now manager of a collective dehkan farm (106 ha), agronomist of the collective dehkan farm and also farm head of a family dehkan farm (5 ha)
22.	18 March 2014, 2 pm	Bohtar district, sub-district Sargar, hospital of the sub-district	Shareholder of the collective dehkan farm (from Interview 21)
23.	18 March 2014, 5 pm	Kholkozobod district (Khatlon province), Kholkozobod city,	Former Minister of Agriculture of the Republic of Tajikistan and now farm head of a family dehkan farm (10 ha),

		house of the family	district administration official responsible for irrigation infrastructure
24.	19 March 2014, 5 pm	Vosé district (Khatlon province), sub-district Miyali, house of the family	Manager of a collective dehkan farm (120 ha)
25.	20 March 2014, 10 am	Vosé district, sub-district Miyali, courtyard of the farm	Two shareholders of the collective dehkan farm (from Interview 24) and the agronomist of the farm
26.	20 March 2014, 12 pm	Vosé district, sub-district Miyali, house of the family	Farm head of a family dehkan farm (6 ha)
27.	20 March 2014, 5 pm	Moskovskaya district (Khatlon province), fields of the farm	Shareholder of a family dehkan farm (5 ha)
28.	20 March 2014, 6 pm	Moskovskaya district, fields of the farm	Farm head and shareholder of a family dehkan farm (8 ha)
29.	27 March 2014, 9 am	Kuhjand City (Sughd province), office of the agricultural consultancy firm SAROB	Director of the agricultural consultancy firm SAROB for Sughd province
30.	27 March 2014, 3 pm	Konibodom district (Sughd province), sub-district Selski Soviet, fields of the farm	Manager of a collective dehkan farm (36 ha) and former head of a kolkhoze brigade
31.	27 March 2014, 4 pm	Konibodom district, sub-district Selski Soviet, fields of the farm	Ten shareholders of the collective dehkan farm (from Interview 30)
32.	27 March 2014, 5.30 pm	Konibodom district, sub-district Ortikof, house of the family	Leading Agronomist for Konibodom district at the agricultural consultancy firm SAROB
33.	27 March 2014, 6 pm	Konibodom district, sub-district Ortikof,	Manager of a collective dehkan farm (74 ha), agronomist of the collective dehkan

		house of the family	farm and also farm head of a family dehkan farm (1,5 ha)
34.	28 March 2014, 12 pm	Mastchoh district (Sughd province), house of the family	Leading Agronomist for Mastchoh district at the agricultural consultancy firm SAROB and also manager of a collective dehkan farm (110 ha)
35.	28 March 2014, 3 pm	Mastchoh district, house of the family	Farm head of a family dehkan farm (5 ha) and former manager of a collective dehkan farm (80 ha)
36.	28 March 2014, 5 pm	Mastchoh district, house of the family	Farm head of a family dehkan farm (3,6 ha)
37.	29 March 2014, 8 am	Kuhjand City, Office of the Deputy-Minister of Agriculture for Sughd province, Tajikistan	Deputy-Minister of Agriculture for Sughd province, Tajikistan
38.	29 March 2014, 11 am	Kuhjand City, office in the Ministry of Agriculture for Sughd province	Leading Agronomist for Sughd province at the agricultural consultancy firm SAROB and also former Deputy-Minister of Agriculture for Sughd province
39.	31 March 2014, 10 am	World Bank Office, Dushanbe	Bobojon Yatimov, staff member and cotton sector expert, World Bank Tajikistan
40.	31 March 2014, 2 pm	GIZ Office, Dushanbe	Torsten Swoboda, Agricultural Consultant at the GIZ Divisions "Business Enabling Environment" und "Value Chains", GIZ Tajikistan
41.	1 April 2014, 9.30 am	Statistics Institute of the Republic of Tajikistan, Dushanbe	Staff member of the Tajik Statistics Institute
42	16 April 2014, 11 am	Skype phone call, office at the University of Munich (LMU)	Former Country-Manager Tajikistan of the cotton trading company ECOM Agroindustrial Corp. Ltd (requested

			anonymous citation)
43	22 January 2014, 4 pm	Skype phone call, office at the University of Munich (LMU)	Former Central-Asia-Manager for the cotton trading company Reinhart AG (requested anonymous citation)
44	14 January 2014, 11 am	Skype phone call, office at the University of Munich (LMU)	Dr. Andreas Mandler, researcher at the research institute „Zentrum für Entwicklungsforschung (ZEF)“ in Bonn and expert on political power structures in rural areas of Tajikistan
45	1 April 2014, 12 pm	GIZ Office, Dushanbe	Zarina Kosymova, Deputy Team Leader, Head of "Business Enabling Environment”, GIZ Tajikistan
Overview of interviews conducted in Tajikistan in November 2014			
	Date, Time	**Location**	**Interview Partners**
46.	11 November 2014, 2 pm	GIZ Office, Dushanbe	Igor Eromenko, Ph.D., Head of GIZ Division “Evidence based decision making”, GIZ Tajikistan
47.	11 November 2014, 4 pm	GIZ Office, Dushanbe	Hartwig Ungethuem, Team Leader of the GIZ Divisions "Business Enabling Environment" and "Value Chains", GIZ Tajikistan
48.	18 November 2014, 11 am	Ministry of Agriculture of the Republic of Tajikistan, Dushanbe	Head of Program “Information Resource Development in Agriculture Sector”, Ministry of Agriculture, Tajikistan (requested anonymous citation)
49.	19 November 2014, 8 am	FAO Office within in the Ministry of Agriculture of the Republic of Tajikistan, Dushanbe	Staff member of the Office of the Food and Agricultural Organization (FAO) in Tajikistan (requested anonymous citation)
50.	19 November 2014, 1.30 pm	Café on Rudaki Street, Dushanbe	Former staff member of the ADB team that planned and accompanied the Agricultural Reforms in Tajikistan from 2005-2008 (requested anonymous cita-

			tion)
51.	20 November 2014, 2 pm	Office of the agricultural finance consultancy firm, Dushanbe	Head of an agricultural finance consultancy firm and former staff member of the EBRD project Tajik Agricultural Finance Framework (TAFF) (requested anonymous citation)
52.	20 November 2014, 5 pm	GIZ Office, Dushanbe	Torsten Swoboda, Agricultural Consultant at the GIZ Divisions "Business Enabling Environment" und "Value Chains", GIZ Tajikistan; Igor Eromenko (Interview 46)
53.	27 November 2014, 5 pm	GIZ Office, Dushanbe	Zara Makhmudova, National Coordinator GIZ Tajikistan and former National Coordinator of the Tajik Farm Restructuring Project of the World Bank, IMF and the Tajik Government
54.	28 November 2014, 2 pm	World Bank Office, Dushanbe	Bobojon Yatimov, staff member and cotton sector expert, World Bank Tajikistan
55	13 November 2014, 6 pm	GIZ Office, Dushanbe	Shahlo Rahimova, Programme Manager, DFID Central Asia
56	7 October 2014, 10 am	Café, Munich, Germany	Paul Frijters, Professor of Economics at the University of Queensland, Researcher on Political Economy in Tajikistan
57.	10 February 2015, 10 am	Phone call, office at the University of Munich (LMU)	Mattes Scheftelowitz, Project Manager at the research institute “Deutsches Biomasseforschungszentrum” and former consultant for GIZ Tajikistan

2. Results of Interviews in March 2014

In the following document, the main questions in the interviews are followed by typical answer categories that occurred during the qualitative and open interviews. For each answer category, I assigned the number of the interview where that statement occurred. Each interview number identifies one unique interview and the assignment of interview numbers is presented in the interview table above. Most interviews were recorded and the audio material can be requested from the author. The transcripts of the interviews can also be requested from the author.

1) Cotton price hike in 2010/2011

Did farm gate prices increase in 2010 and 2011? (spot prices at harvest time vs. prices of futurist contracts at start of the season; same for all farm types?)

Farm gate prices (spot rate) in harvest time increased strongly in 2010 and were still higher in 2011 than in 2009. (Quotes: interviews 1, 3, 4, 5, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 26, 27, 28, 29, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43)

Fixed prices for raw cotton included in futurist contracts at start of the season increased from 2010 to 2011. (Quotes: interviews 4, 5, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 26, 27, 28, 29, 32, 33, 34, 35, 36, 37, 38, 39, 42, 43)

Gins offer higher prices to big farms compared to small farms (big farms deliver higher amount of cotton and have a stronger negotiation power; maybe big farms are politically connected and collude with the gins). (Quotes: interviews 8, 9, 11, 12, 13, 14, 15, 17, 21, 26, 43)

Gins offer higher prices to farms that have not signed a future contract with them (that are independent). (Interview 18, 43)

Farm gate prices are the same for all farm types. (Quotes: interviews 5, 40, 42)

*Note: In recent years, most farmers do not demand future contracts with fixed prices, but opt to repay futurist credit at spot prices in harvest (if they have the choice, see **Interview 42, 43 and also other interviews**). In almost all interviews farmers told me that for futurist contracts the spot price in harvest time is used to repay the credit for inputs (farmers who finance inputs with own capital or bank loans sell raw or ginned cotton at spot prices in harvest time). The price for ginned cotton is computed using the Liverpool stock exchange cotton price index for 2nd quality (middling staple…) minus 3.5% gin capital costs, 25% taxes and distribution costs (10% sales tax plus tariffs in Uzbekistan), 60 USD transport costs for train to the Riga port and around 240 USD ginning*

*costs (also see the official methodica in Kassam 2011). 1st quality gives a 10% higher price and 3rd quality 4% lower price. (**Interview 38**)*

Many farmers said that farm gate prices increased for all farm types in2011 (to around 700 USD per ton of raw cotton in 2011).

*Prices only differ for cotton of different quality. First pick gives higher quality cotton and higher prices than consecutive picks. Intermediary traders exist, because gins often do not have cash to pay farmers that did not sign future contracts with them (or that already delivered the necessary amount of raw cotton and want to sell exceeding quantity). So intermediary traders buy the cotton and give cash to farmers. Later they sell the cotton to the gin at higher prices. (**Interview 40**)*

From the interviews, it seems clear that even in the futurist-gin monopoly case there was an increase of farm gate prices in futurist contracts to incentivize farmers to grow more cotton. But, because in harvest time international prices had gone down again, futurists often did not pay the agreed farm gate price to farmers (only farmers in RRP told that). Thus, farmers increased area under cotton in 2011, but did not receive the profit expected. Could they pay higher wages to harvest the fields? It is more likely that only farmers that benefitted from higher prices because of more competitive gin/futurist market or because they are independent of futurists and have own capital, could have paid larger wages in harvest 2011?! ***The official from the Ministry of Agriculture in Sughd told me that wages are more driven by the area under cotton than by harvest spot prices of cotton. In 2009, because of spring rain many farmers had to sow again and this decreased profits strongly. But to harvest the fields and at least cash in the crop, they had to pay the same wages than usual, even although profits in this year were low. (Interview 37) Thus, in 2011 farmers had to pay the higher wages to harvest their fields, even although world prices for cotton had come down during the summer.***

*The official from the Agricultural Ministry (**Interview 4**) told me that managers of collective dehkan farms often sell the cotton for lower prices than private dehkan farms because they reap a much larger share of the profits due to intransparent accounting (see Sattar and Mohib, 2006; the manager of the collective dehkan farm even accumulates debt for the farm that accrues to every shareholders by putting money in its own pockets). Another reason, why collective dehkan farms may sell for lower farm gate prices is that a larger share of those farms depends on futurists (see end of section 3) or because it is harder for them to store the ginned cotton and wait for better prices (due to lack of storage facilities).*

Did area devoted to cotton increase in 2011 and which crop area was decreased in exchange (e.g. wheat)? Did cotton area increase on small private and big collective dehkan farms?

In 2011, area devoted to cotton increased strongly as reaction to the price increase (20-30%). Area of wheat and also other crops (vegetables, fruits) decreased in exchange. (Quotes: interviews 3, 4, 7, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42)

This was the case for both farm types (private vs. collective dehkan farms, also at enterprises). (Quotes: interviews 3, 4, 7, 10, 11, 15, 16, 17, 18, 19, 20, 21, 23, 24, 27, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42)

The increase of area devoted to cotton was mainly on private dehkan farms, because state influenced collective dehkan farms are reacting less flexible to price signals. (Interview 8, 9, 43)

*Note: An interesting observation is also that a lot of the farmers (collective dehkan farm managers and family farm heads) do look at world prices at start of the season or at last harvest world prices. In 2011, a lot of them planted more cotton because prices were high at harvest 2010 and when season started (January/February 2011). Another important reason is that farmers that do not have internet or more entrepreneurial knowledge just look what successful neighbors did last year: So in 2010 cotton was very profitable and many farmers increased cotton area in 2011 because neighbors got profit out of it last year! (**Interview 26, 42**)*

It was mainly area devoted to wheat that decreased in 2011 (almost all interviews).

Did labor demand increase in harvest 2011? Did picking wages increase?

Yes, labor demand for harvesting increased strongly in 2011, compared to 2010. (Quotes: interviews 4, 10, 11, 15, 16, 18, 20, 23, 24, 26, 27, 28, 29, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42)

Yes, picking wages increased from 2010 to 2011. (Quotes: interviews 4, 7, 8, 10, 11, 15, 16, 18, 20, 23, 24, 26, 27, 28, 29, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42)

Note: Most farmers said that the fact that the world market price declined during the curse of the year 2011 was an additional reason, why labor demand increased so much in harvest 2011. Farmers wanted to cash in the crop as soon as possible to prevent further losses. Thus, cotton area increase and the decreasing world price were the main drivers of labor demand in cotton harvest 2011. To harvest before the rain season starts is a driver for picking labor demand that did not change in 2011 compared to 2009.

Most farmers told me that picking wages increased from around 40 Diram per kg in 2010 to 70 Diram per kg in 2011 on private family dehkan farms. On collective dehkan farms picking wages only slightly increased from around 40 Diram per kg in 2010 to around 40-50 Diram per kg in 2011 (differing statements between interviews).

Did profits for managers of big collective dehkan farms increase in 2011?

Yes, profits increased strongly. (Interview 4, 10, 15, 17, 18, 19, 20, 23, 24, 26, 28, 29)

Notes: In some interviews and meetings in Dushanbe, people told me that the managers of the collective dehkan farms made huge profits in 2011 and invested a lot of these profits in construction sector in Dushanbe. Also people involved in the cotton trade and the ginneries made huge profits and invested in the construction sector.

*The farmer in **Interview 13** told me that in Sharinaw the average leasing price for 1 ha land is 600 USD. Good quality land costs 800 USD. Most farmers in this region grow tomatoes and onions for the Dushanbe markets. Thus, the average profits made by farmers in this region are 600-800 USD per ha.*

*In some interviews, farmers told me that profits were very high in 2010. However, in 2011 spot prices in harvest time were already at lower levels and profits were not so high (**Interview 32, 33, 35**).*

2) Rural labor markets 2010/2011

Do picking wage differences exist between farms and farm types (big vs. small)?

Yes, picking wage differences exist, because there is a competition between all farm types for harvest workers from nearby villages (increased labor demand in 2011). Collective dehkan farms cannot pay higher wages, because they are financially unhealthy and lack the necessary cash reserves to pay harvest workers at the spot (depend more on futurists than smaller farms, political involvement in decisions on collective dehkan farms, collective dehkan farms have to finance part of local government budget; see end of section 3). Most private dehkan farms work with own capital (mostly from remittances) or receive loans from banks or microfinance institutions and can pay higher wages. (Quotes: interviews 4, 11, 13, 15, 16, 19, 23, 27, 29, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 45)

Yes, private dehkan farms try to attract harvest workers from nearby villages (and also wider family members), because private farmers think more economically and want to harvest their fields rapidly to get better output prices from gins and traders. Collective dehkan farms use only shareholders and their families to harvest their fields (kind of

coerced labor); managers do not have to pay them higher wages, because they are tied to the collective (they are not aware of their rights as shareholder, they additionally receive cotton stalks and food crops grown on small plots of the big farm; social norms force wider family members to help in the harvest for low wages). (Quotes: interviews 6, 7, 8, 9, 10, 15, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 29, 34, 38, 40, 42, 44, 45)

Yes, big collective dehkan farms receive harvest workers who work for smaller wages from other poorer Jamoats or from other collective dehkan farms (small private dehkan farms can only attract workers from nearby villages). Those bus transfers are organized by local officials or by private agents. Workers have to pay for the transport, the meals and accommodation by themselves. Mostly, those costs are automatically deducted from the picking wage and workers receive a lower picking wage in cash. Furthermore, farm managers hand out the cash for wages of these workers to an intermediary (organizer of the bus transfer), who keeps a certain part of the cash for himself. (Quotes: interviews 15, 18, 21, 29, 32, 33, 34, 36, 37, 38, 40)

Yes, private dehkan farms employ mostly family members and pay them higher picking wages due to social norms. (Quotes: interviews 2, 3, 4, 5, 35, 37, 40)

No, differences only exist between PSUs due to different degrees of competition per PSU (some PSUs only have few big farms and a local monopsony exists that depresses wages; in PSUs with a higher number of farms, all farm types have to pay higher picking wages). (Quotes: interviews 2, 6, 30)

No, there are no differences. All farm types compete for harvest workers on local labor markets (nearby villages in the Jamoat). (Quotes: interviews 2, 3, 5, 6)

Notes: At least for private dehkan farms, there is competition between farms for seasonal picking workers from nearby villages for sure (farms want to harvest the field rapidly because weather gets bad or prices are high at start of harvest season).

On all farms types, shareholders and their family members work as pickers in the harvest season. However, mostly additional pickers are needed and have to be attracted from local labor markets (landless laborers from nearby villages, shareholders from other farms). The vast majority of picking workers in cotton harvest are female (transport and driving activities and maintenance of irrigation channels is carried out by male). Landless laborers from nearby villages are almost exclusively female (male of these families migrated for work; those female are mostly unemployed during the rest of the year and only work on their small household plot where they grow vegetables and potatoes, may be some grain; young girls finishing high school and waiting to be married are also among those workers), shareholders and their family members on private

*and collective dehkan farms may also be male (but majority is female). Some farmers told me that private dehkan farms have a higher share of male workers are therefore more productive (**Interview 36**). Rustam from Sarob told me that female are much more productive than male in cotton picking due to their dexterity and that is one reason why more female work in cotton harvest (**Interview 38**).*

There is a minimum picking wage for each district that is announced by each hukumats government at the start of the harvest season. However, each farm is allowed to pay more to attract workers. Picking workers will choose those farms that offer higher wages and where wages are paid in cash on the same day. Thus, for farms with big cash reserves it is easier to attract picking workers.

***Evidence for forced labor on collective dehkan farms:** Andreas Mandler and Hafiz Bobojorov told me that in Shartuz; Konibodom and Qumsangir, even landless females from local villages (non-shareholders) are still forced to work on the collective dehkan farms by local officials for very low or no wages and receive cotton stalks (social and cultural norms exist, that create the social pressure for females to work in cotton harvest). Furthermore, Mandler and Bobojorov say that the poor and marginalized households who are shareholders in collective dehkan farms (without connections to local power structures) still have to work on the collective dehkan farm (and receive very low wages plus cotton stalks) and cannot easily opt out and found an own private dehkan farm (because they do not question the status quo, lack of knowledge, capital and political connections to get good land; **Interviews 6, 44**). (However, only 10% of area in Shartuz region is under private dehkan farms, so the monopsony story may also hold) Due to the highly monopolized cotton market (only one gin and one futurist), all farms in this region have to work together with one futurist and this futurist gives cash for wages. Thus, wages do not differ between farms in this region (**Interview 6**).*

*Hafiz Bobojorov said that social norms of family bonds are very important to understand, why wider family members work at all farm types for such low wages. The norm is not to pay your family members better, but that as a family member you have to help in the harvest even for low wages (so coerced labor also because of social norms)! He said that even some heads of private dehkan farms withhold the low wages for wider family members and just give them cotton stalks (**Interview 6**) Sanginow (ex-FAO chief) told me that on all farms bigger than 10 ha the management system and collusion with gins and futurists is the same than 10 years before (**Interview 15**). Shareholders are exploited and receive only cotton stalks, little plots of land and very low wages (not always, often no cash payments at all!).*

It seems that at collective dehkan farms the manager only pays the minimum wage announced by the hukumat and each shareholder is responsible for harvesting his share of the field. Shareholders then mostly use family members to harvest the field for such low wages (because social norms force families to help each other; another reason may be that shareholders on collective dehkan farms want to keep the cotton stalks for themselves, ***Interview 34****). (****Interview 17, 22, 25, 40, 45****) Another hint for low fixed wages and coerced labor on collective dehkan farms is the fact that shareholders from collective dehkan farms (and their family members) try to cheat their manager and sell part of the crop to private dehkan farmers, who pay them more per kg than the picking wage on collective dehkan farms (some private farmers told us;* ***Interview 7, 15****). There is also evidence that collective dehkan farm managers force their shareholders to work on other collective dehkan farms (****Interview 18, 21****).*

In case there are no picking wage differences between small and big farms in one PSU, the effect we find in the quantitative analysis could be because of different levels of competition between farms in different PSUs due to different state of the privatization process (PSUs with only few collective dehkan farms have a monopsony and low picking wages, in PSUs with many small private dehkan farms and few collective farms picking wages are higher due to more competition).

*One shareholder of a big cooperative farm told me that wages in the harvest season are negotiated informally and may differ between farms and even between pickers in one farm (wage may also be paid for harvesting a certain area not wage per kg). (****Interview 7****) Private dehkan farms are more likely to pay picking wages cash at the spot, whereas collective dehkan farms often pay picking wages with a lag of 10 days (****Interview 29****). Another collective dehkan farm and ginnery manager (****Interview 18, also 36****) told me that competition for harvest pickers from local villages is higher in times of bad weather (because the cotton has to be harvested before it rains).*

In Konibodom, I interviewed a brigade manager in a jamoat where the old Kolkhoze still exists (specialized on cotton seed production; ***Interview 30****). He told me that there are no private dehkan farms in this jamoat and there is no competition for harvest workers between the different brigades. All brigades pay the same minimum picking wage announced by the hukumat. Additional picking workers are carried by buses from nearby villages and receive cotton stalks, meals and the picking wage. Shareholders from other brigades come to his fields, when the cotton gets ripe again. However, he said that because of migration and remittances from Russia it is very difficult to find picking workers. Thus, he also employs school children after school and pays them the same wage (although they are less productive).*

*One manager of a collective dehkan farm told me that he would have liked to pay higher picking wages to attract more workers, but he could not because he works together with a futurist and was short of cash. That is why the harvest of the first pick took two weeks at his farm, whereas private dehkan farms could harvest a comparable area in 3 days. Private dehkan farms could pay higher picking wages and attracted more workers that also worked more productively (**Interview 33**). This manager also told me at the same time that collective dehkan farms receive bus transfers of landless picking workers who work for lower wages, because they are from poorer Jamoats and do not know about higher world prices for cotton etc. (private dehkan farms use only family members or females from local villages for harvest). Those workers also receive lower wages in cash, because meals and transport costs (and sometimes accommodation) are deducted (transport costs are paid to the driver) and the cash is handed out to an intermediary who keeps something for himself (this guy keeps about 2-4 Somoni per day per picking workers; **Interview 37, 38**). The official from the Agricultural Ministry told me that 65% of all collective dehkan farms in Sughd receive bus transfers of workers from poorer Jamoats (**Interview 37, 38**). Those bus transfers are from villages not farer away than 40 km from the collective dehkan farm. Rustam told me that there are also bus transfers from other districts, where many poor and landless people live (e.g. from Isfara to Zafarobod) (**Interview 38**). Rustam also told me that only collective dehkan farms receive those bus transfer workers, but 75% of workforce on collective dehkan farm are shareholders and their families and only 25% are those bus transfer workers.*

Did workers on small private farms work faster as workers on big collective farms in 2011 (because of higher wages)?

Yes, harvest workers on family farms work more productive (pick more kg per day), because they are better paid. (Quotes: interviews 4, 26, 32, 33, 36, 37, 40)

Yes, harvest workers on family farms work more productive, because they are mostly (wider) family members and may participate in the profits. (Quotes: interviews 4, 20, 21, 24, 26, 29, 32, 33, 35, 36, 37)

Note: Some farmers said that harvest workers on family farm workers pick more kg per day, perhaps because the picking wage is higher. The average pick per day is about 60 kg, the maximum is 100-150 kg.

*Some farmers told me that private dehkan farms have a higher share of male workers are therefore more productive (**Interview 36**).*

Do shareholders from big collective farms also work on small farms sometimes?

Yes, in the time, when the cotton gets ripe again, shareholders and their family members from collective dehkan farms go to harvest on private farms that offer good wages. (Quotes: interviews 7, 13, 15, 17, 18, 21, 22, 25, 26, 29, 33, 38)

Shareholders from private dehkan farms go to other private dehkan farms, when the cotton plant gets ripe on their fields. (Quotes: interviews 19, 20, 26, 28, 33, 38, 44)

Shareholders from private dehkan farms also work for harvest on collective dehkan farms. (Quotes: interviews)

Shareholders from collective dehkan farms also work on other collective dehkan farms due to social norms or pressure from their managers. (Interview 18, 21, 30, 38)

*Note: **Cotton harvest works as follows**: First pick starts at start of September and everybody wants to harvest it as soon as possible, because 1.) prices are high for the first pick (first pick is best quality cotton and gins give incentives so that farmers harvest early) and 2.) the faster you pick the first pick the faster cotton gets ripe again and you can pick the second pick! (The quality of the cotton in subsequent picks will be the same, if it has not rained since the first pick. Thus, there is an incentive to harvest rapidly. Maximum 5 picks from the same field are possible) Thus, there is huge competition for harvest workers and everybody that can pay higher picking wages to attract workers will do it (you need cash as farm to pay picking workers at the spot!). After one pick, it takes maximum 10 days to be able to pick the cotton again. During the time the cotton gets ripe, workers from private and collective dehkan farms go picking to other farms that offer the best wages.*

*Daily wages in harvest season stay constant or decrease until the end of the season. Picking rate wages increase from 1st until 5th pick, but less kg can be picked per day from 1st until 5th pick (worse quality because of increased rain probability, less cotton left on the plants). (**Interview 29, 30, 33, 38, 40**) Rustam from Sarob in Sughd told me that in normal years 75% of the cotton production are harvested in the 1st pick, 15 % in the 2nd pick and the rest in subsequent picks (average worker picks 100 kg in 1st pick per day, 40 kg in the 2nd and 20 kg in the 3rd). In years without rain until November it is 60% picked in 1st pick, 30% in 2nd and 10% in the 3rd pick, because first quality cotton is picked until the last pick and each time more cotton flowers grow again when there is no rain. In total the quantity harvested is much higher, when there is no rain until November. Rustam said that daily wages for pickers always go down from 1st until the last pick, because quantity picked per day decreases much stronger than wages per kg increase (**Interview 38**).*

*In summary, picking workers at one private farm consist of shareholders and their families, of shareholders from other farms (whose cotton has to ripe) and of landless laborers from nearby villages. Collective farms may additionally receive picking workers from farer and poorer jamoats, were many landless laborers cohabit. There is also evidence that collective dehkan farm managers force their shareholders to work on other collective dehkan farms (**Interview 18, 21**). It seems unlikely that workers from private dehkan farms go to collective dehkan farms to pick cotton **(see Interview 3, 44).** However, at collective farms often only shareholders and their families harvest the fields (or forced labor from other collective dehkan farms). This may be because of liquidity problems of big farms (see end of section 3) or because of higher degree of coerced labor (also due to social norms). (**Interview 7, 8, 17**) Another reason may be that shareholders on collective dehkan farms want to keep the cotton stalks for themselves (**Interview 34**).*

Is forced labor still available for harvest season (maybe in 2011 the international boycott changed the situation completely?)? Is forced labor available for small and big farms?

No, from 2011 on the government prohibited school children to work on the fields because of the international boycott. (Interview 1, 2, 4, 5, 8, 13, 19, 20, 22, 34, 35, 37)

Yes, there is still forced labor of females from local villages, students and school children on the larger collective dehkan farms, but not on small private dehkan farms. (Quotes: interviews 6, 11, 15, 18, 29, 30, 40, 44)

*Notes: Andreas Mandler and Hafiz Bobojorov told me that in Shartuz; Konibodom and Qumsangir, landless females from local villages are still forced to work as harvest pickers on the collective dehkan farms by local officials (social and cultural norms exist, that create the social pressure for females to work in cotton harvest; poor landless females are extremely stigmatized, they are not allowed to found a small shop or travel alone to find work etc., see articles from Mandler and Bobojorov). Mandler and Bobojorov say that the poor and marginalized households (without connections to local power structures) still have to work on the collective dehkan farm and cannot easily opt out and found an own private dehkan farm (**Interviews 6, 17, 18, 44**).*

*Mustafar Olimov told me that before 2011 it was mostly students and school children who were picking cotton in the fields (**Interview 1**).*

*There is also evidence that collective dehkan farm managers force their shareholders to work on other collective dehkan farms (**Interview 18, 21**).*

In Konibodom, I interviewed a brigade manager in a jamoat where the old Kolkhoze still exists (specialized on cotton seed production; ***Interview 30****). He told me that there are no private dehkan farms in this jamoat and there is no competition for harvest workers between the different brigades. All brigades pay the same minimum picking wage announced by the hukumat. Additional picking workers are carried by buses from nearby villages and receive cotton stalks, meals and the picking wage. Shareholders from other brigades come to his fields, when the cotton gets ripe again. However, he said that because of migration and remittances from Russia it is very difficult to find picking workers. Thus, he also employs school children after school and pays them the same wage (although they are less productive).*

Do harvest holidays exist in TJ?

No, since 2011 there are no harvest holidays anymore. (Quotes: interviews 1, 2, 4, 5, 6, 20, 22, 35, 38)

Yes, hukumats still send school children with their teachers to harvest cotton on large collective dehkan farms on the weekends (pupils pay for transport, accommodation and food with the first 20 kg they pick each day). (Interview 29, 30, 33)

On weekends, school children still work on the fields of their parents and receive picking wages too (on all farm types). (Quotes: interviews 2, 3, 4, 20, 22, 32, 34, 35, 36, 37, 38, 40, 42)

Did working hours decrease in harvest 2011 and why? 1.) Later in harvest, hours worked decrease because of less cotton to pick? 2.) Higher HH income from remittances decreases labor supply in agriculture in all regions of TJ?

Higher HH incomes due to increased remittances lead to less labor supply at the intensive margin in all rural (and agricultural) regions of Tajikistan. (Quotes: interviews 27, 29, 34, 37, 40, 45)

*Notes: In Moskovskaya there is a huge shortage of harvest pickers. Both interviewed farmers told me that wages go up until 1 Somoni per kg, because it is so hard to find workers in harvest time. (****Interview 27, 28****)*

3) Credit market and output marketing

How much ginneries and futurists are operating in this region? Is there competition between gins and futurists?

More than 2 gins/ futurists. There is competition between gins (and futurists), contract conditions differ between gins. (Quotes: interviews 5, 8, 11, 16, 17, 18, 20, 21, 24, 25, 26, 27, 28, 29, 30, 32, 35, 38, 43)

There are more than 2 gins/futurists, but there is no real competition. (Quotes: interviews 6, 9, 10, 12, 14, 15, 23, 34, 36)

The number of ginneries increased strongly in Tajikistan before 2009 (in 2009 already around 50 gins active). Interview (3, 4, 5, 16, 21, 24, 25, 28, 29, 34, 37, 39, 40, 42, 43)

*Note: Gins and futurists in Tajikistan have enough own capital or lend from national banks so that they are not doing any future contracts with international traders anymore! There are not much international investors in the Tajik cotton sector anymore. Those who are left buy the cotton at spot prices in harvest time, there are no fixed future contracts with international investors anymore (**Interview 2, 40, 42, 43**). The official from the Ministry of Agriculture told us that Russian and Chinese cotton traders still do future contracts with Tajik gins and that in 2011 90% of the Tajik cotton was sold through Riga. Now it may be less, because in 2011 Chinese entered the market in a big scale (**Interview 4, 5**)*

According to many interviews and statistical figures, the number of active ginneries increased strongly since 2006 (in 2000 there were 23 active gins and from 2006 on the number increased to around 50 in 2008/2009). The ADB and the World Bank financed 8 additional gins in Khatlon that were finished in 2012/2013 and many interview partners say that the competition between gins has increased since 2011/2012 (number of active gins in 2013 was 65). In 2009, the number of gins was already high and the market structure should have been more competitive (by decree 101 from 2007 the collusion of gins and futurists was broken up; and the debt cancellation increased the negotiation power of farmers because old debt dependencies disappeared and they had more freedom in choosing the gin; there were many education programs by international organizations to educate farmers for agricultural activities and to think more market oriented).[89] *But some interview partners told me that the price shock in 2010/2011 was the initial push that really increased competition between gins (farm gate prices for raw*

[89] For competition in the cotton markets to exist, a high number of ginneries is not sufficient. It is also important that farmers selling their raw cotton screen the market and try to find the best offer for themselves (this was not possible before 2008, when farmers were tied to the gins because of the huge debts, and because farmers did not behave market-oriented due to socialization in the collective system).

*cotton increased: 1.) because gins wanted to profit from high world prices and tried to increase their turn over and 2.) farmers were more aware of higher prices and looked for the gin with the best offer). This higher level of competition was persistent (even after the world price has gone down again, farm gate prices for raw cotton are higher in the years 2012 and 2013 than before the price shock), because the conscience and freedom of farmers has increased and the number of gins is very high. (**Interviews: 39, 40, 42, 43**) Due to the high number of gins, turnover per gin is too low to make profits leading to a huge price competition between gins (high farm gate prices to increase turnover of raw cotton). This will lead to the exit of many gins from the market (natural concentration process, see **Interview 40, 42, 43**). Another problem is that cotton debt is piling up again in Tajik banks that finance the gins, because many gins did run losses in the last 2-3 years.*

*However, some interview partners also told me that the vast majority of active gins are still controlled by few people close to the president (through loans of Tajik banks used to finance the gins). Thus, although the number of gins is much higher now, competition may not be a true competition (only small differences between offered prices…). One example is the Shartuz region (Kobodijon and Kumsangir), where the gins and futurists all belong to Ismail Somoni 21st century. In this region the freedom to farm (decree 111 in 2007) did not materialize in higher competition (because the local elites prevented it). The debt cancellation could not lead to more independent farmers, because there was no competition between gins that could be exploited by farmers. So debt of farmers piled up again and only very few farmers opted out of the collective dehkan farms (only about 10%)! (**Interview 2, 6, 44)** The official from the Ministry of Agriculture also told me that gins are still colluding with futurists and private farmers without sufficient capital resources are forced to work with futurists and debts are accumulating for them again. So there is only competition between gins for cotton from independent farmers. There is no competition between futurists or gins that do futurist services. **(Interview 4)***

*Sanginow told me that the ADB built 8 new gins and several storage facilities in Khatlon, but the credit for the project came from banks controlled by the family of the president. Thus, there is no real competition in the cotton market, everything is controlled and exploited by the family **(Interview 15).** Ismail Somoni 21st century is active in the whole South and exploits farmers (there is no free credit access and no freedom in output marketing)!*

Monopsonistic market power by gins was mainly executed by undervaluing the quality and weight of the delivered raw cotton (and supplying overpriced inputs to farmers at start of the season). Gins acting as futurists also tried to prolong the ginning process to

*increase the interest payment farmers had to repay to gins/futurists after the ginned cotton has been sold. With increased competition from 2011/2012 on, those practices of gins started to disappear, but farmers are still mistrusting the gins and undervalue their cotton weight and quality as well (**Interview 42**). Sanginow says that this practices are still present in many areas! (**Interview 15**)*

*Marco Baenninger from Reinhart AG said that the competition between gins already started in 2008 when debt of farmers was cancelled (and the futurist system was abolished). This increased the negotiation power of farmers with gins immensely and thus competition between gins. Since then, farm gate prices are more coupled to world market prices than before the reforms of 2007 (**Interview 5 and 43;** the minimum price rule according to the methodica introduced by the ADB in 2006 also helped in coupling farm gate prices to world prices). However, Antoine Buisson from ECOM argues that it took some time before the institutional changes really materialized in real competition. Farmers needed some time to understand their new freedoms and to start thinking more economically (screen the market, choose another gins than the one they had worked with for decades…). The price shock was the trigger for more competition because farmers and gins now started to behave more economically. (**Interview 42**)*

Can farmers sell their output freely in a competitive market?

Farmers that sign a future contract with the gin, have to sell the raw cotton to this gin to repay the credit (any remaining cotton can be sold freely). (Quotes: interviews 4, 11, 12, 13, 14, 15, 18, 20, 21, 24, 26, 27, 28, 32, 34, 35, 38, 39, 40, 42, 43, 45)

Farmers only have to repay the futurist credit in cash to the gin/futurist, so they can sell the cotton freely to any gin. (Quotes: interviews 5, 17, 21, 29)

Farmers that finance their inputs with own capital or bank loans are free to sell their cotton anywhere. (Quotes: interviews 3, 4, 5, 17, 18, 19, 20, 21, 24, 26, 27, 28, 29, 30, 32, 34, 35, 38, 39, 40, 42, 43, 45)

District authorities still close the borders to neighboring districts in harvest time to prevent selling raw cotton to neighboring gins (tax incentives, participation in rents of gin). (Quotes: interviews 5, 15, 16, 34, 38, 40, 42)

*Note: It seems that even if farmers with futurist contracts are allowed to sell the remaining cotton to other gins (after repaying the credit to the gin), they often do not do this because of higher transport costs and less market oriented attitude (or information costs). Gins still may have some kind of a local monopsony, even if there are several gins per district. (**Interview 9, 38**)*

*Only in 2012/2013, some districts allowed the selling of cotton across its district borders (**Interview 42**).*

*The official from the Ministry of Agriculture also told me that gins are still colluding with futurists and private farmers without sufficient capital resources are forced to work with futurists and to grow cotton (they often divert inputs from cotton to other crops as Kassam 2011 described, **Interview 9, 26**); debts are accumulating for them again. **(Interview 4, 40).** Thus, working with futurists is still a bad deal for small farmers (worse farm gate prices). For managers of collective dehkan farms, working together with futurists maybe privately profitable because of opaque management and collectivization of the debts (Sattar and Mohib, 2006, and end of section 3).*

*Hafiz Bobojorov told me that in Shartuz region (3 districts) there is only one gin and one futurist (Ismail Somoni 21st century) and even farmers that finance their inputs independently are not free to sell their cotton! (**Interview 6).** Also see **Interview 14** for a case, where independent farmers were forced to sell at the gin that is owned by powerful politician in the hukumat (Alimeidon); the newly constructed Chinese gin had to close. Sanginow also told me that there is no freedom to sell the crop (**Interview 15**).*

*It may be that big farms are more forced to work with close gins because they have less possibilities of storing the ginned cotton than small farms. (**Interview 19**)*

*There is also evidence that farms that were already founded before 2010 became more independent from futurists because of the price hike in 2010/2011 (could increase capital resources because of profits, **Interview 17, 35, 39**). Also collective dehkan farms became more independent from futurists because of high profits in 2010/2011 (**Interview 32**).In all districts except Bohtar, the big push in the privatization process seems to have taken place before the price shock in 2010/2011. Yatimov from the World Bank also told me that the price hike was not the cause of the push in the privatization process, but supported the farmers to be more independent from futurist financing. (**Interview 39**)*

How do contracts with gins/futurists look like? Is quantity of output specified? (get copies of contracts) Do offered contracts differ between small vs. large farms?

Farmers are free to decide, whether they sell raw cotton or pay the ginnery for ginning services and later sell the ginned cotton themselves. (Quotes: interviews 4, 8, 17, 18, 21, 24, 28, 29, 42,) This is only true for the Sughd region. (Interview 2, 3, 5, 30, 32, 34, 35, 36, 38, 40)

Contracts do not differ between small and big farms. All farm types have the same options of selling raw vs. ginned cotton. (Quotes: interviews 5, 18, 28, 24)

It is easier for bigger farms to sell ginned cotton themselves and not to the gin (have to find traders themselves). (Quotes: interviews 8, 15, 17, 19, 21, 26, 42)

Note: Since the reforms in December 2007 (decree 101), futurists are not allowed to work as before (intermediaries had to leave the market; now it is commercial banks that provide gins with capital, ***Interview 39****). Mostly gins overtook the business of futurists and most farmers that do not have own capital or bank loans enter into futurist contracts with the gin. These contracts mostly evaluate the raw cotton at harvest time spot prices. Some farmers told me that they are free to sell the cotton somewhere else, but only have to repay the credit including interest rates back to the gin. However, the majority said that they have to deliver the raw cotton to gin that provided the credit and then the cotton is evaluated by this gin; any remaining cotton can be sold freely.*

Futurist contracts specify the amount and prices of inputs delivered to the farmers and include an interest rate on the in kind credit (mostly slightly lower than bank interest rates). Only few farmers told me that they are free to choose input suppliers. Mostly, farmers enter the futurist contracts because futurists/gins provide a full package of input supply, credit and output marketing and because futurists do not demand any collateral for the credit (only the harvest is collateralized). However, according to the interviews in recent years the credit supply of microfinance institutions increased remarkably and many small private dehkan farms can access credits until 20000 USD without providing collateral (mostly any existing assets can be used as collateral, e.g. dwellings, cars). Big collective dehkan farms need credit higher than 20000 USD and cannot access those micro-credits. Thus, big collective dehkan farms seem to be more dependent on futurist contracts to grow cotton than small private dehkan farms.

