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The Effects of Conflict on the Structure of the Economy

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The Effects of Conflict on the Structure of the Economy

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Abstract:

The presence of conflict affects people's economic incentives. Some sectors of activity flourish, while others suffer. For understanding structural problems in developing countries and designing appropriate post-conflict reconstruction policies, it is essential to understand in what ways conflict affects the structure of the economy.

We develop a simple model of conflict and multiple sectors of activity, where conflict efforts, the allocation of factor endowments and the production outputs are endogenous. We predict that for moderately destructive conflicts labor-intensive sectors are most affected by fighting, while for highly destructive conflicts capital-intensive sectors suffer most. In the latter case, under some conditions it is also possible that – in the presence of endogenous conflict - an increase in the price of the capital-intensive commodity reduces the output of this same good. The model further predicts that export-sectors and sectors that require inter-temporal investments are particularly exposed to conflict activity.

In the empirical part of the paper, we study the impact of various forms of conflict, separately and as an aggregate conflict index constructed with principal component analysis. We present some basic stylized facts about the effect of conflict on the productive structure of the economy. Conflict reduces the share of the manufacturing sector in the GDP, increases the exploitation of some simple natural resources (i.e. forestry) and reduces the production of crops.

Using industrial level data for developing countries we study the channels through which conflict affects the manufacturing sector. As expected, we find that industries that are more institutional/transaction intensive are the ones that suffer most in conflictive societies. Labor-intensive sectors are also negatively affected by conflict. It is also found that exporting industries and sectors requiring external financing suffer more during conflict. Our results are robust to sensitivity analysis.

Keywords: Conflict, Production Structure, Resource Curse, Post-Conflict Reconstruction.

JEL Classification: D74, O13, O14.

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1. Introduction

Nicaragua and Costa Rica are neighboring countries that share the same colonial past, the same Independence Day, the same language, and a similar geography and resource endowment. Fifty years ago their level of development was similar. However, nowadays, Costa Rica's per capita GDP is approximately five times larger than Nicaragua's. Costa Rica ranks 48th in the Human Development Index, while Nicaragua ranks 110th. Their productive structures also reflex their divergent development path. Electronics, pharmaceuticals, financial outsourcing, software development, and ecotourism have become the prime industries in Costa Rica's economy. In contrast, the Nicaraguan economy is still basically agrarian and based on the production and export of cash crops such as bananas, coffee, sugar, and tobacco. What are the reasons for such a divergent path? While it is hard to point out only one factor, probably part of the explanation comes from the fact that in the last 50 years Costa Rica has enjoyed greater peace and more consistent political stability than Nicaragua, that went through a long period of dictatorships, the Sandinista rebellion during the 1970s and the Contra War during the 1980s.

The purpose of this paper is to study the effects of conflict on the production structure of the economy. Our hypothesis is that civil conflict is one of the underlying reasons for structural economic problems in poor countries. Of course, we also recognize that more underdeveloped economies have a higher propensity to suffer conflicts due to the lower opportunity cost. We are aware of this endogeneity and perverse dynamics. In this paper, we emphasize the part of the relationship that has been less studied, i.e. how conflicts shape the development path. Civil wars lead to a poorly-developed manufacturing sector that does not allow for the incorporation of low-skilled workers, which increases inequality. It also leads to the under-exploitation of some natural resources and the over-exploitation of others, what could lead to environmental degradation and increasing poverty.

This study is mostly empirical. After building a simple formal model that highlights the various channels through which conflict matters, we construct indices of conflict using different measures of socio-political instability. With the help of principal components analysis they are combined in a single index. Some basic stylized facts of the effect of conflict on the productive structure of the economy are then presented. We find that conflict reduces the share of the

manufacturing sector in the GDP, increases the exploitation of some simple natural resources (forestry) and reduces the production of crops. We find inconclusive evidence on the effects of conflict on the share of the agricultural and service sector in the GDP.

We subsequently focus on explaining the observed negative association between conflicts and manufacturing growth. Using industrial level data for developing countries we study the channels through which conflict may affect the manufacturing sector. This dataset allows within country, between industries differences, beyond the traditional between country differences of the cross-countries studies. As expected, we find that industries that are more institutional/transaction intensive are the ones that suffer the most in more conflictive societies. Surprisingly, we find that labor-intensive industries rather than the capital-intensive ones experience the worst outcomes in more conflictive countries. We present several explanations for this result, which is at odd with previous findings of Collier (1999). Further, we also find that exporting industries and those sectors requiring external financing suffer more during conflict. Our results are robust to sensitivity analysis.

This paper relates to three branches of the economics literature. The first branch is the literature on instability and growth using cross-countries regressions. Barro (1991) and Alesina et al (1996) find that greater instability lowers the growth rate of a country. The inverse relationship also seems to exist. Londregan and Poole (1990) find that lower economic growth increases instability, while Miguel et al (2004) conclude that low growth rates result in a higher risk of civil wars. In contrast, Alesina et al (1996) find that this effect is only important for Coups d'Etat. Alesina and Perotti (1995), using a composite index for instability, test a channel for the inverse relationship between income inequality and growth: income inequality fuels social discontent and increase socio political instability, this creates uncertainty reducing investment and therefore growth.

This paper also relates to the literature on the economics of civil war. While numerous papers focus on the causes of war, only a few papers study the economic effects of conflict. Collier (1999) distinguishes four different economic effects of civil war: diversion of public resources from productive activities to violence, time horizons shortened leading to opportunistic

behavior, lost of human and financial capital, and a shift away from vulnerable economic activities towards those that are less vulnerable. Rohner (2006) shows that conflict can lead to under-exploitation of renewable natural resources and over-exploitation of resources with negative future externalities.

From the methodological point of view, our paper is also related to the literature initiated by Rajan and Zingales (1998) emphasizing the comparison of different industries within countries.

Most of the empirical studies assessing the economic effects of conflict only focus on aggregate measures of instability and growth. Collier (1999) is one exception. He uses national account data for Uganda before and after the social disturbance that started in 1972 when President Idi Amin declared "economic war" against the resident Asian community. He finds important changes in the composition of economic activity that he attributes to the conflict. To our knowledge, our paper is the first to study systematically the effects of conflict on the production structure of a country using industrial level data for a large cross section of countries. Given the important economic effects of conflict, our findings are important for the understanding of post conflict dynamics, the kind of policies needed to reduce the risk of further conflict, and the policy constraints and opportunities the new configuration of the economy imposes[1].

The rest of this paper proceeds as follows. In the next section we provide a brief discussion of the definition and estimation of our measure of conflict. In section 3, we describe our data and sample period. In section 4, we derive theoretical predictions of the effects of conflict on the economy and provide in section 5 some stylized effects of conflict on the structure of the economy using our sample of developing countries. In section 6 of the paper, we present and estimate some plausible channels through which conflict affects the production structure of the economy and in section 7 we conclude.

[1] It may also have policy implications on how post conflict aid should be allocated. According to the new regulations, at least 10% of the IDA budget should be allocated to post conflict countries.

2. Definition and Measurement of Conflict

We shall not focus only on civil wars like most of the literature, but take into account other dimensions of conflict, such as coups and politically motivated assassinations, leading to political and social instability.

The keen interest in political science and economics for understanding the causes of civil conflicts has led to the development of several datasets, using diverse sources, and trying to capture several dimensions of the phenomena, such as duration, intensity and location. This wealth of information leads to the practical problem of how to define conflict and how to measure it. Hibbs (1973) was one of the first to notice this problem and suggested to concentrate on six components of political violence: riots, anti-government demonstrations, political strikes, armed-attack events, and deaths from group violence.

Following this pioneering work we decided to narrow our definition of conflict looking to the following five categories: number of politically motivated murder of government officials (Banks 2008), numbers of coups (Banks 2008), a dummy variable for civil war onsets (PRIO dataset, cf. Gleditsch et al 2002), the number of deaths in civil wars as a proportion of the population (Gleditsch et al 2002) and the democracy/autocracy index (Polity IV project summarized in Marshall and Jaggers 2000). The first two variables reflect political instability and social conflict that may or may not lead to a civil war. Our third variable is an indicator for the incidence of civil conflict and our fourth variable works as a proxy for its intensity. The index for democracy and autocracy is included to correct for possible underreporting in any of our previous four variables in autocratic regimes.