It seems that in Sughd province most farmers sell the ginned cotton and pay for the ginning services (farmers look for cotton traders to sell the ginned cotton and are less dependent on the gin and its offered prices; ***interview 2, 3, 5, 40,*** *). In Khatlon province, most farmers sell the raw cotton to the gin and dependencies from the gin are much higher (less competition on the cotton buyer side leads to lower farm gate prices; however in 2013, competition in Khatlon was so high that farmers earned more selling raw cotton than farmers in Sughd selling ginned cotton,* ***Interview 29****). Another reason is that in the South the gins are still owned by the futurists, whereas in the North the gins are independent and only provide services to the farmers (so reforms of 2007 were not enacted equally in every district;* ***Interview 2****). The officials of the Tajik cotton trader*

*told me that in the North the competition is for ginned cotton and between traders (the conscience of farmers is different between the North and the South). In the South, farmers are not aware of better profitability of selling ginned cotton and competition is for raw cotton and between gins. Thus, in the South in needs much more gins per district to increase competition and farm gate prices for farmers (competition started later in the South). (**Interview 5**)*

*Farmers in the South told me that they do not sell the ginned cotton, because then they have to pay more taxes. If they just sell the raw cotton, they make more profits (**Interview 17, 19**)*

Many farmers said that gins offer service of ginning cotton for around 200 USD per ton of raw cotton and they are free to sell the ginned cotton to traders. This freedom supposedly exists since 5 years (from 2009 on). But see the interviews again.

*The official from the Ministry of Agriculture told me that gins are still colluding with futurists and private farmers without sufficient capital resources are forced to work with futurists and debts are accumulating for them again. Those farmers that are forced to work with futurists are not able to choose selling ginned cotton, independent farmers have the choice. (**Interview 4**) Private dehkan farmers without sufficient capital resources have to grow cotton to be able to get credit from futurists (they often divert inputs from cotton to other crops as Kassam 2011 described) (**Interview 9**).*

How much farmers are still financing cotton production through futurists? (%share by farm type) What are other sources of financing? (remittances, bank loans, own capital) Why do farmers still use futurists for finance?

Big collective farms are still much more dependent on futurist financing, because they do not receive bank loans (due to less secure land titles and much higher amount of credit needed). (Quotes: interviews 4, 19, 20, 21, 23, 29, 32, 33, 34, 35, 37, 38, 39, 40, 42)

Small private dehkan farms mostly finance their inputs with own capital (e.g. from remittances) or loans from banks or microfinance institutions. (Quotes: interviews 4, 8, 12, 13, 14, 18, 19, 20, 21, 23, 24, 28, 29, 32, 33, 34, 35, 37, 38, 39, 40, 45)

Note: According to the interviews, in recent years the credit supply of microfinance institutions increased remarkably and many small private dehkan farms can access credits until 20000 USD without providing collateral (mostly any existing assets can be used as collateral, e.g. dwellings, cars). Big collective dehkan farms need credit higher than 20000 USD and cannot access those micro-credits. Thus, big collective dehkan farms

seem to be more dependent on futurist contracts to grow cotton than small private dehkan farms.

According to the interviews, the share of farms still dependent on futurist contracts is much higher for collective dehkan farms than for private family dehkan farms (in all regions of Tajikistan).

*The Ex-Country-Manager from ECOM (**Interview 42**) told me that his clients from private dehkan farms mostly tried to diversify their credit portfolio (with several gins and banks) to be less dependent on one lender. He said that collective dehkan farms mostly have to recur to futurist contracts (they are too big to receive bank or micro-credit loans). It may also be the case that big collective dehkan farms are still connected to futurists and gins through political connections and the old system of rent extraction by farm managers and futurists/gins (coupled with coerced labor of shareholders) is still in place (see Sattar and Mohib, 2006):*

*1.) Many big collective dehkan farms are still politically connected and this also means that they have to help the local government to finance infrastructure projects, hospitals and schools (with cash transfers or by sending shareholders to work in construction; **Interview 26, 40, 42** gives a hint that collective dehkan farms and gins have to finance political campaigns of local politicians; so there is another incentive for hukumats to pressure for cotton growing next to the tax incentive of the ginning tax). Politicians have a saying in the cropping decision of collective dehkan farms (pressure to grow cotton due to connections of local politicians with the gins and cotton traders and because of national cotton plans….; even pressure to sell to certain gins where politicians have stakes), which leads to less market-oriented and inefficient decision making on the big farms (big farms are less productive). (**Interview 40, 45**) Furthermore, the managers of big farms do not have the same property rights over the land then the private dehkan farmer (land titles of private dehkan family farms are 99 years using rights that are inheritable; shareholders on collective dehkan farms have 5-10 years using rights that are not inheritable). This leads to less willingness of banks to lend big sums of money to big farms. And microfinance institutions only lend less than 20000 USD without any securities. Thus, bigger farms may have indeed bigger problems to raise the working capital needed to finance inputs and wages in harvest time (by common sense, the manager of the collective dehkan farms should have an interest in improving the efficiency of the farms, employ more productive harvest workers by paying higher wages and get more profit, because he mainly reaps all profits that are generated; but maybe he just cannot access enough working capital). **(Interviews: 11, 21, 29, 37, 40, 42, 45)***

*2.) Another argument for inefficiency and cash shortage at collective dehkan farms is that the old system of collusion with local politicians and gins ended in 2007: After the decree 111 in 2007 (supposedly break up of existing collusions), the managers of collective dehkan farms steadily live with the threat that the local politicians split up the farm (local politicians split up the farm, if cotton plan is not fulfilled: so there is pressure of politicians to grow cotton on collective dehkan farms). Many people said that after this decree the big farms came to have real problems (because cannot work with banks anymore, hard to get cash for inputs after that decree 111 and the abolishment of futurists; steady threat of being split up). Before the decree they were subsidized by local hukumats, futurists and gins… (see WB 2006 PSIA paper by Sattar and Mohib). Now these networks were destroyed and the low productivity of these farms became obvious and they cannot raise the necessary cash for inputs and harvest wages (especially because futurists and intermediaries had to leave the market from 2008 on). (**Interview 29, 39**) Another very important fact that may explain smaller profits at collective dehkan farms and higher difficulties to get credit is that collective dehkan farms are taxed much higher than private dehkan farms (private dehkan farms pay a flat tax of 6%; collective dehkan farms have to pay the usual social security contributions and the income tax for workers that amount to 39% plus the profit taxes). Much smaller share of profits is left after taxation at collective dehkan farms (**Interview 5, 38, 39, 40**).*

*3.) The prices shock in 2011 triggered a huge competition between gins. This increased competition is persistent because average turnover of raw cotton per gin is too low to make profits (too many gins were built). The concentration process will lead to the market exit of many gins. The last three years with high farm gate prices have caused many gins to run losses. So this also meant that these gins did not have enough capital to lend on to farmers and this was an opportunity for banks and microfinance institutions to get into the market (Imon bank or Argon entered the agricultural markets!). Small private farmers also demanded more loans in 2012 and 2013! However, big collective farms cannot access bank loans (need to high amounts of capital) and gins are short of cash due to the increased competition: So collective dehkan farms had huge problems to raise sufficient cash for inputs and wages! (**Interview 42**)*

4.) Another reason is that the old system described by Sattar and Mohib (2006) is still in place and managers have no interest in increasing efficiency at collective dehkan farms: The managers of collective dehkan farms still collude with gins and local authorities and extract rents out of the farm to the cost of shareholders (debts are accumulated that accrue to all shareholders; no transparent access to the books for shareholders, lack of conscience of their rights as shareholders). The managers do not think market

*oriented and do not want to increase the efficiency of the farm. They just think short term rational and want to extract the rents. Thus, they do not invest efficiently in the farm and do not pay higher wages to attract more harvest workers; they just exploit the shareholders as a pool of coerced labor (plus workers carried from near jamoats who work for low wages too). (**Interview 4, 6, 11, 15, 26, 40, 45**) Sanginow (ex-FAO chief) told me that on all farms bigger than 10 ha the management system and collusion with gins and futurists is the same than 10 years before (**Interview 15**). Shareholders are exploited and receive only cotton stalks, little plots of land and very low wages (not always, often no cash payments at all!). Torsten from GIZ told me that the big collective dehkan farms often withheld wages for cotton pickers and that is one reason why they now have big problems to receive any additional picking workers (**Interview 40**).*

*However, even in the North there are still private farmers that receive credit from the ginnery and collateralize their cotton crop (about 40% of farmers). This is not due to non-existing credit markets, because bank loans exist! The reason is more that loans from ginneries that are tied to futurists provide much easier credit access (ginneries also provide seed, which is the most important input)! (farmers do not need to provide any securities) So farmers that do not possess any assets can get credit from ginneries. 30% of farmers have enough assets to finance their inputs themselves and 30% get credits from banks and micro credit organizations. **(Interview 3, 43)***

*The official from the Ministry of Agriculture told me that gins are still colluding with futurists and private farmers without sufficient capital resources are forced to work with futurists and debts are accumulating for them again (about 20% of private farmers). He said that all collective dehkan farms work together with futurists! (maybe because the old system of collusion described in Sattar and Mohib 2006 is still in place or because big farms do not get any credit from banks). (**Interview 4, 45**) All collective dehkan farms accumulated new debt again, because the manager and the gin still cheat shareholders and put money in their pockets that is declared as debt for the whole farm (**Interview 6, 11, 15**).*

*A very interesting case is **Interview 10**: This manager of a collective dehkan farm tried to be more independent of the local futurist, because he had enough capital through family remittances. This led to huge problems with the local futurist and officials. **Interview 11** is another such case. This manager of the very big old kolkhoze tried to stop the split up of his big farm. The hukumat that is dominated by Alimeidon (member of the president family, futurist and gin owner who controls about 4000 ha in Hissar) said that this farm does not fulfill the cotton plan. The farm manager moved to more cattle rais-*

ing and less cotton growing to prevent the split up. This and the political connections of the manager lead to keep the farm from being split up.

*Another nice example of strong ties between the managers of collective dehkan farms and politicians is the case in **Interview 34**: This manager received water pumps for irrigation from the local hukumat because he was a former major in the Tajik army (value of the pumps: 26 000 USD).*

*Rustam from Sarob told me that in Sughd 80% of the private dehkan farms work with own capital and are independent of futurists. 40% of collective dehkan farms still have to work with futurists. Zarina from GIZ told me that the main source for own capital of private dehkan farms are remittances (**Interview 45**).*

4) Farm structure

What are the main criteria for founding a private dehkan farm in this region (political connections, HH size, capital resources, entrepreneurial and agricultural skills)? When did the privatization process start (and why?) and when did you start your dehkan farm? Why were you elected manager of this farm?

The privatization process started before 2010 (even before 2007), because the hukumat pushed for the split up of the local kolkhoze or the bigger collective dehkan farms. (Quotes: interviews 3, 4, 5, 6, 9, 11, 12, 13, 17, 19, 24, 26, 28, 29, 32, 34, 36, 37, 40)

The privatization process started because of the reforms in 2007 (debt cancellation for farmers in 1 January 2008, freedom to crop etc.) and not because of the price shock in 2010/2011. (Quotes: interviews 3, 4, 5, 6, 9, 11, 15, 20, 21, 23, 27, 29, 32, 36, 38, 39, 40, 42, 43,)

The privatization process was strongly pushed by the price hike in 2010 (circumvention of credit constraints). (Quotes: interviews 20, 21)

Note: Managers of collective dehkan farms all have political connections or connections to futurists etc. So all of them are backed by local politicians/ officials. In interviews, they told me that they were elected by the shareholders, because they were trusted men and already had experience in managing the brigade or kolkhoze (agricultural and organizational knowledge). They benefit from the connections in the way that they receive better land from the split up kolkhoze, they receive more land (if other private farmers have to give their land away because they do not fulfill the cotton plan or cannot pay their taxes, the land is given to these guys with political connections), they have better access to credit (this is not true for big farms according to many interviews, big farms are more dependent on futurist credits), they may have more freedom in selling

*the cotton and they possibly benefit from forced labor. However, they also have to support local government budgets and help in construction of schools and hospitals. They may also have to support political campaigns of local politicians with cash. (**Interviews 17, 18, 21, 24, 34, 45)***

*All main criteria for founding a private dehkan farm are relevant for farmers: political connections (to receive land with better soil), HH size (family members as workers), capital resources (to repay debts or to finance inputs), entrepreneurial and agricultural knowledge. (see **Interview 6, 8, 22, 24, 34, 39, 44** and article from Mandler). Mandler and Bobojorov say that the poor and marginalized households (without connections to local power structures) still have to work on the collective dehkan farm and cannot easily opt out and found an own private dehkan farm (even if they receive remittances).*

*In principal (by law), everybody has the right to found an own small family dehkan farm. The only requirements from hukumats seem to be that taxes can be paid and that a certain amount of cotton is grown (in some districts hukumats do not allow too small family farms to prevent cases where taxes are not paid or cotton is not grown…). The hukumat has the right to take the land away from private dehkan farms, if taxes are not paid and the cotton plan is not fulfilled. There are several types of cotton plans and there is evidence that those plans are used to take land from less influential farmers to farmers with good political connections. (**Interview 6, 8, 24**)*

*The huge drop in cotton area harvested in 2009 was due to increased area for wheat on dehkan farms (because of huge wheat shortage in 2008 due to drought and high wheat world prices; see FAO 2009 and interviews). This is a sign that reforms of 2007 (freedom to crop, abolishment of cotton quotas, privatization process) were already effective, because dehkan farms in Tajikistan could react to high wheat prices in 2008 and switch from cotton to wheat on a big scale. (However, the government also supported the increase in wheat production in 2009 by provision of higher quality seeds to farmers.) So the privatization process may have happened already before the price shock! (**Interview 37, 38**)*

*In summary, the privatization process started at different years in different districts (**interview 2, 3, 29**): In many districts the big Kolkhoze was split into some big collective dehkan farms around 2000-2002 and the futurist cotton financing scheme was established (so cotton production expanded). This explains the increase in cotton production from 2000-2004 (also the end of the civil war and catch up effect starting in 1999 as well as increasing cotton prices from 2001 on). Then smaller private farms could be founded, when the farmers wanted to opt out (criteria to opt out: HHsize, credit access,*

agricultural knowledge, political connections to get good land). Maybe some districts still prevented too small farms, because they thought they would not be able to pay taxes (see Vose, ***Interview 24****). In 2007-2009 there was a new founding wave of small private dehkan farms due to the reform process starting in 2007 pushed by the international community (debt cancellation in 1 January 2008 etc., information campaign to foster agricultural and economic knowledge of farmers and inform them about legal rights to opt out of the collective, abolishment of cotton plans, restructuring of the cotton financing scheme and increased credit supply). (****Interview 39****)*

However, in the TLSS data, we see that in Khatlon there was an increase in workers on private dehkan farms from 2009 until 2011. Farmers in Bohtar told me that the price shock triggered a huge increase in farmers opting out because they wanted to use the high prices to sustain themselves building up own capital (circumvent credit constraints; ***Interview 20, 21****). Thus, if workers on private farms are more productive, this selection into private farms could be one channel for our effect. But we also find our results only looking at private farm workers that worked at private farms in 2009 and 2011! There is also evidence that farms that were already founded before 2010 became more independent from futurists because of the price hike (could increase capital resources because of profits,* ***Interview 17****).*

The privatization process maybe correlated with the rents that can be extracted from agriculture. In cotton regions privatization process may be much more difficult than in non-cotton regions, because in cotton regions rents are much higher from selling the cash crop and local elites are heavily involved in rent extraction (Satar and Mohib, 2006; ***Interview 6, 44****). One example is the Shartuz region (plus Kobodijon and Kumsangir), where the gins and futurists all belong to Ismail Somoni 21st century. In this region the freedom to farm (decree 111 in 2007) did not materialize in higher competition due to the local and national elites trying to maintain their privileges (21st century is owned by the family of the president). The debt cancellation could not lead to more independent farmers, because there was no competition between gins that could be exploited by farmers. So debt piled up again and very few farmers opted out of the collective (only about 10% of farmers are private dehkan farmers)! (****Interview 2, 6, 44****)*

*One official from the Agricultural Ministry (****Interview 4****) told me that in 2014 already 95% of farms are private dehkan farms. In 2011 this number was not so high; the main push was from 2011 on. The collective dehkan farms that still exist are run by managers that have strong political connections. It is very profitable to be a manager of a collective dehkan farm, but only the ones with political connections can keep their farm from being split up (due to pressure from the international community there is a big trend*

*towards splitting up the collective dehkan farms). (see **Interview 11** as as a case of a manager fighting against the split up, see also **Interview 45**)*

*The official from the biggest Tajik cotton trader told me that it is the private dehkan farmers that have good political connections, because only with good political connections you will receive good quality land that makes it worth it to found a small farm. And he said the private dehkan farms have to pay fewer taxes and thus have higher profits. (**Interview 5, 8**) There are also private dehkan farms with less political connections and capital, but those are not the successful ones. (**Interview 15, 24**)*

*Hafiz Bobojorov said that the collective dehkan farms are still highly influenced by the Jamoats. The private dehkan farms that exist received the high quality land because of good political connections. For the remaining shareholders of the collective farms it is hard to opt out of the collective, because there is no good quality land left or the manager will only give bad land to the shareholders that leave the farm. (**Interview 6, 24, 45**)*

*A very good example for the effects of the reform process initiated in 2006 by the international community and the government is **interview 36**: This head of a family dehkan farm (farm exists since 2004) told me that before the debt cancellation in 2008 (1 January 2008), he was totally dependent on the futurist. This dependency was formally due to large debts that accumulated every year (20000 USD in 2008). However, he was also caught by his own passivity and lack of conscience that persisted because the futurist provided him with a complete service package: At the start of the season, the futurists supplied him with a certain amount of fertilizer, pesticides and seeds per ha and later he just fetched the crop. The farmer did not have any deep agricultural knowledge about seeds, fertilizer or pesticides use, he did not know about cotton world market prices, he did not know about different gins to sell the cotton… Due to the debt cancellation in 2008, the prohibition of the old futurist system (collusion of gins and futurists forbidden in 2008, intermediaries had to leave the market and commercial banks now provide gins with capital directly), the new well defined user right of 99 years for his land (private dehkan farm certificate as quasi property rights) and various information campaigns by the government and international donors he started to think much more about agriculture, input use and marketing of the crops. In this example we see that competition in the cotton market and productivity in the Tajik agriculture can only increase, if farmers are more aware of price signals and try to improve their knowledge about agriculture. A very important incentive for this to happen is that they have well defined property rights on their land. (also see **Interview 39, 45**)*

*Yatimov from the World Bank told me that the split up of the big collective dehkan farms (mainly pushed by the reforms in 2006/2007) was very important for breaking up the old monopoly of big collective dehkan farms, futurists and gins. Thus, it was crucial for introducing more competition in the cotton market and to increase freedom to crop and to diversify the Tajik agriculture (increase food security in the country). He said the vast majority of private dehkan farms was already found in 2009. (**Interview 39**) The collective dehkan farms that still exist are not as strongly connected to gins and local politicians as before the reforms, those farms have big problems to raise the necessary cash for inputs (because futurists had to leave the market). He also told me that the price in 2010/2011 hike was not the cause of the push in the privatization process, but supported the farmers to be more independent from futurist financing (majority of private dehkan farms already found in 2009). (**Interview 39**)*

Who makes the decisions for land use and labor allocation? Who purchases inputs and how are inputs financed (futurist, own capital)? How is the crop sold (by the manager)? How are shareholders paid? Is profit shared between all shareholders? Or do they just receive a maintenance and picking wage and some premia at end of the season?

I finance my inputs with own capital and the major part is from remittances of family members. (Interview 10, 17, 19, 20, 27, 28, 30, 35, 36, 45)

Note: In all interviews it is evident that the managers of the collective dehkan farms make all decisions only consulting their agricultural expert (agronom). The crop is sold by the manager and he is also responsible for acquiring the inputs by signing a contract with the gin or taking a loan from a bank (he often provides equity as collateral; however, debts seem to accrue to all shareholders of the collective dehkan farm). Shareholders have no transparent access to the accounts of the farm and are not participating in the profits. They receive a very low monthly wage for maintenance work (around 200-300 Somoni), which is not sufficient for living expenses (the families of those shareholders can only survive, if other family members migrate to Russia or work in another business). However, shareholders work only around 10-15 days per months during the normal season. At harvest time they are mostly paid the minimum picking wage that is announced by the hukumat. They also receive the cotton stalks and are allowed to crop a small area for own subsistence consumption. At the end of the season, it may be that the manager hands out some premia like in old Soviet times (a carpet, a television set or maybe money). However, there is no transparent participation of shareholders in profits (although by law this should be the case!). The manager of the

collective dehkan farm invests part of the profits in the farm (inputs, machinery) and keeps the rest for himself ***(Interviews: 3, 4, 5, 7, 10, 11, 17, 18, 19, 20, 24, 29, 31, 33, 34, 38, 40, 42, 45)*** *Furthermore, the hukumat or other local politicians may take part in the profits or use them to pay for social services (hospital, school…) (****Interview 11, 40, 42****, 45,* *Sattar and Mohib 2006) In some interviews, people told me that the managers of the collective dehkan farms made huge profits in 2011 and invested a lot of these profits in construction sector in Dushanbe.*

At private dehkan farms, household heads are often running the farm as non-transparent as managers of collective dehkan farms. The household head often makes the decisions on his own, maybe after consulting some family members. The household head often pays wages even to brothers and sons who are shareholders (he has to attract them to work at his farm, also in harvest time). He administers the accounts of the farm and sells the crop. Thus, there is no equal transparent participation of all shareholders in profits of private dehkan family farms (the household head and several parts of the family may receive higher shares of profits than others). Some private farm heads told me that they do not share profits with family members, because this would create expectations and obligations to do that each year (e.g. see ***Interview 6, 42****). The household head finances the budget of the core family that lives in his house. But mostly, sons who are shareholders of the family farm already live in another house with their families and have to finance their own budget (but financial aid from household head to sons is more likely than from collective dehkan farm manager to shareholders from other families).* ***(Interviews: 20, 42)*** *It is also possible, that profits at family farms are allocated according to other logics like social norms (the brother/son that wants to marry in the near future receives a larger share…). (****Interview 37, 40****) There is also evidence that family members migrate to Russia (mostly joint decision of the family) and send back remittances that are used to buy inputs for the private dehkan farm. Zarina from GIZ told me that the main source for own capital of private dehkan farms are remittances (****Interview 45****).*

Family dehkan farms have land area until 10 ha and often have 10-15 shareholders that all belong to one family. When more families are working on one dehkan farm (as it was the case in Sharinaw), the farm structure is more likely to be similar to the collective dehkan farm! (there is one guy making the decisions, providing the capital or securities for credit and selling the crop and deciding about profit sharing etc.; see ***Interview 13****). The number of shareholders is less than number of families at all farm types, families always name more than one member as shareholder.*

*Sanginow (ex-FAO chief) told me that on all farms bigger than 10 ha the management system and collusion with gins and futurists is the same than 10 years before (**Interview 15**). Shareholders are exploited and receive only cotton stalks, little plots of land and very low wages (not always, often no cash payments at all!).*

*In **Interview 31**, several shareholders of a collective dehkan farm told me that they only receive a picking wage of 20-25 Diram per kg and in the rest of the season only 40-60 Somoni per month. The manager had told me about 40 Diram per kg and 300 Somoni per month. Thus, the exploitation at collective dehkan farms may often be understated by managers in many interviews (maybe because part of the wage is paid in cotton stalks that are evaluated at market prices?). The official of the Agricultural Ministry in Sughd also told us about a picking wage of 15-30 Diram per kg (**Interview 37**).*

Do you employ additional workers from local villages for harvest time? Are these mostly wider family members? What picking wage do they get? Is this picking wage different from picking wage paid to shareholders?

Yes, I employ additional harvest workers from nearby villages (landless laborers) and shareholders from other farms. (Quotes: interviews 1, 2, 3, 10, 11, 13, 16, 19, 21, 23, 24, 26, 27, 28, 30, 33, 35, 38, 40,)

All additional workers are family members of shareholders. (Quotes: interviews 6, 7, 8, 9, 12, 14, 17, 18, 25, 34)

I harvest the fields with my shareholders only. (Quotes: interviews 20, 33, 35, 36)

Picking wages are the same for all harvest workers. (Quotes: interviews 3, 6, 9, 17, 22, 25, 26, 33, 34, 40, 42)

Picking wages for family members are higher than for workers from local villages. (Interview 4, 5)

*Note: Hafiz Bobojorov said that social norms of family bonds are very important to understand, why wider family members work at all farm types for such low wages. The norm is not to pay your family members better, but that as a family member you have to help in the harvest even for low wages! (**Interview 6**)*

*At collective farms often only shareholders and their families harvest the fields. This may be because of liquidity problems of big farms (see end of section 3) or because of higher degree of coerced labor. (**Interview 7, 8; see section 2**) Another reason may be that shareholders on collective dehkan farms want to keep the cotton stalks for themselves (**Interview 34**). Family farms often employ additional harvest pickers to harvest the fields rapidly (they think more market-oriented).*

*One shareholder of a big cooperative farm told me that wages in the harvest season are negotiated informally and may differ between farms and even between pickers in one farm (wage may also be paid for harvesting a certain area not wage per kg). (**Interview 7**)*

*Collective dehkan farms also receive bus transfers of picking workers who may work for lower wages than shareholders, because they are from poorer Jamoats and do not know about higher world prices for cotton etc. (private dehkan farms use only family members or females from local villages for harvest). Those workers also receive lower wages in cash, because meals and transport costs are deducted and the cash is handed out to an intermediary who keeps something for himself. (**Interview 33, 34**)*

Are family farms more productive than bigger collective farms?

Yes, because shareholders on family farms have more incentives to work hard due to better defined property rights. (Quotes: interviews 4, 20, 21, 24, 27, 33, 35, 36, 37, 39, 40, 42,)

Note: 99 years of inheritable using rights for a clearly defined piece of land at private/family dehkan farm vs. 5-10 years using rights (that are not inheritable) for undefined piece of land for shareholders at collective dehkan farms.

*Some farmers told me that private dehkan farms have a higher share of male workers are therefore more productive (**Interview 36**).*

*Yatimov from the World Bank told me that private dehkan farms are much more flexible in reacting to price signals (they are more market oriented, less political influence in decisions on the farm etc.) and they are much more efficient (invest in new seeds and fertilizer etc.). Productivity on private dehkan farms increased immensely in the last years as well as diversification of crops. (**Interview 39**)*

When are production decisions made? Are production decisions based on crop prices of the last year or on prices at the beginning of the season?

Production decisions are based on prices at start of season. (Quotes: interviews 8, 26, 40,)

Production decisions are based on prices in last harvest period (because farmers look at profits neighbors made with certain crops or they look at price information of harvest last year). (Quotes: interviews 3, 4, 9, 21, 26, 29, 40, 42)

Note: Production decisions are made in January/February.

***Interview 4**: Production decisions are made in November for the next year.*

Is there still a cotton quota for this jamoat/district?

Yes. (Quotes: interviews 1, 2, 3, 4, 5, 6, 8, 15, 23, 24, 26, 27, 28, 32, 33, 34, 36, 40, 45)

No. (Quotes: interviews 11, 12, 13, 17, 30, 35, 38)

Note: It seems that cotton quotas still exist and are enforced by the Jamoat administration or the hukumat. The cotton quotas are used to calculate the taxes the farm has to pay (predicted yield times area under cotton gives predicted output and amount of taxes to pay). If the farm cannot pay its taxes anymore because of too little profit, the Hukumat can take the land and give it to someone else. Thus, the farms have to grow cotton to be able to pay the taxes. There are also different kinds of cotton plans the hukumat can use to take land away from the private farmers (plans with unrealistically high yields lead to farms not being able to pay the taxes and the land is taken and given to politically connected people; ***Interview 6****). Furthermore, the Jamoat supervises crop area and output statistics and also enforces a certain cotton quota. If the farm does not plant enough cotton, the Jamoat cuts irrigation water or electricity for the farm or prevents the farm from joining Jamoat meetings etc. (see Interviews in Vose,* ***Interview 24, 26****).*

In the North and the South there are still requirements of the hukumat government to place a certain amount of land under cotton. This is due to tax incentives for the hukumat (tax on ginned cotton), but also due to corrupt structures in the district: local officials, ginnery managers and futurists are connected through clan structures or other bonds and act as local elite that exploits farmers (they want to secure a certain supply of raw cotton to capture rents)! ***(Interview 3, 26) Interview 42*** *gives a hint that collective dehkan farms and gins have to finance political campaigns of local politicians; so there is another incentive for hukumats to pressure for cotton growing next to the tax incentive of the ginning tax.*

It seems that all over Tajikistan there are still cotton quotas of 50% and above that are enforced by local officials.

*Tachmina from Sarob told me that the reason, why cotton is still grown on more than 50% of irrigated land in the whole country, is not because of cotton quotas, but because 1.) cotton has much larger market size (other crops are only sold domestically and market size is small) and 2.) there are tax incentives to grow cotton (50% less land tax for area devoted to cotton). (****Interview 29****)*

*Rustam told me that in districts with a dysfunctional irrigation system (Mastchoh and Zafarobod), the soil is already so bad and other crops than cotton do not grow anymore. That is why mainly cotton is grown there. (****Interview 38****)*

5) **What did you do with your profits at end of season in 2011?**

Investments in inputs for the next year? (fertilizer, renting/buying machines)

(Quotes: interviews 4, 7, 8, 11, 12, 14, 17, 18, 19, 21, 24, 26, 35)

Family consumption (also status consumption)

(Quotes: interviews 6, 12, 14, 26)

Repaying wedding debts

Interview 9, 26

Repaying futurist debts

Interview 35

Investment in the dwelling

(Quotes: interviews 6,)

Investment in education of the children or health

(Quotes: interviews 6,)

Notes: In some interviews, people told me that the managers of the collective dehkan farms made huge profits in 2011 and invested a lot of these profits in construction sector in Dushanbe. Also people involved in the cotton trade and the ginneries made huge profits and invested in the Tajik construction sector.

*The official from the Agricultural Ministry in Sughd told me that additional income of farmers is often spent according to the following priorities: 1.) dwelling 2.) new car 3.) marriage 4.) agriculture (**Interview 37**).*

6) **2008 and 2009 season**

Did drought in 2008 affect cotton and wheat in the same way? What other crops were affected?

Wheat was much more affected, because big share of wheat is rain fed in Tajikistan. (Quotes: interviews 33, 34, 35, 37, 38)

Notes: Decisions about planting are made in January/February, because seeds have to be bought. Drought in planting season is bad for cotton and for wheat. However, if the drought is early enough in spring, farmers can buy cotton seeds again and sow a second time (until mid of May; wheat needs much more time and is already sown in February making a second planting more difficult). Farmers that do not have enough capital or credit to buy new seeds will be strongly affected by the drought.

Cotton is always planted on irrigated fields in Tajikistan (even using pumps), so drought only affects cotton output through low water availability in the lakes. Wheat is much more affected by drought, because a lot of wheat is grown rain-fed in Tajikistan. Wheat on non-irrigated fields was completely destroyed in 2008. Cotton harvest was finally quite ok, because there was good weather in harvest time (cotton production did only decline by around 10% from 2007 to 2008, see cotton statistics book from Tajik statistics agency).

If winter wheat is grown, it is possible to grow two crops in one season (with cotton or summer wheat only one crop can be grown per year). Winter wheat is planted in September and harvested in May/June, making a planting of onions (or other vegetables) or corn in June possible. Summer wheat is planted in February, whereas cotton is planted End of March or April.

Why did wheat area and production increase so much in 2009 (and cotton area and production decreased)? 1.) Wheat was more affected from drought in 2008, 2.) prices for wheat very high in 2008 in TJ so cotton was substituted by wheat or 3.) good weather for wheat in 2009 (rain in spring…)

All three reasons are true. (Quotes: interviews 29, 30, 34, 35, 37)

*When we look at production and area statistics, we see that there seem to have been a drought in 2000 and 2007/2008 (but wheat was much more affected than cotton in 2008 drought). The huge drop in cotton area harvested in 2009 was due to increased area for wheat (because of huge wheat shortage in 2008 due to drought and high wheat world prices). This is a sign that reforms of 2007 (freedom to crop, abolishment of cotton quotas, privatization process) were already effective, because farms in Tajikistan could react to high wheat prices in 2008 and switch from cotton to wheat on a big scale. However, the government also supported the increase in wheat production in 2009 by provision of higher quality seeds to farmers (**Interview 38**).*

*In 2009, the rain in spring affected cotton production on good soil negatively, because this soil then becomes too heavy and plants cannot grow (for wheat the spring rain is very good and this is one of the factors for the good wheat harvest in 2009). For many cotton farmers, it was possible to sow again (it was only more costly, but seeds are much cheaper than fertilizer), but area devoted to cotton still decreased somewhat due to the rain issues. However, cotton production did not shrink so much in 2009, because the weather in harvest time was very good and harvest was extended until November. (**Interview 38**) Official statistics from the Tajik statistics agency show that weather issues have not played a big role in the drop of cotton area and production in 2009: the*

area devoted to cotton and cotton production did not increase anymore from 2009 to 2010! So spring rain could not have affected the area and production of cotton so much in 2009! (the main reason was the switch from cotton to wheat)

But why do we not see any decrease in labor supply and wages from 2007 until 2009, when area and production of cotton decreased so much in 2009 (because labor demand in harvest time should have decreased strongly)? (lack of wage decrease could be due to minimum picking wages announced by hukumats, but labor demand should have decreased) Our found effect in 2011 exists compared to 2007 not to 2009, thus our results cannot be confound by drought or weather issues in 2009!

The huge increase in cotton area and production from 2000-2004 was due to farm restructuring (kolkhozes were split up into collective dehkan farms), increasing world cotton prices from 2000-2004 and catch up effects from the civil war.

It is clear that in 2011 cotton area increased to the extent of decreasing area for wheat and other crops. There is no problem of changing crops from one year to the next, because almost all farm types do not grow only one crop! It is even important to change crops to prevent salination of the soil. All farm types grow cotton and other crops jointly and rotate crops on the fields.

7) Additional information

1.) Jamoat borders from the WB Atlas 2005 are wrong. Using Jamoat level variables by matching PSUs and Jamoats with GEO codes makes no sense. (said Martin Lenk from the GIZ and the National Statistics Agency that has worked with that data) For this reason, I had to match Jamoats from the World Bank data with PSUs from the TLSS by hand (looking up Jamoat information for all PSUs).

2.) Many private farmers apparently suffer from the split up of the bigger farms, because irrigation infrastructure and access to machinery and other inputs (fertilizer, pesticides etc.) deteriorated strongly (since the breakup of the SU; this caused the huge drop in cotton yields in Tajikistan in the 1990s). The destruction of the old Soviet system of input and machinery supply was not compensated (especially the human capital left Tajikistan because of the civil war; e.g., nobody is left that has the knowledge for night irrigation, **Interview 15**). There needs to be a new initiative by the national government to solve those problems: Coordination of atomized private farmers to form new cooperations that use scale effects for negotiating with input suppliers and gins (better prices), that care jointly for the irrigation system and that share machinery that is suitable for the smaller field sizes. (**Interview 4, 5**) The lack of machinery, irrigation and

input supply is also a reason some why small private dehkan farmers do not grow cotton anymore (**Interviews 12, 13, 15**). Sanginow also told me that in Soviet times, around 20% of the raw cotton was processed in Tajikistan (now only 3-5%).(**Interview 15**) He also said that input prices (fertilizer, pesticides, machinery) became too expensive after the breakup of the SU. Social benefits for cotton farmers, like free health care and subsidized food do not exist anymore. Thus, growing cotton is not profitable for Tajik farmers anymore (also because picking wages increased due to outmigration to Russia). In SU times, wages of cotton growers were the same than industrial wages. Now wages in Russia are 10 times larger than wages in the cotton sector.

Sanginow said that the only way to save the Tajik cotton sector is 1.) clear access to land and credit for farmers and 2.) freedom in output marketing. At present state, there are no incentives to invest in technology or infrastructure for any farmer. These reforms are only possible, if the international community puts pressure on the government: the president and his family have absolutely no incentive to change those structures, because they profit immensely from the status quo. The international community has not done enough to change the incentive structure for the government, because it heavily depends on the Tajik government due to the retreat of troops from Afghanistan.

Hartwig Ungethuem from the GIZ told me that the main impediments for increased cooperation of private dehkan farms (to solve issues of irrigation, machinery use and input supply and output marketing) are 1.) markets for land do not exist in Tajikistan due to the lack of regulation and due to social norms (people feel tied to their land and do not sell), 2.) lack of regulation for founding larger entities or cooperatives of private dehkan farms and 3.) mentality of farmers is against delegating responsibilities to larger entities again (in general in Tajikistan it is very difficult to convince people that cooperation in business associations or local cooperative banks is beneficial, because experiences in the last decades with Soviet style cooperatives were very bad). (**Interview 3**)

3.) An interesting statement is that production of wheat, vegetables and fruits are more profitable than cotton, because those crops are sold in local markets and cannot be taxed easily (tax evasion is high). So farmers that are not forced to grow cotton will naturally try to grow more of those crops. (**Interview 5**) However, it seems that access to larger markets is also important for the profitability of growing vegetables and fruits. Around Dushanbe, many farmers grow onions and other vegetables because the market of Dushanbe is close. (**Interview 2, 9, 10, 13, 26**)

4.) A general issue for the Tajik cotton sector is that due to migration to Russia the labor supply in rural areas decreases at the extensive margin. As a consequence, picking wages rise every year. (**Interview 13, 40**)

3. Results of Interviews in November 2014

In November 2014, I conducted interviews with experts on the Tajik cotton sector in Dushanbe. During these interviews, I collected anecdotal evidence on political interference and coerced labor on big collective dehkan farms that I present along with other statements below. Most of the interviews were recorded and the audio material can be requested from the author.

Interview 46

Igor, senior economist GIZ Tajikistan, supports our story with qualitative evidence. All he knows and has heard points to the direction that big farms are still heavily intertwined with local politicians and administrations like in kolkhoz times. Managers of big farms are appointed by the political leaders and are committed to them. The managers of big farms get credit through the collusion network of futurists, ginneries and local politicians and reap parts of the benefits of the extractive system. The managers of big farms can count on administrative support for coercing their shareholders and their families to harvest the big farm cotton fields. Those shareholders are not allowed to simply found an own farm (administrative hurdles, only bad quality land is allocated to them etc.) Only shareholders with good political connections and capital can found an own dehkan farms successfully.

Igor says that the reforms have no resulted in a really more competitive cottons sector and cotton intermediary system. The same guys still own the gins, but now through other financial constructions etc.

Interview 47

He also strongly supports the coerced labor story on big farms. There shareholders live in feudal structures and are forced to harvest a certain part of the field. They cannot just go to harvest elsewhere on private farms (and also their family members do not have those rights).

He also says that small private farms are competing for pickers from local villages and pay higher wages to attract them and to make them harvest the field faster. This would not happen on big farms where managers are colluding with local politicians and ginneries and extract the rents from shareholders according to the old system. Small farm managers think much more market oriented.

Splitting up the big farms increases productivity in a first step, because it destroys the old rent seeking structures that prevented change towards productivity increases. Farmers start to think more market oriented because of better defined property rights and because of less dependence on futurists and farm managers.

Interview 48

Behruz showed us all the agricultural production plans of the national government that are still in place and are enforced by the hukumat. Political capital is connected with those plans, so when plans are fulfilled the hukumat government gets political capital and its members may rise in the ranks. So there is still high political influence in the production process besides the private interests that are at stake (politicians owning part of the gin or being involved in cotton trading etc.)

Regarding the channel for our effect, he mentioned that big farms are badly managed and often have not enough cash to additionally attract and incentivize pickers. He also said that the big farms managers do not think market oriented. They just think that they do not have to harvest the fields rapidly and they do not have to incentivize picking workers to harvest faster. They also do not have to attract further workers with higher wages. They use their own shareholders and close families for that (those guys have to harvest the fields of the big farms irrespective of the amount of the wage). Big collective dehkan farms additionally receive students to work on the fields from universities and higher schools in the hukumat. Those coerced workers do not go to small farms, but are carried by the hukumat to the big farms. (both guys said that, Behruz and his friend that entered the room)

Interview 49

He is FAO staff member in Tajikistan. He says that in villages often children and pupils go to the fields for the harvest to earn some money or they go with their family.

He said that Rudaki district was the pilot district for the land reform. Thus, already in 2003/2004 there was only individual dehkan farms in this district (1-2 ha). But, those farms can also grow cotton. They were forced in 2004 to grow cotton so that 20% of the whole land in Rudaki was devoted to cotton. The yield on those small farms was even much higher than the yield on the big farms, although they did have more difficulties in organizing the technology and irrigation (bad cooperation between the small farms).

But, he also said that he knows from some cases where the big collective dehkan farms send requests to local schools and technical universities to provide them with students and school children for the harvest! And they do not have to pay higher wages to attract

them. The students are just carried by buses to the big farms organized by the authorities and they get the minimum picking wage.

They also use their shareholders and their families to harvest the fields. Those guys have the obligation to harvest a certain area of cotton at the big farms. They cannot just leave and go to the small farms to earn higher picking wages. If they would leave the big farm, they would lose the possibility to grow their food on the special small plots provided by the big farm to their shareholders (and their close family) for subsistence consumption. The casual wages the shareholders receive from the manager during the rest of the season for channel maintenance or other carrying and driving works are so small that they cannot finance the families living expenses. So the argument of insurance by the big farms is not valid (that big farms hire shareholders through the whole year and that is why shareholders accept lower wages at harvest time). In most cases, the shareholders of big farms have other family members that send remittances or work in other better paying jobs (like teacher etc.) and those guys are maintaining the family. The shareholders do not leave the big farm, because they would just be unemployed otherwise, because there are no other employment opportunities in rural areas in Tajikistan. They cannot found an own dehkan farm due to a lack of capital, agricultural knowledge, political influence (to receive good land) and too small HH size. So they are somehow bonded to the big farms (they would lose the little land where they grow crops for subsistence consumption).