When selecting our series, we are assuming that the more complete the source of coverage the more likely the data are to reflect the “true” distribution of events. As researchers our main concerns are whether different sources provide data that yield the same underlying

structure among conflict situations and if these sources provide data that lead to the same substantive conclusions in hypothesis testing and model building (Jackman and Boyd, 1979). For that reason, we will provide throughout our analysis robustness checks using different dimensions and sources for our data.

To combine the five selected variables into a single index for our econometric estimations we follow Alesina and Perotti (1996) and employ principal components analysis[2] to create an index of conflict[3]. We use the first principal component of the five variables listed above to construct our Conflict Index = 1.34 Assassinations + 1.15 Coups + 0.97 Onset Civil War + 0.68 Death in Civil War + 0.84 Autocracy. All the estimated signs are as predicted by the theory. Since we standardized all the variables appearing in the index, the order of magnitude of the effects of each variable are comparable. The first component explains around 30% of the total variance.

In order to verify the reliability of our conflict index, we precede to some robustness checks. The first check consists in introducing sensible variations to the index. We selected five variables above to estimate our index. However, Banks (2008) has several other alternative variables to measure political instability and conflict. We use these alternative variables (see Appendix B for the list) to estimate other versions of the conflict index. In all cases, the expected sign corresponds to the one predicted by the theory. In most cases, the indices order the countries in the same way and when they do not, the differences are negligible.

The second robustness check for our conflict index consists in comparing the countries rank order with the facts. In section 5, we will focus on the economic effects of conflicts during the 1980s. For that reason, we are particularly interested in guaranteeing the quality of the conflict index for data of the late 1970s and the 1980s. According to our index, El Salvador, Peru, Philippines, Guatemala and Iran were the most conflicted countries during that period. In contrast, Cote d'Ivoire, Lesotho, Jordan, Malawi, and Albania were the less conflictive during the

[2] See Theil (1971) for a description of the principal components method.

[3] Venieris and Gupta (1986) and Gupta (1990) construct similar indexes by applying the method of discriminant analysis to a large sample of countries.

1980s in our sample of developing countries. To check for the actual facts, we use the Encyclopedia of Conflicts since World War II (Edited by Ciment, 2006). According to this book, all our five top countries suffer from conflict in the 1980s: El Salvador Civil Wars (1970s and 1980s), Peru Shining Path Rebellion (1970s-1997), Philippines Moro Uprising (1970s-1980s), Guatemala Civil War (1970s-1990s), and Iran the Islamic Revolution in 1979 and the War with Iraq (1980-1988). None of the five less conflict countries in our index suffered major political instability during the 1980s. Further, when we estimate the same index using only data for the 1990s and beginning of 2000s, the ranking significatively changes and once again the top and bottom countries corresponds with the narrative in Ciment's book.

In section 4 and 5, we will further discuss the robustness of our results to changes in the specification of our conflict index.

3. Data and Sample Period

Our main task will be to look at the effects of conflict across industries in developing countries. For that purpose, we use the Industrial Statistics Database (2003) of the United Nations Industrial Development Organization (UNIDO). This data is available at the 3-digit level of the International Standard Industrial Classification (ISIC, revision 2) for about forty years. The value added data is only extensively available in the 1980s and therefore we focus on that period to keep our sample as large as possible[4].

We would like to focus on long-term growth and at the same time use the most reliable data available. On that basis, our first selection criterion is to include those industrial sectors for which we have enough observations to compute the average value added growth rate over at least a five-year period in the 1980s. Our aim is to study the effects of conflict on the economic structure only in the developing world and for countries that are roughly comparable. For that

[4] During the robustness analysis we use data for the 1990s, resulting in a much smaller sample size.

reason, our second selection criterion is to include in our analysis only low-income and low middle-income countries. Our cut off is a per capita GDP PPP lower than $7000 (constant 2000 international $) in 1980, the first year of our sample. Applying the two criteria reduces our sample to the 50 developing countries in Appendix A. The UNIDO database contains data on 28 industries in these countries (see the first two columns in Appendix C for a description).

The rest of the data is standard. The manufacture, agricultural, and service data as a share of GDP is from the World Development Indicators (WDI). The forestry volume data and the crop index data come from the Food and Agricultural Organization (FAO). The data and their sources are described in detail in Appendix B.

4. The Effects of Conflict on the Economy: Theory

4.1 The Setting

In this section, we present a simple model of endogenous conflict to illustrate the plausible channels through which conflict may affect the structure of the economy. We start from a standard model of an internationally open country with two sectors and two factors of production, as described in Jones (1965). Similar to Dal Bo and Dal Bo (2008), we include appropriation in this framework. In their model the main effect of appropriation is to reduce the available labor endowment. In several respects our framework is complementary to theirs: First, their model captures mostly organized crime not leading to capital destruction, whereas we include government and rebel contest as occurring in civil wars and resulting in capital destruction. Second, while they emphasize the impact of shocks and various policies on the intensity of appropriation, our focus lies mostly on generating empirically testable predictions of how conflict affects the structure of the economy. Thus, in contrast to Dal Bo and Dal Bo (2008)'s purely theoretical contribution, we allow for various additional channels through which conflict matters, which will then guide our empirical strategy.

There are two sectors, 1 and 2, and two factors of production, capital K and labor L, where the total factor endowments are $\overline{K}$, resp. $\overline{L}$. The output prizes are denoted p_1, resp. 1 (p_2 is normalized to 1), the factor prizes are r per unit of K and w for a unit of L. The capital and labor that is engaged in the sectors 1 and 2, are labeled K_1, K_2, L_1, and L_2 respectively. The production functions take a Leontieff form and are as follows:

$$(1)\quad Y_1 = \min\left\{\frac{L_1}{a_{1L}}, \frac{K_1}{a_{1K}}\right\} \quad ; \quad Y_2 = \min\left\{\frac{L_2}{a_{2L}}, \frac{K_2}{a_{2K}}\right\}$$

where a_{1L}, a_{1K}, a_{2L}, a_{2K} are the amounts of production factors required to produce a unit of output of the commodities 1 and 2, respectively.

Additionally there are two conflict activities: Labor can be spent for government soldiering, L_G, and for rebellion, L_R. The value of rents secured trough appropriation is as follows:

$$(2)\quad Y_G = \frac{L_G}{L_G + L_R} N \quad ; \quad Y_R = \frac{L_R}{L_G + L_R} N$$

where N=rents from natural resources.

The above expression captures the basics of conflict over resource rents.[5] As in Dal Bo and Dal Bo (2008) it is assumed that appropriation is labor-intensive. In contrast, however, we take into account that a part of capital is destroyed in conflict. In particular, the disposable

[5] N could also be interpreted as some other "prize" to be appropriated, like e.g. foreign aid or ego rents from office.

income in the presence of conflict becomes $\overline{K} - \mu(L_G + L_R)$, where parameter μ captures how capital-destructive conflict is.

All results below would go through if we allowed for a part of production output being captured in conflict or if we included particular fighting technologies (such as in Rohner, 2006). Further, including capital in the contest success functions or allowing for further forms of labor-destruction in conflict would not change the qualitative implications of the framework. What is crucial for our results is that in conflict both total disposable capital and labor are reduced and that in some instances either L or K are relatively more strongly affected.

4.2 The Equilibrium

Exogenously given are the relative output price p_1, the production technology parameters $a_{1L,}$ $a_{1K,}$ $a_{2L,}$ a_{2K}, the factor endowments $\overline{K}$ and $\overline{L}$, and the natural resource rents N. Endogenously derived will be the factor prices r and w, the production and appropriation factor allocations K_1, K_2, L_1, L_2, L_G and L_R and the output and appropriation levels Y_1, Y_2, Y_G, and Y_R.