The small farms, on the other hand, mostly use the pool of landless females from local villages that are just unemployed and at home during the whole year. The males from those families are mostly in Russia for work and the female are not allowed to travel to other hukumats for work. They are bonded to their local villages because of the Islamic revival and traditional norms. So there are isolated local labor markets with a flexible supply of landless female workers (that do not have to go to big farms anymore, they are not bonded and can freely chose to go to the small farm that offers the highest wages). Before the agricultural reforms, those female were forced to work at the big farms for the offered wages on those monopsonistic big farms. The creation of many small farms and the breakup of the exploitive collusion of big farms, futurists and gins increased competition for workers and created competitive labor markets for those landless females. So Shahlos statement is absolutely correct that the land reforms created employment opportunities for those increasingly immobile and depreviated landless females in rural Tajikistan.

Interview 50

He is currently consultant for the ADB. But from 2004 until 2008 he worked together with Hans Woldring at the ADB team that drafted the decree 111 for the reform of freedom to farm. In 2008, the ADB left the cotton sector due to disagreement with the government bailout of futurists in the debt resolution. Thus, the ginnery construction program after 2008 was not financed by the ADB, but only by the IFC and World Bank together with national Tajik banks.

The main push for the increase of the numbers of ginneries was the decree 111 in December 2007. The futurist system was abolished and the entrance of new investments was encouraged. By investing in new gins with a better turnover rate of raw cotton (40 % instead of below 30%) huge profits could be made, because those new gins would attract farmer's raw cotton due to higher farm gate prices etc.

Main content of decree 111:

1.) Freedom of farming

Prior to 2006/2007, cotton quotas of over 70% were enforced by the administration in all districts. There was definitely no choice for all kinds of farmers. According to him, this changed with the decree 111. But, in the interviews we saw that still in 2013 there exist cotton quotas that are enforced by the Jamoat or the Hukumat because local officials are involved in the cotton sector. The GIZ political leader data set also proves that cotton quotas still exist.

2.) More competitive ginning sector

Prior to the decree, farmers were locked in the district and could not sell to other gins outside of the district. Thus, gins had a monopsony. This was due to the tax code (tax on ginned cotton in the hukumat belongs to the district) that incentivized hukumat governments to block the borders to other districts to secure that all raw cotton was ginned within the district borders. The other reason was that gins in the district were interested to be the monopsonist and colluded with the hukumat to preserve that rent seeking structure. Mostly, hukumat officials also had a stake in the gin through family connections etc. This was also due to the political solution of the civil war that implied that old civil war gangs were allowed to take over certain hukumats and extract the rents there (so those gangs took over the gins, big farms and the political administration of the hukumat). The reason that in some regions, like Shartuz, the old futurist system is still in place (and cotton debts are piling up again) is that the gangs operating there are still behaving differently than gangs in other parts of the country and the central government

has not enough power to stop that practice without risking the political peace concord after the civil war (at least that was told by Irna and Hafiz, Interview 6).

This monopsonistic ginning sector was broken up by the decree 111. Investments in the ginning sector increased and the number of gins increased strongly from 2008 on. It was mostly national futurists and banks that invested in new gins. However, the competition between gins over district borders (price competition for raw cotton) only started due to the huge price shock. This price shock was the trigger that was needed so that the different parts of the president family started to compete with each other (profits were extremely high end of 2010 and this triggered a change in the collusion behavior of the ginning sector).

3.) Cotton financing was separated from the ginning sector

The competition in the financial sector was increased by opening up the agricultural credit market for banks and micro finance institutions. Futurists were not allowed to work anymore (whatever this means because it is obvious that the same people started to call themselves investor now and still do the same business in the name of the gin; farmers told me that in the interviews). However, the same comments like to the ginnery sector apply here (futurists were also part of the ruling elite in the hukumat, like big farm managers, ginnery managers and local politicians). The whole value chain of cotton was colluding and extracting the rents out of the sector (big farm managers, futurists, gins and local politicians through taxes and private involvement in the cotton sector).

4.) Debt cancellation for farmers

He said he does not know when the debt was effectively cancelled. However, Rustam from Sarob told me that the debt was cancelled 1st January 2008. This had indeed a strong impact on farmer behavior and their freedom to farm. Now, the dependence on futurists was not that strong anymore and at least they could think about using remittances or other resources to start planting another crop. With debt to futurists still active, there was no choice than just to accept the inputs provided by the futurist and grow cotton to the conditions the futurist provided.

On coerced labor and local rural labor markets for female:

He also said that village female are strongly bound to the village and maybe villages close by. The reason is mainly traditional norms in rural Tajikistan and only second comes the Islamic revival.

In 2011, there were still those requests of big farms to schools and local technical universities to provide pickers for the cotton harvest. But, it was not a massive phenomenon. Big farms mostly use the shareholders and their close families for the harvest of cotton. The shareholders are treated as workers on the big farms and they receive a very low flat wage during the whole year (they are not treated as shareholders). That is why the picking wage is not increased for them (they do not have to be attracted). They already receive a wage in other parts of the season. But this wage is very low and I think the main thing the big farm provides to them is the area to grow crops for subsistence consumption (plus the necessary seeds, fertilizer and machinery). However, Shuhrat said that they do not leave the farm mainly because they own parts of the farm and do not want to leave back that land. However, based on the interviews and other papers, I would argue that the shareholders of the big farms do not have any conscience about property of that land (they feel as workers and not as shareholders with land titles). This is described in the WB Report 2012 and other reports I read (look at Sattar and Mohib 2006 again).

Interview 51

He worked in the TAFF project (agricultural finance program from the EBRD) as consultant for agricultural micro-credits and now has his own agro-finance consultancy.

The number of banks currently active in Tajikistan is 17, 16 commercial banks and 1 state bank (Amonatbonk). Until decree 111, there was no rural agro-finance by banks, only futurists colluding with the gins served the farmers with in kind credit and exploited them. After decree 111 and the TAFF program (starting in 2007), agro-lending in rural areas started. But in 2008, there were only 3 banks starting this high risk business that requires deep knowledge about the sector (many banks still do not have enough knowledge for this business; that is why he founded his firm and now consults banks wanting to expand into this business). In 2010, there was a big increase in agro-lending, because the Tajik Ministry of Finance provided a big amount with cheap interest rates (14% for Somoni loans) to increase credit supply for farmers, but especially for cotton farmers. So maybe this was just another step in government involvement in cotton financing and farmers could not freely decide which crops to grow with this loan? But he said from 2010 on more banks entered the agro-lending sector and credit supply increased for farmers.

The competition in the ginnery sector materialized only with the cotton price shock. So in 2010/2011 farm gate prices started to jump. However, even in 2009 there already was a slow increase in farm gate prices due to increased competition between gins.

In general, cotton growing is very unprofitable in Tajikistan due to very high transport costs for inputs. Fertilizer, seeds and fuel have to be imported because there are not produced in Tajikistan. So the natural crop choice of farmers should be other crops. But the national government and the hukumats as well as the gins are highly interested in assuring a certain amount of cotton to reap the rents of the old processing and distribution system that is still in place.

He said that there are still requests by big farms to universities and schools to provide students for the cotton harvest. But it is mostly from agricultural universities and schools.

The landless females in rural villages are organized in brigades of around 20 people and offer their labor services to farms that pay the best wages. Small farms compete for those females at the start of the harvest time.

He said the quotas still exist in all the districts were cotton can be grown. They are at least 50% of land to be grown with cotton. Before the decree 111 the quotas were at least 70%. So it is an improvement, but the interests of the hukumat due to the tax on ginned cotton and of the stakeholders of the gin with good contacts to local politicians are still strong and that is why the quotas for cotton still exist. They are enforced by the hukumat or the jamoat by just cutting electricity, irrigation etc. (see the interviews in Vose). And this is still the case in all the cotton growing districts.

Interview 52

Igor Eromenko said that the statistics agency collects much more data on cotton sector, but only for governmental use. E.g. cotton picked is registered every two weeks during the harvest in the agency for every district or jamoat. This is used to react and bring additional workers to jamoats, where too little cotton is picked due to too little labor supply (many people migrated…). This shows that cotton is still a strategic crop and the national government is strongly interested in assuring a certain amount of cotton to be produced in the country for export earnings. In spite of the freedom to farm decree 111 and efforts of international donors and the government to increase food security and increase free crop choice of farmers, the government also has a strong interest in a minimum production of cotton for export earnings. Other important reasons for the persistence of cotton quotas and political influence to grow cotton is the tax on ginned cotton that goes to the hukumat (incentives for the hukumat to enforce cotton quotas and hinder farmers to sell their cotton across district borders) as well as private involvement of political elites in ginneries and cotton trading.

Torsten Swoboda has real evidence on those bus transfers that are organized to help jamoats or districts that are too slow with the cotton harvest due to too little supply of picking workers. In Asht district, this year the hukumat authorities (government agronomists of the district and the oblast) send 600 picking workers by bus from a district that does not grow much cotton and has an excess labor supply to Asht. The farms had to pay those workers. Those guys also worked on some small farms, but mainly on the big farms. Most small farms had already attracted the local laborers and had harvested their fields and those workers mainly worked on big farms that were late in finishing the harvest. The story shows in general that authorities are still heavily involved in the cotton sector (see notes above).

Another very important story is that in Asht Jamoat authorities still force all people except children to go to the harvest! So there is still strong political and social pressure to harvest cotton. It may be that cotton is so heavily intertwined with local social identities that helping in cotton harvest just belongs to your social identity. But there are also social sanctions involved for deviating behavior. The powerful big farm managers are using those social identities for their own benefits (also the hukumat government and the private interests in ginning and cotton trading).

Maybe this strong coercion to work in the cotton harvest is stronger in districts with less labor supply? (would be in line with the paper by Acemoglu et al. about labor coercion) But interestingly, labor supply is especially low in the core cotton districts because of the strong change in conditions in those districts. In SU times, workers in the cotton districts were at the upper end of the wage distribution. Now, cotton farmers and pickers are at the lower end of the wage distribution. This deception triggered many people from cotton regions to migrate to Russia for work.

Gins are also still doing futurists schemes, where they pre-finance taxes and irrigation payments that farmers later have to pay in raw cotton to the gins. Thus, new dependencies are created for farmer. The old elites are still trying to take a hold on the rents in the sector and will not give easily up this profitable business.

Torsten says that cotton quotas are decreasing, but are still existent.

Farmer behavior could be best explained by following your neighbor behavior. If the technology works with the neighbor or this crop was profitable for the neighbor, you will also try it out. So you always need a first mover in those regions to bring new technologies to use etc. (it all takes time).

Interview 53

She coordinated the whole farm restructuring program of the World Bank, IMF and the Tajik government.

Regarding the Lerman (2012) numbers for the farm restructuring program of the World Bank, she said that the huge increase of certificates of individual dehkan farms happened from mid of 2010 until 2011. The reason was that the program deadline was close and that the money had to be spent and program goals had to be reached. So this huge increase in individual dehkan farm certificates from 2010 until 2011 is probably not a real privatization, but only privatization on paper. She said that many farms still work like the collective dehkan farm with one manager organizing everything and reaping the profits and the rest of the farmers are workers on this farm, although each farmer has a new individual farm certificate! The farmers have no conscience and knowledge and the old structures still persist in spite of the new legal frame. So it is hard to find reliable figures on how much farms are still big farms and how much real individual private farms exist. The data from Lerman (2012) about the World Bank privatization program is not reliable. It only tells the legal frame story not the process of real structural change.

Firuza Ganieva from Sughd province (personal assistant to Rainer Woytek) and Zara told me that there is still coercion of state employees and employees of public institutions to work in the cotton harvest. The parents of Firuza work as a doctor in a hospital and at the Khujand airport and in both institutions all divisions had to close for a certain time (not all at the same time) to help in the cotton harvest. They would have lost their job, if they would not have participated in the cotton harvest! All those forced people go to the big state related farms like joint stock companies or big collective dehkan farms (whose managers have strong political ties). So there is even coerced labor from other jobs to the cotton harvest.

People in the villages also face a strong social pressure to go to the cotton harvest. Also students and older school children are forced to harvest cotton (requests from big parastatal farms to schools and universities). If they do not participate in the obligatory harvesting activities, they might be dismissed from the Universities or even get problems in the school! Even smaller school kids have to help in the harvest, although the official version is that they do it to earn some money. In fact, in most cases the money is not paid to them, Zara said.

The privatization is often only on the paper. E.g. in Asht (example Torsten was talking about in Interview 52) formally there are only individual dehkan farms left. But if you go there, you see that the central place of the old kolkhoz is still the central meeting

place where cotton pickers come and are allocated to the fields. The individual farmers still get the machines from there and all decisions about selling the crop and employing machines etc. are made by the old manager of the big farm. So the real privatization process is much slower than the legal one on paper. The interests involved are very strong (farm managers, politicians and cotton sector business men) and it takes long time to change the conscience of farmers and to change social and cultural habits and structures (individual farmers often do not know anything about agriculture etc.; so they still go to the old boss and he then has a leverage to still exploit them; he would not give inputs or advice, if they do not hand over the crop to him). The real structural change is not going to happen from year to another like Yatimov from the World Bank said (Interview 54).

Interview 54

He presented the official story that the habits and the conscience and mentality of the farmers changed in the moment the new certificates are in their hands and the debt was cancelled. So for him, every individual dehkan farmer that has an individual dehkan farm certificate in his hands has absolutely free crop choice, sense of his right and his property, will never be forced to work by the old big farm manager (only works in cotton harvest, if he agrees to the wage) and will only grow cotton himself, when he thinks it is profitable (because an export market exists and because he can use it as a collateral for credit). But, I think, this is impossible: Mentality and conscience cannot change that rapidly, because most shareholders on big farms also do not have any agricultural knowledge. So they are still dependent from the old agronomist and managers for knowing about inputs, technology etc. This does not change from one day to another. And the interests of gins, local hukumats and big farm managers are against that process. So there are many ways to still maintain the old power structures and cotton rent seeking structures, e.g. enough negative sanctions (like electricity cuts, irrigation cuts by the Jamoat, social sanctions etc., see Interview 26). E.g. the collective dehkan farm of Zafar was also helping his shareholders and people in the village with money for the wedding: If those guys would not go to the cotton harvest, they would not receive any help anymore (Interview 24, 25; same for small farmers dependent on administration etc.).

For Yatimov, after decree 111 in 2007 there were no cotton quotas anymore and free crop choice was suddenly established. Competition between gins increased strongly, because small farmers had no debt anymore and could freely choose to get credit from microfinance institutions (and the number of small farms went strongly up, number of big farms still dependent on gins went down). Decreased dependence of small farms on

certain gins led to a huge increase of competition for farmers between gins. The decree 111 also abolished the incentive of hukumats to close the border and opened the competition between gins of different districts. That is why farm gate prices for raw cotton increased from 400 USD to 800 USD per ton from 2009 to 2010. (actually I think the main reason was the huge world market price increase that triggered the competition) After the price shock, prices for raw cotton still remained high.

The majority of new small and much more efficient gins were build from 2006 until 2009 from new investors. The reason was that those investors foresaw the decree 111 and the increased competition between gins, where the old Soviet gins would miss out because of their huge inefficiencies and old machinery. After the decree 111, futurist financing (the intermediary system) was totally abolished and the supply of microfinance institutions increased tremendously. Small farmers only need little amounts of credit and were now independent of gins. Big farms, however, had huge credit constraints, because they needed much higher amounts of credit and microfinance institutes would not give them those amounts without collateral. But, the managers of those farms do not have collateral, because they do not own the farm. All shareholders now have to agree to give their land as collateral. This is often not possible or the bank does not accept that. In most cases the big farms had to recur to the gin for input financing and thus had to still grow huge amounts of cotton. Thus, big farms are less flexible in their crop choice.

He said that 3 dehkan farm types still exist: 1-5 ha are private dehkan farms, 5-25 ha are family dehkan farms, 25-200 ha are collective dehkan farms. Joint stock companies (private cotton seed or livestock enterprises) also still exist. And you also have cooperatives, which are 3-4 collective dehkan farms working together. As of 2014, 149000 dehkan farms exist with an average area of 7 ha. (see Lerman 2012)

He says no forced labor exists. If so, only few cases where big farm managers are friends of hukumats and public enterprise managers etc. (but actually those cases are widespread, because the farm manages were backed by the local government, they extracted the rents together before; why should they suddenly not continue to extract those rents? They have means of sanctioning the farmers and force local people to cotton picking, if those farmers and people are not important politicians or have good political connections) If directors would follow requests for harvest help of pupils, the director would go to jail (he says).

Interview 55

Private Sector is doing what we expect them to do - small private cotton farms are responsive to market realities and tend to make use of female labour at competitive price. Considering that Tajik female workforce is increasingly not mobile, farms indeed are offering an employment choice locally.

The government also recognises that cotton farming has a strong social aspect. It seems that women are better off working for small private farms rather than large state farms affiliated with influential groups where pay is not as great.

Interview 56

In Tajikistan, the current regime is becoming more and more powerful in the last years, because they can play out the different foreign interests and receive a lot of money from Russia, China and Western countries.

The regime tried to crack down on former Pamirean military commanders in 2012 and 2014 to enlarge its control of the country (this triggered uprisings…; but now they silently move more military in this area to be able to control the region effectively). Until those events, the Pamireans had supported the Tajik national identity that the regime tries to establish to maintain power (the elite is highly rational and ruthlessly interested in appropriating the rents for their own family and clan; other Tajik people are outsiders and do not participate, the regime is not interested in any welfare of the Tajik people; without participation in the rents, the risk is high that other groups might try to fight against the regime and that is why the regime tries to push the national identity story to prevent conflict between ethnicities or other groups…)

The government extracts the rents trough explicit and implicit taxation in different fields: taxes of remittances through control of the banking system, very low educational quality to prevent opposition, trade taxes, cotton monopsony in financing and sale, aluminum and electricity exports. It receives loans from China (in exchange for territory with minerals) and bribes from Russia (in exchange for letting the Russians control the border and participate in the drug trade). They even tax the fundamentalism in the country by posing high taxes on the construction of mosques in the country from Saudi Arabia or Quatar. They play the game in all fields and try to extract as much rents as possible.

Thus, concerning the cotton sector, there is definitely no real break up of old monopsony and monopoly structures! All “privatization” is carried out to accommodate international donors somewhat, but the regime still strongly taxes the cotton sector by other means. There is huge pressure on private farms to grow cotton and sell it to certain

gins (sanctions are: cutting electricity or irrigation or just taking away the land again). The ginnery sector and cotton trade seems to be more competitive (number of gins and traders went up), but in the end the elite is still controlling the major banks and holdings and captures the rents.

Also at the farm level there is still huge repression and coercion. Only some of the big farms were "privatized" (The government still owns the land and is able to take it away easily. Only 99 year usage rights were given out.). On the other big farms, the shareholders are still tied strongly to the land and do not have the option to found an own dehkan farm. The managers of those big farms are still colluding with the local elites and implicit taxation exists that prevents shareholders from opting out (receive only bad soil when opting out, are forced to grow cotton and sell at certain gins, cutting of electricity and irrigation…, placing high debt on farmers that want to opt out). All private farms that received good land are necessarily connected to the elites.

Family members of shareholders on big farms have to work on the big farms in harvest time, if not the shareholder would be sanctioned by the manager and has no choice (has no own land…). It is still a feudal system at those big farms. They cannot just go to private farms that offer higher wages.

Interview 57

He did the farm head and shareholder survey end of 2011 and February/March 2012. He interviewed 237 shareholders and 257 farm heads.

He had a direct impression of the consequences of the cotton price shock in 2011 and said that the shareholders at the big farms were still like serf laborers in feudalist times. They have absolute no conscience of their rights as shareholders and do not know that they own a part of the land. They have been working at the big farm for several decades and have always been the workers receiving very low wages, cotton stalks and cotton oil as well as the possibility of planting crops for own consumption in exchange for their work at the big farm. The reforms have not triggered down to them yet, the old realities and habits are still in place and farm managers can still exploit them. So wages at the big farm do not have to go up to incentivize those people to come to the cotton harvest there. They not even think about going to another farm because wages are higher there. They have to first harvest at the big farm and then the small farms have already harvested the first sort of cotton at their fields (the later sorts will not bring much additional income).

They also have no other job choices than working at the big farm (no employment opportunities exist at the rural areas in TJ) and the small farms would only hire extra peo-

ple for the harvest time (not for the whole year). At the big farm they have the possibility of planting their crops for consumption using the inputs provided there, thus they do not risk sanctions from the farm head for not harvesting first the big farm fields that were assigned to them. They do not have the entrepreneurial and agricultural knowledge for opting out of the big farm with their own share of the land (mostly, they do not know about this option). It is only those guys who have entrepreneurial and agricultural knowledge, good political connections to get good land and also access to capital for inputs that opt out of the big farms and found a smaller family farm.

The small farms mostly get additional pickers from nearby villages: the unemployed and landless females whose husbands are working in Russia. The other pickers at small farms are wider family members that do not have the obligation to pick at the big farms first.

Appendix 2 E Data Cleaning and Matching

The main dataset we use in our empirical analysis is the Tajikistan Living Standards Measurement Survey (TLSS). This household survey was conducted in 2007 and 2009 by the World Bank and in 2011 by the Institute for East and Southeast European Studies (IOS) in Regensburg (Germany). The first two waves can be downloaded at the website of the World Bank. My co-author Alexander Danzer was part of the team at the IOS that conducted the third wave and had access to the data.

Unfortunately, the three waves of this potential panel household survey had not been matched at the individual level so far and I had to undertake this task. Furthermore, having closer looks at the data during the matching procedure, I found many inconsistencies and errors in the identifiers at the individual, household and village level (primary sampling units, PSUs) as well as in many other variables. It was the work of more than six month to clean and match this household panel dataset. Additionally, I matched this dataset with further data from the FAO-GAEZ database, the World Bank Socio-Economic Atlas for Tajikistan as well as data on the privatization process I organized during my field research in Tajikistan (Appendix 2 B). Moreover, I had to digitalize by hand many statistics I obtained in Tajikistan that we use for descriptive purposes in the paper (Appendix 2 B). This additional data matching and digitalization took another four month. In this appendix, I will describe the main steps of the data cleaning and matching procedures.

Data cleaning and matching of the three waves of the Tajikistan Living Standards Measurement Survey (TLSS)

The first wave of the TLSS household panel survey was conducted in 2007 by the World Bank (World Bank 2008). 30318 individuals in 4860 households living in 270 primary sampling units (PSUs) in Tajikistan were interviewed (18 households per PSU). The survey sample is based on the national census in the year 2000 and is representative for Tajikistan (World Bank 2008). Out of the 4860 households in the TLSS 2007, a random sample of 1503 households in 167 PSUs was revisited and 10069 individuals interviewed in 2009 by the World Bank (9 households per PSU, World Bank 2010). In 2011, the Institute for East and Southeast European Studies (IOS) revisited 1503 households in 167 PSUs and interviewed 9608 individuals (Danzer et al. 2013).[90]

[90] 159 households included in the TLSS 2009 could not be located in 2011. Those 159 missing households were replaced by 114 households from the TLSS 2007 and 45 new households randomly selected in PSUs with no households left for replacement (Danzer et al. 2013). During the data cleaning procedure, I noticed that in 2011 two households were wrongly coded as one household and the number of households in 2011 increased to 1504.

Within each wave of the panel survey, around 40 blocks of variables (sections) exist that are defined at different observation levels (individual, household and PSU level). There is a unique household identifier (hhid) and an identifier for individuals (or members) within one household (memid) that are specific to each wave and can be used to merge the various blocks of variables within each wave. For merging the data across waves, one needs to use the PSU identifier (psuid) and another household identifier that is only unique for households within one PSU (hhuid). Furthermore, the waves in 2009 and 2011 include the member identifiers within households (memid) from former waves to facilitate the matching of individuals across waves (memid07in09 is memid for 2007 reported in 2009, memid07in11 is memid for 2007 reported in 2011 and memid09in11 is memid for 2009 reported in 2011). However, many of those member identifiers for former waves as well as household identifiers (hhuid) were incorrect. I corrected all detected inconsistencies of identifiers across waves using the cleaning procedures described in the next paragraphs. Another major issue was the matching of variables across waves. Variable names and in some cases variable values were not the same across waves. So I had to redefine variable names and values in each wave before merging the waves. The do-files for these procedures can be obtained from the author. In the following, I will describe the major steps of the data cleaning procedure.

During a first step of data cleaning, I noticed that five pairs of households had the same household identifiers (psuid and hhuid) in the 2011 wave. I contacted the local partner institute that had conducted the survey in 2011 and they were successful in obtaining the correct identifiers from the original interview questionnaires. In the 2007 wave, I found another 2 pairs of households with the same PSU and household identifier (hhuid). I was able to assign the correct household identifier by looking at the households within the same PSU in the 2009 wave. During the merging of blocks of variables within waves, I had to reorganize variables within blocks and found many inconsistencies in variable values. I corrected the errors where possible, e.g. missing values coded wrongly as 9999. In some cases, I had to leave out variables with too many obviously wrongly coded values. I even noticed some errors of individual identifiers in some variable blocks and could correct them by looking at other similar variable blocks and comparing names and characteristics of individuals.

Trying to match individuals across waves, I noticed many inconsistencies in the member identifiers for former waves as well as in the PSU and household identifiers through several checks. The first check was to look if member identifiers for former waves identify one unique individual. In the 2009 wave, I found 10 pairs of individuals with the same identifier for 2007 (same psuid, hhuid and memid07in09). In the 2011 wave, I

found 41 pairs of individuals with the same identifier for 2007 (same psuid, hhuid and memid07in11) and 37 pairs of individual observations with the same identifier for 2009 (same psuid, hhuid and memid09in11). I corrected all of those wrongly assigned identifiers by comparing members in the same households across waves. In the 2007 and 2011 waves, the detailed names of the individuals are reported and I used this information as my main criteria to identify individuals within households across waves and to allocate the correct memid07in09, memid07in11 or memid09in11. Additionally, I used information on age, gender, ethnicity, education, occupation, marital status and memid of the spouse to identify individuals. It was impossible to program a matching algorithm, because names in 2007 are reported in cyrillic letters and in 2011 in latin letters. Furthermore, names were mostly written differently across the two waves. The other mentioned variables also showed inconsistencies across waves (reported age, ethnicity, education and marital status were not consistent for individuals). To obtain a clean and reliable dataset I opted for the described data cleaning by hand instead of trying to match individuals across waves through an error prone programmed matching procedure.

During this first cleaning procedure, I noticed many additional inconsistencies of member identifiers for former waves within households with beforehand detected coding errors. I even found two households with wrong household identifiers (hhuid) in 2011 and could identify the correct hhuid by looking at all households within the same PSU in 2007 and 2009. In both cases, it was possible to identify the correct household by comparing names of members of all households between 2007 and 2011. During the first check of the individual matching procedure, I corrected 250 cases of incorrect memid07in09, memid07in11 and memid09in11 as well as two incorrect household identifiers in 2011. Additionally, I corrected at least one of the variables gender, age, ethnicity and identifier of the spouse for ten individuals. The overwhelming majority of the coding errors were typos (e.g. 9 entered instead of a 3) and entries shifted by one line.

For the second check, I detected households that were not observed in all three waves by using the PSU and the household identifier (hhuid). There are households only observed in 2007, households only observed in 2007 and 2009, households only observed in 2007 and 2011 and households only observed in 2011. The second check consisted in looking at the member identifiers for former waves (memid07in09, memid07in11 and memid09in11) for the households only appearing in 2007 and 2009, only in 2007 and 2011 and only in 2011. I found six households where member identifiers for a former wave were reported although the household did not appear in that wave. The reason for

this inconsistency was that the household identifier hhuid was incorrect. I corrected the hhuid by looking at all households within the same PSU in all other waves and compared households across waves through names and other characteristics of their members like in the first check described above. I also corrected 20 inconsistencies of member identifiers for former waves.

The third check consisted in merging the three waves using PSU, household and member identifiers for former waves. For many individuals in the 2009 and 2011 waves, former member identifiers were reported, but they could not be matched with individuals from the former waves. Thus, either the member identifier for the former wave was incorrect, should have been a missing or the household identifier was incorrect. Again I used the cleaning procedure described above for the first and second check to correct the member and the household identifiers. I corrected 8 household identifiers and 200 member identifiers for former waves reported in 2009 or 2011.

In the fourth check, I used a similar procedure like in the second step. In the 2009 and 2011 wave, I looked at households that were included in the former wave but reported missing values for the member identifiers for that former wave for all or a high share of its household members. I looked in detail at those households using the same cleaning procedure described above and was able to correct another 60 individual identifiers. I also detected 5 wrongly coded household identifiers and even two households that had been assigned to the wrong PSU in 2011. I assigned the correct PSU identifier to these households by searching for the household head and its members in the former waves using the name, age and other individual characteristics.

In the fifth check, I tried to extract as much information as possible from the data to match the individuals across all three waves. There were many individuals in 2009 with missing values in memid07in09, but they could be matched to the 2011 wave (using non-missing values in memid09in11) where they had non-missing values in memid07in11. Using this procedure, I could replace 253 missing values in memid07in09 with memid07in11. Additionally, I compared non-missing values of memid07in11 with the non-missing values of memid07in09 and detected 220 inconsistencies for those member identifiers. I corrected those inconsistencies by the cleaning procedure described above. Similar to the missing values in memid07in09, many individuals in 2011 had missing values in memid07in11, but could be matched to the 2009 wave (using memid09in11) where they had non-missing values in memid07in09. I could replace 77 missing values in memid07in11 from memid07in09. After that step, I could match the 2007 wave with the 2009 wave and the 2011 wave using memid07in09 and memid07in11 and look at inconsistencies in memid09in11 by comparing

memid09in11 with memid09 in the 2009 wave. I found another 40 inconsistencies in memid09in11 and corrected them using the cleaning procedure described above for the first and the second check.

After matching the individuals across the three waves using PSU, household identifiers and member identifiers for former waves, I performed a sixth check for consistency of the individual matching. I compared gender and age for individuals across waves and found another 170 wrongly coded member identifiers for former waves (those were cases with varying gender or too strong age differences). I corrected the member identifiers using the cleaning procedure described above. After the data cleaning, there were still 110 individuals left that showed varying gender or too strong variance in age and I cleaned those inconsistencies using the following procedure. For individuals that appear in all three waves, I replaced the inconsistent gender value by the value that appeared in the two other waves. For individuals only appearing in two waves, I corrected gender by looking at the name of the individual and the gender of the spouse in case the individual was married. I determined the typical gender for a name by sorting the data and looking at the gender of other individuals with the same name. I only corrected age differences, if age values changed by more than 5 between two panel waves. For individuals appearing in all three waves, I interpolated the age values of two waves that were close to each other to the third wave. For individuals only appearing in two waves, I could only correct the age values, if the family member status indicated a clear miscoding, e.g. in cases where the grandmother was 70 years old in one wave and 25 years in the other wave.

Using the corrected PSU, household (hhuid) and member identifiers, I was able to match 6097 individuals across all three waves, 1987 individuals across 2007 and 2009, 1052 individuals across 2009 and 2011 and 769 individuals across 2007 and 2011. For our main empirical analyzes, we only include the 167 PSUs from the TLSS 2007 that were revisited in 2009 and 2011.[91] In total, the cleaned and matched panel data set includes 22616 individuals and 38618 individual-time-specific observations. 1345 households are included in all three waves, 158 households only appear in 2007 and 2009, 114 households only appear in 2007 and 2011, 45 households only appear in 2011 and 1388 households only appear in 2007.[92] The reason why so many households only appear in 2007 is that in the TLSS 2007 18 households per PSU were visited, whereas in

[91] Including the other 103 PSUs (with 11377 individuals) from the TLSS 2007, the number of total individual-time-specific observations increases to 49995. If we include those individuals from 2007 in the empirical analyzes, the results do not change.

[92] As described in the footnote on the first page of this Appendix, I noticed that in 2011 two households were wrongly coded as one household and the number of households in 2011 increased to 1504. Those two households were households that had been in the TLSS 2007 already.

2009 and 2011 only 9 households per PSU were interviewed.[93] The selection procedure for selecting 9 out of the 18 households in the revisited 167 PSUs for the TLSS 2009 and 2011 was based on random sampling and should not influence our results (Danzer et al. 2013).

The following step consisted in the construction of variables for our empirical analysis. During this step, I noticed inconsistencies in the monthly wages reported in 2007. Ten individuals working in agriculture reported wage outliers of 9999 Somoni. The next smaller value was 5000 Somoni, the 99% percentile was 3000 Somoni, the median wage around 200 Somoni and the mean wage 400 Somoni. Thus, I decided to impute the wages for these ten agricultural workers in 2007 using the median wage for 2007 for workers with the same gender, same education and the same occupation. Using other imputations, e.g. the mean wage instead of the median wage or excluding the observations does not change the empirical results. In addition, 1517 individual-year observations reported having a job but did not indicate any wage in cash or in kind. Over 90% of those observations work on small household farms as unpaid family workers. We decided not to impute wages for those workers because they are not participating in rural labor markets and are mostly engaged in subsistence farming.

Matching the TLSS panel dataset with additional external datasets

For our empirical analysis, we decided to match the TLSS household panel survey with additional data at the PSU, sub-district or district level (an overview of those additional datasets is presented in Appendix 2 B). The main problem for matching those additional datasets with the TLSS was that the information on the GEO-coordinates of the 270 PSUs as well as on the names of PSUs and sub-districts in the TLSS was not reliable. I had to conduct an extensive cleaning procedure before matching the datasets that lasted another two month. The cleaning procedure for the matching of each dataset is described below.

The first dataset I matched with the TLSS is the Global Agro-Ecological Zones (GAEZ) Database from the Food and Agricultural Organization (FAO). This dataset contains detailed information on the suitability of cultivatable land for the production of various crops for many countries of the world. I downloaded information on the suitability of cultivatable land in Tajikistan for the production of cotton. The downloaded indices evaluate information on the soil quality and climatic and geographic conditions to report production capacity for cotton based on different assumptions on the irrigation infra-

[93] Those 1388 households only appearing in the TLSS 2007 comprise 10088 individuals that only appear in 2007. If we exclude those individuals, our regression results do not change.

structure and the quality of inputs used.[94] Based on those indices, we construct an alternative treatment definition defining PSUs as cotton or non-cotton PSUs. The data in the FAO-GAEZ database is coded in the Geo Information System (GIS) implying that the data can only be matched with PSUs using GEO-coordinates.

Unfortunately, the information on the GEO-coordinates of the 270 PSUs in the TLSS 2007 was completely wrong. The World Bank dataset had switched longitude and latitude information and even after correcting this reported for more than 60 PSUs coordinates that lie outside the borders of the assigned districts or even outside of Tajikistan. It was extremely difficult to obtain the correct GEO-coordinates for the 270 PSUs because for many PSUs the village name or the name of the sub-district (Jamoat) was not reported or had already changed since 2007.[95] Furthermore, within districts many villages have the same names and it was very difficult to identify the correct village or sub-district. In addition, there was no single source of information on GEO-coordinates of Tajik villages. I had to use six different websites to identify villages and retrieve GEO-coordinates. In all of these six websites, village names were differently spelled and I spent a lot of time to combine information from the different websites.

In the first step of the cleaning procedure, I entered the coordinates of all 270 PSUs from the TLSS in the GIS program Quantum GIS and noticed that many PSUs lay outside the borders of Tajikistan. I found out that longitude and latitude information was switched in the TLSS dataset and corrected that. However, using GIS information on district borders from the Socio-Economic Atlas of Tajikistan (Appendix 2 B), it appeared that still more than 60 PSUs lay outside the borders of the assigned districts or even outside of Tajikistan. I sorted PSUs by district and computed the distances of longitude and latitude from the district mean for each PSU to identify outliers. In a next step, I started to look for information on GEO-coordinates of Tajik communities in the Internet and found six websites whose information I could combine to identify the correct GEO-coordinates for PSUs (websites are listed at the end of this Appendix). The Tajikistan Water Supply and Sanitation (TajWSS) database includes the up to date list of all villages within sub-districts for the whole Republic of Tajikistan. Because village and sub-district names in the TLSS are from 2007 and many names have changed in the last years, I used the Wikipedia website to retrieve information on past sub-district names. In most cases, I was able to map sub-district names from 2007 to present sub-

[94] For our empirical analysis, we use several indices that assume the use of low or intermediate level inputs and differ with respect to the quality of irrigation infrastructure.

[95] Due to the new political strategy of the Tajik government to create a nationalist Tajik identity, many village-and sub-district-names from former Soviet times (e.g. Karl Marx, Telman or Soviet) were changed to new Tajik names (mostly ancient Persian writers, kings or religious figures).

district names because in most districts not more than two sub-districts had changed names.

The other four websites contain information on GEO-coordinates of Tajik communities. At the longitudestore website the user can enter the name of the community or the GEO-coordinates and the website will show the location of the community on google maps. GEO-coordinates for points on the map are always displayed. Unfortunately, I could not find many PSUs on the website because this website uses completely different spellings of Tajik communities (compared with the TLSS and the TajWSS website) and only includes very few communities. I mainly used this website to enter GEO-coordinates of PSUs from the TLSS and check where they are located. I also used this website to retrieve GEO-coordinates for a point in the map, where another website (mapcarta) reported the village I was searching. The mapcarta includes most villages for Tajikistan on its detailed map, but it did not report any GEO-coordinates and used completely different spellings for communities then the TLSS or the TajWSS website.[96] Thus, I could not search the communities using the search engine at the website. I needed to know in which sub-district (Jamoat) and close to which bigger community (that I could find on google maps) the PSU lies to be able to search the PSU in the surroundings of this bigger community at the mapcarta website by hand. I retrieved information on bigger communities within the sub-district of the PSU from the TajWSS website. When I found the PSU at the mapcarta website, I first tried to retrieve its coordinates using the geoco website that used the same spellings of community names then the mapcarta website. If I could not find the GEO-coordinates of the PSU at the geoco website, I tried to find them at the Islamic Finder website. This website includes the option to search for communities in the surrounding of bigger communities and presents the detailed GEO-coordinates for listed communities. This website included many communities that were not included in the geoco website, but did not include all communities. Thus, I finally had to use the longitudestore website to retrieve GEO-coordinates by hand for the point the mapcarta website indicated as the location of the village of interest.

I succeeded in retrieving the GEO-coordinates for almost all obviously wrongly located PSUs from the TLSS 2007.[97] Only for two PSUs I had to use the GEO-coordinates of the sub-district center, because I could not find those communities at the mapcarta-

[96] As of March 2015, this website now includes the exact GEO-Coordinates of Tajik villages. However, I corrected the TLSS GEO-coordinates for PSUs in spring 2013 when the website did not include this information.

[97] As noted above, I defined outliers by computing the difference of latitude and longitude to the district mean of PSUs in the TLSS. I also used district borders and Quantum GIS to infer, if the coordinates lie inside the borders of the reported district.

website. Due to the low reliability of the location data in the TLSS, I decided to check the location information for every single PSU of the 270 PSUs included in the TLSS using the procedures described in the last paragraph.[98] During these procedures, I recorded old and updated names for PSUs and sub-districts in case they had changed in the last decade. This proofed to be important for matching the subsequent datasets with the TLSS panel dataset. After having corrected and checked the GEO-coordinates of all 270 PSUs, I matched the FAO-GAEZ data with the PSUs in the TLSS using the program Quantum GIS.

The second dataset I matched with the TLSS is the Socio-Economic Atlas of Tajikistan, which includes many socio-economic variables at the sub-district (Jamoat) level for the year 2000 (Appendix 2 B; World Bank 2005). I am very thankful to Cem Mete from the World Bank and to Craig Hutton and Andy Murdoch from the GeoData Institute of the University of Southampton for providing me with the raw data of the Atlas. The raw data for sub-districts is available in GIS format as well as reported for old sub-district names in the year 2000. Unfortunately, the GIS information on sub-district borders in the Atlas is not reliable and I could not match the sub-districts with PSUs using the corrected GEO coordinates. Instead, I had to match the 270 PSUs from the TLSS to the 356 sub-districts using the mapping of old and new sub-district names as well as the TajWSS website. I succeeded in matching all 270 PSUs to its respective sub-district information for the year 2000.

The next step was to match information on the privatization process per sub-district with the TLSS dataset. During a field research stay in Tajikistan, I had obtained detailed sub-district-level data on the number of new certificates for small farms (<25 employees) handed out by the Tajik State Committee for Land and Geodesy (SCLG). I am very thankful to Bobojon Yatimov from the World Bank Office in Dushanbe for providing me with this data. To match the data with the TLSS, I first had to digitalize the information because I was provided with a hard copy. Then I had to match the up to date sub-district names from this dataset with the older sub-district names of the 270 PSUs from the TLSS. I succeeded in matching all 270 PSUs to their respective sub-district using the mapping of old and new sub-district names I had prepared before. Two additional datasets, which I had also collected during the field research in Tajikistan, contain detailed information on the production of and area cultivated with cotton and wheat by district (hukumat). I obtained this information during interviews with staff members of the National Statistic Agency and the FAO Office in Dushanbe (Appendix 2 B). Again, I had to digitalize this information and then matched the data with the TLSS at the dis-

[98] I detected another two PSUs with correct GEO-coordinates but wrongly assigned district identifiers.

trict level by assigning the district identifier of the TLSS to the new data. I also matched the TLSS with information on world prices of cotton and wheat from the IMF as well as import and export prices for Tajikistan obtained from the National Statistics Institute.