We shall start by characterizing the fighting equilibrium. The first order conditions lead to the following reaction functions[6] (note that the labor opportunity costs wL_G, resp. wL_R are included in the optimization functions):

$$(3)\quad RFL_G(L_R) = L_G = -L_R + \sqrt{\frac{L_R N}{w}} \quad ; \quad RFL_R(L_G) = L_R = -L_G + \sqrt{\frac{L_G N}{w}}$$

[6] The FOC's for the Nash Equilibrium lead directly to the solution but we follow the literature in showing the reaction functions first.

The intersection of the two reaction functions corresponds to the Nash Equilibrium[7], which takes the following values: $L_G^* = L_R^* = N/(4w)$. These values feed into the production equations. Now the labor endowment that is disposable for production becomes: $\overline{L} - L_G^* - L_R^* = \overline{L} - N/(2w)$. Similarly, the capital available for production becomes $\overline{K} - \mu(L_G^* + L_R^*) = \overline{K} - (\mu N)/(2w)$. The following lemma is intuitive:

Lemma 1: *Conflict is most intensive (i.e. high L_G and L_R) in countries with low salaries (i.e. low w) and large rents from natural resources (i.e. high N).*

Proof: Follows from $\partial L^*_G/\partial w < 0$, $\partial L^*_R/\partial w < 0$, $\partial L^*_G/\partial N > 0$, $\partial L^*_R/\partial N > 0$.

This is consistent with the empirical studies of the determinants of civil war (Collier, Hoeffler and Rohner, 2009).

We shall initially focus on a competitive production equilibrium with an interior solution (i.e. without specialization). Thus, the following conditions have to hold. The zero-profit condition implies:

(4) $ra_{1K} + wa_{1L} = p_1 \quad ; \quad ra_{2K} + wa_{2L} = 1$

The production factors are fully employed when:

[7] We focus in the Nash Equilibrium that is the standard solution in the literature of conflict when there are strategic interactions. However this may not be the only solution as other sort of equilibrium constructs are possible. For instance, the government might take account of the effects of its own choice on the choice of the rebel leader, or vice versa. Also, if conflict is costly and commitment technologies were available, a (cooperative) rent sharing equilibrium could be sustainable.

(5) $Y_1 a_{1K} + Y_2 a_{2K} = \overline{K} - (\mu N)/(2w)$; $Y_1 a_{1L} + Y_2 a_{2L} = \overline{L} - N/(2w)$

This leads to following factor prices and output levels:

(6) $w = \dfrac{a_{1K} - p_1 a_{2K}}{a_{1K} a_{2L} - a_{1L} a_{2K}}$; $r = \dfrac{p_1 a_{2L} - a_{1L}}{a_{1K} a_{2L} - a_{1L} a_{2K}}$

(7) $Y_1 = \dfrac{a_{2L}[\overline{K} - (\mu N)/(2w)] - a_{2K}[\overline{L} - N/(2w)]}{a_{1K} a_{2L} - a_{1L} a_{2K}}$

(8) $Y_2 = \dfrac{a_{1K}[\overline{L} - N/(2w)] - a_{1L}[\overline{K} - (\mu N)/(2w)]}{a_{1K} a_{2L} - a_{1L} a_{2K}}$

Introducing w into Y_1, resp. Y_2 we obtain:

(9) $Y_1 = \dfrac{a_{2L}\overline{K} - a_{2K}\overline{L}}{a_{1K} a_{2L} - a_{1L} a_{2K}} - \dfrac{a_{2L}\mu N}{2(a_{1K} - p_1 a_{2K})} + \dfrac{a_{2K} N}{2(a_{1K} - p_1 a_{2K})}$

(10) $Y_2 = \dfrac{a_{1K}\overline{L} - a_{1L}\overline{K}}{a_{1K} a_{2L} - a_{1L} a_{2K}} - \dfrac{a_{1K} N}{2(a_{1K} - p_1 a_{2K})} + \dfrac{a_{1L}\mu N}{2(a_{1K} - p_1 a_{2K})}$

We shall now perform some comparative statics. Without loss of generality we can assume that sector 1 is capital-intensive and that $a_{1K} > a_{2K}$, $a_{1L} < a_{2L}$. The following intermediate result is straightforward:

Lemma 2: *An increase in the price of the capital-intensive good p_1 increases r, reduces w and in this way leads to higher conflict efforts L_G, resp. L_R.*

Proof: The first half of this lemma is simply the well-known Stolper-Samuelson result and follows from $\partial r / \partial p_1 > 0$, resp. $\partial w / \partial p_1 < 0$ in equation (6). The second half of this lemma follows from $\partial L_G / \partial w < 0$, resp. $\partial L_R / \partial w < 0$ in equation (3).

A variant of this intermediate result of Lemma 2 is also found in Dal Bo and Dal Bo (2008)'s related model of crime. In contrast, the rest of our results presented below are novel, and have to the best of our knowledge not been obtained before in the literature. Now, we shall analyze whether capital- or labor-intensive sectors suffer most from conflict.

Proposition 1: *For moderately destructive conflicts (i.e. low μ) labor-intensive sectors suffer most, while in very destructive conflicts (i.e. high μ) capital-intensive sectors are most affected.*

Proof: For low levels of *μ* the reduction in disposable labor prevails, while for large levels of *μ* the decrease in available capital dominates. It follows from equations (9) and (10) that in the former case the relative size of the labor-intensive sector 2 shrinks, while in the latter case the capital-intensive sector 1 is downsized.

Empirically, conflict is mostly capital-destructive in rich countries, where fighting technologies are more powerful and high-profile targets are readily available.[8] In these countries also non-tangible forms of capital like brand names or a reputation for political stability are most fragile. This leads to the following corollary:

Corollary 1: *Empirically, conflicts in low-income countries are expected to hurt labor-intensive sectors most extensively, while in high-income countries capital-intensive sectors are most affected by conflict.*

Proof: Follows from Proposition 1.

Interestingly, this is consistent with the empirical evidence that driving forces and effects of conflict are very different for rich versus poor countries (Collier and Rohner, 2008).

Next, we shall assess how price changes affect the outputs of the two sectors.

Proposition 2: *If conflict is not very destructive (i.e. low μ), a marginal increase in the relative price of the capital-intensive commodity, p_1, increases the output Y_1 of the corresponding sector and decreases the output Y_2 of the labor-intensive sector. In contrast, if conflict is very destructive (i.e. high μ), a marginal increase in p_1 decreases the output Y_1 of the capital-intensive sector and increases the output Y_2 of the labor-intensive sector.*

Proof: Follows from equations (9) and (10). If μ is low: $\partial Y_1 / \partial p_1 > 0$, $\partial Y_1 / \partial p_2 < 0$. In contrast, if μ is large: $\partial Y_1 / \partial p_1 < 0$, $\partial Y_1 / \partial p_2 > 0$.

[8] Our findings contrast with Dal Bo and Dal Bo (2008)'s prediction that conflict always harms labor-intensive sectors most, which is driven by their assumption that conflict does not reduce the stock of available capital.

Note that here we focused on marginal changes in relative prices. For larger changes in prices specialization in the production of one single commodity can occur in the underlying framework.

The result of Proposition 2 is interesting. The possibility that exogenous price increases in commodity 1 can reduce the output of this same commodity may seem at first sight paradoxical. This finding is due to the channel of conflict: An increase in p_1 leads to lower wages w, which reduces the opportunity cost of appropriation. If conflict is very destructive the disposable capital can be reduced to such an extent that the output of the capital-intensive commodity Y_1 actually decreases.

4.3 Extensions and Further Comparative Statics

So far we focused on the effects of conflict on sectors of varying factor-intensity. Now we shall put emphasis on other empirically relevant aspects of the structure of an economy. For this purpose we shall in the following extensions close the factor intensity channel and assume that $a_{1K}=a_{2K}$, $a_{1L}=a_{2L,}$. In this case, the country will specialize in sector 1 if $p_1>1$, and specialize in sector 2 if $p_1<1$. We shall assume that initially $p_1=1$ and no specialization occurs.

In such a setting clearly an increase in p_1 will increase the output of commodity 1 by triggering specialization towards sector 1. However, often, as it was mentioned above, an increase in the price of the good the countries specialize in, triggers conflict because it increases the amount of rents available for grabbing. In the light of this, we can analyze the effects of conflict on domestic versus export sectors. To fix ideas, let us assume that sector 1 produces an exported good, while sector 2 produces exclusively for the domestic market. Countries in civil war are often subject to trade sanctions or export barriers broadly understood[9],

[9] During conflict basic infrastructure is damaged or inaccessible, external financing (export credit) scarce, and contracts riskier.

which makes it harder to export and increase "costs" for a given price level p_1, resulting in the following empirically testable prediction:

Proposition 3: *In a setting with small differences in factor intensities, where price changes trigger specialization, export sectors are expected to suffer more from conflict than domestic sectors.*

Proof: Follows from the discussion above.

Our simple framework can also generate predictions on how the investment requirements of sectors influence their vulnerability in conflict. Assume that in sector 1 the returns to investment are received with some lag and that future gains are discounted. Initially, production takes place in both sectors, with $\delta p_1=1$. Conflict reduces the discount factor δ of future payoffs by decreasing life expectancy. Put differently, as producers know that with some positive probability they get killed in conflict they discount future rewards more heavily. This leads to $\delta p_1<1$, which triggers specialization away from sector 1 to sector 2 which delivers immediate gains. This can be summarized in the following proposition.

Proposition 4: *In a setting with small differences in factor intensities, where price changes trigger specialization, sectors that require future investments (i.e. manufacturing, crop farming) are expected to suffer most from conflict.*

Proof: Follows from the discussion above.

5. The Effects of Conflict on the Economy: Some Stylized Facts

The presence of conflict alters the incentives, constraints, and planning time horizons of the economies that suffer it. We are interested in getting some stylized facts of the effects of conflict on the economic structure of a country. However, this task poses several practical challenges. The first problem is how to measure conflict. As we mentioned in section 2 of this paper, the variable is multidimensional and hard to pin down in a numerical value. For the purpose of this paper, we are more interested in getting a ranking for conflictive countries than a particular meaningful number. For that reason, we decided to construct an index of conflict using principal components analysis.

The second practical problem is that often statistics are the first casualty in a conflict. Lacking superior information to those who constructed the data, our only remedy is to work with average data over long periods of time, check for outliers, and see if a pattern emerges. We also control for country and time effects to try to minimize this difficulty. In the next section, we can partially avoid this problem by looking between industries variation instead of the typical cross-countries regressions.

To estimate the effect of conflict on the structure of the economy, we plot the log of the variable of interest in a country against the conflict index for two separate dates, after controlling for GDP pc PPP, GDP PPP pc square, time and country fixed effects as displayed in equation (7) below:

$$\begin{aligned} \mathrm{LogY}_{jt} &= \alpha + \beta * \mathrm{Conflict}_{jt} + \gamma * \mathrm{GDPpcPPP}_{jt} + \delta * \mathrm{GDPpcPPPsq}_{jt} + \\ &+ \eta * \mathrm{timedummy} + \zeta * \mathrm{country\ indicators(j)} + \varepsilon_{jt} \end{aligned} \qquad (7)$$

Since we include fixed effects, the association between conflict and the dependent variable is temporal, within countries, over time, rather than a relationship between countries. The dependent variable is the average for 1980-1985, and 2000-2005. For the conflict variable, we use our benchmark index from section 2 averaged over 1976-1985, and 1996-2005. We include the previous five years in the conflict index estimates to pick up the fact that the current configuration of a country may have been very much affected by recent conflicts[10].

[10] Our main results are not affected if we average the conflict variable over 1966-1985 and 1986-2005.

Our first variable of interest is manufacturing growth. As pointed out by Jones and Olken (2008), practically all countries which have had a sustained period of growth in the post-war period have experienced a large increase in their share of manufacturing. Our regressions results (Table 1, first column) show that increases in the conflict level are associated with a reduction in the share of manufacture in the GDP. The coefficient estimate suggests very important effects: a change in conflict from the first quartile to the third quartile implies a reduction in the share of manufacturing in total GDP of about 7 percentage points. The relationship showed in Figure 1 is robust to different specifications of the conflict index and to the removal of the most influential observations. Without further analysis, we do not know if the relationship is casual. However, the argument for reverse causality is unconvincing -as the country get poorer or the income distribution more unequal and the manufacturing shrinks, it become more prone to conflict- because we have controlled for initial per capita GDP. Given the importance of manufacturing growth in the development process, we will further study the issue in next section. In particular, we will test some possible channels through which conflict affects manufacture growth.

Figures 2 and 3 show the relationship between conflict and agricultural and service respectively. The estimated coefficients in the second and third columns in Table 1 are not significantly different from zero. This result does not change if we use different variations in the conflict index or if we check for outliers. These no results are hardly a surprise. Production in the agricultural sector drops on average by 12.3% per year during periods of violent conflict[11] (Messer et al 1998). However, we are measuring agricultural as a share of GDP and given the important negative effect we found for the manufacturing sector it may be the case that the agricultural sector suffers relatively less as it is a less complex and a more vital activity. Furthermore, the argument for reverse causality here is much stronger than in the case of the manufacturing sector. There are many examples where issues within the agricultural sector have unquestionably had direct impacts on the outbreak of violent conflict[12]. In the case of the service sector, the variable is not very informative and we could hardly expect to find any effect

[11] Angola is an extreme example, having production drop by as much as 44.5% during the war years from 1975-1993.

[12] Crisis in the agricultural sector has been cited as a contributing factor to the conflicts in Rwanda and Cote d'Ivoire (UNU-IAS, 2004) as well as in over two dozen other conflicts in a direct or indirect fashion (de Soysa and Gleditsch, 1999).

of conflict as it includes from very complex business services to very simple personal services that may be affected in very different ways during conflict.

The exploitation of natural forests is a very simple economic activity in the development world. For that reason, we would expect conflict to increase the utilization of this natural resource in detriment of more complex activities that required coordination and resources that are not available during conflict. The breakdown in cooperation and shortening of time horizons may also lead to an overexploitation of this resource since the negative externality may not be internalized. Le Billlon (2000) illustrates this in the case of Cambodia where the forest exploitation for timber financed the continuation of the civil war, leading to the depletion of Cambodia's most valuable resource. Our estimate (column four in Table 1) shows a positive effect of conflict in the forestry production volume (Figure 4). However, conflict in the long run may lead to an abrupt decrease in forestry production if the overexploitation depletes this resource.

More clear is the effect conflict has in crops production (Figure 5), one of the main activities in the development world. This is an activity that requires an investment that takes some time to mature. Conflict affects the provision of the infrastructure and financial capital required to raise cash crops. It also reduces the planning horizon leading many farmers to focus only on subsistence agriculture. It is also a well recorded fact that rebel factions usually target crops producers to affect the ability of the government to raise revenues from the crops commercialization (Meredith 2005). Our estimated coefficient in column five of Table 1 is negative and significative. We found the same results when we tried with sensible variations in our definition of conflict.

To sum up, in this section we found that conflict has a sizable negative effect on the manufacture share of GDP, while it does not have any evident effect on the share of agriculture and the service sector. We also found that activities, such as forestry, that involve a natural resource that is easily sizable increase during conflict, while other activities that require investment decrease in the presence of conflict. In the next section, we explore in more detail the effects of conflict on the manufacturing sector.

6. Conflict and Production Structure: The Channels

The manufacture share in GDP declines with conflict, but what are the deep underlying causes? To answer this question, we use the methodology developed in Rajan and Zingales (1998) to test channels through which conflict may have an effect on the production structure. This methodology moves away from the between countries differences of cross-countries regressions where endogeneity is a big concern to within countries between industries differences. However, to be valid, this methodology needs "technology" to be similar among the countries being compared, and for that reason, we decided to focus on developing countries.