Preparing additional statistics for descriptive purposes

For our empirical analysis, we use further datasets I obtained during the field research in Tajikistan (Appendix 2 B). I am indebted to the GIZ Office in Tajikistan that provided me with three very valuable micro datasets from surveys conducted by the GIZ in 2011 and 2013. One datasets contains information from farm heads on the organizational structure and the business operations of 253 farms of all sizes in 13 cotton growing districts of Tajikistan in 2011. The second dataset reports information on farm characteristics of 4253 farms of all sizes in 51 (out of 58) districts of Tajikistan for the year 2013. The third dataset contains information on the personal opinion of district and subdistrict leaders on the agricultural reforms in Tajikistan for the year 2011. I also obtained data on business operations of 135 farms from the FAO for the year 2005. Before we could use the information from those four datasets for our empirical analysis, I had to clean some inconsistencies and entry errors in the datasets. I also had to merge different blocks of variables for the political leader dataset. The do-files for this procedure can be requested from the author.

For descriptive purposes, we also use data on the agricultural sector and the privatization process I obtained during interviews with officials from the National Statistics Institute of Tajikistan (Appendix 2 B). This information was provided at hard copies and I had to digitalize this data by hand. I also downloaded data on the production and area harvested for several crops from the websites of the US Department of Agriculture (USDA) as well as from the FAO.

Websites used to identify GEO-Coordinates for PSUs:

Tajikistan Water Supply and Sanitation (TajWSS) Database (2014). Accessible at: http://tajwss.tj/site/en/tajwss-data-base2

Wikipedia information on Jamoats in Tajikistan (2014): http://en.wikipedia.org/wiki/Jamoats_of_Tajikistan

Longitudestore Website: http://www.longitudestore.com/find-coordinates.html

Mapcarta Website: http://mapcarta.com

Geoco Website: http://geoco.org

Islamic Finder Website: http://www.islamicfinder.org

3 Transitory income shocks and household behavior: impacts of a cotton export price surge on rural households in Tajikistan

3.1 Introduction

How do short run income fluctuations due to trade openness affect the behavior of poor households in developing countries? Answering this question is crucial for evaluating the overall effects of globalization and trade on poverty in developing countries. So far, there is a broad consensus among economists that trade openness is beneficial for countries in the long run. Nonetheless, changes in trade openness have distributional impacts that may lead to adverse effects for poor households (Winters et al. 2004). Particularly in the short run, changes in trade openness cause adjustment processes and income fluctuations that might have strong impacts for poorer households, especially in developing countries (Goldberg and Pavcnik 2007; Attanasio et al. 2004). Although important parts of the population in developing countries are strongly exposed to income risk caused by world price fluctuations, the literature has, thus far, mainly focused on how households in developing countries deal with income risk induced by weather shocks or illness (Wolpin 1982, Paxson 1992, Gertler and Gruber 2002).

This paper contributes to the literature by investigating the impact of a surge in the world market price of cotton on income and behavioral responses of rural households in a developing country, namely Tajikistan. In contrast to many other empirical studies that face identification problems due to the endogeneity of trade related income shocks, this paper exploits a natural experiment to identify the effects of a positive transitory income shock on several dimensions of household behavior. In Tajikistan, around 67 percent of the working population is employed in agriculture. The most important agricultural product is cotton, which is almost exclusively exported accounting for around 30 percent of export earnings (FAO 2011). However, Tajikistan exports only around 1 percent of world cotton exports and is a price taker on world cotton markets. Thus, the surge of the world market price for cotton from August 2010 to March 2011 by over 300 percent, which was triggered by a drought and subsequent cotton import surges in China, can be treated as exogenous to Tajikistan (Fig. A3.2, Tab. A3.14). Furthermore, within Tajikistan, only specific areas command the climatic and geographic preconditions for cotton growing. The remaining rural areas exclusively produce crops for the domestic market and are not affected by cotton price fluctuations. I exploit this geographic variation in the suitability for cotton production combined with the surge in the world market price of cotton to identify the causal effect of cotton prices on rural

household income. Using a novel household panel dataset and a difference-in-difference estimation, I find that the cotton price shock increased real monthly income of agricultural households in cotton regions by over 70 percent compared to agricultural households in non-cotton regions.

Furthermore, this paper investigates how agricultural households responded to this positive income shock on several dimensions of household behavior. There is a broad literature that shows to what extent credit constraints in developing countries influence household decisions on investments in productive assets and human capital (Rosenzweig and Wolpin 1993, Udry 1995, Jacobi and Skoufias 1997, Björkman-Nyqvist 2013). A positive transitory income shock may be a unique opportunity to circumvent those credit constraints and increase household investments. Recent literature finds that households in developing countries react to such positive transitory income shocks by increasing household investments in health and education (Qian 2008, Maccini and Yang 2009, Edmonds and Pavcnik 2005, Rose 1999). In addition, Yang (2008) finds that increased household income due to a positive shock in remittances leads households to enhance entrepreneurial activity and start capital-intensive household enterprises. This study contributes to the literature by using a natural experiment to identify the causal effects of a transitory income shock due to an export price increase on household investments in health, education, migration and entrepreneurial activity.

In addition, this paper adds to a broader literature that discusses the various strategies households in developing countries apply to cope with income shocks and to smooth household consumption (Besley 1995, Morduch 1995, Townsend 1995, Deaton 1992). Due to non-existing or imperfect credit and insurance markets, households in developing countries create a broad set of behavioral responses to smooth consumption, e.g. by depleting and accumulating non-financial assets (Rosenzweig and Wolpin 1993, Udry 1995, Attanasio and Szekely 2004), adjusting labor supply (Kochar 1999) or using remittances as insurance device (Yang 2007). If those coping strategies sufficiently replace perfect credit and insurance markets, household consumption should not react to (positive or negative) transitory income shocks (Morduch 1995, Townsend 1995). This paper focusses on a trade induced positive transitory income shock and identifies its causal effects on household consumption and labor supply. In contrast to most of the related literature on consumption smoothing, I focus on the impacts of a positive (not a negative) transitory income shock.

Regarding consumption, I find that rural households in Tajikistan cannot fully insure against transitory income shocks. Household consumption significantly increases by 29 log-points in response to the positive income shock. Interestingly, households that have

at least one migrant abroad and, thus, can use remittances to insure consumption against income shocks do not increase household consumption in response to the shock. Households without migrants significantly increase consumption by 36 log-points. Moreover, I find that households with at least one migrant abroad significantly increase the number of migrants in response to the positive income shock. These findings indicate that migration and remittances act as an insurance device for transitory income shocks in developing countries (Yang and Choi 2007). Furthermore, I find that consumption in non-food products, durable goods and services increases much stronger than food consumption. The income elasticity of non-food products with respect to the transitory income shock is 0.71, whereas the one for food products is only 0.29. This indicates that households use the positive transitory income shock more for investment or savings related disbursements than for simple consumption motives (Rosenzweig and Wolpin 1993, Attanasio and Szekely 2004, Yang 2008). Interestingly, the main drivers for the increase in non-food consumption are personal care products and beauty services, spending for marriage gifts and ceremonies as well as household articles, which are important marriage gifts in Tajikistan. These findings indicate that Tajik households invest parts of the positive transitory income shock in creating, stabilizing and extending social relationships that may work as an insurance mechanism in lean times (Grimard 1997). In Tajikistan, marriages are an essential social ritual to ensure and stabilize social networks and hierarchies in local communities and create new linkages between families (Bloch et al. 2004, Brown et al. 2011, Danzer 2013).

Analyzing household investments in human capital, I find some evidence that spending for enrolled females increases stronger in reaction to the positive income shock than spending for enrolled males (Björkman-Nyqvist 2013). Enrollment of students slightly decreases due to the cotton price surge, which could indicate that households use student members for working on household farms in harvest times. The impact of the transitory income shock on health spending is strong and positive. Households increase spending per treated member as well as per overall member meaning that health spending increases at the extensive and the intensive margin. Concerning investments in entrepreneurial activity, I find strong increases of labor supply on household and family enterprises in reaction to the income shock. The number of household members working at family enterprises significantly increases by 0.9, whereas at the intensive margin hours worked at entrepreneurial activities do not increase. The probability of at least one household member owning a small enterprise increases by 11 percentage points, but is not significant. These findings indicate that the positive income shock has been used by households to circumvent credit constraints and invest in entrepreneurial activity, in line

with findings by Yang (2008). In addition, I find strong positive effects of the transitory income shock on investments in migration. The number of foreign migrants per household increases significantly. However, the probability of having at least one migrant abroad does not increase. These results indicate that the fixed costs of international migration are high. Due to migration networks, households already having a migrant abroad face lower fixed costs for an additional migrant and significantly increase the number of migrants in reaction to the positive income shock (Massey et al. 1998, Stark and Bloom 1985, Görlich and Trebesch 2008). This is in line with the insurance motive for remittances (Yang and Choi 2007). For households with no migrants, fixed costs of migration are still too high and the income shock was not sufficient to circumvent credit constraints. Those households strongly increased consumption in reaction to the income shock showing that they do not command of sufficient mechanisms to smooth consumption (Morduch 1995).

Analyzing labor supply reactions, I find that households facing the cotton price surge and enhanced demand for cotton pickers on rural labor markets increase labor supply at the extensive margin in agricultural activities. The increase in the supply of agricultural workers on rural labor markets is dominated by female agricultural workers. The reason is that cotton picking in Tajikistan is highly labor intensive and mostly done by females (due to higher dexterity and labor migration of male to Russia). The number of female non-agricultural workers per household slightly decreases, but does not explain the strong increase in female agricultural workers. The results indicate that agricultural households in cotton regions substitute leisure or household production for labor supply at local labor markets to take the opportunity of further increasing their household wage income. This is in line with the results of Edmonds and Pavcnik (2006), who find that rural households in Vietnam increase labor supply at formal labor markets in reaction to the price increase for rice. At the intensive margin, households slightly reduce hours worked in agriculture, especially for male agricultural workers. Hours worked in non-agriculture do not change. Thus, I do not find reallocation effects of labor supply between agriculture and non-agriculture at the intensive margin.

The article closest to this study is Yang (2008), who investigates the effects of a transitory exchange rate shock on remittances and household income, consumption and investments in education and entrepreneurial activity for migrant households in the Philippines. Compared to Yang (2008), this paper has the advantage of using three waves of a genuine household panel survey to control for unobserved heterogeneity as well as pre-trends in dependent variables. Furthermore, by exploiting an exogenous shock in the world market price for cotton, this paper investigates the short term adjustment costs of

a transitory income shock due to trade openness for households in a developing country. Thus, the paper adds to the literature on trade and poverty and provides insights on short term household responses to transitory income shocks caused by trade price changes (Winters et al. 2004).

The remainder of this article is as follows. The second section will introduce some background information on the Tajik cotton sector and the cotton price hike in 2010/2011. The third section will present the data and the empirical methodology. In the fourth section, I will present the results and discuss further robustness checks and the fifth section will offer concluding remarks.

3.2 Tajikistan and the cotton sector

Tajikistan is the poorest country in Central Asia. It is land locked and located between Afghanistan, China, Kyrgyzstan and Uzbekistan. With a GDP per capita (PPP) of 2216 USD in in the year 2011, Tajikistan ranked 150 out of 185 countries according to the IMF. It is populated by 7.6 million inhabitants and around 67 percent of its working population is employed in agriculture, in rural areas this share comes close to 100 percent (FAO 2011). Because agriculture is the least paying sector of this poor economy, there is large-scale temporary labor emigration from rural areas to Russia, particularly of males who work in the Russian construction industry and other low-skilled occupations (van Atta 2009, Danzer and Ivaschenko 2010). In 2008, around 33 percent of the economically active population was engaged in external labor migration (FAO 2011) and remittances accounted for 49.3 percent of the Tajik GDP according to the World Bank (in 2011, this share was 46.9 percent). Due to this large-scale labor emigration of males, the economically active population in rural areas of Tajikistan mainly consists of women (FAO 2011).

Most of Tajikistan's territory is hilly or mountainous, making crop production only feasible on around 800 000 hectares or 7 percent of its total land surface (FAO 2011). The most important crops grown in Tajikistan are cotton, wheat and vegetables (FAO 2009). Cotton is a cash crop that is almost exclusively exported accounting for around 30 percent of Tajik export earnings.[99] Cotton is grown on only around one third of the arable land, because it relies on specific climatic and geographic preconditions leading to a concentration of growing areas in the few flat regions below 1000m above sea level, which command irrigation as well as transport infrastructure (Fig. 3.1.). Apart from cot-

[99] Only around 3 percent of ginned cotton produced in Tajikistan is sold on domestic markets. After the decline of the manufacturing industry due to the breakup of the Soviet Union, Tajikistan is only now trying to establish a textile industry (van Atta 2009, Kassam 2011).

ton, wheat and vegetables are important crops that are grown on all parts of the arable land in Tajikistan. Those crops are predominantly produced for the domestic market, whereby wheat production only covers around 50 percent of the domestic demand leading to a strong dependence on wheat imports from Kazakhstan and other neighboring countries (FAO 2011). In Tajikistan, rural labor markets are local and there is no large scale labor migration between agricultural districts. This is mainly due to the remote territory and the Islamic revival, which impedes women to travel without male family members (who are mostly working in Russia).

Agricultural production in Tajikistan takes place on three types of farms which use comparable production techniques and land qualities. During the privatization process, state-owned farms (*kolkhozes* and *sovkhozes*) have been split up into bigger collective dehkan farms and state owned enterprises (from 20 to over 1000 hectares) as well as smaller private family (dehkan) farms (<20 ha).[100][101] As described in chapter 2.2, collective dehkan farms and state owned enterprises are very similar in their organizational structure. They are still heavily intertwined with local governments and rents from cotton production are appropriated by farm managers, cotton ginneries and local elites. According to the law, farmers organized in those farms are shareholders of the farm and free to opt out to found own private farms using their respective land shares. However, in reality strong dependencies due to credit constraints, social norms and political pressure exist that tie those shareholders to the big farms and their managers. In addition, in many districts of Tajikistan, cotton production quotas are still enforced by local governments to ensure a steady supply of raw cotton for rent appropriation. Although existing small private family farms also have to comply with cotton quotas to some degree, they command more freedom over production and investment decisions on their land than shareholders on bigger collective dehkan farms (Sattar and Mohib 2006, World Bank 2012). Less political interference and better defined land titles on small private dehkan farms may explain why there are no productivity differences between the two farm types, in spite of possibly larger effects of scale on bigger collective farms (chapter 2.2).

On world markets for cotton, Tajikistan is a small producer accounting for only about 1 percent of world cotton exports. Thus, the world market price for cotton can be treated as exogenous to Tajikistan. From August 2010 to March 2011, the world market price

[100] As shown in chapter two, the share of arable land cropped by (private and collective) dehkan farms and state owned enterprises did not change significantly over the last years. The split up of larger collective dehkan farms into smaller private dehkan farms mainly took place until 2009 and decelerated from 2009 until 2011. In the last chapter, I show that our results are robust to controlling for the privatization process at the sub-district level.

[101] In Tajikistan, household plots are another agricultural production unit, but they solely produce food for subsistence consumption and local markets (FAO 2009).

for cotton increased by over 300 percent, which was triggered by a drought and subsequent cotton import surges in China (Fig. A3.2, Tab. A3.14). This surge in the world market price directly affected the FOB export price for Tajik cotton leading to an increase in the area cropped with cotton by around 26 percent in the year 2011 (Fig. A3.3). Due to the high relative price for cotton in the harvest of 2010 and the sowing season of 2011 (January until March), all farm types located in cotton regions of Tajikistan had increased the area cropped with cotton and decreased the area cropped with wheat and other crops (FAO 2011, Fig. A3.4 and A3.5). Because harvesting cotton is much more labor intensive than harvesting of wheat or vegetables, the labor demand for harvest workers in 2011 significantly increased on all farm types. In chapter two, my co-author and I showed that due to political interference and coerced labor on big collective dehkan farms, this increase in harvest labor demand only led to rising picking wages on small private dehkan farms, but not on bigger collective farms. We found that real wages per hour increased by around 93 percent on small private farms due to the price shock, whereas wages on big collective farms did not change. Because the overwhelming majority of the economically active population in rural areas is female and they have a comparative advantage in cotton picking (due to higher dexterity), it is almost exclusively women that pick cotton in Tajikistan. Consistent with this fact, we find that harvest wages only increased for female agricultural workers, not for male ones. Interestingly, small private farms do not only hire family members, but also landless female workers from local villages. Thus, the export price increase did not only benefit small holders and their families, but also poor landless females from local villages that lack other income opportunities. However, we also find strong positive effects of the price shock on profits of mostly male managers on big farms as well as smaller increases for owners of small farms.

Building on those insights on the labor market effects of the export price shock, in this paper, I will analyze the impact of the positive transitory income shock for rural households in cotton regions on several dimension of household behavior. The central question for the empirical strategy of this paper is to define an adequate treatment and control group of households. I apply various reasonable categorizations that I will present along with the dataset in the next section.

3.3 Data and empirical strategy

3.3.1 Data

The dataset I use in this paper is based on the Tajikistan Living Standards Survey (TLSS) conducted by the World Bank and UNICEF in 2007 and 2009 and a follow up survey for 2011 conducted by the Institute for East and Southeast European Studies (IOS). The three waves of this representative household panel survey were all conducted in harvest time of each year (September-November), so that I have comparable measures of harvest time household income, expenditures, labor market participation of household members and various other household characteristics. In 2007, 4860 households living in 270 primary sampling units (PSUs) in Tajikistan were interviewed (18 households per PSU). This sample was reduced to only 167 PSUs and 9 households per PSU resulting in 1503 revisited households in 2009 and 2011 (Danzer et al. 2013). In the analysis, I will only include households living in the 167 PSUs that were revisited in 2009 and 2011.[102]

The data I obtained from the World Bank and the IOS was quite erroneous regarding individual and household identifiers across waves. Thus, to be able to correctly aggregate individual level variables within households and to link them across waves, I had to apply extensive cleaning procedures that are described in Appendix 2 E. In addition, the single modules of the raw data on household income and expenditures as well as on education, health and migration of household members had to be cleaned and merged internally before it was possible to connect them to the individual level dataset, which I had already constructed for the research presented in the last chapter.[103] After applying all these corrections, I constructed the final household level panel dataset for this study by aggregating over individuals within households. The final dataset contains 3050 households, whereby 1345 households appear in all three waves in 2007, 2009 and 2011. 158 households only appear in 2007 and 2009, 114 households only in 2007 and 2011 and 45 households only in 2011. This is due to the fact that in 2011, 159 households could not be located by the interviewers and were replaced by 114 reserve households in the respective PSU from 2007 and 45 newly sampled households.[104] Further-

[102] As noted in Appendix 2 E, I conducted robustness checks including those 103 PSUs and results of the last chapter and also of this chapter do not change.

[103] The most serious issue was that missing values were coded differently across modules and waves. Sometimes they were coded as 99, 999, 9999, as "." or as negative values. Another issue was that remittances in 2007 were apparently reported in USD by some interviewers and in Somoni by others (but this was not explicitly indicated in the dataset). The applied cleaning procedure is described in Appendix 3 B.

[104] As noted in Appendix 2 E, after cleaning the data set the number of households only in the dataset in 2007 and 2009 was reduced to 158 and the number of households in 2011 increased to 1504.

more, due to the reduction of the survey sample from 18 to 9 households per PSU in 2009 and 2011, 1388 households only appear in 2007. Although those sample adjustments were carefully conducted to prevent selection issues (Danzer et al. 2013, World Bank 2010), I present robustness checks in the Appendix that show that those sample adjustments are indeed random conditional on our independent variables and that they do not change our main results (Tab. A3.26, A3.27).[105]

3.3.2 Empirical strategy

The identification strategy of this paper exploits Tajikistan's geographic variation in the suitability for cotton production combined with the surge in the world market price of cotton in 2010/2011 to identify the causal effects of cotton prices on income and behavioral responses of rural households. The baseline approach uses the 2007 community survey that was conducted alongside the TLSS to classify the 167 primary sampling units (PSUs) into cotton and non-cotton PSUs. PSUs in which cotton was reported as the first or second most important crop, are defined as cotton communities. Non-cotton communities are all remaining PSUs which are predominantly characterized by agricultural production (Fig. 3.1 and Table A3.15 and Table A3.16).

As expected, cotton PSUs are characterized by lower altitude, better connectivity to federal or district capitals and by better infrastructure (roads, irrigation) than non-cotton PSUs while population size and school enrolment do not differ significantly (Table A3.17). In the main empirical specification, I include district dummies as well as province-year dummies and in robustness checks I also control for sub-district and community level variables pre-shock in 2007 (Table A3.20).[106] For further robustness checks, I also use three additional definitions for cotton communities using external GIS data from (i) the FAO GAEZ data base (FAO 2013), (ii) the World Bank (World Bank 2005) as well as (iii) a definition based on altitudes below 1000m sea level. In addition, I define cotton communities at the district level, whereby all communities in a cotton district are defined as cotton communities.[107]

[105] To be precise, solely the reduction of the number of households per PSU from 18 to 9 seems to have affected our control group somewhat more than the treatment group. However, this reduction of the sample was the most carefully conducted one (World Bank 2010). In addition, excluding those households dropping out of the sample after 2007 does not change our results. Results also do not change, if I exclude each of the other sub-groups of households that are not in the dataset in all waves (Tab. A3.26, A3.27).

[106] Tajikistan comprises 5 provinces (Oblasts), 58 districts (Hukumats/Raions) and 406 sub-districts (Jamoats). I decided not to control for the additional community and sub-district level variables in the main regression, because unfortunately some of those variables are not available for all PSUs.

[107] For a detailed description of the different cotton community and cotton district definitions, see chapter 2.2. For all those different treatment definitions for cotton communities, the main results of this paper hold. Results are not shown here, but can be requested from the author. In chapter two, I show that the effects of the cotton price shock on wages are highly robust to using any of those other treatment definitions for cotton communities.

Because of the cotton price spike in 2010/2011 and the increased harvest labor demand in 2011, harvest wages for agricultural workers increased strongly in cotton growing communities in 2011 (see chapter 2). Thus, I expect household income for agricultural households in cotton communities (treatment group) to increase from 2009 until 2011 relative to the agricultural households in non-cotton communities (control group). In the baseline, I define an agricultural household as a household, where at least one member is working in agriculture. The main driver for increased household income of the treatment group should be household wage income. From 2007 to 2009, cotton prices and wages slightly decreased and I expect a negative or no effect on household income of the treatment group relative to the control group (see chapter 2). To control for selection effects, I will also include non-agricultural households in the estimation by using a Dif-in-Dif-in-Dif estimator. Non-agricultural households are defined as households with at least one member working in non-agricultural activities, but no one working in agriculture. I will present various robustness checks for these definitions of agricultural and non-agricultural households in Table A3.20.[108]

I will estimate the following linear model for all households with at least one working member using OLS:

$$\begin{aligned}\ln(\text{HH income})_{it} &= \alpha + \beta_1(\text{cottonPSU} \times \text{year09}) + \beta_2(\text{cottonPSU} \times \text{year11}) \\ &+ \beta_3\text{cottonPSU} + \beta_4\text{year09} + \beta_5\text{year11} + \beta_6(\text{agriHH} \times \text{year09}) \\ &+ \beta_7(\text{agriHH} \times \text{year11}) + \beta_8(\text{agriHH} \times \text{cottonPSU}) + \beta_9\text{agriHH} \\ &+ \beta_{10}(\text{cottonPSU} \times \text{year09} \times \text{agriHH}) \\ &+ \beta_{11}(\text{cottonPSU} \times \text{year11} \times \text{agriHH}) + X_{it}'\gamma + \tau \\ &+ u_{it} \qquad (1)\end{aligned}$$

for household *i* at time *t*.

The dependent variable is the contemporary log of real household income per month for household i in year t. Since regional CPIs are unavailable, I deflate income by national CPI and control for province-year dummies (which also pick up other differential time trends across provinces, e.g. GDP growth or weather shocks). CottonPSU is a dummy that indicates whether the PSU/community is a cotton growing community or not and agriHH is a dummy that turns one for an agricultural household and zero for a non-agricultural household. I interact the year dummy for 2011 (year11) with the dummy for

[108] For example, I exclude households containing agricultural as well as non-agricultural workers from the treatment group, I define agricultural households as households with at least 2 members working in agriculture or I include households without any member working as non-agricultural households (TableA3.20).

cotton PSU and the agricultural household dummy to capture the effect of the rising cotton price on income of the treatment group (β_{11}) in the year 2011. The coefficient β_{10} tests whether the income growth between cotton and non-cotton agricultural households differed already in the pre-price hike period from 2007 to 2009. In addition, the dummies for the years 2009 and 2011, the cotton PSU dummy, the agricultural household dummy and their remaining interactions are included separately. The vector of control variables X includes household size, the age of the household head, the share of household members with age below 17, the share of members already retired as well as dummy variables for the household head being married, being single, being female, having secondary education, having higher education and three dummy variables for the occupational group of the household head.[109] I also include dummies that indicate in which decile of the household income distribution the household was located in 2007. To control for time invariant institutional and other characteristics of the 58 districts, I also include district fixed effects τ in the model. Because interviews were conducted over the harvest time period of 3 months and many variables including wage income are reported for the last month, I control for the month of the interview in every specification. Standard errors are clustered at the PSU/community level throughout all specifications.

As shown in chapter two, only harvest wages of female agricultural workers increased in reaction to the cotton price surge. Thus, I would expect that household income should only increase in agricultural households with at least one female working. To investigate this I will split the sample into households with at least one female member working and households with only male members working and estimate the described specification for each sub sample separately.[110] Furthermore, I will also use various continuous treatment definitions to check for the robustness of the man specification. Instead of the agricultural household dummy, I will use the share of agricultural workers, the number of male and the number of female agricultural workers per household. Moreover, because only agricultural wages for women on small private farms had increased due to the cotton price surge, I will estimate the main specification only for agricultural households and replace the agricultural household dummy with a dummy for containing at least one female working on a small private farm. Again, I will also use a continuous treatment definition by replacing the dummy with the number of females working on a small private farm per household. However, due to the fact that in chapter

[109] For household income as dependent variable, I include the number of migrants in the measure for household size. For other dependent variables, household size only comprises household members living in Tajikistan.

[110] As robustness check, I will also look at households with at least two female members working (Table A3.20).

two we also found strong increases of profits for male owners on big and small farms, I will prefer the main specification throughout this paper.[111]

Because there is no measure for monthly household income in the dataset, I had to construct this variable making different kinds of assumptions that are discussed in Appendix 3 B. In the main specification, monthly household income comprises wage income last month plus last bonuses and average monthly in kind payments, average monthly remittances, social benefits paid last month, average monthly household income from other sources as well as a monthly average of net household transfers. In Table A3.20, I show regression results for other measures of household income, e.g. excluding in kind payments or using a monthly average for social benefits and bonuses instead of the amounts paid last month. Because 286 of our 6012 household-year observations report zero household income, I impute wages and remittances for those 286 households and check if the results are robust to using the imputed measure of household income (Table A3.20).[112] I also check, if including the households with zero income by using log(1+income) changes the results (Table A3.20).

Besides income, I will use many other dependent variables to investigate the effects of the transitory income shock on several dimensions of household behavior. In most of these specifications, I will estimate a reduced form model using OLS, where I include the same set of explanatory variables as described above.[113] Thus, I will analyze the impact of the cotton price surge on those other dependent variables for agricultural households in cotton PSUs (treatment group) compared to agricultural households in non-cotton PSUs (control group). In addition, I will use a Two-Stage-Least-Square (2SLS) instrumental variable model to estimate the elasticity of household consumption with respect to household income for different product groups. In this specification, I will instrument the independent variable nominal household income using the interaction of the cotton PSU dummy with the agricultural household dummy and the year 2011 dummy as external instrument.

In the Appendix Table A3.18 and A3.19, I present descriptive statistics for the control and the treatment group. Table A3.19 presents the means of all dependent and independent variables for the control and the treatment group in the year 2007. Using un-

[111] The main specification includes all households with at least one member working, whereby owners of the farms reported themselves working (as managers/owners). This specification includes 5214 households and, thus, another advantage for preferring this specification compared to only including the 1983 agricultural households is efficiency.

[112] I only impute wages for household members that were working, but did not report a wage. Accordingly, I only impute remittances for households with migrants that did not report remittances. The detailed imputation procedure can be found in Appendix 3 B.

[113] For dependent variables that are weighted by household size, I will exclude the independent variable household size. In case the weighting is by oxford scales, I will additionally exclude the shares of young and old household members.

paired T-tests, I also test, whether there are significant differences between the control and the treatment group. Apparently, there is no significant difference in household income for control and treatment group. Interestingly, the treatment group purchases more food on markets, whereas the control group shows a larger total food consumption meaning that those households produce more food in subsistence farming. Monthly spending in education and health as well as school enrollment do not differ significantly. The share of migrant households and the number of migrants is significantly higher in the agricultural households in non-cotton PSUs, whereas the number of workers and agricultural workers, the share of female agricultural workers as well as hours worked per worker are significantly higher in agricultural households in cotton PSUs. Household characteristics do not differ significantly between treatment and control group, except the share of young members, which is higher in the treatment group, and the share of old members, which is higher in the control group. Regarding PSU and subdistrict level characteristics, results are similar to the ones shown in Tables A3.15 - A3.17.

3.4 Results

3.4.1 Income

In a first step, I present the results for the main specification and the dependent variable log of real household income in Table 3.1. For the overall sample (column 1), I find that due to the cotton price surge in 2010/2011 real household income increases by 29 log-points in agricultural households in cotton PSUs (treatment group) compared to agricultural households in non-cotton PSUs (control group). In the period of stable cotton world market prices from 2007 until 2009, there was no differential trend in household income between the control and the treatment group. Because women perform most of the cotton harvesting activities in Tajikistan, household income should have mainly increased in households with women working. As expected, the treatment effect of the cotton price surge on household income is most pronounced for the subsample of households with at least one female member working (col. 3). For these households, real household income increases by 61 log-points compared to the control group and the effect is significant at the 1 percent level. For households with no female working (col. 2), I find no significant effects of the cotton price surge on household income.

To check for the robustness of the main specification presented in Table 3.1, I test for different kinds of treatment definitions in Table 3.2. In the first column, I use the same specification than in column 3 of Table 3.1, but I replace the agricultural household

dummy by the share of agricultural workers per household. In Columns 2 and 3, I include all households and replace the share of agricultural workers by the number of male and female agricultural workers, respectively. These continuous treatment definitions render very similar results compared to the main specification. If the share of agricultural workers increases by 10 percentage points, real household income significantly increases by 6.1 log-points after the cotton price surge in 2011, but not before in 2009 (col. 1). In columns 2 and 3, the results indicate that this increase is exclusively due to female agricultural workers. The number of female agricultural workers has a significant and strong positive effect on household income after the cotton price spike, whereas before the price shock the effect is even slightly negative. The number of male agricultural workers has no significant effect on household income after the cotton price spike. In columns 4 and 5, I only include agricultural households and replace the agricultural household dummy with a dummy for containing at least one female working on a small private farm (col. 4) and with the number of females working on small private farms per household (col. 5). As expected from the results of the last chapter, the income increases for agricultural households due to the cotton price shock are mainly driven by females working on small private farms.

Although it is reassuring that the results are robust to other treatment definitions and consistent with the findings of chapter two, I will use the main specification from Table 1 column 3 throughout this paper. For this specification, I conduct additional robustness checks for the discrete definition of an agricultural household, for the definition of a household with females working and for various other measures of the dependent variable real monthly household income (Tab. A3.20). In column 6 of Table A3.20, I additionally include pre-shock control variables at the PSU and the sub-district level and in column 7 I add dummy variables for each household. The results are very robust to all these changes of the specification.[114]

Due to the results of the last chapter, I expect that the main driver for the increased household income of the treatment group is household wage income. In Table 3.3, I present the results for the effects of the cotton price surge on different sources of household income using the sub-sample of households with at least one female working. It is evident that household wage income is the main driver for the increased household income due to the cotton price shock. Wage income increases by 70 log-points and the effect is significant at the 1 percent level. The other sources of income do not show significant increases for the treatment group compared to the control group in 2011. Solely

[114] Solely including household dummies strongly reduces the degrees of freedom and leads to insignificant coefficients. However, the size of the treatment effect is still in the same ballpark.

household transfers received increase significantly by 185 log-points. However, only 266 household-year observation show non-zero transfers meaning that for the whole sample transfers cannot explain the significant increase of household income in the treatment group compared to the control group in 2011. Hence, I conclude that the treatment effect in column 1 is the causal effect of the world cotton price surge on real household income of the treatment group.

3.4.2 Consumption of food, durable goods and services

In the next step, I analyze the impact of the increased household income on consumption of several food and non-food product groups. As described above, I first employ a reduced form model based on the main specification, where I replace the dependent variable log of real income by log of consumption spending. Second, I use a Two-Stage-Least-Square (2SLS) instrumental variable model to estimate the elasticity of household consumption with respect to household income. In this specification, I will instrument the independent variable nominal household income using the interaction of the cotton PSU, the agricultural household and the year 2011 dummy as external instrument.[115] Columns 1-4 in Table 3.4 present the results of the reduced form estimation for purchased food products, consumed food products (purchased plus self-produced food and in kind payments in food), non-food consumption and total consumption. Columns 5-8 present the results for the 2SLS instrumental variable approach. As mentioned above, because the exogenous cotton price surge only affected the income of households with at least one female working, I will only use this subsample for the rest of the paper.

Columns 1 and 2 show that the rise in household income by 61 log-points (col. 3 of Tab. 3.1) results in a slight increase of food purchased and food consumed by 20 and 21 log-points, respectively. These effects correspond to income elasticities of 0.27 and 0.29, respectively, but the elasticities are not significantly different from zero (col. 5 and 6). In contrast, the consumption of non-food items strongly increases by 50 log-points leading to a rise in total consumption by 29 log-points (both coefficients are significant at the 5 percent level). The income elasticity for non-food products is 0.71 and significant at the 5 percent level (col. 7). Hence, it is evident that households in Tajikistan cannot fully insure consumption against transitory income shocks. Moreover, in response to the positive transitory income shock, households increase their consumption in possibly investment and savings related non-food products more than consumption of food. Hence, households might have used the positive income shock for accumulating non-

[115] Due to efficiency reasons, I use the imputed measure for household income Table A3.20 column 10.

financial assets to insure against future negative income shocks (Rosenzweig and Wolpin 1993, Attanasio and Szekely 2004).

To further investigate the underlying consumption patterns, I estimate the reduced form equation for 7 food product (Tab. 3.5) and 13 non-food product categories (Tab. 3.6). The results in Table 3.5 indicate that households took advantage of the positive income shock and increased the consumption of fruits and sweets by 51 and 61 log-points, respectively. In Tajikistan, a large share of those products is imported and households used the increased wage income to purchase those products on the local markets (FAO 2009, 2011; Tab. A3.22). It seems that Tajik households mainly adjust consumption in those two product groups to smooth consumption of the remaining food items. In the presence of a positive transitory income shock, consumption of fruits and sweets strongly increases, whereas consumption of other food items does not change. This indicates that in Tajikistan fruits and sweets are not considered as basic necessities and their consumption is highly elastic to income changes (Tab. A3.23).[116] Due to the increased consumption of fruits, the income shock may have longer lasting positive effects on the health of household members through increased vitamin supply.

Regarding the consumption of non-food product groups, I find very interesting effects depicted by Table 3.6. The main drivers for the increase in non-food consumption are personal care products and beauty services (col. 1), spending for marriage gifts and ceremonies (col. 13) as well as household articles (col. 7), which are important marriage gifts in Tajikistan (e.g. dishes, household linens, kitchen utensils and household hand tools). Due to the positive income shock, household consumption of those three subcategories significantly increases by 48, 101 and 89 log-points, respectively.[117] These findings indicate that Tajik households invest parts of the positive transitory income shock in arranging and celebrating marriages as well as in other social ceremonies. In Tajikistan, marriages are an essential social ritual to ensure and stabilize social networks and hierarchies in local communities and create new linkages between families (Bloch et al. 2004, Brown et al. 2011, Danzer 2013). Thus, the results indicate that Tajik households invest parts of the positive transitory income shock in creating, stabilizing and extending social relationships that may work as an insurance mechanism in lean times (Grimard 1997).

[116] Table A3.23 presents the estimation of the income elasticities of consumption for the seven food product groups.

[117] In Table A3.24, I present the IV estimates for the income elasticities of consumption for the 13 non-food product groups. Due to smaller sample size and low values for the partial F-Test, some of these estimates should be taken with cautiousness.

To investigate the effects of the positive income shock on poverty and to make my results comparable to the development literature, I apply a standard methodology used in this literature and weight overall consumption in food and non-food products by oxford scales.[118] Using these weighted variables as dependent variables in the reduced form estimation, gives very similar results compared to the results on consumption presented above (Tab. A3.21).[119] Weighted total household consumption significantly increases by 29 log-points due to the positive income shock. Thus, poverty as measured by weighted household consumption is strongly reduced in households that are affected by the positive transitory income shock.

3.4.3 Migration

To analyze the effects of the positive income shock on investments in migration, I estimate the reduced form equation using an indicator for having at least one migrant abroad, the number and the share of migrants per household as dependent variables (Tab. 3.7 col. 1-3). I find strong positive and significant effects of the positive transitory income shock on the number and the share of foreign migrants per household. The number of migrants increases by 0.36 and the share of migrants by 5 percentage points (significant at 5 percent level). Before the cotton price shock from 2007 until 2009, the number and the share of migrants per household did not increase in the treatment relative to the control group. Interestingly, the probability of having at least one migrant abroad does not increase due to the positive income shock. These results indicate that for Tajik households the fixed costs of international migration are high. Due to migration networks, households already having a migrant abroad face lower fixed costs for an additional migrant and significantly increase the number of migrants in reaction to the positive income shock (Massey et al. 1998, Stark and Bloom 1985, Görlich and Trebesch 2008). For households with no migrants, fixed costs of migration are still too high and the income shock was not sufficient to circumvent credit constraints and start sending household members abroad. Table A3.25 supports this argument by showing that household income increased due to the cotton price shock for both, households with and without migrants, by the same amount.

[118] The weight for a household is computed by allocating 1 to the first adult, 0.7 to any other adult and 0.5 to each children and then summing up over all household members.

[119] I do not use the results for the weighted consumption measures as main results, because the weighted consumption measure implicitly contains the independent variables household size and number of young household members. Thus, I have to exclude those variables from the right hand side. This is problematic for the IV estimation, because it reduces the strength of the instruments and may introduce omitted variable bias (if other independent variables are correlated with household size or the number of young household members).

Furthermore, I find very interesting evidence that migrant households use remittances to insure consumption against income shocks (Yang and Choi 2007). I split the sample of households affected by the income shock into households with at least one migrant and households without migrants and estimate the consumption equation for each sub-sample separately. I find that households without migrants strongly increase the consumption of food and non-food products in reaction to the positive income shock (Tab. 3.7 col. 7-9, Tab. A3.25 col. 3). This shows that they do not command of sufficient mechanisms to smooth consumption (Morduch 1995). In contrast, households with at least one migrant abroad do not increase household consumption in response to the positive income shock (Tab. 3.7 col. 4-6, Table A3.25 col. 6). Moreover, those households use the rising income to significantly increase the number of migrants. In line with the insurance motive for remittances, those additional migrants and their remittances may act as an insurance device for negative transitory income shocks in the future (Yang and Choi 2007).

3.4.4 Education and health

In a next step, I investigate the effects of the positive income shock on household investments in education and health. Table 3.8 shows the results of the positive income shock on the enrollment of school children and students per household, whereby I differentiate between male and female members. Controlling for the number of household members in enrollment age (6-30 years), the total number of enrolled household members decreases by 0.26 due the shock, but the coefficient is not significantly different from zero (column 1).[120] There is no major difference between male and female members (col. 2, 3). Looking at enrollment of school children vs. students, it seems that the decrease in enrollment is mainly driven by a decrease in student enrollment (col. 4-9). This could indicate that households use student members for working on household farms in harvest times or that students have to join the cotton harvest on bigger collective farms. However, the estimated coefficients are not significantly different from zero. Another interesting insight from Table 3.8 is that the number of male children has a stronger effect on school enrollment of males (89 log-points) than the number of female children on school enrollment of females (80 log-points). Thus, the share of male school enrollment is higher than the share of female school enrollment throughout the whole sample (a fact also corroborated by Table A3.19). This is also true for student enroll-

[120] Instead of using enrollment shares as dependent variables, I include the number of household members in the respective enrollment age as independent variable. Because this variable is strongly correlated with household size, using enrollment shares as dependent variable could lead to severe endogeneity issues. However, using enrollment shares as dependent variables does not strongly change the results. The tables for these estimations can be requested from the author.

ment. However, I find no evidence that the positive income shock increased school enrollment, neither for male nor for female children (Qian 2008, Björkman-Nyqvist 2013).