In the model of the previous section, we suggested that conflict may affect to the largest extent those productive sectors that are most complex, and require most intermediate inputs and coordination among different agents in the economy. We would like to check this by looking whether industries that might be most affected by a channel grow differentially in countries where the channel is likely to be more operative (countries where conflict is more extensive). Therefore, our estimation strategy is to run regressions of the form:

$$GrowthVA_{ji} = \alpha + \beta * \text{Conflict}_j * \text{IndustryCharacteristic}_i + \gamma * \text{IndustryInitialVAShare}_{ji} + \\ + \delta * \text{IndustryIndicators}_i + \zeta * \text{CountryIndicators}_j + \varepsilon_{ji} \quad (8)$$

Our dependent variable is the real annual average value added growth of industry i in country j during the 1980s, the period for which our sample is larger and the value added data more reliable. The explanatory variables include the initial period share of industry i in total value added in country j, country and industry fixed effects, and the interaction term between the country-specific conflict level and the industry-specific characteristics through which the channels operate. Our focus is the coefficient β associated with this interaction term.

We have to define now the industry characteristics that we shall use to test the effects of conflict. We are interested in three different groups of industry characteristics: (i) Institutional Complexity[13], (ii) Production Factor Intensity, and (iii) Exportability.

(i) Institutional Complexity

We expect industries that are transaction intensive, and require complex contracting and specific inputs to rely more on the institutional environment in which they operate. Therefore, they should be the most affected during conflict because of the effect it has on the general quality of the country's institutions and policies.

To estimate the channels, we use two different measures developed using the US economy as a benchmark. Both measures use the Input Output matrix of the US economy to obtain the level of institutional complexity of industry i. The first industry characteristic we use is the "relation specific investment" measure developed by Nunn (2007). He asks whether or not the input is sold in an organized exchange (thick market) and for each industry he gets a measure of the proportion of its intermediate goods that are relationship-specific. The second industry measure is a Herfindahl index of the intermediate good requirements from other industries. This measure was first used by Blanchard and Kremer (1997) and later by Cowan and Neut (2007) and the idea is that the fewer the industries an industry buys from the less it needs institutional quality. The assumption behind this approach is that the existing structure of intermediate good use in the US is driven by technology differences across sectors, and that these technological differences persist across economies (Cowan and Neut, 2007). The first two columns in Appendix C show these measures for the 28 industries.

We then move to estimate equation (8) using our two measures of industry-specific institutional complexity. The results appear in the first two columns in Table 2 where the industry and country fixed effect coefficients have been removed for presentation simplicity. The two

[13] Which is what Collier (1999) calls "transaction intensive" sectors.

estimated coefficients are negative as expected: industries that are more "institutions intensive" suffer more during conflict. This result is in line with the findings of Collier (1999). Our first institutional complexity proxy, the relation specificity variable, is significantly different from zero when we use our benchmark conflict index, while the second proxy, the Herfindhal index is not.

To check for the robustness of our result, we use different specifications for our conflict index, in line with what we did in the previous section. In all cases, the estimated coefficients remain negative for both proxies, significantly different from zero for the relationship specificity variable, and for some cases now the Herfindhal variable becomes significantly different from zero. A second source of concern is the possibility that our results are driven by omitted country-level variables that are correlated with the conflict index and have a differential effect across industries. The main candidate for this omitted variable is official aid. Conflict countries often receive post-conflict aid to help rebuild their economies. It is a well documented fact (Rajan and Subramanian, 2005) that aid has a negative effect on governance and therefore affects more those industries that are governance/institution intense. To control for this possibility, we include interactions of our complexity variable with the amount of aid (as a share of GDP) the country received during the 1980s. The introduction of this term results in negligible changes in our previous estimates.

(ii) Production Factor Intensity

Conflict generally affects the price and availability of inputs required in the production process. Physical capital is destroyed and the investment rates remain low during conflict. Wars and confrontations kill and displace people. Skilled workers often leave the country and part of the labor force becomes part of government and rebels armies. Financial capital often also leaves the country reducing the availability of credit to finance working capital and large operations.

To study these channels, we characterize industries according to their factor intensity. The first measure we use is the logarithm of the capital labor relation that Cowan and Neut (2007) estimate using US data to construct a measure of the factor intensity for each industry. Our second measure is the labor share values from Rajan and Subramanian (2005). They estimate the labor factor intensity as the wage to value added for each industry across developing countries during the 1980s. Our last measure of factor intensity is the financial dependence variable in Rajan and Zingales (1998). This variable measures the external financial dependence for all firms in industry i during the 1980s. Columns 3-5 in Appendix C show these three industry-specific variables.

We once again estimate equation (8) using the three industry specific variables mentioned in the previous paragraph. The estimates (columns 3 to 5 in Table 2) show that conflicts have a larger negative effect on value added growth in those sectors that are more labor intensive and that depend more on external financing. Specifically, we find the estimated coefficient on the interaction term between conflict and labor intensity and between conflict and financial dependence to be negative in the three cases and significantly different from zero in the cases of the labor intensity and external financial dependence variables. This last result is not surprising; conflicts are often associated to major disruptions in domestic capital markets and capital flights. In contrast, the finding that labor and not capital intense sectors suffer more during conflict goes against previous findings (Collier, 1999). This is a result that requires more study and probably a more disaggregate study at the country-conflict specific level. A possible explanation could be that civil conflicts are labor intensive in the developing world and that physical capital is less mobile than labor in the short run[14].

We carry out several robustness checks. Our basic results are not affected by sensible variations in our conflict index. The estimate of β could be biased due to a combination of cross-sector differences in factor intensity and cross-country differences in relative factor prices that are correlated with conflict. Unfortunately, it is hard to find good proxies for factor prices in

[14] Conflicts in the developing world are often characterized by important loss of lives and the displacement of large parts of the population.

developing countries. We use different measures of financial development[15] under the assumption that poorly-developed financial markets imply higher effective costs of capital and that firms in those countries substitute capital for labor. The introduction of the financial dependence term does not significantly affect our previous results.

(iii) Exportability

Further, we are interested in assessing whether "exporting" industries suffer more or less from conflict. We use two industry-specific measures developed by Rajan and Subramanian (2005). The first measure of exportability consists in the average ratio of export to value added across developing countries during the 1980s. The second measure is a dummy variable taking the value 1 if the industry i had a ratio of exports to value added above the industry median value during the 1980s. The last two columns in Appendix C display the values of these two measures across the 28 industries.

The last two columns in Table 2 show the estimates of equation (8) for the exportability variables. In both cases, the coefficients are negative and highly significantly different from zero, indicating that exporting sectors suffer more during conflict. This result is robust and it is not affected by prudent variations in our conflict index.

This result does not come as a surprise since there is wealth of anecdotic evidence of conflicts were rebels target activities that are the main source of export revenue for the government, like coffee in Colombia or oil in the Nigerian delta. Exporting sectors also require advance financing and infrastructure, two sectors that are often affected by conflict. However,

[15] We approximate financial development using the extensive set of indices found in the World Bank's Financial Development and Structure database. However, data is not available for all the countries in our sample and therefore we lose some observations when we do this robustness check.

the result could also have gone the other way around, since the government may stimulate exporting sectors during conflict to obtain extra revenue for distributive or defense purposes.

Our estimates could also be biased due to endogeneity issues. Higher export growth may generate additional rents to fight for or commodity price collapses may increase poverty, which could fuel conflict. The bias could go either way and we do not have data available to disentangle the two effects. The correlation between a country specific commodity export price index[16] and our conflict index is very low. The introduction of this extra interaction term in (8) does not affect our previous results.

To summarize, the reduction in manufacturing share in conflict countries can be explained by several channels. In this section, we found evidence that conflict affects more industries that require good institutions, are labor intensive, need external financing, and export an important part of their production. These results are robust to sensible variations in our conflict index and to the introduction of control variables to take into account possible omitted variable bias.

7. Conclusions

Most of the literature on civil wars focuses on its causes. The present contribution instead looks at the effects of conflict on the structure of the economy. We develop an index of conflict using principal component analysis and apply it to assess the effects of conflict across economic activities in a sample of developing countries.

We find that conflict reduces the share of the manufacturing sector in the GDP, which may have important effects on the developing path of these countries. In contrast, in particular

[16] The commodity export price index comes from Collier and Goderis (2007)

those associated to natural resources, are likely to be over-exploited during conflict leading in the long run to environmental degradation and increasing poverty. We do not find conclusive evidence on the effect of conflict on the agricultural and service share of GDP.

Using industrial level data for a sample of developing countries in the 1980s, we find that industries that are more institutional, labor, and external finance intensive are the most affected by conflict. Exporting sectors also suffer from war. These results are robust to sensible variations in our conflict index and to several checks for omitted variables bias.

While we could not rule out the possibility that our results are driven by defective and incomplete data, the use of inappropriate proxies, or by other omitted variables, the results provide a benchmark for future studies. This is one of the first papers to look systematically at the economic effects of conflict and further work is needed. In particular, we came around the problem of defining conflict using an index, but this could and should be improved trying to disaggregate different dimensions of conflict such as duration, intensity, location and motivation. Some of the industry characteristics used to estimate the channels were based on US data that may not be relevant for developing countries and alternative proxies should be considered. Future work should also consider strategies to instrument for conflict and ways to take the analysis to the country case study level.

Appendix A: List of Countries in the Sample

Albania	Cote d'Ivoire	Jamaica	Papua New Guinea
Algeria	Dominican Republic	Jordan	Peru
Bangladesh	Ecuador	Kenya	Philippines
Bolivia	Egypt, Arab Rep.	Lesotho	Senegal
Botswana	El Salvador	Madagascar	Sri Lanka
Burundi	Ethiopia	Malawi	Syrian Arab Republic
Cameroon	Fiji	Malaysia	Togo
Central African Rep.	Ghana	Mauritius	Turkey
Chile	Guatemala	Morocco	Uruguay
China	Honduras	Nicaragua	Venezuela, RB
Colombia	India	Nigeria	Zimbabwe
Congo, Rep.	Indonesia	Pakistan	
Costa Rica	Iran, Islamic Rep.	Panama	

Appendix B: Data Sources and Description

Macroeconomic Variables	Source
Manufacture as % of GDP	World Development Indicators
Agriculture as % of GDP	World Development Indicators
Service as % of GDP	World Development Indicators
Crop Index	Food and Agricultural Organization
Foretry Production Volume	Food and Agricultural Organization
Population	World Development Indicators
GDP Per Capita, PPP (constant 2000 international $)	World Development Indicators
Industry Level Data	
Growth Rate of Value Added$_{ij}$: Industry i's annual growth rate of value added in country j, averaged over each decade	UNIDO (2003)
Initial Industry Share$_{ij}$: Industry i's in country j total manufacturing value added at the beginning of each decade	UNIDO (2003)
Relation specific investment: for each industry get measure of the proportion of its intermediate goods that are relationship-specific	Nunn (2007)
Herfindahl Index of Intermediate good requirements from other industries	Blanchard and Kremer (1997)
Log K/L: US data to construct factor intensity for each industry	Cowan and Neut (2007)
Labor share: wage to value added for each industry across developing countries during the 1980s.	Rajan and Subramanian (2005)
Financial Dependence: measure of external financial dependence for all firms in industry i during the 1980s	Rajan and Zingales (1998)
Exportability in the 1980s: average ratio of export to value added across developing countries	Rajan and Subramanian (2005)
Exportability dummy: takes value 1 if industry i has a ratio of exports to value added above the industry median value	Rajan and Subramanian (2005)
Variables in the Conflict Index	
Number of politically motivated murder of government officials	Banks (2008)
Number of coups	Banks (2008)
Dummy for war onsets	Gleditsch et al (2002)
Number of death in civil wars	Gleditsch et al (2002)
Autocracy/Democracy scores (0 to 10)	Polity IV
Alternative Variables in the Conflict Index	
Number of general strikes with more than 1000 people involved	Banks (2008)
Number of armed activity, sabotage etc in the aim of overthrowing government	Banks (2008)
Number of government crisis	Banks (2008)
Number of systematic purges of opposition	Banks (2008)
Number of violant demonstration involving more than 100 people	Banks (2008)
Number of anti-government demonstrations	Banks (2008)
Number of attempted revolutions	Banks (2008)
Number of major constitutional changes	Banks (2008)
Dummy for coups	Banks (2008)

Appendix C: Industry Level Indexes

ISIC	Description	Relation Specific Investment	HH Institutional Intensity	LogK/L (Negative)	Labor Share'80s	External Finance Dependence	Exporability in the 1980s	Exportability Dummy
311	Food products	0.331	-0.497	-1.028	0.360	0.140	1.250	1
313	Beverages	0.713	-0.794	-1.205	0.260	0.080	0.140	0
314	Tobacco	0.317	-1.519	-1.199	0.240	-0.450	0.230	0
321	Textiles	0.376	-1.049	-0.934	0.470	0.400	1.350	1
322	Wearing apparel, except footwear	0.745	-1.232	-0.567	0.510	0.030	2.460	1
323	Leather products	0.571	-1.488	-0.726	0.450	-0.140	2.650	1
324	Footwear, except rubber or plastic	0.650	-1.825	-0.627	0.490	-0.080	1.690	1
331	Wood products, except furniture	0.516	-1.156	-0.899	0.470	0.280	1.240	1
332	Furniture, except metal	0.568	-0.462	-0.742	0.500	0.240	0.460	0
341	Paper and products	0.348	-0.983	-1.159	0.390	0.180	0.360	0
342	Printing and publishing	0.713	-0.907	-0.830	0.510	0.200	0.130	0
351	Industrial chemicals	0.240	-1.761	-1.260	0.350	N/A	1.810	1
352	Other chemicals	0.490	-0.586	-1.227	0.360	0.220	0.790	0
353	Petroleum refineries	0.058	-4.160	-1.575	0.190	0.040	2.150	1
354	Misc. petroleum and coal products	0.395	-1.492	-1.093	0.300	0.330	16.770	1
355	Rubber products	0.407	-0.545	-0.995	0.420	0.230	0.610	0
356	Plastic products	0.408	-1.366	-0.923	0.360	1.140	0.460	0
361	Pottery, china, earthenware	0.329	-0.560	-0.828	0.460	-0.150	1.030	0
362	Glass and products	0.557	-0.703	-1.081	0.440	0.530	0.660	0
369	Other non-metallic mineral products	0.377	-0.467	-1.081	0.370	0.060	0.250	0
371	Iron and steel	0.242	-0.810	-1.272	0.380	0.090	0.810	0
372	Non-ferrous metals	0.160	-0.668	-1.147	0.330	0.010	3.520	1
381	Fabricated metal products	0.435	-0.847	-0.949	0.450	0.240	0.480	0
382	Machinery, except electrical	0.764	-0.352	-0.980	0.510	0.450	1.390	1
383	Machinery, electric	0.740	-0.533	-0.942	0.380	0.770	1.050	0
384	Transport equipment	0.859	-0.549	-1.015	0.470	0.310	2.680	1
385	Professional & scientific equipment	0.785	-0.383	-0.881	0.430	0.960	6.880	1
390	Other manufactured products	0.547	-0.450	-0.828	0.430	0.470	2.570	1

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Table 1: Conflict and Economic Activities

	Manufacture/GDP	Agriculture/GDP	Service/GDP	Forestry/Population	Crop Index
GDP pc PPP	12.50	-13.37	-27.23	73.95	37.66*
	(0.42)	(0.89)	(-1.61)	(1.58)	(1.99)
GDP pc PPP sq	-6.234	6.428	13.70	-36.99	-18.79*
	(-0.41)	(-0.86)	(1.62)	(-1.58)	(-1.99)
Conflict	-0.0978*	-0.0711	0.0649	0.230*	-0.109*
	(-1.66)	(1.28)	(1.38)	(1.87)	(-1.73)
Number Observations	92	95	95	97	98
R-square	0.877	0.964	0.800	0.957	0.788

T-values reported below the coefficient, standard errors are robust, ***, **, * denote significance at, or below, 1, 5, and 10 percent respectively.
All regressions include country and time fixed effects, not reported for presentation simplicity.
See text for definitions of variables.