In Table A3.9, I investigate whether monthly household spending in education was affected by the positive income shock. Although the coefficient estimates for the treatment effects are not significantly different from zero at standard significance levels, I still find interesting patterns regarding differential treatment of boys and girls. Total monthly spending for education of females increases due to the positive income shock by 28 log-points (col. 3), whereas spending for education of males only increases by 17 log-points (col. 2). Even more pronounced are the effects per enrolled members. Spending on education per female member increases by 35 log-points due to the income shock, but decreased before the price shock in the treatment compared to the control group (col. 6). Spending per enrolled male is almost not affected by the positive income shock (col. 5). The same pattern also appears, when I look at spending for school children (col. 7-8) or spending for students (col. 9-10). Due to the positive income shock, spending for female school children and for female students increases by 29 and 124 log-points, respectively. Spending for male school children slightly decreases by 15 log-points due to the price shock, whereas spending for male students increases not half as strongly as for female students. These findings are in line with results of Björkman-Nyqvist (2013), who reports for households in Uganda that negative income shocks lead to a stronger decrease in resources allocated to the education of girls than to the education of boys. Households smooth consumption by varying resources allocated to the education of girls and mainly shelter resources allocated to the education of boys. I find that in the presence of a positive income shock households seem to use the available resources to positively adjust the spending for the education of girls. Regarding fertility and health status, this effect has been shown by Rose (1999) and Maccini and Yang (2009). They find that in reaction to a positive income shock households increase their spending for the nutrition and nurturing of girls more than for boys.

Regarding household investments in health, I find strong increases in spending on health due to the positive income shock (Table 3.10). Total spending for the treatment of ill household members increases by 53 log-points due to the positive income shock, whereas before the shock there was no differential trend between the treatment and the control group (col. 1). Due to many households showing zero health spending, the sample size for this regression reduces to 1036 households leading to insignificance of the treatment effect. However, I find a strong and significant positive treatment effect on spending for ambulatory medical assistance of 122 log-points (col. 2). Households seem to use the additional resources due to the positive income shock to send more members

to ambulatory care, but also to increase the spending per treated member (col. 4-6). Although the effects are not significant due to the small sample size, the magnitude of the coefficients is large. Because I control for province-year dummies, seasonal effects and many household characteristics, I assume that the number of ill household members conditional on the covariates does not change in time and between the treatment and the control group. Thus, the increased spending for ambulatory care reflects a better medical treatment of ill household members due to the positive income shock. This enhanced medical treatment of ill household members may lead to a shorter period of illness. Indeed, I find that the number of hours household members were not able to work during the last month because of illness decreased due the positive income shock (col. 10).[121] Regarding spending for hospitalization, I find no effects in response to the positive income shock (col. 7-9).

3.4.5 Entrepreneurial activity

To investigate how the positive income shock has affected entrepreneurial activity of rural households in Tajikistan, I estimate the reduced form equation using a dummy for owning a family enterprise, the number of workers and hours worked in that enterprise as dependent variables (Table 3.11). I find that the probability of owning a family enterprise increases by 11 percentage points in response to the positive income shock, but the effect is not significant at standard levels of significance (col. 1). However, I find that households that already own a family enterprise significantly increase the number of workers engaged in entrepreneurial activities by 0.9 due to the positive income shock (col. 2). At the intensive margin, hours worked in the family enterprise do not increase, if I control for the number of household members working there (col. 3). Thus, I only find weak evidence that households in Tajikistan use the positive income shock to start new enterprises (Yang 2008). However, entrepreneurial activities within existing family enterprises significantly increase due to the shock.

3.4.6 Labor supply

Finally, I analyze the effects of the cotton price surge and the enhanced demand for cotton pickers on the labor supply decisions of households (Tab. 3.12, 3.13). I find that households in cotton PSUs significantly increase labor supply in agricultural activities at the extensive margin by 0.5 workers compared to non-cotton PSUs in 2011 (Tab.

[121] This variable was not included in the TLSS 2009. Thus, I can only look at changes from 2007 until 2011.

3.12 col. 2).[122] This increase is dominated by female agricultural workers (col. 5, 8). The reason is that cotton picking in Tajikistan is mostly done by females (due to higher dexterity and labor migration of male to Russia). The number of female non-agricultural workers per household slightly decreases by 0.14, but does not explain the strong significant increase in female agricultural workers by 0.3 (col. 5, 6). The number of males working in non-agricultural activities does not change in response to the shock (col. 9). The results indicate that, at the extensive margin, agricultural households in cotton regions substitute leisure or household production for labor supply on local labor markets to take the opportunity of further increasing their household wage income. This is in line with the results of Edmonds and Pavcnik (2006), who find that rural households in Vietnam increase labor supply at formal labor markets in reaction to the price increase for rice.

Regarding child labor, I find no significant effects of the cotton price shock on the number of children working, although the coefficient for the treatment effect is positive (col. 10, 11). The probability of sending household member to other farms for harvesting activities increases by 10 percentage points due to the shock, although the effect is not significantly different from zero (col. 12).[123] At the intensive margin, households slightly reduce hours worked in agriculture, especially for male agricultural workers (Tab. 3.13 col. 7-12).[124] However, the coefficients are not significantly different from zero. Hours worked in non-agriculture do not change (col. 10, 12). Thus, I do not find reallocation effects of labor supply between agriculture and non-agriculture at the intensive margin. The insignificant decrease in hours worked by male workers could be interpreted as weak evidence for an income effect, i.e. the positive income shock may have led to a reduction in labor supply of males at the intensive margin (col. 3, 11). Because I use the log of hours worked as dependent variable, households with zero hours worked drop out of the sample and this may lead to a selection bias in the estimation. To address this issue, I estimate quantile regressions for the first, second and third quartile of the dependent variable hours worked using the same independent variables as in

[122] I use a Dif-in-Dif and not the Dif-in-Dif-in-Dif specification here, because the dummy for an agricultural household would be endogenous to the number of agricultural workers as dependent variable. For comparability, I use this specification for all dependent variables in Table 3.12. The same applies to columns 7-13 in Table 3.13.

[123] This variable does not appear in the TLSS 2009 and, hence, I can only look at the change from 2007 to 2011.

[124] Instead of using log of hours worked per respective worker as dependent variable, I use log of hours worked for the whole household as dependent variable and include the number of respective workers as independent variable. Because the number of workers is strongly correlated with household size, using log of hours worked per worker as dependent variables leads to severe endogeneity problems.

the reduced form estimation. The results are shown in Table A3.28 in the Appendix and support the results shown here.[125]

3.5 Conclusion

This paper exploits a natural experiment to identify the effects of a transitory income shock due to trade openness on several dimensions of household behavior for rural households in Tajikistan. Although important parts of the population in developing countries are strongly exposed to income risk caused by world price fluctuations (Winters et al. 2004, Goldberg and Pavcnik 2007), the literature has, thus far, mainly focused on how households in developing countries deal with income risk induced by weather shocks or illness (Wolpin 1982, Paxson 1992, Gertler and Gruber 2002). In this paper, I focus on agricultural households living in the sharply defined cotton regions of Tajikistan and are additionally exposed to income risk caused by fluctuations of the world price of cotton. Agricultural households living in non-cotton regions of Tajikistan comprise the control group and are solely exposed to income risk induced by domestic shocks. Exploiting an exogenous surge in the world price of cotton in 2010/2011 and the geographic variation in the suitability for cotton production, I find that the cotton price shock increased real monthly income of agricultural households in cotton regions by over 70% compared to agricultural households in non-cotton regions.

Furthermore, in this paper I investigate how agricultural households responded to this positive income shock on several dimensions of household behavior. Credit constraints in developing countries strongly influence household decisions on investments in productive assets and human capital (Rosenzweig and Wolpin 1993, Udry 1995, Jacobi and Skoufias 1997, Björkman-Nyqvist 2013). Thus, a positive transitory income shock may be a unique opportunity to circumvent those credit constraints and increase household investments (Qian 2008, Maccini and Yang 2009, Edmonds and Pavcnik 2005, Rose 1999, Yang 2008). I find compelling evidence that the trade induced positive transitory income shock led agricultural households in cotton regions of Tajikistan to increase their investments in education, health, migration and entrepreneurial activity. Due to the positive income shock, spending for ambulatory medical treatment of household members significantly increased at the extensive and intensive margin. In addition, I find large but insignificant effects of the income shock on spending for the education of household members, whereby spending for the education of girls increased much more than for boys. These findings are in line with other studies reporting that households

[125] I do not include the quantile regression results for hours worked by activity or for kids and old people, because the estimation procedure using these dependent variables did not converge.

smooth consumption by varying resources allocated to the education and nutrition of girls and mainly shelter resources allocated to the education of boys (Björkman-Nyqvist 2013, Rose 1999, Maccini and Yang 2009). Regarding entrepreneurial activity, I find that households affected by the positive income shock significantly increase their entrepreneurial activity on existing family enterprises. Concerning investments in migration, I find that households with at least one migrant abroad use the positive income shock to further increase the number of migrants. However, for households without migrants the increase in available resources was not sufficient to pay for the fixed costs of starting external migration.

In addition, this paper adds to a broader literature that discusses the various strategies households in developing countries apply to cope with income shocks and to smooth household consumption (Besley 1995, Morduch 1995, Townsend 1995, Deaton 1992). I find that rural households in Tajikistan cannot fully insure against transitory income shocks. Household consumption significantly increases by 29 log-points in response to the positive income shock. Interestingly, the rise in consumption is mainly driven by non-food products, which indicates that households use the positive transitory income shock more for investment or savings related disbursements than for simple consumption motives (Rosenzweig and Wolpin 1993, Attanasio and Szekely 2004, Yang 2008). In particular, households increase the spending for personal care products and beauty services, marriage gifts and ceremonies as well as household articles, which are important marriage gifts in Tajikistan. These findings indicate that Tajik households invest parts of the positive transitory income shock in creating, stabilizing and extending social relationships that may work as an insurance mechanism in lean times (Grimard 1997). In addition, I find that households that have at least one migrant abroad and, thus, can use remittances to insure consumption against income shocks do not increase household consumption in response to the shock. Moreover, those households significantly increase the number of migrants in response to the positive income shock. These findings indicate that migration and remittances act as an insurance device for transitory income shocks in developing countries (Yang and Choi 2007).

The article closest to this study is Yang (2008), who investigates the effects of a transitory exchange rate shock on remittances and household income, consumption and investments in education and entrepreneurial activity for migrant households in the Philippines. Compared to Yang (2008), this paper has the advantage of using three waves of a genuine household panel survey to control for unobserved heterogeneity as well as pre-trends in dependent variables. Furthermore, by exploiting an exogenous shock in the world market price for cotton, this paper investigates the short term adjustment costs of

a transitory income shock due to trade openness for households in a developing country. Thus, the paper adds to the literature on trade and poverty and provides insights on short term household responses to transitory income shocks caused by trade price changes (Winters et al. 2004). Unsurprisingly, poor agricultural households in a developing country like Tajikistan are less well insured and less able to cope with income shocks than are non-poor households in developed countries (Jalan and Ravallion 1999). This makes it particularly important to consider the effectiveness of mechanisms available to poor households for consumption smoothing when introducing trade reforms likely to increase the variability of their incomes (Winters et al. 2004). Next time, the shock in the world price of cotton may be a negative one and rural households in the cotton regions of Tajikistan will have to reduce their consumption and investments in human capital and entrepreneurial activity. Thus, in developing countries, rising trade openness should be accompanied by improvements in domestic credit and insurance markets to provide sufficient mechanisms to insure consumption against the extended income risk induced by trade price fluctuations.

For future research, it seems promising to further investigate the various mechanisms of income smoothing that are available to rural households in developing countries like Tajikistan as well as the institutional context facilitating the use of those mechanisms (Morduch 1995). In this study and chapter two, I find that small private as well as bigger collective farms in Tajikistan strongly react to the cotton price surge in 2010/2011 and increase the area devoted to cotton production in exchange for area devoted to the production of other crops. It is not clear, if this substitution between crops would be feasible on all farm types in case of a relative decline in the price for cotton. In Tajikistan, there is still a strong interference of local politicians and elites in the cotton sector, especially on big collective dehkan farms. Managers of big farms, cotton gins and local politicians appropriate the rents from exporting ginned cotton and try to secure a steady supply of raw cotton. Breaking up those monopolistic structures to increase the freedom of crop choice for all farmers is a necessary precondition for the appropriate use of income smoothing mechanisms for rural households in Tajikistan. It remains an open question, what other precondition like knowledge and credit supply are still necessary for rural households in Tajikistan to adequately apply mechanisms of income smoothing.

Building on the dataset and insights presented in this paper, another promising direction of future research is the analysis of the effects of gender specific income changes on household behavior (Qian 2008). Because the increase in household income due to the cotton price surge is mainly driven by female wage income, the results in this paper

already suggest interpretations in line with the findings by Qian (2008). For example, I find that spending for the education of girls increases more due to the positive income shock than for the education of boys. However, this argument needs to be analyzed in more detail to be able to contribute to the literature on empowerment of women and its effects on household behavior, e.g. on fertility, nutrition and education of girls versus boys.

Tables and Figures

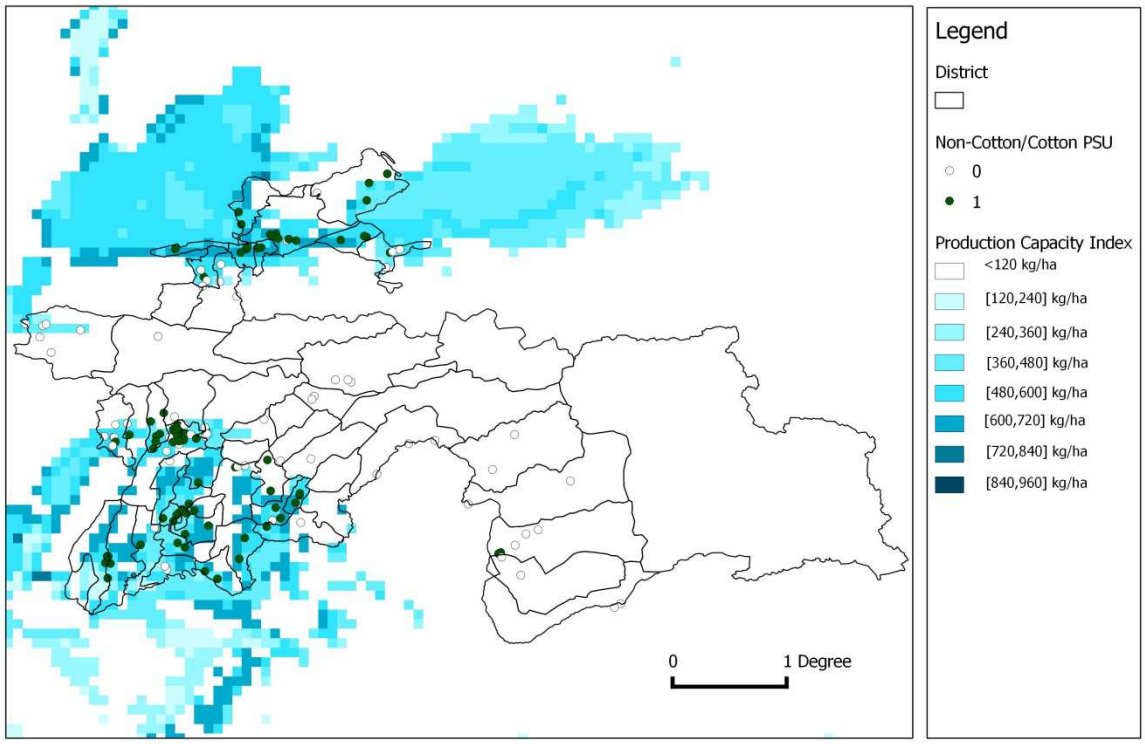


Figure 3.1.: Regional variation of cotton production in Tajikistan (cotton/non-cotton communities in the TLSS 2007)

Note: Cotton/non-cotton communities (PSUs) from TLSS 2007 (in green/white), cotton communities are communities that grow cotton as first or second most important crop. FAO - GAEZ – Production capacity index for cotton (for current cultivated land and intermediate input level irrigated cotton). Administrative units are districts (hukumats or raions); there are 58 districts in Tajikistan.

Table 3.1.: Effects on log of total real household income

VARIABLES	(1) Log of HH income	(2) Log of HH income	(3) Log of HH income
Cotton PSU*year 2009*agricultural HH	-0.05	-0.34	0.07
	(0.16)	(0.27)	(0.22)
Cotton PSU*year 2011*agricultural HH	0.29°	-0.36	0.61**
	(0.16)	(0.24)	(0.21)
HH head married	0.19**	0.16*	0.22**
	(0.05)	(0.06)	(0.07)
HH head single	0.17	0.21	0.12
	(0.11)	(0.18)	(0.10)
HH size	0.06**	0.07**	0.06**
	(0.01)	(0.01)	(0.01)
HH head age	0.01**	0.01**	0.00*
	(0.00)	(0.00)	(0.00)
HH head secondary education	0.06°	0.10°	0.01
	(0.03)	(0.05)	(0.04)
HH head tertiary education	0.18**	0.18**	0.15*
	(0.04)	(0.06)	(0.06)
HH head high occupation	0.14**	0.11*	0.12*
	(0.04)	(0.06)	(0.05)
HH head occupations 4,5,7 or 8	0.25**	0.23**	0.24**
	(0.03)	(0.05)	(0.04)
HH head skilled agricultural occupation	-0.02	0.01	-0.02
	(0.04)	(0.08)	(0.05)
HH female head	0.22**	0.11	0.24**
	(0.05)	(0.07)	(0.07)
HH share of young members	-0.46**	-0.53**	-0.39**
	(0.06)	(0.09)	(0.08)
HH share of old members	-0.22*	-0.08	-0.28*
	(0.10)	(0.14)	(0.14)
Constant	4.97**	4.84**	5.24**
	(0.16)	(0.20)	(0.24)
Observations	5,074	2,479	2,595
R-squared	0.51	0.50	0.57
Adjusted R-squared	0.50	0.48	0.55

Robust standard errors in parentheses (clustered at the village/PSU level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. The first column shows results for the whole sample of households with at least one member working, the second column shows results for the subsample of households with no female member working and the third column the results for the subsample of households with at least one female member working. An agricultural HH is defined as a household with at least one member working in agriculture.

Table 3.2.: Alternative Treatment Definitions (log of total real household income)

VARIABLES	(1) Log of HH income	(2) Log of HH income	(3) Log of HH income	(4) Log of HH income	(5) Log of HH income
Cotton PSU*year 2009*small farm agricultural HH				-0.16	
				(0.22)	
Cotton PSU*year 2011*small farm agricultural HH				0.69**	
				(0.23)	
Cotton PSU*year 2009*number/share of agricultural workers	-0.04	-0.15°	-0.14°		-0.18
	(0.24)	(0.09)	(0.08)		(0.11)
Cotton PSU*year 2011*number/share of agricultural workers	0.61*	-0.08	0.29**		0.28*
	(0.24)	(0.09)	(0.11)		(0.13)
HH head married	0.22**	0.18**	0.19**	0.27**	0.27**
	(0.07)	(0.05)	(0.05)	(0.09)	(0.09)
HH head single	0.13	0.17	0.17	0.63**	0.62**
	(0.10)	(0.11)	(0.11)	(0.17)	(0.16)
HH size	0.06**	0.07**	0.06**	0.07**	0.07**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH head age	0.00*	0.01**	0.01**	0.00°	0.00°
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	0.01	0.07*	0.07*	0.08	0.08
	(0.04)	(0.03)	(0.03)	(0.06)	(0.06)
HH head tertiary education	0.14*	0.17**	0.18**	0.12	0.12
	(0.06)	(0.04)	(0.04)	(0.09)	(0.09)
HH head high occupation	0.10*	0.14**	0.15**	0.24**	0.23**
	(0.05)	(0.04)	(0.04)	(0.07)	(0.07)
HH head occupations 4,5,7 or8	0.21**	0.25**	0.27**	0.34**	0.34**
	(0.04)	(0.03)	(0.03)	(0.06)	(0.06)
HH head skilled agricultural occupation	0.03	0.02	-0.06	0.01	-0.00
	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)
HH female head	0.24**	0.20**	0.23**	0.51**	0.52**
	(0.07)	(0.04)	(0.05)	(0.10)	(0.10)
HH share of young members	-0.38**	-0.51**	-0.44**	-0.71**	-0.68**
	(0.08)	(0.06)	(0.06)	(0.11)	(0.11)
HH share of old members	-0.28*	-0.22*	-0.22*	-0.10	-0.08
	(0.14)	(0.10)	(0.10)	(0.19)	(0.19)
Constant	5.27**	4.99**	4.90**	4.67**	4.76**
	(0.23)	(0.16)	(0.16)	(0.24)	(0.24)
Observations	2,595	5,074	5,074	1,899	1,899
R-squared	0.57	0.52	0.51	0.56	0.56
Adjusted R-squared	0.55	0.51	0.50	0.54	0.54

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household (or a continuous treatment variable), a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy (or continuous treatment) and the cotton PSU dummy. The first column shows results for continuous treatment defined as the share of household working members that work in agriculture. This specification includes all households with at least one female member working. The second and third columns include all households with at least one working member. The specification in the second column defines continuous treatment as the number of males in the household that work in agriculture. The third column defines continuous treatment as number of females that work in agriculture. The fourth and the fifth column only include households with at least one member working in agriculture. The fourth column defines discrete treatment as households that have at least one female working in agriculture on a small farm. The fifth column defines continuous treatment as the number of female household members that work on small farms in agriculture.

Table 3.3.: Effects on different sources of household income

VARIABLES	(1) Log of HH income	(2) Log of HH Wage income	(3) Log of HH remittances	(4) Log of HH Other income	(5) Log of HH Social benefits	(6) Log of HH Transfers received	(7) Log of HH Transfers sent
Cotton PSU*year 2009*agricultural HH	0.07	0.14	-0.61	0.92	-0.09	-1.17	-2.47
	(0.22)	(0.28)	(0.51)	(0.74)	(0.24)	(1.26)	(2.71)
Cotton PSU*year 2011*agricultural HH	0.61**	0.70**	0.48	1.00	-0.27	1.85°	0.06
	(0.21)	(0.24)	(0.53)	(0.73)	(0.28)	(1.12)	(2.28)
HH head married	0.22**	-0.13	0.37*	-0.01	0.25*	-0.44	0.79
	(0.07)	(0.08)	(0.17)	(0.21)	(0.10)	(0.49)	(0.64)
HH head single	0.12	-0.04	0.09	-1.62**	-0.13	-0.00	0.00
	(0.10)	(0.15)	(0.23)	(0.54)	(0.20)	(0.66)	(0.00)
HH size	0.06**	0.06**	0.02	0.05*	0.02°	0.08°	-0.03
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.04)	(0.05)
HH head age	0.00*	0.01**	0.01	0.00	0.01**	-0.01	0.01
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.02)
HH head secondary education	0.01	0.00	-0.15	0.19	0.09	-0.11	-0.02
	(0.04)	(0.05)	(0.09)	(0.16)	(0.06)	(0.27)	(0.37)
HH head tertiary education	0.15*	0.16*	0.01	0.28	0.24*	-0.03	0.08
	(0.06)	(0.07)	(0.17)	(0.21)	(0.09)	(0.46)	(0.49)
HH head high occupation	0.12*	0.37**	-0.08	0.24	0.06	0.09	0.09
	(0.05)	(0.06)	(0.14)	(0.21)	(0.10)	(0.34)	(0.35)
HHhead occupations 4,5,7 or 8	0.24**	0.52**	-0.04	0.20	-0.17°	0.14	-0.17
	(0.04)	(0.05)	(0.12)	(0.15)	(0.09)	(0.21)	(0.42)
HH head skilled agricultural occupation	-0.02	0.16*	-0.10	0.12	0.14	0.64°	-0.19
	(0.05)	(0.07)	(0.15)	(0.17)	(0.09)	(0.34)	(0.55)
HH female head	0.24**	-0.24**	0.26°	-0.30	0.01	-0.47	0.72
	(0.07)	(0.08)	(0.15)	(0.19)	(0.09)	(0.46)	(0.61)
HH share of young members	-0.39**	-0.08	-0.26	-0.15	-0.19	-0.42	1.00
	(0.08)	(0.11)	(0.25)	(0.31)	(0.18)	(0.47)	(0.84)
HH share of old members	-0.28*	-0.78**	-1.23°	-0.70	0.65**	0.04	-1.20
	(0.14)	(0.18)	(0.66)	(0.51)	(0.19)	(0.80)	(1.86)
Constant	5.24**	5.12**	4.47**	3.50**	2.93**	6.32**	4.12
	(0.24)	(0.25)	(0.66)	(0.99)	(0.39)	(1.15)	(2.74)
Observations	2,595	2,454	393	543	1,071	266	164
R-squared	0.57	0.48	0.53	0.31	0.49	0.44	0.65
Adjusted R-squared	0.55	0.46	0.38	0.16	0.44	0.13	0.32

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Column 1 shows the baseline results from column 3 of Table 1. Column 2 until 7 show results for the same specification than in column 1, but for different sources of household income as dependent variables.

Table 3.4.: Effects on household consumption

	OLS Reduced Form (1-4)				IV (5-8)			
VARIABLES	(1) Log of Food purchased	(2) Log of Food consumed	(3) Log of Non-food spending	(4) Log of total consumption	(5) Log of Food purchsed	(6) Log of Food consumed	(7) Log of Non-food spending	(8) Log of total consumption
Cotton PSU*year 2009*agricultural HH	-0.16	-0.05	-0.04	-0.05	-0.17	-0.05	-0.04	-0.05
	(0.20)	(0.13)	(0.23)	(0.13)	(0.20)	(0.12)	(0.24)	(0.13)
Cotton PSU*year 2011*agricultural HH	0.20	0.21°	0.50*	0.29*				
	(0.16)	(0.12)	(0.22)	(0.13)				
HH head married	0.07	0.01	0.03	0.01	-0.01	-0.07	-0.17	-0.10
	(0.06)	(0.04)	(0.09)	(0.05)	(0.09)	(0.06)	(0.12)	(0.07)
HH head single	0.19	0.14°	-0.10	0.10	0.15	0.10	-0.19	0.04
	(0.13)	(0.08)	(0.17)	(0.08)	(0.12)	(0.07)	(0.17)	(0.08)
HH size	0.07**	0.07**	0.08**	0.07**	0.05**	0.06**	0.05**	0.05**
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.02)	(0.01)
HH head age	0.00**	0.00**	0.01*	0.00**	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	0.10*	0.08**	0.18**	0.10**	0.10*	0.08*	0.17**	0.10**
	(0.04)	(0.03)	(0.06)	(0.03)	(0.05)	(0.03)	(0.06)	(0.04)
HH head tertiary education	0.19**	0.12**	0.34**	0.17**	0.16*	0.09°	0.27**	0.12*
	(0.06)	(0.04)	(0.07)	(0.05)	(0.07)	(0.05)	(0.08)	(0.05)
HH head high occupation	0.13*	0.12**	0.14*	0.12**	0.09	0.08°	0.04	0.06
	(0.05)	(0.03)	(0.07)	(0.04)	(0.06)	(0.04)	(0.09)	(0.05)
HHhead occupations 4,5,7 or 8	0.12**	0.09**	0.09°	0.09**	0.06	0.02	-0.08	-0.01
	(0.04)	(0.03)	(0.05)	(0.03)	(0.07)	(0.05)	(0.11)	(0.06)
HH head skilled agricultural occupation	0.03	0.05	-0.01	0.04	0.04	0.06°	0.02	0.05
	(0.05)	(0.03)	(0.07)	(0.03)	(0.05)	(0.04)	(0.07)	(0.04)
HH female head	-0.01	-0.07°	-0.12	-0.07°	-0.09	-0.15*	-0.32*	-0.19**
	(0.06)	(0.04)	(0.08)	(0.04)	(0.09)	(0.06)	(0.13)	(0.07)
HH share of young members	-0.14	-0.04	-0.26*	-0.10	-0.02	0.09	0.04	0.08
	(0.09)	(0.07)	(0.10)	(0.07)	(0.12)	(0.10)	(0.18)	(0.10)
HH share of old members	-0.55**	-0.43**	-0.86**	-0.54**	-0.43**	-0.30*	-0.55**	-0.36**
	(0.13)	(0.10)	(0.16)	(0.11)	(0.16)	(0.12)	(0.21)	(0.13)
Log of HH income					0.27	0.29	0.71*	0.41*
					(0.23)	(0.18)	(0.34)	(0.20)
Constant	3.60**	4.15**	4.36**	5.84**	2.26°	2.72**	0.86	3.82**
	(0.21)	(0.14)	(0.29)	(0.15)	(1.16)	(0.91)	(1.76)	(0.99)
First stage (log of HH income instrumented)								
Cotton PSU*year 2011*agricultural HH					0.70**	0.70**	0.70**	0.70**
					(0.19)	(0.19)	(0.19)	(0.19)
Partial F-Test (F-statistics)					12.98	13.03	13.09	13.03
Observations	2,647	2,652	2,650	2,652	2,646	2,651	2,649	2,651
R-squared	0.47	0.52	0.33	0.50	0.45	0.46	0.21	0.41
Adjusted R-squared	0.45	0.50	0.30	0.48	0.43	0.44	0.18	0.38

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Consumption is measured in Tajik Somoni. Food purchased and consumed is reported for the last 7 days, whereas food consumed includes food purchased plus self-produced food and in kind payments in food. Non-food consumption and overall consumption is computed as a monthly average.

Table 3.5.: Effects on consumption detailed food items

VARIABLES	(1) Log of grains cons.	(2) Log of vegetables cons.	(3) Log of fruits cons.	(4) Log of meat cons.	(5) Log of milk cons.	(6) Log of beverages cons.	(7) Log of sweets cons.
Cotton PSU*year 2009*agricultural HH	-0.18	0.07	-0.07	0.32°	0.03	0.01	-0.20
	(0.15)	(0.16)	(0.23)	(0.18)	(0.16)	(0.19)	(0.21)
Cotton PSU*year 2011*agricultural HH	0.10	0.09	0.51°	0.31	0.05	0.14	0.61°
	(0.15)	(0.20)	(0.30)	(0.21)	(0.19)	(0.22)	(0.35)
HH head married	0.05	-0.03	0.00	0.06	0.02	0.01	-0.05
	(0.05)	(0.06)	(0.08)	(0.07)	(0.05)	(0.08)	(0.09)
HH head single	0.16	0.10	0.08	0.27°	0.13	0.23	0.07
	(0.14)	(0.13)	(0.21)	(0.16)	(0.11)	(0.23)	(0.20)
HH size	0.09**	0.06**	0.06**	0.04**	0.07**	0.03**	0.05**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH head age	0.00*	0.01**	0.01*	0.01**	0.00*	0.00	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	0.03	0.12**	0.15*	-0.01	0.14**	0.08°	0.14*
	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.05)	(0.06)
HH head tertiary education	-0.04	0.15**	0.22**	0.12*	0.22**	0.15*	0.18*
	(0.05)	(0.06)	(0.08)	(0.06)	(0.05)	(0.07)	(0.08)
HH head high occupation	0.07	0.08°	0.09	0.11°	0.10*	0.20**	0.10
	(0.04)	(0.05)	(0.07)	(0.06)	(0.05)	(0.06)	(0.06)
HH head occupations 4,5,7 or8	0.05	0.02	0.11*	0.12**	0.11**	0.11*	0.08
	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)
HH head skilled agricultural occupation	0.00	0.08	0.06	0.07	0.08°	0.14*	0.02
	(0.04)	(0.05)	(0.05)	(0.05)	(0.04)	(0.06)	(0.07)
HH female head	-0.07	-0.05	-0.10	-0.08	-0.00	-0.06	-0.10
	(0.05)	(0.05)	(0.08)	(0.07)	(0.05)	(0.08)	(0.08)
HH share of young members	-0.03	-0.03	-0.09	-0.02	-0.03	0.04	0.13
	(0.08)	(0.08)	(0.10)	(0.10)	(0.08)	(0.10)	(0.11)
HH share of old members	-0.40*	-0.62**	-0.41°	-0.29°	-0.22°	-0.29°	-0.88**
	(0.16)	(0.14)	(0.21)	(0.15)	(0.13)	(0.17)	(0.16)
Constant	2.78**	1.98**	1.35**	2.49**	2.33**	0.61°	1.35**
	(0.19)	(0.17)	(0.22)	(0.21)	(0.20)	(0.32)	(0.36)
Observations	2,652	2,651	2,370	2,077	2,625	2,610	2,629
R-squared	0.47	0.34	0.22	0.32	0.39	0.30	0.32
Adjusted R-squared	0.45	0.31	0.19	0.28	0.36	0.27	0.29

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Consumption is reported for the last 7 days and measured in Tajik Somoni. It includes purchased items on local markets as well as self-produced food and in kind payments in food.

Table 3.6.: Effects on consumption detailed non-food items

VARIABLES	(1) Log of spending Personal care	(2) Log of spending Cleaning products	(3) Log of spending Fuel and transport	(4) Log of spending informati-on	(5) Log of spending Other articles	(6) Log of spending Clothing and shoes	(7) Log of spending HH arti-cles	(8) Log of spending Hobbies, Services	(9) Log of spending Cars and dwellling	(10) Log of spending Personal articles	(11) Log of spending For travel	(12) Log of spending Insurance and taxes	(13) Log of spending Marriage, oth. cer.
Cotton PSU*year 2009*agricu. HH	-0.13	-0.14	0.36	-0.13	-0.31	0.15	-0.19	-0.13	0.39	0.29	0.79	0.36	0.73°
	(0.17)	(0.17)	(0.28)	(0.59)	(0.57)	(0.24)	(0.32)	(0.80)	(0.65)	(0.97)	(1.15)	(0.44)	(0.42)
Cotton PSU*year 2011*agricu. HH	0.48°	0.15	0.43	-0.21	0.84	0.31	0.89*	-0.06	0.38	0.03	0.22	0.72	1.01*
	(0.27)	(0.24)	(0.38)	(0.47)	(0.64)	(0.22)	(0.40)	(0.55)	(0.52)	(0.89)	(1.45)	(0.50)	(0.39)
HH head married	-0.05	-0.04	0.09	0.00	0.01	0.02	-0.04	0.07	0.16	-0.10	-0.46	0.32*	-0.13
	(0.07)	(0.06)	(0.12)	(0.17)	(0.23)	(0.08)	(0.13)	(0.23)	(0.25)	(0.36)	(0.62)	(0.14)	(0.16)
HH head single	-0.04	0.05	-0.06	0.36	-0.47	-0.16	-0.27	0.67	-0.57	0.13	2.79**	-0.37	-0.25
	(0.24)	(0.18)	(0.38)	(0.48)	(0.40)	(0.28)	(0.27)	(0.46)	(0.36)	(0.87)	(0.65)	(0.47)	(0.40)
HH size	0.05**	0.06**	0.08**	0.06**	0.05*	0.08**	0.05**	0.05*	0.01	0.08*	0.07	0.04*	0.06**
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.06)	(0.01)	(0.01)
HH head age	0.00	0.00	0.01*	-0.01	0.01	0.00°	0.01	0.00	0.01	-0.02°	-0.00	0.01°	-0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.02)	(0.00)	(0.00)
HH head secondary education	0.04	0.07	0.16	-0.19	0.04	0.13*	0.06	0.25°	-0.03	-0.34	-0.16	0.12	0.06
	(0.05)	(0.04)	(0.10)	(0.14)	(0.16)	(0.06)	(0.09)	(0.13)	(0.17)	(0.27)	(0.35)	(0.12)	(0.10)
HH head tertiary education	0.15*	0.18**	0.31*	-0.07	-0.11	0.23**	0.22°	0.48*	0.15	-0.14	0.14	0.09	0.20
	(0.06)	(0.06)	(0.12)	(0.16)	(0.20)	(0.08)	(0.13)	(0.22)	(0.21)	(0.32)	(0.46)	(0.14)	(0.13)
HH head high occupation	0.14**	-0.01	0.16	0.23*	0.35*	0.21**	0.04	0.08	-0.07	0.03	-0.68°	-0.14	0.01
	(0.05)	(0.05)	(0.10)	(0.11)	(0.17)	(0.07)	(0.11)	(0.18)	(0.18)	(0.21)	(0.36)	(0.14)	(0.11)
HH head occupations 4,5,7 or8	0.13**	0.08°	0.21**	0.15	0.14	0.06	0.11	0.09	-0.14	0.06	0.23	-0.02	0.12
	(0.04)	(0.04)	(0.08)	(0.14)	(0.15)	(0.05)	(0.09)	(0.14)	(0.15)	(0.20)	(0.27)	(0.14)	(0.10)
HH head skilled agricult. occupation	0.06	0.02	0.00	-0.03	0.20	-0.00	-0.05	-0.05	-0.42*	0.18	-0.18	-0.03	0.15
	(0.06)	(0.05)	(0.09)	(0.22)	(0.18)	(0.07)	(0.10)	(0.24)	(0.19)	(0.38)	(0.46)	(0.14)	(0.13)
HH female head	-0.10	-0.07	-0.05	0.02	0.22	-0.10	-0.26*	0.10	0.09	-0.31	-0.27	0.17	-0.22
	(0.07)	(0.06)	(0.13)	(0.15)	(0.24)	(0.07)	(0.12)	(0.20)	(0.24)	(0.35)	(0.60)	(0.14)	(0.15)
HH share of young members	-0.13	0.10	-0.36*	-0.23	-0.08	-0.02	-0.07	0.13	0.29	-0.21	-0.36	-0.09	-0.77**
	(0.10)	(0.08)	(0.15)	(0.25)	(0.33)	(0.11)	(0.19)	(0.34)	(0.28)	(0.52)	(0.76)	(0.19)	(0.21)
HH share of old members	-0.68**	-0.33*	-0.46°	0.12	-0.02	-0.97**	-0.73*	-0.03	-0.75	2.38**	-0.01	-0.32	-0.47
	(0.16)	(0.14)	(0.24)	(0.36)	(0.46)	(0.27)	(0.33)	(0.63)	(0.68)	(0.72)	(1.10)	(0.41)	(0.36)
Constant	2.64**	2.33**	2.75**	2.42**	2.42**	4.86**	2.58**	2.89**	4.13**	6.38**	5.60**	1.45°	5.31**
	(0.25)	(0.21)	(0.46)	(0.73)	(0.62)	(0.28)	(0.49)	(0.97)	(0.95)	(1.61)	(1.71)	(0.74)	(0.57)
Observations	2,518	2,556	1,777	568	918	2,537	1,646	594	881	396	355	771	1,580
R-squared	0.30	0.30	0.24	0.37	0.31	0.29	0.31	0.30	0.21	0.43	0.53	0.34	0.20
Adjusted R-squared	0.27	0.27	0.20	0.24	0.23	0.26	0.26	0.16	0.11	0.25	0.36	0.25	0.15

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1 Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Consumption is measured in Tajik Somoni and reported for the last month (columns 1-5), the last 6 month (columns 6-8) or the last 12 months (columns 9-13).

Table 3.7.: Migration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Households with migrants			**Households without migrants**		
VARIABLES	HH with migrants	Number of migrants	Share of migrants	Log of food consumption	Log of non-food consump-tion	Log of total consumption	Log of food consumption	Log of non-food consumption	Log of total consumption
Cotton PSU*year 2009*agricultural HH	0.13	0.08	0.02	0.22	0.37	0.15	-0.10	-0.16	-0.09
	(0.08)	(0.12)	(0.02)	(0.29)	(0.68)	(0.34)	(0.13)	(0.25)	(0.14)
Cotton PSU*year 2011*agricultural HH	0.12	0.36*	0.05*	-0.00	0.36	-0.00	0.27°	0.53*	0.36*
	(0.09)	(0.16)	(0.02)	(0.28)	(0.56)	(0.30)	(0.14)	(0.24)	(0.15)
HH head married	0.20**	0.22**	0.05**	-0.10	-0.13	-0.11	0.04	0.10	0.04
	(0.04)	(0.06)	(0.01)	(0.08)	(0.17)	(0.09)	(0.05)	(0.11)	(0.06)
HH head single	0.12°	0.15	0.02°	0.03	-0.24	-0.04	0.14	-0.14	0.09
	(0.07)	(0.10)	(0.01)	(0.18)	(0.25)	(0.18)	(0.10)	(0.21)	(0.11)
HH size	0.02**	0.06**	0.07**	0.08**	0.07**	0.07**	0.08**	0.07**	0.07**
	(0.00)	(0.01)	(0.01)	(0.02)	(0.02)	(0.00)	(0.01)	(0.00)	(0.01)
HH head age	-0.00	-0.00	0.00	-0.00	0.00	-0.00	0.00**	0.01*	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	-0.01	-0.01	0.00	0.11°	0.30*	0.15*	0.07°	0.13*	0.08*
	(0.02)	(0.04)	(0.00)	(0.07)	(0.15)	(0.07)	(0.04)	(0.06)	(0.04)
HH head tertiary education	-0.04	-0.04	-0.00	0.11	0.35°	0.15	0.10*	0.29**	0.14*
	(0.03)	(0.05)	(0.01)	(0.09)	(0.18)	(0.09)	(0.05)	(0.09)	(0.06)
HH head high occupation	-0.05*	-0.09**	-0.01**	0.16°	0.07	0.15	0.11**	0.15°	0.12**
	(0.02)	(0.03)	(0.00)	(0.09)	(0.15)	(0.09)	(0.04)	(0.08)	(0.04)
HH head occupations 4,5,7 or 8	-0.06**	-0.09**	-0.02**	-0.02	-0.00	-0.03	0.09**	0.09	0.10**
	(0.02)	(0.03)	(0.00)	(0.08)	(0.14)	(0.08)	(0.03)	(0.06)	(0.03)
HH head skilled agricultural occupation	0.00	-0.01	-0.00	0.02	0.06	0.04	0.06°	-0.02	0.04
	(0.03)	(0.05)	(0.01)	(0.08)	(0.18)	(0.09)	(0.04)	(0.08)	(0.04)
HH female head	0.30**	0.36**	0.07**	-0.03	-0.03	-0.02	-0.06	-0.08	-0.07
	(0.04)	(0.06)	(0.01)	(0.07)	(0.17)	(0.08)	(0.06)	(0.11)	(0.06)
HH share of young members	-0.32**	-0.64**	-0.08**	-0.27	-0.48	-0.36°	-0.03	-0.29*	-0.09
	(0.04)	(0.09)	(0.01)	(0.19)	(0.32)	(0.19)	(0.07)	(0.11)	(0.07)
HH share of old members	-0.20**	-0.17°	-0.06**	-0.36	-0.52	-0.41	-0.46**	-0.96**	-0.58**
	(0.05)	(0.09)	(0.01)	(0.35)	(0.58)	(0.36)	(0.10)	(0.17)	(0.11)
Constant	-0.21*	-0.17	-0.03	4.86**	4.38**	6.61**	4.03**	4.35**	5.73**
	(0.09)	(0.16)	(0.02)	(0.37)	(0.90)	(0.41)	(0.16)	(0.32)	(0.17)
Observations	2,652	2,652	2,652	472	472	472	2,180	2,178	2,180
R-squared	0.22	0.22	0.20	0.61	0.45	0.61	0.52	0.32	0.50
Adjusted R-squared	0.19	0.19	0.17	0.51	0.31	0.51	0.50	0.29	0.48

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1 Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Columns 4-6 show the results of the consumption equations for the sub-sample of households with migrants and columns 7-9 the results for the sub-sample of households without migrants.

Table 3.8.: Effects on education - Enrollment

VARIABLES	(1) Number of enrolled HH mem-bers	(2) Number of enrolled male HH members	(3) Number of enrolled fem. HH members	(4) Number of enrolled school kids	(5) Number of enrolled male school kids	(6) Number of enrolled female school kids	(7) Number of enrolled students	(8) Number of enrolled male students	(9) Number of enrolled female students
Cotton PSU*year 2009*agricultural HH	0.04	0.02	0.02	0.12	0.03	0.08	-0.11	-0.06	-0.05
	(0.26)	(0.18)	(0.15)	(0.11)	(0.07)	(0.08)	(0.11)	(0.09)	(0.07)
Cotton PSU*year 2011*agricultural HH	-0.26	-0.11	-0.10	0.02	0.02	-0.00	-0.13	-0.07	-0.07
	(0.27)	(0.17)	(0.18)	(0.12)	(0.09)	(0.09)	(0.10)	(0.07)	(0.07)
HH head married	-0.23°	-0.11°	-0.10	-0.02	-0.03	-0.00	-0.00	-0.01	-0.00
	(0.12)	(0.07)	(0.07)	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)
HH head single	-0.53*	-0.29*	-0.25*	-0.04	-0.02	-0.04	-0.15°	-0.12**	-0.05
	(0.20)	(0.14)	(0.12)	(0.10)	(0.07)	(0.08)	(0.08)	(0.05)	(0.06)
HH size	-0.05**	-0.04**	-0.06**	-0.03**	-0.01**	-0.01**	-0.02**	-0.01**	-0.02**
	(0.02)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
HH head age	-0.02**	-0.01**	-0.01**	0.00°	0.00	0.00	0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	-0.22**	-0.10*	-0.13**	0.03	0.03	0.00	-0.04	-0.02	-0.03
	(0.07)	(0.05)	(0.04)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
HH head tertiary education	-0.03	0.03	-0.07	0.05	0.03	0.01	0.03	0.03	-0.00
	(0.09)	(0.06)	(0.05)	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)	(0.02)
HH head high occupation	0.06	-0.01	0.06	0.05	0.01	0.04°	0.13**	0.08**	0.04°
	(0.09)	(0.05)	(0.05)	(0.03)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)
HH head occupations 4,5,7 or8	0.09	0.03	0.04	0.05	0.01	0.04°	0.05°	0.03	0.02
	(0.07)	(0.04)	(0.04)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
HH head skilled agricultural occupation	-0.07	-0.05	-0.04	0.06	0.03	0.03	0.03	0.02	-0.00
	(0.09)	(0.05)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
HH female head	-0.18°	-0.08	-0.12°	-0.06°	-0.03	-0.03	-0.04	-0.01	-0.03
	(0.11)	(0.06)	(0.07)	(0.04)	(0.03)	(0.03)	(0.04)	(0.02)	(0.03)
HH share of old members	0.33°	0.27*	0.19°	-0.05	-0.01	-0.04	-0.24**	-0.05	-0.14**
	(0.20)	(0.11)	(0.11)	(0.06)	(0.04)	(0.04)	(0.06)	(0.05)	(0.04)
Number of HH members in respective enrollment age	0.48**	0.63**	0.54**	0.87**	0.89**	0.80**	0.11**	0.18**	0.12**
	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Constant	1.81**	0.80**	0.93**	-0.19	-0.04	-0.08	0.42*	0.22*	0.25**
	(0.35)	(0.19)	(0.23)	(0.15)	(0.09)	(0.12)	(0.16)	(0.10)	(0.09)
Observations	2,652	2,652	2,652	2,652	2,652	2,652	2,652	2,652	2,652
R-squared	0.35	0.52	0.42	0.86	0.88	0.82	0.19	0.23	0.18
Adjusted R-squared	0.33	0.51	0.40	0.86	0.88	0.82	0.16	0.20	0.14

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Instead of using enrollment shares as dependent variables, I include the number of household members in the respective enrollment age as independent variable. Because this variable is strongly correlated with household size, using enrollment shares as dependent variables could lead to severe endogeneity problems.

Table 3.9.: Effects on education – Spending per month

VARIABLES	(1) Log of spending on educ.	(2) Log of spending educ. for male	(3) Log of spending educ. for fem.	(4) Log of ed. spend. per enroll. member	(5) Log of ed. spend. per enroll. male	(6) Log of ed. spend. per enroll. female	(7) Log of spending school for male	(8) Log of spending school for female	(9) Log of spending for male students	(10) Log of spending for female students	(11) Log of spend. for adults and children
Cotton PSU*year 2009*agricultural HH	0.01	-0.01	-0.32	0.02	0.19	-0.18	0.11	0.19	0.38	-1.40	0.02
	(0.29)	(0.35)	(0.28)	(0.26)	(0.31)	(0.27)	(0.29)	(0.26)	(0.80)	(1.58)	(0.29)
Cotton PSU*year 2011*agricultural HH	0.18	0.17	0.28	0.26	0.23	0.35	-0.15	0.29	0.53	1.24	0.29
	(0.34)	(0.38)	(0.35)	(0.29)	(0.34)	(0.31)	(0.36)	(0.29)	(0.83)	(1.80)	(0.34)
HH head married	-0.14	-0.16	-0.05	-0.10	-0.13	-0.04	-0.10	-0.03	0.14	-0.31	-0.15
	(0.11)	(0.13)	(0.14)	(0.10)	(0.12)	(0.13)	(0.13)	(0.13)	(0.51)	(0.49)	(0.10)
HH head single	-0.57*	-0.63**	0.09	-0.39°	-0.47*	0.01	-0.50*	0.01	-0.18	0.42	-0.57*
	(0.28)	(0.20)	(0.29)	(0.20)	(0.20)	(0.28)	(0.25)	(0.30)	(0.87)	(0.88)	(0.27)
HH size	0.05**	0.04**	0.03**	0.01	0.01	-0.00	0.01	0.02*	0.03	0.05	0.05**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.07)	(0.01)
HH head age	-0.00	-0.01	0.00	-0.00	-0.00	0.00	-0.00	0.00	0.02	0.01	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.02)	(0.00)
HH head secondary education	0.16*	0.20*	0.18*	0.16*	0.21**	0.16*	0.20**	0.15*	0.51	0.61	0.18*
	(0.07)	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)	(0.07)	(0.08)	(0.33)	(0.45)	(0.07)
HH head tertiary education	0.38**	0.41**	0.29*	0.37**	0.38**	0.33**	0.35**	0.16	0.71	0.88°	0.40**
	(0.10)	(0.13)	(0.12)	(0.10)	(0.12)	(0.11)	(0.10)	(0.11)	(0.48)	(0.51)	(0.10)
HH head high occupation	0.26**	0.26*	0.21*	0.20*	0.22*	0.17°	0.13	0.25*	0.22	0.55	0.27**
	(0.09)	(0.10)	(0.10)	(0.08)	(0.09)	(0.09)	(0.10)	(0.10)	(0.30)	(0.42)	(0.09)
HH head occupations 4,5,7 or 8	0.13°	0.07	0.16°	0.07	0.03	0.09	0.05	0.16°	0.11	0.55	0.11
	(0.07)	(0.09)	(0.08)	(0.06)	(0.08)	(0.08)	(0.08)	(0.08)	(0.29)	(0.43)	(0.07)
HH head skilled agricultural occupation	0.12	0.18°	0.05	0.11	0.12	0.06	0.10	0.05	0.11	0.56	0.13
	(0.08)	(0.09)	(0.09)	(0.07)	(0.08)	(0.08)	(0.08)	(0.08)	(0.35)	(0.49)	(0.08)
HH female head	-0.10	-0.14	-0.01	-0.09	-0.09	-0.02	-0.09	-0.03	0.26	0.20	-0.12
	(0.11)	(0.13)	(0.13)	(0.10)	(0.12)	(0.13)	(0.12)	(0.12)	(0.44)	(0.46)	(0.11)
HH share of young members	-0.10	-0.93**	-0.24	-1.15**	-1.39**	-0.72**	0.30°	0.73**	0.20	-1.29	-0.11
	(0.15)	(0.20)	(0.18)	(0.13)	(0.18)	(0.15)	(0.18)	(0.16)	(0.62)	(0.96)	(0.15)
HH share of old members	-0.10	0.22	-0.54	-0.06	0.19	-0.35	0.40	-0.15	-1.48	-1.43	-0.02
	(0.34)	(0.47)	(0.38)	(0.32)	(0.45)	(0.36)	(0.46)	(0.36)	(1.44)	(2.17)	(0.35)
Constant	3.68**	3.34**	2.98**	3.44**	3.33**	3.00**	2.51**	2.00**	1.15	3.21°	3.73**
	(0.43)	(0.52)	(0.49)	(0.40)	(0.49)	(0.47)	(0.57)	(0.45)	(1.47)	(1.72)	(0.45)
Observations	1,988	1,538	1,426	1,988	1,538	1,426	1,382	1,288	296	218	2,006
R-squared	0.27	0.28	0.31	0.36	0.34	0.37	0.31	0.34	0.42	0.52	0.28
Adjusted R-squared	0.24	0.23	0.26	0.32	0.30	0.32	0.26	0.29	0.16	0.19	0.24

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Spending in education is reported in Tajik Somoni on average per month.

Table 3.10.: Effects on household investments in health

VARIABLES	(1) Log of total health spending	(2) Log of spend. for ambulatory care	(3) Log of spend. for hospital	(4) Number of treated in ambulatory care	(5) Log of ambulatory spend. per treated	(6) Log of ambulatory spend. per capita	(7) Number of members in hospital	(8) Log of hospital spend. per treated	(9) Log of hospital spend. per capita	(10) Log of hours not worked due to illness
Cotton PSU*year 2009*agricultural HH	0.10	0.73	0.30	0.06	0.72	0.69	-0.08	0.28	0.55	
	(0.49)	(0.58)	(0.38)	(0.18)	(0.60)	(0.63)	(0.14)	(0.40)	(0.42)	
Cotton PSU*year 2011*agricultural HH	0.53	1.22°	0.37	0.14	0.84	0.97	0.01	0.42	0.35	-0.23
	(0.57)	(0.68)	(0.55)	(0.14)	(0.67)	(0.74)	(0.15)	(0.55)	(0.55)	(0.41)
HH head married	-0.02	0.14	0.12	0.05	0.11	-0.05	0.04	0.02	-0.05	-0.10
	(0.24)	(0.25)	(0.17)	(0.07)	(0.22)	(0.26)	(0.05)	(0.17)	(0.21)	(0.19)
HH head single	-0.08	-0.27	0.24	-0.17	-0.03	0.12	-0.03	0.16	0.32	-0.35
	(0.55)	(0.73)	(0.40)	(0.12)	(0.85)	(0.92)	(0.09)	(0.40)	(0.73)	(0.27)
HH size	0.02	-0.00	0.00	0.07**	-0.03°		0.06**	-0.01		0.03°
	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)		(0.01)	(0.01)		(0.02)
HH head age	0.00	0.00	0.00	-0.00°	0.00	-0.02**	0.00	0.00	-0.02**	0.01
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	0.06	0.10	0.00	-0.00	0.03	0.14	0.01	0.01	-0.01	0.21°
	(0.14)	(0.16)	(0.11)	(0.05)	(0.16)	(0.17)	(0.03)	(0.11)	(0.12)	(0.12)
HH head tertiary education	0.36°	0.25	0.06	0.01	0.18	0.34	0.05	0.06	0.13	0.14
	(0.19)	(0.23)	(0.17)	(0.05)	(0.23)	(0.23)	(0.05)	(0.16)	(0.17)	(0.15)
HH head high occupation	-0.36*	-0.04	-0.28*	-0.10*	-0.01	0.02	-0.04	-0.27°	-0.22	-0.15
	(0.16)	(0.16)	(0.13)	(0.04)	(0.16)	(0.17)	(0.04)	(0.14)	(0.14)	(0.12)
HH head occupations 4,5,7 or 8	-0.15	-0.27°	-0.08	-0.02	-0.20	-0.19	0.01	-0.10	-0.02	-0.10
	(0.13)	(0.15)	(0.12)	(0.05)	(0.16)	(0.17)	(0.03)	(0.11)	(0.12)	(0.12)
HH head skilled agricultural occupation	0.02	-0.19	-0.03	-0.04	-0.17	-0.23	-0.01	-0.04	-0.03	0.04
	(0.16)	(0.17)	(0.13)	(0.05)	(0.17)	(0.18)	(0.04)	(0.14)	(0.14)	(0.13)
HH female head	-0.08	0.13	-0.12	0.09	0.12	0.19	0.12*	-0.20	-0.02	-0.17
	(0.22)	(0.24)	(0.17)	(0.07)	(0.21)	(0.24)	(0.05)	(0.15)	(0.20)	(0.17)
HH share of young members	-0.22	-0.70°	-0.30	-0.16°	-0.67°	-1.70**	-0.14*	-0.28	-1.12**	-0.45*
	(0.28)	(0.37)	(0.22)	(0.08)	(0.38)	(0.35)	(0.07)	(0.22)	(0.23)	(0.21)
HH share of old members	-0.06	-0.68	0.24	0.31**	-0.86	0.73	0.07	0.11	1.54**	0.17
	(0.49)	(0.50)	(0.44)	(0.11)	(0.52)	(0.50)	(0.09)	(0.42)	(0.45)	(0.39)
Constant	4.01**	3.73**	6.00**	0.19	3.62**	3.72**	-0.19	6.24**	5.51**	1.92**
	(0.61)	(0.96)	(0.59)	(0.19)	(0.95)	(0.95)	(0.16)	(0.53)	(0.62)	(0.49)
Observations	1,036	592	707	2,652	592	592	2,652	707	707	598
R-squared	0.17	0.27	0.19	0.13	0.26	0.29	0.13	0.19	0.22	0.19
Adjusted R-squared	0.09	0.12	0.06	0.10	0.11	0.15	0.10	0.06	0.10	0.05

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Spending on health is reported in Tajik Somoni. Spending for ambulatory medical assistance is reported for the last month and spending for hospital treatment for the last year. For total spending on health in column1, I compute the monthly average for hospital spending and add ambulatory spending.

Table 3.11.: Effects on entrepreneurial activity

VARIABLES	(1) HH owns a family enter-prise	(2) N. of workers in family enterprise	(3) Log of hours worked in family enter-prise
Cotton PSU*year 2009*agricultural HH	-0.01	0.43	-0.27
	(0.11)	(0.35)	(0.22)
Cotton PSU*year 2011*agricultural HH	0.11	0.90*	-0.08
	(0.13)	(0.35)	(0.19)
N. of workers in family enterprise			0.43**
			(0.02)
HH head married	0.02	-0.17°	0.02
	(0.03)	(0.09)	(0.06)
HH head single	-0.07	-0.19	-0.02
	(0.05)	(0.17)	(0.24)
HH size	0.01*	0.16**	-0.01
	(0.00)	(0.02)	(0.01)
HH head age	-0.00	-0.00	0.00*
	(0.00)	(0.00)	(0.00)
HH head secondary education	-0.02	0.03	-0.01
	(0.03)	(0.07)	(0.04)
HH head tertiary education	-0.02	-0.04	0.03
	(0.03)	(0.10)	(0.06)
HH head high occupation	-0.04	0.12	-0.09
	(0.03)	(0.09)	(0.06)
HH head occupations 4,5,7 or 8	0.17**	0.37**	0.06
	(0.03)	(0.07)	(0.04)
HH head skilled agricultural occupation	0.05	0.62**	-0.01
	(0.03)	(0.11)	(0.05)
HH female head	0.01	-0.12	-0.04
	(0.03)	(0.08)	(0.06)
HH share of young members	-0.01	-0.93**	0.05
	(0.05)	(0.16)	(0.08)
HH share of old members	-0.01	-0.07	-0.56**
	(0.08)	(0.16)	(0.17)
Constant	0.28*	0.24	3.08**
	(0.11)	(0.30)	(0.24)
Observations	2,652	2,652	1,539
R-squared	0.17	0.39	0.58
Adjusted R-squared	0.14	0.37	0.55

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1
Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy.

Table 3.12.: Effects on extensive labor supply

VARIABLES	(1) N. of workers	(2) N. of agr. workers	(3) N. of non-agr. workers	(4) N. of female workers	(5) N. of fem. agr. workers	(6) N. of fem. Non-agr. workers	(7) N. of male workers	(8) N. of male agr. workers	(9) N. of male Non-agr. workers	(10) N. of kids working	(11) N. of kids working in agric.	(12) N. of old working	(13) HH sends mem. to oth. farms
Cotton PSU*year 2009	0.10	0.30*	-0.20	0.07	0.27**	-0.20**	0.03	0.03	-0.00	0.02	0.03	-0.02	
	(0.13)	(0.14)	(0.12)	(0.09)	(0.10)	(0.07)	(0.09)	(0.07)	(0.09)	(0.06)	(0.05)	(0.04)	
Cotton PSU*year 2011	0.33*	0.50**	-0.16	0.17°	0.30**	-0.14°	0.16	0.19°	-0.03	0.04	0.07	0.02	
	(0.16)	(0.18)	(0.13)	(0.09)	(0.11)	(0.08)	(0.10)	(0.10)	(0.09)	(0.05)	(0.05)	(0.04)	
Cotton PSU*year 2011*agricultural HH													0.10
													(0.13)
HH head married	-0.16*	-0.07	-0.09	-0.03	0.01	-0.04	-0.13*	-0.08	-0.05	0.03	0.04	0.04*	-0.06
	(0.08)	(0.08)	(0.07)	(0.06)	(0.06)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.02)	(0.05)
HH head single	-0.20	0.11	-0.31*	-0.10	-0.02	-0.08	-0.10	0.13	-0.23*	-0.03	-0.02	-0.03	-0.04
	(0.19)	(0.17)	(0.13)	(0.11)	(0.13)	(0.09)	(0.13)	(0.10)	(0.09)	(0.02)	(0.02)	(0.05)	(0.11)
HH size	0.31**	0.20**	0.11**	0.12**	0.11**	0.01*	0.19**	0.09**	0.10**	0.01**	0.01**	0.01**	0.02**
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
HH head age	-0.00	-0.01*	0.01**	-0.00**	-0.01**	0.00	0.00*	-0.00	0.00**	-0.00**	-0.00*	0.00**	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	-0.02	-0.10	0.08	-0.04	-0.10*	0.06°	0.02	-0.00	0.02	-0.03	-0.01	0.03	0.03
	(0.06)	(0.07)	(0.06)	(0.04)	(0.05)	(0.03)	(0.05)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)	(0.04)
HH head tertiary education	-0.02	-0.29**	0.27**	-0.00	-0.12*	0.12**	-0.02	-0.16**	0.15**	-0.00	0.02	0.03	0.00
	(0.07)	(0.08)	(0.07)	(0.05)	(0.06)	(0.04)	(0.05)	(0.05)	(0.05)	(0.03)	(0.02)	(0.03)	(0.05)
HH head high occupation	0.66**	0.08	0.58**	0.04	-0.06	0.10**	0.62**	0.14**	0.48**	-0.05**	-0.05**	0.16**	-0.15**
	(0.07)	(0.07)	(0.07)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.02)	(0.02)	(0.03)	(0.04)
HH head occupations 4,5,7 or 8	0.54**	-0.20**	0.74**	0.01	-0.12**	0.13**	0.53**	-0.08*	0.61**	0.00	-0.02	0.10**	-0.09**
	(0.06)	(0.06)	(0.05)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.02)	(0.01)	(0.02)	(0.04)
HH head skilled agricultural occupation	0.85**	1.25**	-0.40**	0.19**	0.44**	-0.25**	0.66**	0.81**	-0.15**	0.04	0.05°	0.19**	-0.15**
	(0.07)	(0.09)	(0.05)	(0.05)	(0.07)	(0.03)	(0.05)	(0.05)	(0.04)	(0.03)	(0.03)	(0.02)	(0.06)
HH female head	-0.30**	-0.21**	-0.09	0.14*	-0.00	0.14**	-0.44**	-0.20**	-0.23**	0.04	0.05	0.03°	-0.02
	(0.07)	(0.07)	(0.06)	(0.05)	(0.06)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.02)	(0.05)
HH share of young members	-2.11**	-1.22**	-0.89**	-0.94**	-0.62**	-0.31**	-1.17**	-0.59**	-0.58**	0.01	0.02	-0.01	-0.20**
	(0.14)	(0.16)	(0.10)	(0.09)	(0.10)	(0.06)	(0.09)	(0.09)	(0.08)	(0.04)	(0.04)	(0.04)	(0.06)
HH share of old members	-0.52**	-0.02	-0.50**	-0.09	-0.02	-0.07	-0.43**	-0.00	-0.43**	-0.00	0.02	1.27**	-0.17°
	(0.13)	(0.15)	(0.11)	(0.08)	(0.10)	(0.06)	(0.10)	(0.09)	(0.08)	(0.03)	(0.03)	(0.09)	(0.08)
Constant	1.25**	0.54*	0.71**	1.15**	0.40*	0.76**	0.10	0.14	-0.05	0.09	0.03	-0.37**	0.10
	(0.25)	(0.27)	(0.21)	(0.17)	(0.20)	(0.15)	(0.17)	(0.15)	(0.14)	(0.10)	(0.09)	(0.08)	(0.18)
Observations	2,652	2,652	2,652	2,652	2,652	2,652	2,652	2,652	2,652	2,652	2,652	2,652	1,252
R-squared	0.56	0.54	0.45	0.29	0.44	0.38	0.52	0.43	0.42	0.10	0.11	0.36	0.29
Adjusted R-squared	0.54	0.52	0.43	0.26	0.42	0.35	0.51	0.40	0.40	0.06	0.07	0.34	0.24

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

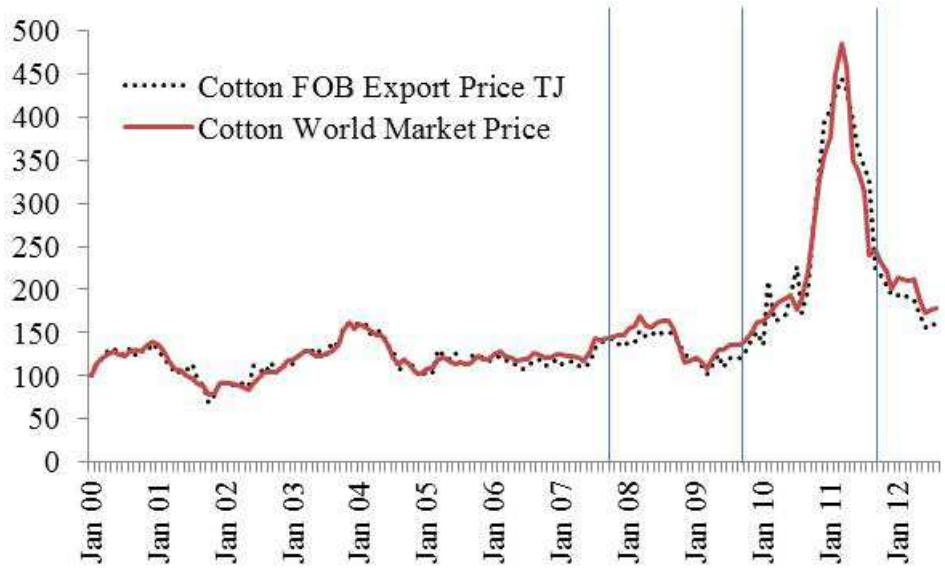
Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Columns 1-12 use the number of workers of a specific type per household as dependent variables. I do not use the Dif-in-Dif-in-Dif specification here, because the dummy for an agricultural household would be endogenous to the number of agricultural workers. For comparability, I use this specification for all dependent variables. Column 13 uses a dummy as dependent variable that indicates whether the household had sent members to other farms for harvesting activities. This variable is only available for the years 2007 and 2011.

Table 3.13.: Effects on intensive labor supply

VARIABLES	(1) Log of hours worked	(2) Log of h. worked by female	(3) Log of h. worked by male	(4) Log of h. worked by kids	(5) Log of h. work, by fem. kids	(6) Log of h. worked by old	(7) Log of hours worked in agricu.	(8) Log of h. worked in non-agricu.	(9) Log of h. w. of fem. in agric.	(10) Log of h. w. of fem. in non-agri.	(11) Log of h. w. of male in agric.	(12) Log of h. w. of male in non-agri.	(13) Log of h. w. of kids in agric.
Cotton PSU*year 2009							-0.13	0.05	-0.13	0.11	-0.23*	0.07	-0.71*
							(0.09)	(0.07)	(0.10)	(0.10)	(0.10)	(0.08)	(0.34)
Cotton PSU*year 2011							-0.14	-0.04	-0.16	-0.10	-0.24	0.04	-0.07
							(0.11)	(0.08)	(0.10)	(0.10)	(0.15)	(0.08)	(0.54)
Cotton PSU*year 2009*agricultural HH	-0.19°	-0.25*	-0.43**	-1.77*	0.00	0.16							
	(0.11)	(0.12)	(0.13)	(0.88)	(0.00)	(0.61)							
Cotton PSU*year 2011*agricultural HH	-0.10	-0.17	-0.24	0.23	0.71	-0.92							
	(0.13)	(0.12)	(0.15)	(0.66)	(0.62)	(0.67)							
Number of respective workers	0.33**	0.53**	0.50**	0.66**	0.72**	0.75**	0.38**	0.49**	0.52**	0.63**	0.53**	0.56**	0.67**
	(0.01)	(0.01)	(0.02)	(0.09)	(0.23)	(0.16)	(0.01)	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)	(0.11)
HH head married	-0.00	0.05	-0.04	0.10	-0.15	-0.02	0.03	-0.03	0.12°	0.01	-0.11	-0.03	0.17
	(0.04)	(0.05)	(0.05)	(0.23)	(0.21)	(0.21)	(0.07)	(0.05)	(0.07)	(0.07)	(0.09)	(0.06)	(0.27)
HH head single	-0.06	0.07	0.07	0.00	0.00	-0.30	0.43*	-0.08	0.47**	-0.01	0.68**	-0.03	0.00
	(0.10)	(0.10)	(0.13)	(0.00)	(0.00)	(0.38)	(0.17)	(0.10)	(0.16)	(0.11)	(0.19)	(0.14)	(0.00)
HH size	0.00	-0.01	0.00	0.02	0.05°	0.00	-0.01°	0.00	-0.01	-0.00	-0.00	-0.00	0.02
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
HH head age	0.00*	0.00°	0.00	-0.00	-0.01*	-0.01	0.01*	0.00	0.00*	0.00	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
HH head secondary education	-0.05°	-0.01	-0.05	-0.14	-0.49**	0.03	-0.01	-0.06°	-0.00	-0.02	-0.10*	-0.05	-0.14
	(0.03)	(0.03)	(0.03)	(0.12)	(0.16)	(0.13)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.15)
HH head tertiary education	-0.03	-0.04	-0.04	0.03	-0.44°	-0.17	-0.07	-0.04	-0.07	-0.00	-0.07	-0.02	0.00
	(0.04)	(0.04)	(0.04)	(0.17)	(0.24)	(0.16)	(0.04)	(0.05)	(0.05)	(0.06)	(0.07)	(0.06)	(0.22)
HH head high occupation	0.11**	-0.00	-0.06	-0.34°	-0.44°	0.15	-0.00	0.01	-0.03	0.00	0.01	-0.14**	-0.33
	(0.03)	(0.03)	(0.04)	(0.18)	(0.24)	(0.18)	(0.05)	(0.03)	(0.06)	(0.04)	(0.09)	(0.05)	(0.22)
HH head occupations 4,5,7 or 8	0.19**	0.06°	0.06*	0.06	-0.01	-0.14	-0.07	0.12**	-0.05	0.11**	0.06	0.02	0.01
	(0.03)	(0.03)	(0.03)	(0.12)	(0.14)	(0.24)	(0.04)	(0.03)	(0.04)	(0.04)	(0.05)	(0.04)	(0.16)
HH head skilled agricultural occupation	0.08*	-0.01	-0.02	-0.01	-0.21	-0.11	0.08°	0.03	-0.04	0.02	0.02	-0.03	0.00
	(0.03)	(0.04)	(0.03)	(0.11)	(0.14)	(0.20)	(0.04)	(0.05)	(0.04)	(0.08)	(0.05)	(0.06)	(0.12)
HH female head	-0.13**	0.04	-0.08°	0.05	-0.11	-0.05	-0.13*	-0.08°	0.00	0.04	-0.24**	-0.02	0.07
	(0.04)	(0.04)	(0.04)	(0.20)	(0.19)	(0.20)	(0.06)	(0.05)	(0.06)	(0.06)	(0.09)	(0.05)	(0.25)
HH share of young members	-0.04	-0.08	-0.02	0.16	-0.61	-0.26	0.02	-0.07	0.03	-0.15°	0.08	-0.06	0.09
	(0.06)	(0.06)	(0.07)	(0.31)	(0.50)	(0.42)	(0.09)	(0.07)	(0.09)	(0.08)	(0.12)	(0.08)	(0.36)
HH share of old members	-0.40**	-0.27*	-0.14	0.77	0.24	0.03	-0.55**	-0.21°	-0.55**	-0.19	-0.07	-0.15	0.60
	(0.11)	(0.11)	(0.12)	(0.62)	(0.97)	(0.35)	(0.17)	(0.11)	(0.16)	(0.12)	(0.26)	(0.15)	(0.77)
Constant	3.36**	2.89**	3.51**	2.92**	1.77	3.57**	3.11**	3.37**	3.35**	2.86**	3.36**	3.60**	3.24**
	(0.14)	(0.15)	(0.17)	(0.97)	(1.28)	(0.69)	(0.39)	(0.16)	(0.30)	(0.20)	(0.49)	(0.19)	(0.94)
Observations	2,648	2,639	1,969	193	141	210	1,428	1,947	1,335	1,420	819	1,404	161
R-squared	0.62	0.48	0.54	0.72	0.80	0.61	0.68	0.57	0.59	0.32	0.61	0.47	0.74
Adjusted R-squared	0.60	0.46	0.51	0.50	0.54	0.32	0.66	0.55	0.56	0.27	0.56	0.43	0.51

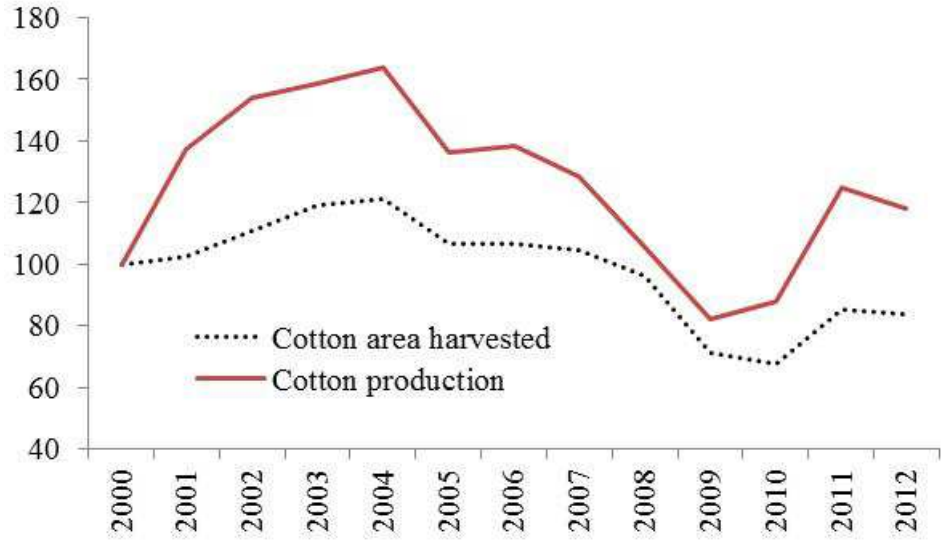
Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1 Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. The dependent variable hours worked is reported per week during the last two weeks. Instead of using hours worked per respective worker as dependent variable, I include the number of respective workers as independent variable. Because this variable is strongly correlated with household size, using hours worked per worker as dependent variables leads to severe endogeneity problems.

Appendix 3 A Tables and Figures



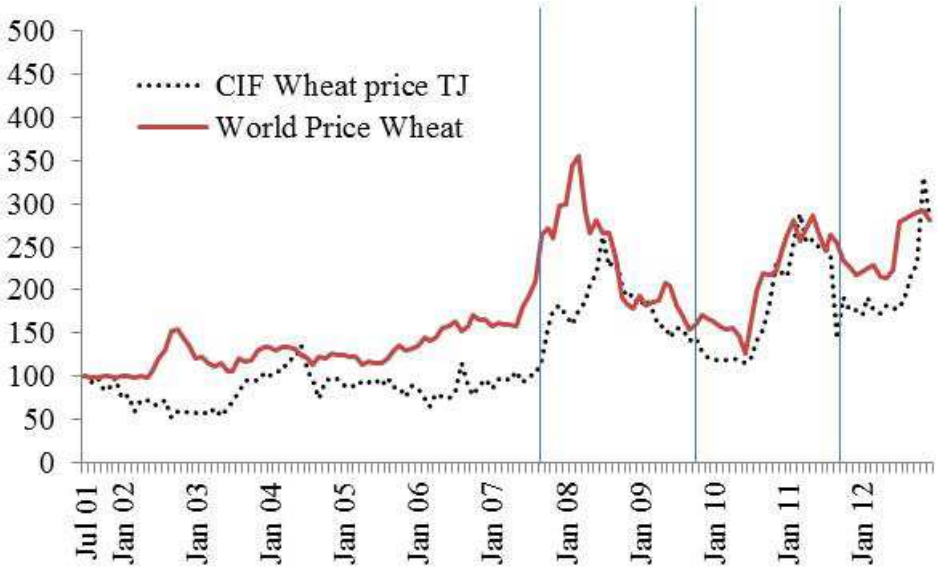
Appendix Figure 3.2.: Cotton world market price (100=2000)

Note: The vertical lines mark survey dates. Source: IMF Primary Commodity Prices (Cotton Outlook 'A Index', Middling 1-3/32 inch staple, CIF Liverpool, US cents per pound) and Statistical Agency of Tajikistan.