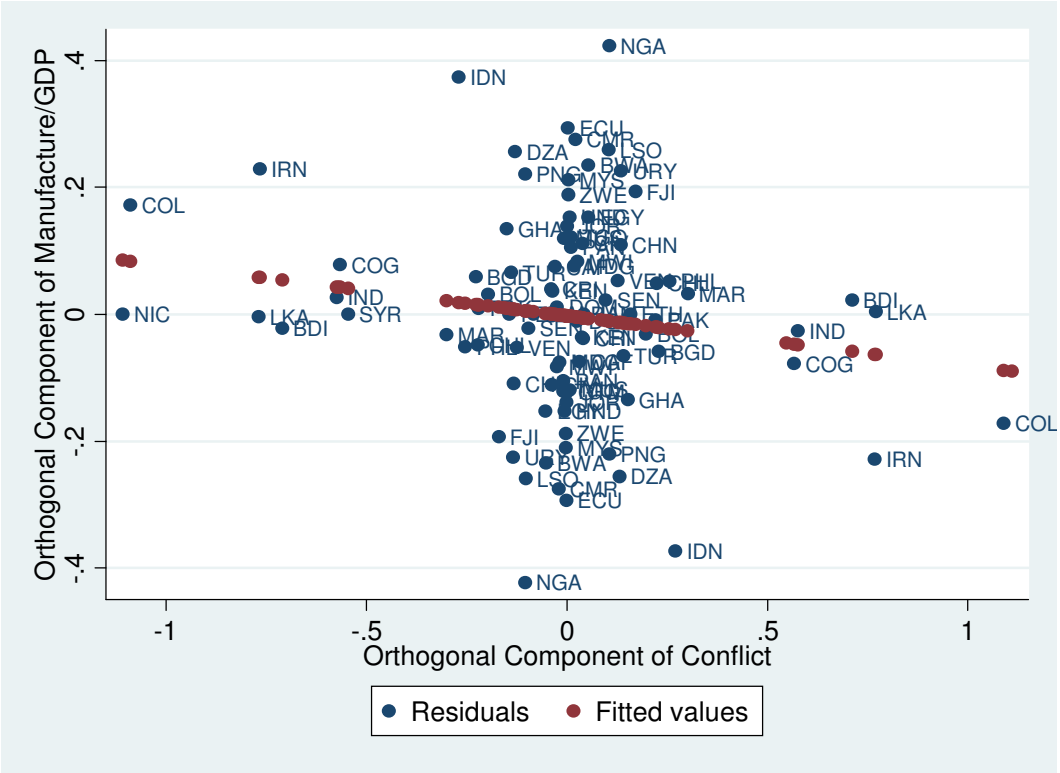
Table 2: Impact of Conflict on the Production Structure

Dependent variable is the annual average rate of real value added growth of industry (i) in country (j) during the 1980s

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Institutional Complexity		**Production Factor Intensity**			**Exportability**	
Initial industry share (ij)	-0.130**	-0.131**	-0.134**	-0.132**	-0.0973**	-0.133**	-0.129**
	(-2.47)	(-2.51)	(-2.55)	(-2.51)	(-2.00)	(-2.55)	(-2.47)
Conflict Index (j)*Relationship Specificity(i)	-0.0107*						
	(-1.67)						
Conflict Index (j)*Institutional Intensity HH(i)		-0.00135					
		(-0.73)					
Conflict Index (j)*Labor Intensity(i)			-0.0124**				
			(-1.96)				
Conflict Index (j)*Average Labor Share in 1980s(i)				-0.0208			
				(-1.19)			
Conflict Index (j)*External Financial Dependence(i)					-0.00797*		
					(-1.80)		
Conflict Index (j)*Exportability Index(i) in 1980s						-0.00196***	
						(-4.65)	
Conflict Index (j)*Exportability Dummy in 1980s							-0.00634**
							(-2.15)
Number of observations	1372	1372	1372	1372	1323	1372	1372
R-Squared	0.259	0.257	0.259	0.258	0.268	0.260	0.268

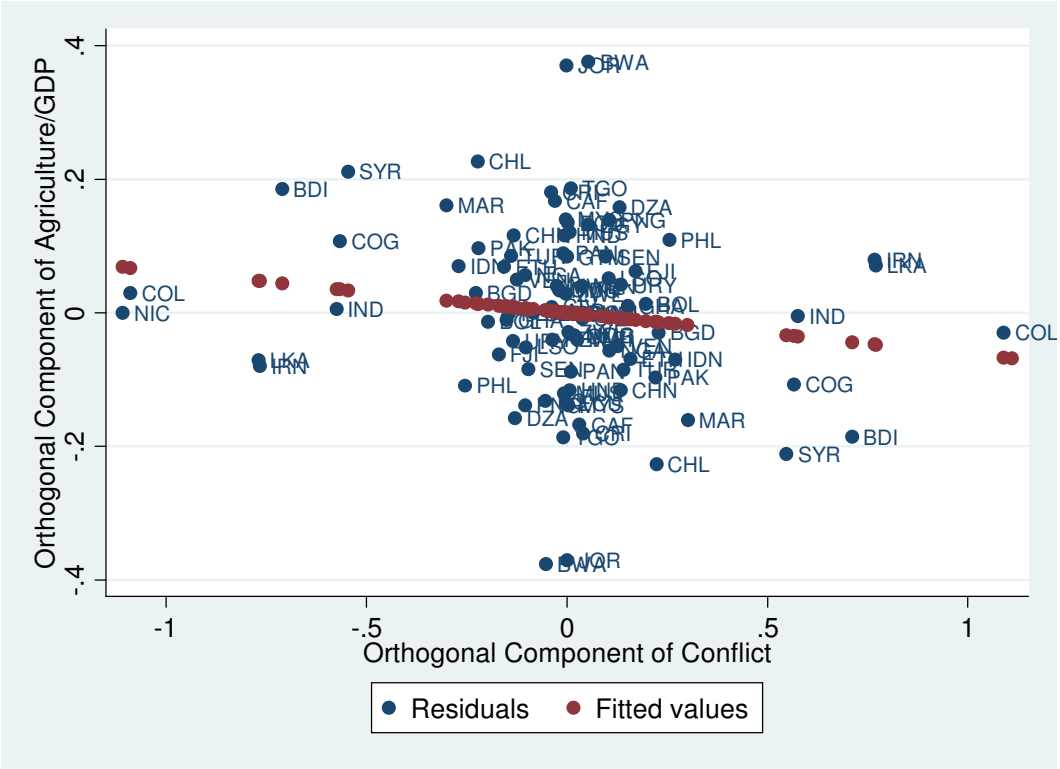
T-values reported below the coefficient, standard errors are robust, ***, **, * denote significance at, or below, 1, 5, and 10 percen respectively.
All regressions include industry and country fixed effects, not reported for presentation simplicity. See text for definitions of variables.

Figure 1: Conflict and Manufacture/GDP



This graph represents the conditional relationship between the change in the average size of the manufacturing sector between 1980-1985 and 2000-2005 in a country and the change in the conflict index between 1976-1985 and 1996-2005. It is based on running a panel regression for our sample of 50 developing countries where the dependent variable is the log of the share of manufacturing value added in the GDP for a country in the early 1980s and early 2000s, and the explanatory variables are the country's per capita PPP GDP, per capita PPP GDP square, country and time fixed effects, and our benchmark conflict index from section 2 of the paper estimated around the 1980s and the 2000s. The relationship between conflict and manufacture growth is negative, significative, and robust to sensible variations in our conflict index.

Figure 2: Conflict and Agriculture/GDP

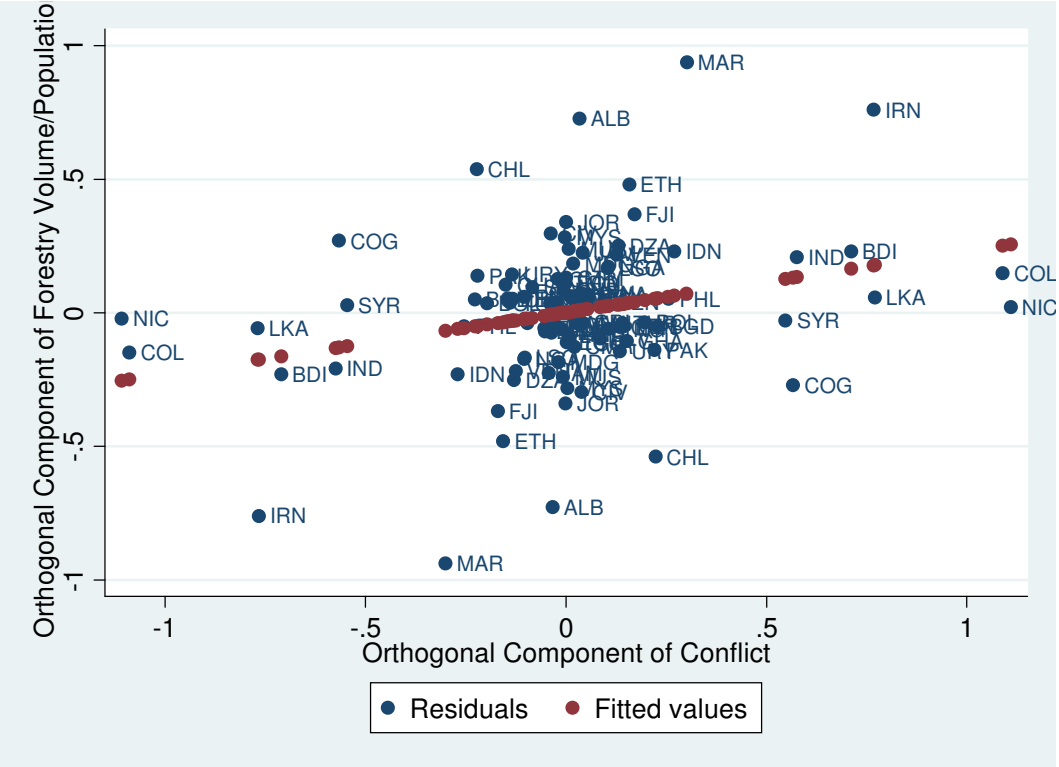


This graph represents the conditional relationship between the change in the average size of the agricultural sector between 1980-1985 and 2000-2005 in a country and the change in the conflict index between 1976-1985 and 1996-2005. It is based on running a panel regression for our sample of 50 developing countries where the dependent variable is the log of the share of agricultural value added in the GDP for a country in the early 1980s and early 2000s, and the explanatory variables are the country's per capita PPP GDP, per capita PPP GDP square, country and time fixed effects, and our benchmark conflict index from section 2 of the paper estimated around the 1980s and the 2000s. The relationship between conflict and agriculture value added growth is not significative. Sensible variations in our conflict index generate different results (12 negative and 4 positive coefficients) that are never significative.

Figure 3: Conflict and Service/GDP

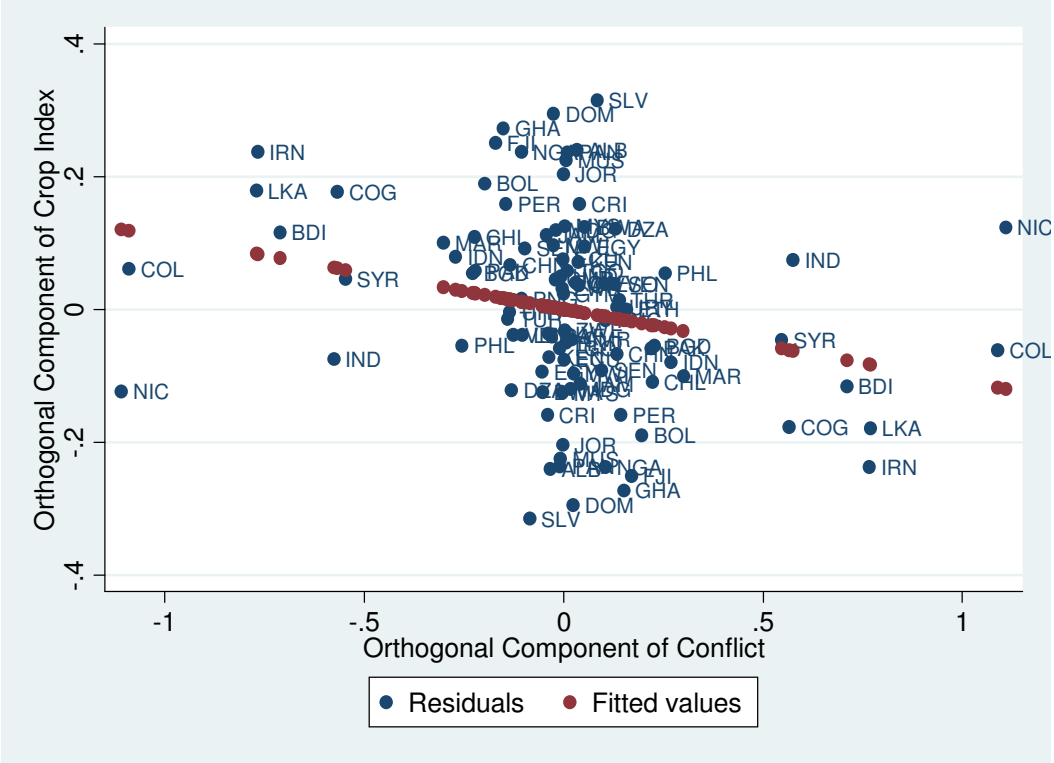
This graph represents the conditional relationship between the change in the average size of the service sector between 1980-1985 and 2000-2005 in a country and the change in the conflict index between 1976-1985 and 1996-2005. It is based on running a panel regression for our sample of 50 developing countries where the dependent variable is the log of the share of service value added in the GDP for a country in the early 1980s and early 2000s, and the explanatory variables are the country's per capita PPP GDP, per capita PPP GDP square, country and time fixed effects, and our benchmark conflict index from section 2 of the paper estimated around the 1980s and the 2000s. The relationship between conflict and service value added growth is not significative. Sensible variations in our conflict index generate different results (7 negative and 9 positive coefficients) that are never significative.

Figure 4: Conflict and Forestry Volume/Population



This graph represents the conditional relationship between the change in the average size of the forestry production volume between 1980-1985 and 2000-2005 in a country and the change in the conflict index between 1976-1985 and 1996-2005. It is based on running a panel regression for our sample of 50 developing countries where the dependent variable is the log of the ratio of forestry production volume to the population of a country in the early 1980s and early 2000s, and the explanatory variables are the country's per capita PPP GDP, per capita PPP GDP square, country and time fixed effects, and our benchmark conflict index from section 2 of the paper estimated around the 1980s and the 2000s. The relationship between conflict and forestry production volume growth is positive and significative in most cases. Sensible variations in our conflict index generate different results (14 positive and 2 negative coefficients). The positive coefficients are significative in 13 out of 14 cases. The negative coefficients are not significative.

Figure 5: Conflict and Crop Index



This graph represents the conditional relationship between the change in the crop production index between 1980-1985 and 2000-2005 in a country and the change in the conflict index between 1976-1985 and 1996-2005. It is based on running a panel regression for our sample of 50 developing countries where the dependent variable is the log of the crop production index of a country in the early 1980s and early 2000s, and the explanatory variables are the country's per capita PPP GDP, per capita PPP GDP square, country and time fixed effects, and our benchmark conflict index from section 2 of the paper estimated around the 1980s and the 2000s. The relationship between conflict and crop production growth is always negative and significative. Sensible variations in our conflict index confirm this result.