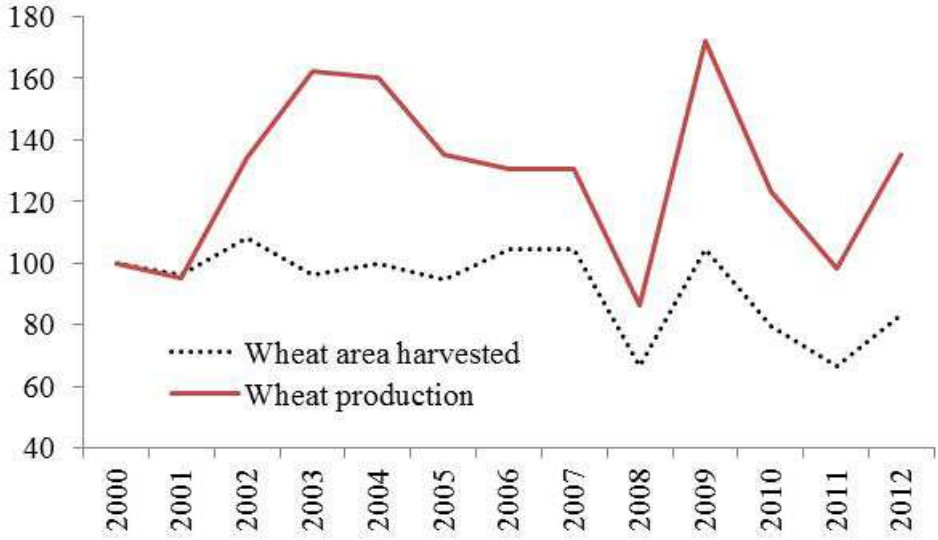
Appendix Figure 3.3.: Cotton production and land area harvested (100=2000)

Source: United States Department of Agriculture (USDA) - Foreign Agricultural Service (FAS)



Appendix Figure 3.4.: Wheat world market price (100=2001)

Note: Vertical lines mark survey dates. Source: IMF Primary Commodity Prices (Wheat, No.1 Hard Red Winter, ordinary protein, FOB Gulf of Mexico, US$ per metric ton) and Statistical Agency of Tajikistan



Appendix Figure 3.5.: Wheat production and land area harvested (100=2000)

Source: United States Department of Agriculture (USDA) - Foreign Agricultural Service (FAS)

Appendix Table A 3.14.: Cotton exports and imports by country

	Share of world export for ginned cotton (lint) Ranking according to 2011				Cotton imports (in 1'000 480 lb. Bales) Ranking according to 2011			
	Country	**2010**	**2011**		**Country**	**2009**	**2010**	**2011**
1	United States	40.5%	25.5%	1	China	10,903	11,979	24,533
2	India	14.1%	24.1%	2	Bangladesh	3,900	3,700	3,200
3	Brazil	5.6%	10.4%	3	Turkey	4,394	3,350	2,382
4	Australia	7.1%	10.1%	4	Indonesia	2,500	2,400	2,300
5	Uzbekistan	7.5%	5.4%	5	Vietnam	1,695	1,569	1,625
6	Pakistan	1.9%	2.7%	6	Thailand	1,806	1,752	1,263
7	Malaysia	n.a.	2.2%	7	South Korea	1,010	1,038	1,170
8	Greece	2.1%	2.2%	8	Malaysia	271	290	1,125
9	Turkmenistan	3.1%	1.6%	9	Mexico	1,393	1,196	1,000
10	Mali	1.3%	1.4%	10	Pakistan	1,574	1,443	900
12	Tajikistan	1.1%	1.1%					

Source: United States Department of Agriculture (USDA) - Foreign Agricultural Service (FAS)

Appendix Table A 3.15.: Two most important agricultural crops in cotton and non-cotton communities (communities included in the TLSS)

	First crop in PSU		**Second crop in PSU**	
	Non-cotton PSUs	Cotton PSUs	Non-cotton PSUs	Cotton PSUs
Cotton-growing	0	**44**	0	**60**
Gardening	5	1	**20**	2
Grain crops	**32**	6	8	**26**
Plant growing	3	1	0	0
Vegetable growing	**21**	**51**	**33**	**16**
Vineyard	2	1	0	0
Legumes	0	0	2	0
Total	**63**	**104**	**63**	**104**

Source: TLSS 2007

Appendix Table A 3.16.:Two most important economic activities in cotton and non-cotton communities (PSUs)

	First economic activity in PSU		Second economic activity in PSU	
	Non-cotton PSUs	Cotton PSUs	Non-cotton PSUs	Cotton PSUs
Agriculture	**55**	**56**	1	2
Mining	**5**	**6**	**2**	**5**
Manufacturing	0	5	2	5
Energy, Gas and Water	0	1	1	1
Construction	1	1	3	9
Retail Trade, Restaurants and Hotels	1	**30**	**13**	**21**
Transport	0	1	3	5
Finance, Real Estate and Insurance	0	0	0	2
Public Administration and Defense	0	0	2	2
Education	0	3	**29**	**14**
Health and Social Services	0	0	0	8
Other Services	0	0	0	11
Other	1	1	3	1
Total	**63**	**104**	**59**	**86**

Source: TLSS 2007

Appendix Table A 3.17.: Comparison of Cotton and Non-Cotton communities (Double T-tests or Ranksum-tests)

Variable	Cotton PSUs	Non-Cotton PSUs	P-Value for group comparison test (H0: no difference)
Population	6600	7210	68%
Altitude	684m	1301m	0%
Distance to Dushanbe	152km	257km	0%
Hours to drive to Dushanbe	5.9h	9.8h	1%
Distance to District Capital	13km	25km	0%
Hours to drive to District Capital	0.24h	1h	4%
School enrolment	same median	same median	97%
Weeks school close because of agriculture	0.4	0.2	15%
Share of population working in agriculture	lower than median	higher than median	0%
Quality of Roads	better	worse	1.6%
Part of crops planted on irrigated fields	higher than median	lower than median	2%

Source: TLSS 2007

Appendix Table A 3.18.: Number of households in controland treatment groups

	2007	**2009**	**2011**
Control group (agricultural households in non-cotton PSUs)	479	195	156
Treatment group (agricultural households in cotton PSUs)	595	291	267
Non-agricultural households in non-cotton PSUs	493	293	306
Non-agricultural households in cotton PSUs	1085	536	518
Total	**3050**	**1503**	**1504**

Appendix Table A 3.19.: Initial Characteristics of treatment and control group in 2007

Variable	Mean Control Group	Mean Treated HH	Difference Control minus Treated HH	SE of Difference	P-value (two-sided-TTest)	N Control group	N Treat-ment group
Dependent variables							
HH income (monthly)	549.36	597.82	-48.46	48.57	0.32	479	595
HH income per capita (monthly)	79.52	89.79	-10.27	7.41	0.17	479	595
HH wage income (monthly)	361.04	417.71	-56.67	42.24	0.18	479	595
Remittances (monthly)	606.08	748.91	-142.83	86.32	0.10	112	90
Other HH income (monthly)	14.42	39.95	-25.53	14.66	0.08	479	595
Social benefits received (last month)	22.70	19.94	2.75	2.89	0.34	479	595
Transfers received (monthly)	119.50	86.42	33.08	24.33	0.18	58	50
Transfers sent (monthly)	132.38	32.57	99.81	44.69	0.04	18	6
Food purchased (last 7 days, oxford scales), in Somoni	18.39	21.60	-3.21	1.02	0.00	479	595
Food consumed (last 7 days, oxford scales), in Somoni	38.11	32.80	5.31	1.55	0.00	479	595
Non-food consumed (per month, oxford scales), in Somoni	52.06	43.32	8.74	3.46	0.01	479	595
Total consumption (per month, oxford scales), in Somoni	204.51	174.53	29.98	7.91	0.00	479	595
HH spend on education per enrolled member (monthly)	21.86	21.79	0.07	3.45	0.98	374	482
Ed. Spend. per enrolled kid (monthly)	11.82	10.92	0.90	0.87	0.30	362	465
Share of kids enrolled	0.77	0.79	-0.02	0.02	0.32	398	506
Share of female kids enrolled	0.75	0.78	-0.03	0.03	0.35	297	379
Share of male kids enrolled	0.81	0.83	-0.02	0.02	0.47	324	395
Health spending per member (monthly)	4.73	2.56	2.17	1.30	0.09	479	595
Health spend. per ill member (monthly)	88.29	60.54	27.75	23.18	0.23	131	149
Share of ill members	0.05	0.05	0.01	0.01	0.22	479	595
HH with migrant (dummy)	0.23	0.15	0.08	0.02	0.00	479	595
Number of migrants	0.33	0.21	0.12	0.04	0.00	479	595
Share of migrants	0.04	0.03	0.02	0.00	0.00	479	595
Number of workers	2.44	2.65	-0.21	0.09	0.02	479	595
Number of non-agr. workers	0.60	0.58	0.02	0.05	0.74	479	595
Number of agri. workers	1.84	2.07	-0.23	0.08	0.00	479	595
Share of agri. workers	0.79	0.81	-0.02	0.02	0.33	479	595
Number of female workers	0.95	1.27	-0.32	0.06	0.00	479	595
Share of female workers	0.36	0.46	-0.10	0.02	0.00	479	595
Number of female agri. workers	0.84	1.16	-0.32	0.06	0.00	479	595
Share of female agri. workers	0.32	0.43	-0.11	0.02	0.00	479	595
Hours worked per worker (per week)	42.38	46.35	-3.97	0.88	0.00	479	595
Hours worked p. fem. work. (per week)	39.10	44.45	-5.34	1.20	0.00	305	468
Hours worked p. male worker (per week)	43.78	48.25	-4.47	0.99	0.00	430	516
Hours worked per kid work. (per week)	34.95	45.86	-10.91	2.89	0.00	51	76
Hours worked per fem. kid (per week)	38.96	46.80	-7.83	3.63	0.04	28	57
Hours worked per agr. Work. (per week)	41.57	46.43	-4.87	1.04	0.00	479	595
Hours work. p. fem. agr. work. (p. week)	39.48	45.11	-5.62	1.30	0.00	281	445
Hours worked per non-agr. w. (per week)	43.04	44.79	-1.75	1.33	0.19	204	245

HH Characteristics							
HH size (excluding migrants)	7.22	7.39	-0.17	0.17	0.31	479	595
HH size	7.54	7.60	-0.06	0.17	0.74	479	595
HH head single	0.01	0.00	0.00	0.00	0.50	479	595
HH head age	52.66	51.70	0.96	0.79	0.22	479	595
HH head sec educ	0.58	0.65	-0.07	0.03	0.02	479	595
HH head ter educ	0.15	0.10	0.05	0.02	0.01	479	595
HH head occhigh	0.14	0.09	0.05	0.02	0.02	479	595
HH head occ4578	0.13	0.18	-0.06	0.02	0.01	479	595
HH head occ ag skill	0.38	0.34	0.04	0.03	0.18	479	595
HH head low skill	0.35	0.38	-0.03	0.03	0.36	479	595
HH fem head	0.11	0.14	-0.03	0.02	0.18	479	595
HH sh young	0.37	0.39	-0.02	0.01	0.08	479	595
HH sh old	0.06	0.05	0.01	0.01	0.03	479	595
Household in deciles 1 and 2 of income distribution	0.35	0.24	0.12	0.03	0.00	479	595
Household in deciles 3 and 4 of income distribution	0.15	0.22	-0.08	0.02	0.00	479	595
Household in deciles 5 and 6 of income distribution	0.13	0.18	-0.05	0.02	0.04	479	595
Household in deciles 7 and 8 of income distribution	0.18	0.16	0.02	0.02	0.43	479	595
Household in deciles 9 and 10 of income distribution	0.19	0.20	-0.01	0.02	0.60	479	595
PSU and Sub-District Characteristics							
Distance of PSU to the province capital	3.63	1.03	2.60	0.20	0.00	358	530
Urban location (dummy)	0.05	0.07	-0.02	0.01	0.14	479	595
Male employment in the PSU (ordinal scale)	1.95	2.09	-0.14	0.07	0.03	479	595
Importance of non-agricultural activities in PSU (ordinal scale)	1.47	2.01	-0.54	0.08	0.00	479	595
Share of sub-district population below the poverty line (defined by 4th percentile of consumption distribution in Tajikistan in 2005)	41.94	45.08	-3.14	1.24	0.01	479	595
Percent of working population economically active in sub-district in 2005	56.80	71.59	-14.79	1.07	0.00	479	595
Percent of female working population economically active in sub-district in 2005	49.46	67.86	-18.40	1.35	0.00	479	595
Dependency ratio in sub-district in 2005	90.16	95.33	-5.17	0.87	0.00	479	595
Unemployment rate in sub-district in 2005	2.99	3.30	-0.31	0.24	0.19	479	595
Percentage of population above 17 with no or primary education in sub-district in 2005	20.89	20.51	0.38	0.43	0.37	479	595
Percentage of population above 17 with secondary education in sub-district in 2005	72.19	73.45	-1.26	0.41	0.00	479	595
Population density in sub-district (population per km2)	101.85	174.61	-72.76	9.85	0.00	454	500
Percentage of households with electricity in sub-district in 2005	92.25	93.73	-1.48	0.54	0.01	479	595
Percentage of households with landline telephone in sub-district in 2005	17.71	18.81	-1.10	1.29	0.39	479	595

Notes: All income and spending figures are in Tajik Somonis of 2007.

Appendix Table A 3.20.: Effects on total real HH income further robustness checks

VARIABLES	(1) logHHinc	(2) logHHinc	(3) logHHinc	(4) logHHinc	(5) logHHinc	(6) logHHinc	(7) logHHinc	(8) logHHinc	(9) logHHinc	(10) logHHinc	(11) logHHinc
Cotton PSU*year 2009*agricultural HH	0.07	0.00	0.05	-0.16	0.14	-0.03	-0.07	0.19	0.09	0.01	-0.36
	(0.22)	(0.23)	(0.22)	(0.27)	(0.54)	(0.27)	(0.56)	(0.23)	(0.23)	(0.22)	(0.31)
Cotton PSU*year 2011*agricultural HH	0.61**	0.55*	0.63**	0.61*	0.60°	0.61*	0.44	0.52*	0.76**	0.67**	0.54°
	(0.21)	(0.22)	(0.20)	(0.24)	(0.36)	(0.27)	(0.56)	(0.22)	(0.24)	(0.19)	(0.29)
HH head married	0.22**	0.10	0.22**	0.21**	0.14	0.24**	0.03	0.23**	0.23**	0.23**	0.35**
	(0.07)	(0.07)	(0.07)	(0.08)	(0.14)	(0.08)	(0.41)	(0.07)	(0.07)	(0.07)	(0.09)
HH head single	0.12	0.09	0.12	0.09	0.47	0.21°	-0.15	0.11	0.16	0.09	0.32**
	(0.10)	(0.10)	(0.10)	(0.10)	(0.29)	(0.12)	(0.45)	(0.11)	(0.11)	(0.10)	(0.11)
HH size	0.06**	0.06**	0.06**	0.06**	0.05**	0.06**	0.12**	0.06**	0.06**	0.07**	0.08**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
HH head age	0.00*	0.00*	0.00*	0.01*	0.00	0.01*	0.01	0.00*	0.00°	0.00*	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	0.01	0.00	0.01	-0.01	0.11	-0.02	0.08	0.00	0.01	-0.00	0.08
	(0.04)	(0.04)	(0.04)	(0.05)	(0.07)	(0.05)	(0.19)	(0.04)	(0.04)	(0.04)	(0.06)
HH head tertiary education	0.15*	0.13*	0.15*	0.14*	0.16	0.15°	-0.06	0.14*	0.14*	0.11°	0.18*
	(0.06)	(0.07)	(0.06)	(0.07)	(0.12)	(0.08)	(0.28)	(0.06)	(0.06)	(0.06)	(0.08)
HH head high occupation	0.12*	0.14*	0.13*	0.14*	0.07	0.11°	0.20	0.15**	0.10*	0.16**	0.21**
	(0.05)	(0.06)	(0.05)	(0.06)	(0.10)	(0.06)	(0.17)	(0.05)	(0.05)	(0.05)	(0.07)
HH head occupations 4,5,7 or 8	0.24**	0.21**	0.24**	0.22**	0.19*	0.23**	0.37*	0.26**	0.26**	0.26**	0.32**
	(0.04)	(0.05)	(0.04)	(0.05)	(0.08)	(0.05)	(0.15)	(0.04)	(0.04)	(0.04)	(0.07)
HH head skilled agricultural occupation	-0.02	0.01	-0.03	0.03	0.05	-0.05	-0.13	-0.04	-0.01	-0.03	-0.11
	(0.05)	(0.07)	(0.05)	(0.07)	(0.09)	(0.06)	(0.21)	(0.06)	(0.05)	(0.05)	(0.07)
HH female head	0.24**	0.10	0.25**	0.19*	0.27°	0.25**	0.39	0.25**	0.27**	0.27**	0.33**
	(0.07)	(0.07)	(0.07)	(0.08)	(0.14)	(0.08)	(0.36)	(0.07)	(0.07)	(0.07)	(0.09)
HH share of young members	-0.39**	-0.39**	-0.39**	-0.40**	-0.68**	-0.42**	-0.61	-0.39**	-0.44**	-0.52**	-0.39**
	(0.08)	(0.09)	(0.08)	(0.09)	(0.21)	(0.10)	(0.48)	(0.09)	(0.08)	(0.08)	(0.13)
HH share of old members	-0.28*	-0.30*	-0.28*	-0.27°	0.14	-0.32°	-0.21	-0.33*	-0.38**	-0.29*	-0.37*
	(0.14)	(0.14)	(0.14)	(0.15)	(0.44)	(0.17)	(0.91)	(0.14)	(0.14)	(0.13)	(0.16)
Constant	5.24**	5.50**	5.24**	5.22**	5.50**	4.50**	4.87**	5.19**	5.23**	5.00**	2.34**
	(0.24)	(0.25)	(0.24)	(0.26)	(0.50)	(1.57)	(0.91)	(0.24)	(0.26)	(0.20)	(0.39)
Observations	2,595	2,087	2,595	1,891	703	1,848	2,595	2,576	2,594	2,651	2,650
R-squared	0.57	0.58	0.57	0.60	0.59	0.57	0.82	0.56	0.55	0.57	0.49
Adjusted R-squared	0.55	0.56	0.55	0.57	0.52	0.54	0.43	0.54	0.53	0.55	0.47

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. The first column shows the baseline results for households with at least one female working member from table 1. Column 2 defines agricultural households as households with at least two members working in agriculture. Column 3 also considers the second occupations of individuals for the definition of agricultural HHs. The fourth column excludes all mixed households that have both agricultural and non-agricultural workers, whereas column five defines female households as households with at least two female working members. Column six excludes additional control variables at the village and sub-district level that are described in the summary statistics table. Column seven includes dummies for each household. In column eight until column eleven, I use the same specification as in column 1, but other measures for household income. Column eight uses household income excluding in kind payments and column nine includes a monthly average for bonus payments and social benefits instead of the payments received last month. In column ten, I treated households with zero income by imputing wage income and remittances for households that reported having workers or migrants, but did not show any wage earnings or remittances. Finally in column eleven, I simply included households with zero income by using log(1+income) instead of log(income).

Appendix Table A 3.21.: Effects on consumption (weighting consumption using oxford scales)

	OLS Reduced Form (1-4)				IV (5-8)			
VARIABLES	(1) Log of Food purchased	(2) Log of Food consumed	(3) Log of non-food spending	(4) Log of total consumption	(5) Log of Food purchased	(6) Log of Food consumed	(7) Log of non-food spending	(8) Log of total consumption
Cotton PSU*year 2009*agricultural HH	-0.15	-0.02	-0.04	-0.02	-0.14	-0.01	-0.00	-0.01
	(0.20)	(0.13)	(0.24)	(0.14)	(0.20)	(0.13)	(0.24)	(0.14)
Cotton PSU*year 2011*agricultural HH	0.20	0.21°	0.49*	0.29*				
	(0.17)	(0.13)	(0.21)	(0.13)				
HH head married	-0.01	-0.06	-0.04	-0.06	-0.09	-0.15*	-0.26*	-0.18*
	(0.06)	(0.05)	(0.08)	(0.05)	(0.10)	(0.08)	(0.13)	(0.08)
HH head single	0.27°	0.22**	-0.04	0.18°	0.24°	0.19*	-0.13	0.12
	(0.14)	(0.08)	(0.18)	(0.09)	(0.14)	(0.09)	(0.20)	(0.11)
HH head age	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00°	-0.01°	-0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	0.11*	0.09**	0.19**	0.11**	0.10*	0.08*	0.17**	0.10*
	(0.04)	(0.03)	(0.05)	(0.03)	(0.05)	(0.04)	(0.06)	(0.04)
HH head tertiary education	0.21**	0.13**	0.36**	0.18**	0.17*	0.10°	0.28**	0.13*
	(0.06)	(0.05)	(0.07)	(0.05)	(0.07)	(0.05)	(0.09)	(0.06)
HH head high occupation	0.18**	0.17**	0.18**	0.17**	0.15*	0.13**	0.09	0.11*
	(0.05)	(0.03)	(0.07)	(0.04)	(0.06)	(0.04)	(0.08)	(0.05)
HH head occupations 4,5,7 or 8	0.16**	0.13**	0.13*	0.13**	0.10	0.06	-0.04	0.03
	(0.04)	(0.03)	(0.05)	(0.03)	(0.07)	(0.05)	(0.10)	(0.06)
HH head skilled agricultural occupation	0.06	0.08*	0.03	0.07*	0.06	0.09*	0.05	0.08*
	(0.05)	(0.04)	(0.06)	(0.03)	(0.05)	(0.04)	(0.07)	(0.04)
HH female head	0.07	0.01	-0.06	0.00	0.00	-0.07	-0.24*	-0.10
	(0.06)	(0.04)	(0.08)	(0.04)	(0.09)	(0.07)	(0.12)	(0.07)
logHHinc					0.28	0.30	0.71*	0.42*
					(0.24)	(0.19)	(0.34)	(0.20)
Constant	2.91**	3.50**	3.70**	5.19**	1.58	2.06*	0.26	3.18**
	(0.23)	(0.15)	(0.29)	(0.16)	(1.21)	(0.96)	(1.72)	(1.01)
First stage (log of HH income instrumented)								
Cotton PSU*year 2011*agricultural HH					0.70**	0.70**	0.70**	0.70**
					(0.19)	(0.19)	(0.19)	(0.19)
Partial F-Test (F-statistics)					12.98	13.03	13.09	13.03
Observations	2,647	2,652	2,650	2,652	2,646	2,651	2,649	2,651
R-squared	0.47	0.46	0.27	0.44	0.43	0.38	0.13	0.31
Adjusted R-squared	0.44	0.44	0.25	0.42	0.41	0.35	0.10	0.28

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Consumption is measured in Tajik Somoni and weighted by oxford-scales. Food purchased and consumed is reported for the last 7 days, whereas food consumed includes food purchased plus self-produced food and in kind payments in food. Non-food consumption and overall consumption is computed as monthly average.

Appendix Table A 3.22.: Effects on consumption detailed food items (comparing purchased vs. subsistence consumption)

VARIABLES	(1) Log of grain purch.	(2) Log of grain not purch.	(3) Log of meat purch.	(4) Log of meat not purch.	(5) Log of fruits purch.	(6) Log of fruits not purch.	(7) Log of sweets purch.	(8) Log of sweets not pur.
Cotton PSU*year 2009*agricultural HH	-0.30	0.09	0.35°	0.00	0.14	-0.31	-0.13	-0.54
	(0.29)	(0.24)	(0.18)	(0.65)	(0.27)	(0.27)	(0.22)	(0.42)
Cotton PSU*year 2011*agricultural HH	0.08	-0.05	0.35	1.04	0.55°	-0.23	0.85*	0.29
	(0.24)	(0.32)	(0.22)	(1.06)	(0.32)	(0.32)	(0.36)	(0.71)
HH head married	0.12	0.01	0.05	0.41	0.08	-0.11	-0.00	0.15
	(0.08)	(0.09)	(0.07)	(0.25)	(0.09)	(0.11)	(0.09)	(0.21)
HH head single	-0.05	0.13	0.19	0.88*	0.07	-0.33	0.25	-0.07
	(0.26)	(0.30)	(0.18)	(0.43)	(0.23)	(0.24)	(0.19)	(0.58)
HH size	0.08**	0.10**	0.04**	0.10**	0.05**	0.05**	0.06**	-0.00
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)	(0.02)
HH head age	0.00	0.01*	0.00*	-0.00	0.00	0.00	0.01*	0.02**
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
HH head secondary education	-0.01	0.02	-0.02	-0.17	-0.02	0.20**	0.11°	0.18
	(0.06)	(0.06)	(0.05)	(0.16)	(0.07)	(0.07)	(0.06)	(0.12)
HH head tertiary education	0.02	-0.08	0.15*	-0.47°	0.11	0.18°	0.16°	0.33*
	(0.09)	(0.08)	(0.07)	(0.25)	(0.08)	(0.10)	(0.09)	(0.16)
HH head high occupation	0.08	0.03	0.09	0.03	0.10	0.00	0.06	0.11
	(0.08)	(0.06)	(0.06)	(0.17)	(0.07)	(0.08)	(0.07)	(0.13)
HH head occupations 4,5,7 or 8	0.07	0.02	0.11*	-0.31°	0.14**	0.01	0.04	0.04
	(0.06)	(0.06)	(0.04)	(0.19)	(0.05)	(0.07)	(0.06)	(0.12)
HH head skilled agricultural occupation	0.02	-0.00	-0.03	0.16	0.05	-0.04	0.04	0.22
	(0.09)	(0.07)	(0.06)	(0.19)	(0.07)	(0.07)	(0.06)	(0.14)
HH female head	0.03	-0.05	-0.07	-0.08	-0.02	-0.15	-0.06	0.05
	(0.08)	(0.09)	(0.07)	(0.20)	(0.09)	(0.10)	(0.08)	(0.19)
HH share of young members	-0.08	-0.01	-0.05	-0.45	-0.18	0.06	-0.06	0.41
	(0.13)	(0.11)	(0.10)	(0.36)	(0.12)	(0.12)	(0.10)	(0.25)
HH share of old members	-0.45*	-0.54*	-0.32*	-0.17	-0.50*	0.09	-0.58**	-0.62*
	(0.22)	(0.21)	(0.15)	(0.81)	(0.23)	(0.27)	(0.18)	(0.31)
Constant	2.16**	1.94**	2.48**	0.95	1.47**	1.43**	1.55**	-0.37
	(0.33)	(0.32)	(0.22)	(0.89)	(0.28)	(0.30)	(0.31)	(0.66)
Observations	2,447	1,791	1,919	271	1,804	1,371	2,312	1,359
R-squared	0.38	0.26	0.31	0.52	0.24	0.27	0.32	0.26
Adjusted R-squared	0.35	0.21	0.27	0.26	0.19	0.21	0.29	0.20

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. Consumption is reported for the last 7 days and measured in Tajik Somoni. Food purchased includes all items purchased on local markets. Food not purchased includes as self-produced food and in kind payments in food, but is also evaluated at market prices.

Appendix Table A 3.23.: IV Effects on consumption detailed food items

VARIABLES	(1) Log of grains cons.	(2) Log of vegetables cons.	(3) Log of fruits cons.	(4) Log of meat cons.	(5) Log of milk cons.	(6) Log of beverages cons.	(7) Log of sweets cons.
Log of HH income	0.13	0.11	0.69	0.42	0.06	0.19	0.90
	(0.21)	(0.28)	(0.46)	(0.30)	(0.27)	(0.30)	(0.57)
HH head married	0.02	-0.06	-0.18	-0.07	0.00	-0.05	-0.30°
	(0.08)	(0.10)	(0.16)	(0.11)	(0.09)	(0.11)	(0.18)
HH head single	0.15	0.08	-0.01	0.15	0.12	0.21	-0.05
	(0.14)	(0.13)	(0.22)	(0.20)	(0.11)	(0.23)	(0.20)
HH size	0.09**	0.06**	0.03	0.03	0.06**	0.02	0.01
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.03)
HH head age	0.00	0.01*	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
HH head secondary education	0.03	0.12**	0.15*	-0.03	0.14**	0.08°	0.14*
	(0.04)	(0.04)	(0.07)	(0.05)	(0.04)	(0.05)	(0.07)
HH head tertiary education	-0.06	0.13*	0.16°	0.07	0.21**	0.13°	0.09
	(0.05)	(0.06)	(0.09)	(0.08)	(0.06)	(0.07)	(0.10)
HH head high occupation	0.05	0.07	-0.01	0.04	0.09	0.17*	-0.03
	(0.05)	(0.06)	(0.10)	(0.08)	(0.06)	(0.08)	(0.11)
HH head occupations 4,5,7 or 8	0.02	-0.01	-0.04	0.02	0.10	0.06	-0.14
	(0.06)	(0.08)	(0.12)	(0.08)	(0.08)	(0.09)	(0.15)
HH head skilled agricultural occupation	0.01	0.09°	0.08	0.09	0.08°	0.15**	0.05
	(0.04)	(0.05)	(0.06)	(0.06)	(0.04)	(0.06)	(0.08)
HH female head	-0.11	-0.08	-0.28°	-0.21*	-0.02	-0.11	-0.37*
	(0.08)	(0.10)	(0.16)	(0.11)	(0.09)	(0.11)	(0.18)
HH share of young members	0.03	0.02	0.22	0.13	-0.00	0.13	0.52°
	(0.11)	(0.14)	(0.24)	(0.16)	(0.13)	(0.16)	(0.27)
HH share of old members	-0.35*	-0.57**	-0.12	-0.12	-0.19	-0.21	-0.50
	(0.17)	(0.17)	(0.29)	(0.19)	(0.18)	(0.20)	(0.32)
Cotton PSU*year 2009*agricultural HH	-0.18	0.07	-0.06	0.30	0.03	0.01	-0.19
	(0.15)	(0.16)	(0.26)	(0.18)	(0.15)	(0.19)	(0.28)
Constant	2.15*	1.45	-2.03	0.49	2.02	-0.32	-3.09
	(1.08)	(1.41)	(2.28)	(1.46)	(1.38)	(1.55)	(2.90)
First stage (log of HH income instrumented)							
Cotton PSU*year 2011*agricultural HH	0.70**	0.70**	0.72**	0.71**	0.69**	0.70**	0.67**
	(0.19)	(0.19)	(0.21)	(0.21)	(0.19)	(0.20)	(0.20)
Partial F-Test (F-statistics)	13.03	13.06	12.02	11.44	12.69	12.92	11.84
Observations	2,651	2,650	2,369	2,076	2,624	2,609	2,628
R-squared	0.47	0.33		0.22	0.39	0.29	0.03
R-squared (un-centered)	0.98	0.96	0.89	0.96	0.97	0.71	0.82

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. The table presents estimates for the income elasticity of consumption for 7 different food product groups using a Two-Stage-Least-Square (2SLS) estimation. I instrument the independent variable nominal household income using the interaction of the cotton PSU, the agricultural household and the year 2011 dummy as external instrument. Because for the 2SLS estimation using the ivregress-command in Stata the R-squared could not be computed for two columns, I also include the uncentered R-Square from a GMM-estimation using ivreg2.

Appendix Table A 3.24.: IVEffects on consumption detailed non-food items

VARIABLES	(1) Log of spending Personal care	(2) Log of spending Cleaning products	(3) Log of spending Fuel and transport	(4) Log of spending information	(5) Log of spending Other articles	(6) Log of spending Clothing and shoes	(7) Log of spending HH articles	(8) Log of spending Hobbies, Services	(9) Log of spending Cars and dwellling	(10) Log of spending Personal articles	(11) Log of spending For travel	(12) Log of spending Insurance and taxes	(13) Log of spending Marriage, oth. cer.
Log of HH income	0.64°	0.23	0.58	-0.24	2.39	0.43	1.16°	-0.20	0.26	0.04	0.24	0.86	1.80°
	(0.38)	(0.36)	(0.52)	(0.54)	(2.76)	(0.31)	(0.62)	(1.66)	(0.37)	(1.14)	(1.36)	(0.63)	(1.08)
HH head married	-0.21°	-0.10	-0.07	0.06	-0.38	-0.10	-0.39°	0.12	0.10	-0.11	-0.56	0.10	-0.60°
	(0.12)	(0.11)	(0.19)	(0.21)	(0.63)	(0.12)	(0.23)	(0.44)	(0.23)	(0.40)	(0.74)	(0.22)	(0.36)
HH head single	-0.11	0.01	-0.22	0.37	2.79	-0.23	-0.45	0.58	-0.58°	0.16	2.78**	-0.41	-0.50
	(0.22)	(0.17)	(0.40)	(0.47)	(3.86)	(0.27)	(0.31)	(0.82)	(0.35)	(1.17)	(0.53)	(0.43)	(0.32)
HH size	0.02	0.04*	0.05°	0.07*	-0.07	0.06**	-0.00	0.06	-0.01	0.08	0.07	-0.00	-0.03
	(0.02)	(0.02)	(0.03)	(0.03)	(0.15)	(0.02)	(0.03)	(0.12)	(0.03)	(0.14)	(0.06)	(0.03)	(0.06)
HH head age	-0.00	0.00	0.00	-0.00	-0.01	0.00	-0.00	0.00	0.01	-0.02	-0.01	0.00	-0.01
	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
HH head secondary education	0.01	0.07	0.15	-0.20	-0.21	0.13*	0.00	0.25°	-0.04	-0.34	-0.12	0.03	0.08
	(0.05)	(0.04)	(0.10)	(0.13)	(0.40)	(0.06)	(0.11)	(0.14)	(0.16)	(0.23)	(0.40)	(0.15)	(0.14)
HH head tertiary education	0.08	0.16*	0.25°	-0.05	-0.46	0.19*	0.06	0.50°	0.10	-0.14	0.18	0.09	0.07
	(0.08)	(0.07)	(0.13)	(0.16)	(0.52)	(0.08)	(0.18)	(0.28)	(0.20)	(0.33)	(0.48)	(0.15)	(0.19)
HH head high occupation	0.04	-0.04	0.08	0.29°	-0.25	0.13	-0.12	0.14	-0.10	0.02	-0.75	-0.35°	-0.35
	(0.08)	(0.06)	(0.13)	(0.16)	(0.76)	(0.09)	(0.14)	(0.47)	(0.19)	(0.30)	(0.52)	(0.20)	(0.25)
HH head occupations 4,5,7 or 8	-0.03	0.02	0.08	0.23	-0.28	-0.05	-0.20	0.15	-0.19	0.06	0.15	-0.22	-0.35
	(0.12)	(0.10)	(0.14)	(0.21)	(0.57)	(0.10)	(0.20)	(0.53)	(0.16)	(0.22)	(0.54)	(0.20)	(0.32)
HH head skilled agricultural occupation	0.08	0.03	0.02	-0.00	0.03	0.01	0.00	-0.05	-0.40*	0.18	-0.18	0.04	0.17
	(0.07)	(0.05)	(0.10)	(0.21)	(0.38)	(0.08)	(0.13)	(0.23)	(0.18)	(0.35)	(0.39)	(0.17)	(0.16)
HH female head	-0.28*	-0.13	-0.19	0.06	-0.60	-0.23°	-0.67**	0.14	0.02	-0.32	-0.37	-0.07	-0.74*
	(0.13)	(0.12)	(0.19)	(0.18)	(1.07)	(0.12)	(0.25)	(0.39)	(0.24)	(0.38)	(0.77)	(0.24)	(0.37)
HH share of young members	0.14	0.20	-0.10	-0.24	1.36	0.17	0.32	-0.02	0.44	-0.18	-0.29	0.29	0.17
	(0.20)	(0.17)	(0.29)	(0.25)	(1.79)	(0.18)	(0.31)	(1.26)	(0.34)	(0.99)	(0.78)	(0.32)	(0.60)
HH share of old members	-0.41°	-0.23	-0.26	-0.00	0.65	-0.83**	-0.30	-0.08	-0.56	2.37**	0.09	-0.19	0.09
	(0.22)	(0.21)	(0.28)	(0.45)	(1.08)	(0.27)	(0.44)	(0.77)	(0.71)	(0.72)	(1.20)	(0.45)	(0.55)
Cotton PSU*year 2009*agricultural HH	-0.18	-0.14	0.41	-0.18	0.74	0.13	-0.15	-0.19	0.27	0.29	0.91	0.35	1.06
	(0.18)	(0.17)	(0.30)	(0.62)	(1.79)	(0.22)	(0.37)	(1.12)	(0.55)	(0.89)	(1.49)	(0.47)	(0.68)
Constant	-0.43	1.17	-0.19	3.58	-10.16	2.76°	-3.08	4.01	2.72	6.17	4.34	-3.21	-3.68
	(1.89)	(1.87)	(2.72)	(2.91)	(14.74)	(1.59)	(3.15)	(9.43)	(2.18)	(6.46)	(7.56)	(3.59)	(5.46)
First stage (log of HH income instrumented)													
Cotton PSU*year 2011*agricultural HH	0.76**	0.65**	0.74**	0.82*	0.37	0.72**	0.77**	0.30	1.34**	0.67	0.90	0.83**	0.56*
	(0.20)	(0.19)	(0.23)	(0.38)	(0.30)	(0.20)	(0.24)	(0.37)	(0.32)	(0.62)	(0.64)	(0.28)	(0.26)
Partial F-Test (F-statistics)	14.71	11.63	10.55	4.61	1.48	13.34	9.84	0.67	17.61	1.2	1.99	9.02	4.69
Observations	2,517	2,555	1,776	567	917	2,536	1,645	593	880	396	355	771	1,579
R-squared	0.11	0.28	0.17	0.32		0.25	0.03	0.27	0.23	0.44	0.54	0.12	
R-squared (un-centered)	0.92	0.95	0.92	0.85	0.67	0.98	0.87	0.93	0.95	0.93	0.95	0.94	0.91

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. The table presents estimates for the income elasticity of consumption for 13 different food product groups using a Two-Stage-Least-Square (2SLS) estimation. I instrument the independent variable nominal household income using the interaction of the cotton PSU, the agricultural household and the year 2011 dummy as external instrument. Because for the 2SLS estimation using the ivregress-command in Stata the R-squared could not be computed for two columns, I also include the un-centered R-Square from a GMM-estimation using ivreg2

Appendix Table A 3.25.: Real monthly household income for HHs without/with migrants

	(1)	(2)	(3)	(4)	(5)	(6)
	Households without migrants			**Households with migrants**		
VARIABLES	logHHinc	logHHinc	logHHinc	logHHinc	logHHinc	logHHinc
Cotton PSU*year 2009*agricultural HH	-0.18	-0.49	-0.07	0.23	0.11	-0.16
	(0.17)	(0.30)	(0.24)	(0.35)	(0.50)	(0.52)
Cotton PSU*year 2011*agricultural HH	0.19	-0.55*	0.59**	0.57*	0.12	0.51
	(0.16)	(0.25)	(0.20)	(0.28)	(0.43)	(0.48)
HH head married	0.08°	0.06	0.09	0.11	0.05	0.10
	(0.05)	(0.07)	(0.07)	(0.11)	(0.28)	(0.11)
HH head single	-0.05	-0.08	-0.02	0.25	-0.10	0.27
	(0.11)	(0.17)	(0.12)	(0.21)	(0.49)	(0.25)
HH size	0.06**	0.05**	0.06**	0.04**	0.05**	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
HH head age	0.01**	0.01**	0.01**	0.00	-0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
HH head secondary education	0.06°	0.10°	0.01	0.02	-0.07	0.02
	(0.03)	(0.05)	(0.04)	(0.07)	(0.13)	(0.09)
HH head tertiary education	0.17**	0.17**	0.13*	0.16	0.17	0.12
	(0.04)	(0.06)	(0.06)	(0.10)	(0.21)	(0.14)
HH head high occupation	0.18**	0.10	0.21**	0.05	-0.11	0.05
	(0.04)	(0.06)	(0.05)	(0.09)	(0.16)	(0.13)
HH head occupations 4,5,7 or 8	0.29**	0.23**	0.31**	0.11	0.02	0.11
	(0.03)	(0.05)	(0.05)	(0.07)	(0.13)	(0.09)
HH head skilled agricultural occupation	-0.04	-0.06	-0.00	0.02	0.11	0.03
	(0.05)	(0.08)	(0.06)	(0.07)	(0.18)	(0.10)
HH female head	0.07	0.00	0.07	0.03	-0.08	0.08
	(0.05)	(0.07)	(0.07)	(0.09)	(0.23)	(0.11)
HH share of young members	-0.28**	-0.32**	-0.22*	-0.24	0.04	-0.39°
	(0.06)	(0.09)	(0.09)	(0.16)	(0.29)	(0.20)
HH share of old members	-0.09	0.06	-0.16	-0.07	0.74	-0.98*
	(0.10)	(0.16)	(0.13)	(0.33)	(0.54)	(0.43)
Constant	4.99**	4.92**	5.28**	5.64**	5.52**	5.54**
	(0.16)	(0.21)	(0.26)	(0.38)	(0.62)	(0.52)
Observations	4,294	2,167	2,127	780	312	468
R-squared	0.53	0.51	0.60	0.51	0.66	0.55
Adjusted R-squared	0.52	0.48	0.58	0.44	0.53	0.43

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. This table reproduces the results of Table 1 for the subsamples of households with and without migrants. Columns 1-3 show the results of the HH income equations from Table 1 for the sub-sample of households without migrants and columns 4-6 the results for the sub-sample of households with migrants.

Appendix Table A 3.26.: Attrition

VARIABLES	(1) HHattrit	(2) HHattrit	(3) HHattrit	(4) HHattrit	(5) HHattrit	(6) HHattrit
Cotton PSU*year 2009*agricultural HH	-0.03	-0.08*	-0.01	-0.04	0.02	0.01
	(0.03)	(0.03)	(0.03)	(0.04)	(0.02)	(0.04)
Cotton PSU*year 2011*agricultural HH	-0.03	-0.13*	-0.03	-0.09	0.03	0.03
	(0.04)	(0.05)	(0.06)	(0.08)	(0.05)	(0.07)
HH head married	-0.01	-0.02°	-0.01	-0.03	-0.02	-0.04*
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
HH head single	-0.02	0.01	-0.03	-0.03	-0.04	-0.03
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
HH size	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH head age	-0.00	-0.00°	0.00	-0.00	-0.00**	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	0.00	0.01	0.02°	0.02°	0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH head tertiary education	0.01	0.00	0.02°	0.01	0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
HH head high occupation	0.01	0.01	0.01	0.01	-0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH head occupations 4,5,7 or 8	0.01	0.00	0.01	-0.01	-0.00	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH head skilled agricultural occupation	0.01	-0.00	-0.00	0.00	0.02°	0.03
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
HH female head	0.00	-0.03*	0.01	-0.02	-0.00	-0.04*
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
HH share of young members	0.01	-0.01	0.03	0.02	0.05**	0.04
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)
HH share of old members	0.05	0.05	0.00	-0.00	0.03	0.03
	(0.03)	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)
Constant	0.27**	0.36**	0.26**	0.38**	0.10*	0.09
	(0.05)	(0.07)	(0.05)	(0.08)	(0.05)	(0.06)
Observations	7,996	4,082	4,282	2,174	4,159	2,114
R-squared	0.75	0.78	0.17	0.22	0.25	0.29
Adjusted R-squared	0.75	0.78	0.15	0.19	0.23	0.26

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. The data set is now constructed to include every household in every year (independent variables for households not appearing in every year are taken from the earliest year possible). The dependent variable indicates, whether the household appears in that year (1) in the dataset or not (0). The first column shows the results for the whole sample of households with at least one worker, the second column only includes households with at least one female working member. Column 3 and 4 are equal to column 1 and 2, only that they exclude households only in the data set in 2007. Column 5 and 6 exclude households only in the dataset in 2011.

Appendix Table A 3.27.: Robustness of the main specification to attrition

VARIABLES	(1) logHHinc	(2) logHHinc	(3) logHHinc	(4) logHHinc	(5) logHHinc
Cotton PSU*year 2009*agricultural HH	0.07	0.16	0.16	0.16	0.10
	(0.22)	(0.23)	(0.23)	(0.23)	(0.24)
Cotton PSU*year 2011*agricultural HH	0.61**	0.70**	0.76**	0.73**	0.69**
	(0.21)	(0.22)	(0.22)	(0.23)	(0.22)
HH head married	0.22**	0.26**	0.28**	0.30**	0.29**
	(0.07)	(0.09)	(0.09)	(0.09)	(0.10)
HH head single	0.12	0.10	0.10	0.12	0.11
	(0.10)	(0.14)	(0.14)	(0.14)	(0.14)
HH size	0.06**	0.07**	0.07**	0.07**	0.07**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH head age	0.00*	0.01**	0.01**	0.01**	0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH head secondary education	0.01	0.03	0.03	0.02	0.02
	(0.04)	(0.05)	(0.05)	(0.05)	(0.06)
HH head tertiary education	0.15*	0.19**	0.19**	0.18*	0.19*
	(0.06)	(0.07)	(0.07)	(0.08)	(0.08)
HH head high occupation	0.12*	0.16**	0.17**	0.18**	0.17*
	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
HH head occupations 4,5,7 or 8	0.24**	0.28**	0.28**	0.27**	0.30**
	(0.04)	(0.05)	(0.05)	(0.05)	(0.06)
HH head skilled agricultural occupation	-0.02	-0.03	-0.04	-0.04	-0.04
	(0.05)	(0.07)	(0.07)	(0.08)	(0.08)
HH female head	0.24**	0.25**	0.27**	0.28**	0.27**
	(0.07)	(0.08)	(0.08)	(0.09)	(0.09)
HH share of young members	-0.39**	-0.46**	-0.43**	-0.49**	-0.46**
	(0.08)	(0.10)	(0.10)	(0.11)	(0.11)
HH share of old members	-0.28*	-0.38*	-0.38*	-0.32	-0.33
	(0.14)	(0.18)	(0.18)	(0.19)	(0.20)
Constant	5.24**	5.05**	4.96**	4.99**	4.99**
	(0.24)	(0.26)	(0.25)	(0.27)	(0.27)
Observations	2,595	1,976	1,956	1,835	1,733
R-squared	0.57	0.48	0.48	0.49	0.48
Adjusted R-squared	0.55	0.45	0.45	0.46	0.45

Robust standard errors in parentheses (clustered at the village level); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy. The first column shows the baseline results for households with at least on female member working. Column 2 excludes households only in the data set in 2007, column 3 additionally excludes HHs only in the dataset in 2007, column 4 additionally excludes HHs only in the data set in 2007 and 2009 and the last column additionally excludes HHs only in the data set in 2007 and 2011.

Appendix Table A 3.28.: Quantile Regressions Effects on intensive labor supply

	(1)	(2)	(3)	(1)	(2)	(3)	(7)	(8)	(9)
		Hours worked			Hours worked by female			Hours worked by male	
VARIABLES	q25	q50	q75	q25	q50	q75	q25	q50	q75
Cotton PSU*year 2009*agricultural HH	-25.25*	-26.94**	-16.91*	-18.90**	-14.72*	-6.29	-5.47	-8.09*	-5.84°
	(10.02)	(9.12)	(8.55)	(6.58)	(6.13)	(5.28)	(4.40)	(3.21)	(3.01)
Cotton PSU*year 2011*agricultural HH	-11.14	-18.57°	-16.52°	-11.05°	-8.98	-3.19	-6.43	-11.17**	-6.93*
	(9.15)	(10.07)	(9.42)	(6.02)	(5.54)	(5.84)	(4.78)	(4.31)	(3.30)
Number of respective workers	33.14**	41.60**	49.10**	31.61**	39.17**	48.68**	37.23**	43.83**	51.86**
	(1.15)	(1.23)	(1.13)	(1.29)	(1.27)	(1.29)	(0.82)	(0.80)	(0.78)
HH head married	-1.36	3.38	0.37	0.15	1.22	1.88	0.13	-0.26	-0.08
	(3.20)	(2.84)	(2.67)	(2.13)	(1.76)	(1.63)	(0.69)	(0.73)	(0.81)
HH head single	3.17	2.89	-4.25	-0.00	2.27	-2.52	0.22	-0.07	0.99
	(6.09)	(4.77)	(5.73)	(5.14)	(4.12)	(5.23)	(0.82)	(0.79)	(1.42)
HH size	0.32	-0.09	-0.03	-0.49°	-0.31	-0.00	-0.12	-0.09	0.05
	(0.50)	(0.44)	(0.48)	(0.25)	(0.23)	(0.24)	(0.16)	(0.12)	(0.15)
HH head age	0.10	0.07	-0.11	0.14*	0.08	-0.03	0.02	0.00	-0.04
	(0.10)	(0.09)	(0.09)	(0.06)	(0.05)	(0.06)	(0.03)	(0.02)	(0.03)
HH head secondary education	-0.13	-3.03	-4.98*	1.62	0.20	-2.43°	-0.14	-0.44	-1.33
	(2.48)	(2.14)	(2.39)	(1.55)	(1.25)	(1.39)	(0.59)	(0.65)	(0.85)
HH head tertiary education	-0.12	-4.78°	-6.19*	0.95	-1.54	-4.80**	0.01	-0.54	-1.77°
	(2.94)	(2.79)	(3.00)	(1.90)	(1.67)	(1.86)	(0.76)	(0.80)	(1.03)
HH head high occupation	2.35	-0.55	-4.70°	0.42	-0.02	-1.09	0.20	0.06	-1.75°
	(2.65)	(2.36)	(2.59)	(1.58)	(1.38)	(1.48)	(0.79)	(0.77)	(0.94)
HH head occupations 4,5,7 or 8	7.75**	4.04*	2.73	1.82	1.47	1.07	0.87	1.03	0.81
	(2.26)	(2.00)	(2.36)	(1.46)	(1.24)	(1.25)	(0.80)	(0.80)	(1.00)
HH head skilled agricultural occupation	-1.49	1.11	1.18	-0.63	-0.06	1.44	-0.33	2.25	0.97
	(3.42)	(2.85)	(2.71)	(1.85)	(1.65)	(1.72)	(1.54)	(1.42)	(1.24)
HH female head	-2.24	0.37	-2.10	0.23	1.78	1.26	-0.44	-1.06	0.08
	(2.89)	(2.68)	(2.44)	(2.03)	(1.59)	(1.49)	(0.96)	(0.83)	(0.86)
HH share of young members	1.16	0.89	-0.64	1.25	0.76	-2.09	0.48	0.51	1.16
	(4.36)	(4.22)	(4.12)	(2.81)	(2.36)	(2.44)	(1.04)	(1.01)	(1.28)
HH share of old members	-9.72	-7.85	4.80	-10.52*	-8.69*	-0.10	-1.05	-0.23	1.71
	(6.64)	(6.08)	(5.46)	(4.64)	(3.80)	(3.86)	(1.18)	(1.14)	(1.32)
Constant	-5.11	1.36	14.56	-11.84°	-7.13	-0.72	0.49	1.81	7.39*
	(11.05)	(9.51)	(10.10)	(6.67)	(5.66)	(6.47)	(3.27)	(2.66)	(3.18)
Observations	2,652	2,652	2,652	2,652	2,652	2,652	2,652	2,652	2,652

Bootstrapped standard errors in parentheses (400 replications); ** p<0.01, * p<0.05, ° p<0.1

Note: All specifications include district dummies, province-year dummies, dummies for the month of the interview, dummies for the deciles of the household income distribution in 2007, year dummies, a dummy for agricultural household, a dummy for living in a cotton PSU as well as all interaction terms between year dummies, the agricultural household dummy and the cotton PSU dummy.

Appendix 3 B Data Cleaning and Matching

The dataset I use in this paper is based on the Tajikistan Living Standards Survey (TLSS) conducted by the World Bank and UNICEF in 2007 and 2009 and a follow up survey for 2011 conducted by the Institute for East and Southeast European Studies (IOS). In 2007, 4860 households living in 270 primary sampling units (PSUs) in Tajikistan were interviewed (18 households per PSU). This sample was reduced to only 167 PSUs and 9 households per PSU resulting in 1503 revisited households in 2009 and 2011 (Danzer et al. 2013). In the analysis, I only include households living in the 167 PSUs that were revisited in 2009 and 2011.[126] The data I obtained from the World Bank and the IOS was quite erroneous regarding individual and household identifiers across waves. Thus, to be able to correctly aggregate individual level variables within households and to link them across waves, I had to apply extensive cleaning procedures that are described in Appendix 2 E.

In addition, for the research presented in this chapter, I had to clean and prepare the single modules of the raw data on different sources of household income and various types of expenditures as well as on education, health and migration of household members. Only then it was possible to merge these modules internally and across waves and to connect them to the individual level dataset, which I had already constructed for the research presented in the last chapter. The most serious issue was that in each single module of the raw data missing values were coded differently across waves, e.g. they were coded as 99, 999, 9999, as "." or as negative values. I had to look closely at the raw data using several descriptive statistics to determine whether a certain value may have been used as the identifier for missing responses. If the frequency of a certain value containing only the number 9 (e.g. 99, 999 or 9999) was more than 10 times higher than for other values above or below that value, I assumed that this value indicates missing responses.[127] In some cases, I could retrieve the correct information on the coding of missing values in the respective module from the original questionnaires. I changed all values indicating missing responses into a true missing symbol "." in Stata. For an additional robustness check, I decided to impute wages and remittances and the respective procedure is described below. Furthermore, I also had to correct miscoded individual and item identifiers in single modules by closely looking at the structure of

[126] As noted in Appendix 2 E, I conducted robustness checks including those 103 PSUs and results of the last chapter and also of this chapter do not change.

[127] In cases where this value was the highest one of the whole distribution and smaller values were bigger than half of that value, I did not change the data. However, in most cases the highest value was 9999 and the next smaller value appearing in the data was less than half that value, e.g. 4000. In those cases I turned the 9999 into missing.

the data. For example, in the module for transfers received the identifiers for donors per household were often not unique.

Because there were no constructed measures for most of the variables I use in this paper, I had to construct those measures making different kinds of assumptions. The variable that needed the most attention was monthly household income. In the survey, different sources of household income are reported in different modules for different time horizons at the individual or the household level. Wages paid in cash are reported at an individual basis for the last month, but the money equivalent of wages paid in kind is reported for the whole year. The amount of bonuses paid is reported for the last event together with an average number on how many bonuses are received per year. Remittances are reported at the household level and per year in Tajik Somoni in 2007, on average per month in USD in 2009 and on average per month in several currencies in 2011. Unfortunately, it seems that many interviewers misunderstood the question and asked for yearly remittances in USD in 2007. I applied a cleaning procedure to this issue that is described below. Furthermore, in 2007 and 2009 remittances in cash and in kind are separated in the questionnaire, but in 2011 they are not. Thus, I use the sum of remittances in cash and in kind throughout the analysis. Social benefits received from the state are reported at the household level for the last month together with the time period the payment refers to. Transfers received and sent by the household as well as other income sources like rent income are reported per year at the household level. In the main specification, I define monthly household income in Tajik Somoni as the sum of wage income last month plus last bonuses and average monthly in kind payments, average monthly remittances, social benefits paid last month, average monthly household income from other sources as well as a monthly average of net household transfers. I assume that current income in terms of last bonuses and social benefits paid last month is more relevant for current household decisions, e.g. food consumption that is reported for the last 7 days, then the monthly average per year. However, for robustness checks, I use many other measures for household income, e.g. using a monthly average for social benefits and bonuses instead of the amounts paid last month or excluding wage in kind payments. The results do not depend on the specific definition of monthly household income (Tab. A3.20).

Because 286 of our 6012 household-year observations report zero monthly household income, I impute wages and remittances for those 286 households and check if the results are robust to using the imputed measure for household income (Tab. A3.20). However, I only imputed wages for household members that were working, but did not re-

port a wage.[128] Accordingly, I only imputed remittances for households with migrants that did not report remittances.[129] I imputed wages in cash and in kind using the median wage for workers with the same gender, same education and the same occupation in the same year. Using other imputations, e.g. the mean wage instead of the median wage, does not change the empirical result. Following Yang (2008), I imputed average monthly remittances using the lowest percentile of the unconditional remittance distribution in the respective year. However, for another robustness check, I also used the median of the distribution, because the distribution of monthly remittances is quite concentrated around the median and not skewed. I used the simple unconditional median because more than 95% of Tajik migrants are male that work in the Russian construction industry and other low skilled occupations and earn about the same foreign wage per month (Danzer and Ivaschenko 2010, descriptives of this dataset). The results are robust to using any of that imputed measures for remittances and household wage income. I also check, if including the households with zero income by using log(1+income) changes the results. Results are also robust to using this procedure (Table A3.20).

Another variable I had to construct using some assumptions is health spending. For 3 provinces in the TLSS 2007, the questions on health spending did not include spending for medicaments. Thus, I constructed one measure for spending on health excluding spending for medicaments in all three waves and another one, where I assume that the missing question in 2007 lead households to report the amounts spent on medicaments in the question for spending on ambulatory medical care. The results do not change using both measures indicating that households may have reported spending on medicaments within the other spending category. Concerning the definition of an agricultural household, I conducted many robustness checks that are explained in the paper and presented in Table A3.20. The only one not explained in the paper is the one presented in column 3 of Table A3.20. For this robustness check, I additionally used the second occupation of workers to determine, whether they work in agriculture or not. I also defined workers as agricultural workers, if they work in non-agriculture as first occupation but in agriculture as second occupation. Thus, the number of agricultural households with at least one female working slightly increased due to this definition from 1414 to 1430, whereas the number of non-agricultural households with at least one female working decreases from 1238 to 1222. However, the results are not affected by this change compared to the main specification in column 1, where I only use the first occupation to

[128] I did not impute missing wages for other working individuals living in households with non-zero income, because many workers in the dataset are unpaid family workers.

[129] For another robustness check, I imputed the remittances for all households with migrants and zero or missing remittances, not only for the households that also reported zero household income. The results do not change.

determine an agricultural worker. In column 2, I define an agricultural household as a household with at least two agricultural workers, whereas the definition of a non-agricultural household remains the same. The same is true for column 4, where I exclude mixed households, i.e. households with agricultural and non-agricultural households, from the treatment group. Thus, the sample is reduced in column 2 and 4 compared to column 1 by the number of households with only one agricultural worker and the number of mixed households, respectively. The construction of the other variables is more straightforward and can be inferred from the main text of the paper. I have accurately documented the construction of the variables within the do-files, which can be requested from the author.

Another important issue I had to address during the data cleaning procedure was the miscoding of remittances in 2007. In the questionnaire, household remittances should have been reported per year in Tajik Somoni in 2007, on average per month in USD in 2009 and on average per month in several currencies in 2011. Unfortunately, it seems that many interviewers misunderstood the question and asked for yearly remittances in USD in 2007. I detected this problem by closely looking at the descriptive statistics for remittances and the sum of wages earned by migrants abroad per household. The median of the sum of monthly wages earned abroad per household was 300 USD in 2007, but the median of yearly remittances only 1720 Tajik Somoni equivalent to 42 USD per month. In 2009 and 2011, the median of monthly remittances was 200 USD and the median wage earned abroad was 400 and 500 USD, respectively. Thus, I assumed that in the TLSS 2007 yearly remittances were on average not reported in Somoni, but in USD. The average exchange rate in 2007 was 3.44 Somoni/USD and I multiplied the reported remittances with this value leading to the new median for monthly remittances of 143 USD in 2007. However, apparently some households actually reported remittances in Tajik Somoni and I identified and corrected those cases using the following procedure. I computed the ratio of monthly remittances divided by the sum of the monthly foreign wages of all migrants per household. For all observations with a ratio higher than 1.5, I assumed that remittances were actually reported in Somoni (because it is unlikely to remit 150% of the foreign wages earned). For those cases, I divided remittances by the average exchange rate in 2007. For cases with a ratio between 1 and 1.5, I had a closer look on the occupation and education of the migrants. In most cases it was obvious, that in the respective occupations it was very unlikely to remit amounts higher than 1000 USD per month and I assumed that remittances were reported in Somoni not in USD. In some cases, interviewers or coders had mistakenly added a zero and I cleaned those cases too. I did not change any remittance values for households that had

not reported the foreign wages of their migrants. I also applied the described procedure to the remittances sent in kind (not in cash) in 2007, which apparently have also been reported in USD on average, not in Tajik Somoni as indicated in the questionnaire. In addition, I also applied the described procedure using the ratio of remittances and the sum of foreign wages earned by migrants to detect errors in the remittances reported for 2009 and 2011. In particular in 2011, there were many cases where remittances had been reported in Ruble but the interviewer indicated USD as currency. I cleaned those cases applying the average exchange rate of the Ruble to the USD in 2011. The detailed do-files on the cleaning procedure described here can be requested from the author.

After applying all these corrections, I first merged the new data files internally and then with the dataset I had constructed for the analysis presented in the last chapter. Finally, I constructed the final household level panel dataset for this study by aggregating over individuals within households. This final dataset is presented in the data section of this paper.

References

Acemoglu, D., A. Finkelstein and M.J. Notowidigdo (2013). Income and Health Spending: Evidence from Oil Price Shocks. *Review of Economics and Statistics*, 95(4), p. 1079-1095.

Acemoglu, Daron (2003). Patterns of Skill Premia. *Review of Economic Studies*, 70(2), p. 199–230.

Aghion, Philippe, Robin Burgess, Stephen Redding, and Fabrizio Zilibotti (2005). Entry Liberalization and Inequality in Industrial Performance. *Journal of the European Economic Association*, 3(2–3), p. 291–302.

Akramov, K.T. and G. Shreedhar (2012). Economic Development, External Shocks, and Food Security in Tajikistan. IFPRI Discussion Paper 01163.

Alexander M. Danzer, Barbara Dietz and Ksenia Gatskova (2013). Migration and Remittances in Tajikistan: Survey Technical Report. IOS Working Papers 327.

Amiti and Davis (2011). Trade, Firms, and Wages: Theory and Evidence. *Review of Economic Studies*, 79, p. 1–36

Anders, Sven and Julie Caswell (2009). Standards as Barriers versus Standards as Catalysts: Assessing the Impact of HACCP Implementation on U.S. Seafood Imports. *American Journal of Agricultural Economics*, 91, p. 310–321.

Anderson, K., G. Rausser and J. Swinnen (2013). Political Economy of Public Policies: Insights from Distortions to Agricultural and Food Markets. *Journal of Economic Literature*, 51(2), p. 423-77.

Angrist, J. D. and A. D. Kugler (2008). Rural windfalls or a new resource curse? Coca, income and civil conflict in Colombia. *Review of Economics and Statistics*, 90(2), p. 191–215.

Arellano, Manuel and Stephen Bond (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Review of Economic Studies*, 58, p. 277-297.

Artecona, R. and Fernando A. Flores (2009). Observatory of customs controls for United States imports: technical standards. UN – ECLAC Studies and Perspectives series – Washington – No. 5 (July 2009).

Artecona, R. und R. Grundke (2010). Estimating the effects of United States food safety and agricultural health standards on agro-food exports from Latin America and the Caribbean. UN – ECLAC Studies and Perspectives series – Washington – No. 11 (October 2010).

Attanasio, O., P.K. Goldberg, and N. Pavcnik (2004). Trade reforms and wage inequality in Colombia. *Journal of Development Economics*, 74(2), p. 331-366.

Attanasio, Orazio P. & Szekely, Miguel (2004). Wage shocks and consumption variability in Mexico during the 1990s. *Journal of Development Economics*, 73(1), p. 1-25.

Autor, D., D. Dorn and G. H. Hanson (2013). The China Syndrome: Local Labor Market Effects of Import Competition in the United States. *American Economic Review*, 103(6), p. 2121-2168.

Baldwin, Richard (2000). "Regulatory Protectionism, Developing Nations, and a Two-Tier World Trade System," in: Brookings Trade Forum, S. Collins and D. Rodrik (eds.), The Brookings Institution, Washington DC, p. 237-293.

Baldwin, Richard and Simon Evenett (2009). The Collapse of Global Trade, Murky Protectionism, and the Crisis: Recommendations for the G20. A VoxEU.org Publication.

Baldwin, Robert (1970). Nontariff Distortions of International Trade. The Brookings Institution, Washington DC.

Barrett, C.B. and P.A. Dorosh. (1996). Farmers' welfare and changing food prices: Non-Parametric Evidence from Rice in Madagascar, *American Journal of Agricultural Economics*, 78, p. 656–669.

Baylis, Kathy, Andrea Martens and Lia Nogueira (2009). What Drives Import Refusals? *American Journal of Agricultural Economics*, 91, p. 1477-1483.

Baylis, Kathy, Lia Nogueira and Kathryn Pace (2010). Food Import Refusals: Evidence from the European Union. *American Journal of Agricultural Economics*, 93, p. 566–572.

Bazzi, Samuel and Michael Clemens (2013). Blunt Instruments: Avoiding Common Pitfalls in Identifying the Causes of Economic Growth. *American Economic Journal: Macroeconomics*, 5, p. 152-186.

Behrman, Jere R., Nancy Birdsall, and Miguel Székely (2000). Economic Reform and Wage Differentials in Latin America. IADB Working Paper No. 435.

Bernard, Andrew B., and J. Bradford Jensen (1997). Exporters, Skill Upgrading, and the Wage Gap. *Journal of International Economics*, 42(1–2), p. 3–31.

Besley, Tim. 1995. Nonmarket Institutions for Credit and Risk Sharing in Low-Income Countries. *Journal of Economic Perspectives*, 9(3), p. 115-127.

Björkman-Nyqvist, Martina (2013). Income shocks and gender gaps in education: Evidence from Uganda. *Journal of Development Economics,* 105, p. 237–253.

Black D., T. McKinnish and S. Sanders (2005). The economic impact of the coal boom and bust. *The Economic Journal,* 115 (April), p. 449–476.

Bloch, Francis, Vijayendra Rao, and Sona lde Desai (2004). Wedding Celebrations as Conspicuous Consumption: Signaling Social Status in Rural India. *Journal of Human Resources*, 39(3), p. 675-695.

Boffa, Mauro and Marcelo Olarreaga (2012). Protectionism During the Crisis: Tit-for-Tat or Chicken-Games? *Economics Letters,* 117, p. 746-749.

Bown, Chad and Meredith Crowley (2013). Import Protection, Business Cycles, and Exchange Rates: Evidence from the Great Recession. *Journal of International Economics,* 90, p. 50–64.

Brambilla, I. and G.G. Porto (2011). Market structure, outgrower contracts, and farm output. Evidence from cotton reforms in Zambia. *Oxford Economic Papers*, 63, p. 740–766.

Brown, Philip H., Bulte, Erwin and Xiaobo Zhang (2011). Positional Spending and Status Seeking in Rural China. *Journal of Development Economics*, 96, p. 139-149.

Buzby, Jean, Laurian Unnevehr and Donna Roberts (2008). Food Safety and Imports: An Analysis of FDA Food-related Import Refusal Report. Economic Information Bulletin, EIB-39, U.S. Department of Agriculture.

Buzby, Jean, Laurian Unnevehr and Donna Roberts (2008). Food Safety and Imports: An Analysis of FDA Food-related Import Refusal Report. Economic Information Bulletin, EIB-39, U.S. Department of Agriculture.

C. Richard Shumway, Rulon D. Pope, and Elizabeth K. Nash (1984). Allocatable Fixed Inputs and Jointness in Agricultural Production: Implications for Economic Modeling. *American Journal of Agricultural Economics,* Feb. 1984, p. 72-78.

Cato, James and Carlos Lima dos Santos (2000). "Costs to Upgrade the Bangladesh Frozen Shrimp Processing Sector to Adequate Technical and Safety Standards and to Maintain a HACCP Program," in L. Unnevehr (ed.): "HACCP: New Studies of Costs and Benefits," St. Paul: Eagen Press.

Cato, James, Steven Orwell and Agnes Coze (2003). Nicaragua's Shrimp Subsector: Developing a Production Capacity and Export Market during Rapidly Changing Worldwide Safety and Quality Regulations. World Bank, Agriculture and Rural Development Discussion Paper No. 47844.

Chiquiar, D. (2008). Globalization, regional wage differentials and the Stolper–Samuelson Theorem: Evidence from Mexico. *Journal of International Economics*, 74, p. 79–93.

Costinot, A., J. Vogel and S. Wang (2012*)*. Global Supply Chains and Wage Inequality. *American Economic Review*, 102(3), p. 396-401.

Cragg, Michael Ian, and Mario Epelbaum (1996). Why Has Wage Dispersion Grown in Mexico? Is It the Incidence of Reforms or the Growing Demand for Skills? *Journal of Development Economics*, 51(1), p. 99–116.

Crivelli, Pramina and Jasmin Gröschl (2012). The Impact of Sanitary and Phytosanitary Measures on Market Entry and Trade Flows. Ifo Working Paper No. 136, August 2012.

Danzer, A.M. and O. Ivaschenko (2010). Migration patterns in a remittances dependent economy: Evidence from Tajikistan during the global financial crisis. *Migration Letters*, 7(2), p. 190 – 202.

Danzer, A.M., B. Dietz and K. Gatskova (2013). Migration and Remittances in Tajikistan: Survey Technical Report. Working Paper of the Institute for East and Southeast European Studies, Regensburg.

Danzer, Alexander (2013). Can Anti-Poverty Policies Reduce Conspicuous Consumption? Evidence from Wedding Expenditures in Tajikistan. Mimeo.

Deaton, A. (1992), Understanding Consumption, Clarendon Press, Oxford.

Deaton, A. (1999). Commodity Prices and Growth in Africa. *Journal of Economic Perspectives*, 13(3), p. 23-40.

Department of State (2010). Trafficking in Persons Report – 10th edition.

Disdier, Anne-Célia, Lionel Fontagné, and Mondher Mimouni (2008). The Impact of Regulations on Agricultural Trade: Evidence from SPS and TBT Agreements. *American Journal of Agricultural Economics*, 90, p. 336-350.

Edmonds, E.V. and N. Pavcnik (2005). The effect of trade liberalization on child labor. *Journal of International Economics*, 65, p. 401–419.

Edmonds, E.V. and N. Pavcnik (2006). Trade liberalization and the allocation of labor between households and markets in a poor country. *Journal of International Economics*, 69, p. 272–295.

Engel, Eduardo (1999). Poisoned Grapes, Mad Cows and Protectionism. NBER Working Paper No. 6959.

Essaji, Azim (2008). Technical Regulations and Specialization in International Trade. *Journal of International Economics*, 76, p. 166-176.

Essaji, Azim (2010). Trade Liberalization, Standards and Protection. *The B.E. Journal of Economic Analysis & Policy* (Topics), Vol. 10, Article 55.

European Union Rapid Alert System for Food and Feed (EU-RASFF) (2012). RASFF Portal. Available at: http://ec.europa.eu/food/safety/rasff/portal/index_en.htm

FDA (2010). Ensuring the Safety of Imported Products: Question and Answer with David Elder. FDA Consumer Updates. U.S. Food and Drug Administration.

FDA (2011a). Federal Food, Drug, and Cosmetic (FD&C) Act. U.S. Food and Drug Administration.

FDA (2011b). Pathway to Global Product Safety and Quality. A Special Report. U.S. Food and Drug Administration.

Feenstra, Robert C., and Gordon H. Hanson (1997). Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras. *Journal of International Economics*, 42(3–4), p. 371–393.

Feenstra, Robert C., and Gordon H. Hanson (1999). The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979–1990. *Quarterly Journal of Economics*, 114(3), p. 907–940.

Fischer, Ronald and Pablo Serra (2000). Standards and Protection. *Journal of International Economics*, 52, p. 377-400.

Fontagne, Lionel, Gianluca Orefice, Roberta Piermartini and Nadia Rocha (2013). Product Standards and Margins of Trade: Firm Level Evidence. CEPII Working Paper No. 2013-06.

Food and Agricultural Organization (FAO) (2009). FAO crop and food security assessment mission to Tajikistan. Special report 2009. Download: http://www.fao.org/docrep/012/ak339e/ak339e00.htm

Food and Agricultural Organization (FAO) (2011). Crop and Food Security Assessment Mission Report Tajikistan 2011. Download: http://www.fao.org/docrep/015/an110e/an110e00.pdf

Food and Agricultural Organization (FAO) (2013). Global Agro-Ecological Zones (GAEZ) Database. Access: http://gaez.fao.org/Main.html#

Gertler, Paul and Jonathan Gruber (2002). Insuring Consumption Against Illness. *American Economic Review*, 92(1), p. 51-70.

Goldberg, P.K. and N. Pavcnik (2005). Trade, Wages, and The Political Economy Of Trade Protection: Evidence From The Colombian Trade Reforms. *Journal of International Economics*, 66(1), p. 75-105.

Goldberg, P.K. and N. Pavcnik (2007). Distributional Effects of Globalization in Developing Countries. *Journal of Economic Literature*, 45(1), p. 39-82.

Görlich, D. and Trebesch, C. (2008). Seasonal Migration and Networks: Evidence on Moldova's Labour Exodus. *Review of World Economics*, 144, p. 107–133.

Greenstone, M. and E. Moretti (2003). Bidding for industrial plants: Does winning a 'Million Dollar Plant' increase welfare? NBER working paper 9844.

Greenstone, M., R. Hornbeck and E. Moretti (2010). Identifying Agglomeration Spillovers: Evidence from Winners and Losers of Large Plant Openings. *Journal of Political Economy*, 118(3), p. 536-598.

Grimard, Franque. 1997. Household Consumption Smoothing Through Ethnic Ties: Evidence from Cote d'Ivoire, *Journal of Development Economics*, 53(2), p. 391-422.

Harrison, Ann E., and Gordon H. Hanson (1999). Who Gains from Trade Reform? Some Remaining Puzzles. *Journal of Development Economics*, 59(1), p. 125–154.

Hawthorne, Fran (2005). Inside the FDA, The Business and Politics Behind the Drugs We Take and the Food We Eat. John Wiley & Sons, New Jersey.

Helpman, Elhanan, Marc Melitz, and Yona Rubinstein (2008). Estimating trade flows: trading partners and trading volumes. *Quarterly Journal of Economics*, 123(2), p. 441-487.

Henson, Spencer and Rupert Loader (2011). Barriers to Agricultural Exports from Developing Countries: The Role of Sanitary and Phytosanitary Requirements. *World Development*, 29, p. 85-102.

Hudson, D. and D. Ethridge (1999). Export Taxes and Sectoral Economic Growth: Evidence from Cotton and Yarn Markets in Pakistan, *Agricultural Economics*, 20, p. 263-276.

International Crisis Group (ICG) (2005). The Curse of Cotton: Central Asia's Destructive Monoculture. Asia Report No. 93.

International Labor Rights Forum (ILRF) (2007). Labor Conditions in the Tajikistan Cotton Industry.

Ivanic, M. and W. Martin (2008). Implications of higher global food prices for poverty in low-income countries. *Agricultural Economics*, 39(s1), p. 405–416.

Jacks, David S., Kevin H. O'Rourke and Jeffrey G. Williamson (2011). Commodity Price Volatility and World Market Integration since 1700. *Review of Economics and Statistics*, 93(3), p. 800-813.

Jacoby, Hanan and Emmanuel Skoufias. 1997. Risk, Financial Markets and Human Capital in a Developing Country. *Review of Economic Studies*, 64(3), p. 311-336.

Jaffee, Steven and Spencer Henson (2005). "Agro-Food Exports from Developing Countries: The Challenges posed by Standards," Global agricultural trade and developing countries, Ataman Aksoy and John Beghin (eds.), Washington D.C., World Bank, p. 91-114.

Jalan, Jyotsna and Martin Ravallion (1999). Are the Poor Less Well Insured? Evidence on Vulnerability to Income Risk in Rural China. *Journal of Development Economics*, 58(1), p. 61-81.

Jaud, Melise and Madina Kukenova (2011). Financial Development and Survival of African Agri-food Exports. World Bank Policy Research Working Paper 5649.

Josling, Tim, Donna Roberts, and David Orden (2004). Food Regulation and Trade: Toward a Safe and Open Global System. Washington, DC: Institute for International Economics.

Jouanjean, Marie-Agnes (2012). Is Fresh Fruits and Vegetables Market Access for Sale in the U.S.? The Ins and Outs of U.S. FF&V Market Access Regulation. Mimeo, February 2012.

Jouanjean, Marie-Agnes, Jean-Christophe Maur and Ben Shepherd (2012). Reputation Matters - Spillover Effects in the Enforcement of US SPS Measures. World Bank Policy Research Working Paper 5935.

Juhn, C., G. Ujhelyi and C. Villegas-Sanchez (2013). Trade Liberalization and Gender Inequality. *American Economic Review*, 103(3), p. 269-273.

Kassam, S.N. (2011). One explanation for why farmers produce cotton collectively in post-Soviet Tajikistan. PhD thesis. University Of British Columbia: Vancouver.

Kaur, S. (2012). Nominal Wage Rigidity in Village Labor Markets. Mimeo, Harvard University.

Kee, Hiau Looi, Cristina Neagu and Alessandro Nicita (2013). Is Protectionism on the Rise? Assessing National Trade Policies During the Crisis of 2008. *Review of Economics and Statistics*, 95, p. 342-345.

Kleibergen, Frank and Richard Paap (2006). Generalized Reduced Rank Tests Using the Singular Value Decomposition. *Journal of Econometrics*, 133, p. 97-126.

Kochar, Anjini. 1999. Smoothing Consumption by Smoothing Income: Hours-of-Work Responses to Idiosyncratic Agricultural Shocks in Rural India. *Review of Economics and Statistics*, 81(1), p. 50–61.

Kovak, B.K. (2013). Regional Effects of Trade Reform: What is the Correct Measure of Liberalization? *American Economic Review*, 103(5), p. 1960-1976.

Kranton, R. and A.V. Swamy (2008). Contracts, Hold-Up, and Exports: Textiles and Opium in Colonial India. *American Economic Review*, 98(3), p. 967-989.

Krishna, P., J.P. Poole and M. Zeynep Senses (2012). Trade, Labor Market Frictions, and Residual Wage Inequality across Worker Groups. *American Economic Review*, 102(3), p. 417-423.

La Porta, Rafael, Florencio Lopez-deSilanes, Andrei Shleifer and Robert Vishny (1999). The quality of government. *Journal of Law, Economics and Organization*, 15 (1), p. 222-279.

Lamb, Rusell (2006). Rent Seeking in U.S. – Mexican Avocado Trade. *Cato Journal*, 26, p. 159 – 177.

Lerman, Zvi (2012). Agrarian reform of the Republic of Tajikistan. Farm reform and restructuring cooperative development report (final draft). Download: http://departments.agri.huji.ac.il/economics/lerman-main.html

Levchenko, Andrei A., Logan T. Lewis and Linda L. Tesar (2011). The “Collapse in Quality” Hypothesis. *American Economic Review*, 101(3), p. 293–297.

Liu, Chenglin (2010). The Obstacles of Outsourcing Imported Food Safety to China. *Cornell International Law Journal*, 43, p. 249-305.

Luechinger, Simon and Christoph Moser (2014). The Value of the Revolving Door: Political Appointees and the Stock Market. *Journal of Public Economics*, 119, p. 93-107.

Maccini, Sharon and Dean Yang (2009). Under the Weather: Health, Schooling, and Economic Consequences of Early-Life Rainfall. *American Economic Review*, 99(3), p. 1006–1026.

Maertens, Miet and Johan Swinnen (2008). Trade, Standards, and Poverty: Evidence from Senegal. *World Development*, 37, p. 161-187.

Marette, Stephan and John Beghin (2010). Are Standards Always Protectionist? *Review of International Economics*, 18, p. 179-192.

Maskus, Keith, Tsunehiro Otsuki and John Wilson (1999). Quantifying the Impact of Technical Barriers to Trade - A Framework for Analysis. World Bank Policy Research Working Paper 2512.

Massell, B.F. (1964). Export Concentration and Fluctuations in Export Earnings: A Cross-Section Analysis. *American Economic Review*, 54(2), p. 47-63.

Massey, D.S., Arango, J., Hugo, G., Kouaouci, A., Pellegrino A. and Taylor, J.E. (1998). Worlds in Motion: Understanding International Migration at the End of the Millennium (Oxford: Clarendon Press).

Moenius, Johannes (2004). Information versus Product Adaptation: The Role of Standards in Trade. Working Paper, Evanston, Illinois, United States, Kellogg School of Management, Northwestern University.

Morduch, Jonathan (1995). Income Smoothing and Consumption Smoothing. *Journal of Economic Perspectives*, 9(3), p. 103-114.

Otsuki, Tsunehiro, John Wilson and Mirvat Sewadeh (2001). What Price Precaution? European Harmonisation of Aflatoxin Regulations and African Groundnut Exports. *European Review of Agricultural Economics*, 28, p. 263-283.

Pavcnik, N. (2002). Trade liberalization, entry and productivity improvements: evidence from Chilean plants. *Review of Economic Studies*, 69, p. 245–76.

Paxson, Christina H. (1992). Using Weather Variability to Estimate the Response of Savings to Transitory Income in Thailand. *The American Economic Review*, 82(1), p. 15-33.

Qian, N. (2008). Missing Women and the Price of Tea in China: The Effect of Sex-Specific Earnings on Sex Imbalance. *Quarterly Journal of Economics*, 123(3), p. 1251-1285.

Roodman (2009). How to Do xtabond2: An Introduction to Difference and System GMM in Stata. *The Stata Journal*, 9, p. 86-136.

Rose, Andrew (2013). The March of an Economic Idea? Protectionism Isn't Countercyclical (anymore). *Economic Policy*, 28, p. 569-612.

Rose, Elaina (1999). Consumption Smoothing and Excess Female Mortality in Rural India. *Review of Economics and Statistics*, 81, p. 41-49.

Rosenzweig, Mark and Kenneth Wolpin (1993). Credit Market Constraints, Consumption Smoothing and the Accumulation of Durable Production Assets in Low-Income Countries: Investments in Bullocks in India. *Journal of Political Economy*, 101(2): 223–44.

Sattar, S. and S. Mohib (2006). "Tajikistan: Cotton Farmland Privatization," in: Coudouel, A., A.A. Dani and S. Paternostro (eds.) Poverty and Social Impact Analysis of Reforms. Washington DC: The World Bank, p. 453-490.

Stark, O. and Bloom, D. (1985). The New Economics of Labor Migration. *American Economic Review*, 75(2), p. 173–178.

Stock, James and Motohiro Yogo (2005). "Testing for Weak Instruments in Linear IV Regression," in: Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg, D. Andrews and J. Stock (eds.), Cambridge University Press, New York, p. 80-108.

Sturm, Daniel (2006). Product Standards, Trade Disputes, and Protectionism. *Canadian Journal of Economics*, 39, p. 564-581.

Swinnen, J. and P. Squicciarini (2012). Mixed Messages on Prices and Food Security. Science, 335, p. 405-406.

TajStat (Agency on Statistics under the President of the Republic of Tajikistan) (2012). Statistical Year Book on Agriculture in the Republic of Tajikistan (Сельское хозяйство Республики Таджикистан статистический сборник). Purchased in Dushanbe in November 2014.

Thoenig, Mathias and Thierry Verdier (2003). A Theory of Defensive Skill-Biased Innovation and Globalization. *American Economic Review*, 93(3), p. 709–728.

Topalova, P. (2010). Factor Immobility and Regional Impacts of Trade Liberalization: Evidence on Poverty from India. *American Economic Journal: Applied Economics*, 2, p. 1-41.

Townsend, Robert M. (1995). Consumption Insurance: An Evaluation of Risk-Bearing Systems in Low-Income Economies. *Journal of Economic Perspectives*, 9(3), p. 83–102.

Trefler, Daniel (1993). Trade Liberalization and the Theory of Endogenous Protection: An Econometric Study of U.S. Import Policy. *Journal of Political Economy*, 101, p. 138-160.

U.S. Food and Drug Administration (FDA) (2012a). Product code builder. Available at: http://www.accessdata.fda.gov/scripts/ora/pcb/pcb.cfm

U.S. Food and Drug Administration (FDA) (2012b). Product code tutorial. Available at: http://www.accessdata.fda.gov/scripts/ora/pcb/tutorial/tutorial.cfm

U.S. International Trade Commission (ITC) (2012). Harmonized (HS) Tariff Schedule of the United States. Available at: http://hts.usitc.gov/

Udry, Christopher. 1995. Risk and Saving in Northern Nigeria. *The American Economic Review*, 85(5), p. 1287-1300.

USAID (2011). A Regional View of Wheat Markets and Food Security in Central Asia. With a Focus on Afghanistan and Tajikistan. Download: http://www.wfp.org/content/regional-view-wheat-markets-and-food-security-central-asia-july-2011

Van Atta, D. (2009). "White Gold" or Fool's Gold? The Political Economy of Cotton in Tajikistan. Problems of Post-Communism, 56(2), p. 17–35.

Verhoogen, Eric A. (2008). Trade, Quality Upgrading, and Wage Inequality in the Mexican Manufacturing Sector. *The Quarterly Journal of Economics*, 123(2), p. 489-530.

Wacziarg, Romain and Jessica Seddon Wallack (2004). Trade Liberalization and Intersectoral Labor Movements. *Journal of International Economics*, 64(2), p. 411–439.

Warr P.G. (2002). Export Taxes and Income Distribution: The Philippine Coconut Levy. Weltwirtschaftliches Archiv, 138(3), p. 437-457.

Warr, P.G. (2001). Welfare Effects of an Export Tax: Thailand's Rice Premium. *American Journal of Agricultural Economics*, 83(4), p. 903-920.

Watson, William and Sallie James (2013). Regulatory Protectionism: A Hidden Threat to Free Trade. Policy Analysis No. 723, Cato Institute.

Winters, A.L., N. McCulloch, and A. McKay. 2004. Trade Liberalization and Poverty: The Evidence So Far. *Journal of Economic Literature*, 42(1), p. 72-115.

Wolpin, Kenneth I. (1982). A New Test of the Permanent Income Hypothesis: The Impact of Weather on the Income and Consumption of Farm Households in India. *International Economic Review*, 23, p. 583-594.

Wood, A. (1997). Openness and Wage Inequality in Developing Countries: The Latin American Challenge to East Asian Conventional Wisdom. *World Bank Economic Review*, 11 (1), p. 33-57.

Wood, Adrian (1995). How Trade Hurt Unskilled Workers. *Journal of Economic Perspectives*, 9(3), p. 57–80.

World Bank (2005). Socio-Economic Atlas of Tajikistan. Download: http://siteresources.worldbank.org/INTTAJIKISTAN/Resources/atlas_11.pdf

World Bank (2005). Socio-Economic Atlas of Tajikistan. Download: http://siteresources.worldbank.org/INTTAJIKISTAN/Resources/atlas_11.pdf

World Bank (2008). Tajikistan Living Standards Measurement Survey 2007 - Basic Information Document. Available at: http://microdata.worldbank.org/index.php/catalog/72

World Bank (2010). Tajikistan Living Standards Measurement Survey 2009 – Notes for Users. Available at: http://microdata.worldbank.org/index.php/catalog/73

World Bank (2010). Tajikistan Living Standards Measurement Survey 2009 – Notes for Users. Available at: http://microdata.worldbank.org/index.php/catalog/73

World Bank (2012). Tajikistan: Farmer and Farm Worker Perceptions of Land Reform and Sustainable Agriculture in Tajikistan. Report No. AAA81 – TJ.

World Food Programme (WFP) (2005). Tajikistan: Market Profile for Emergency Food Security Assessments. United Nations World Food Programme: Rome.

Yang, Dean (2008). International Migration, Remittances and Household Investment: Evidence from Philippine Migrants´ Exchange Rate Shocks. *The Economic Journal*, 118 (April), p. 591–630.

Yang, Dean (2011). Migrant Remittances. *Journal of Economic Perspectives*, 25(3), p. 129–152.

Yang, Dean and HwaJung Choi (2007). Are Remittances Insurance? Evidence from Rainfall Shocks in the Philippines. *The World Bank Economic Review*, 21 (2), p. 219–248.

Yogo, Motohiro (2004). Estimating the Elasticity of Intertemporal Substitution When Instruments Are Weak. *Review of Economics and Statistics*, 86, p. 797-81

Zhu, Susan Chun (2005). Can Product Cycles Explain Skill Upgrading? *Journal of International Economics*, 66(1), p. 131–155.

Eidesstattliche Versicherung

Ich versichere hiermit eidesstattlich, dass ich die vorliegende Arbeit selbständig und ohne fremde Hilfe verfasst habe. Die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sowie mir gegebene Anregungen sind als solche kenntlich gemacht. Die Arbeit wurde bisher keiner anderen Prüfungsbehörde vorgelegt und auch noch nicht veröffentlicht. Sofern ein Teil der Arbeit aus bereits veröffentlichten Papers besteht, habe ich dies ausdrücklich angegeben.

München, den 26. Juni 2015 .....

Robert Grundke