

# Essays in Labour Economics and Entrepreneurship

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MSc Helke Seitz

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Referentin: Apl. Prof. Dr. Susan Steiner

Koreferent: Prof. Dr. Lukas Menkhoff

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## Abstract

This dissertation is concerned with research questions in the fields of labour economics and entrepreneurship. Chapter 1 introduces the four different research areas of this thesis and provides an overview of the subsequent chapters.

Chapter 2 contributes to the understanding of the participation in on-the-job training from a behavioural perspective. This is done by incorporating individual's subjective beliefs about the return to training. These beliefs depend on their locus of control, a psychological concept about beliefs regarding an individual's control over the outcome of events in their life. Our empirical results suggest that having an internal locus of control is associated with higher participation in general but not in specific training. Specifically, general training is associated with greater expectations of future wage growth for those with an internal locus of control. There is no evidence of any link between locus of control and wage expectations or post-training wages in case of specific training.

Chapter 3 evaluates the relationship between intergenerational co-residence and female labour force participation in Kyrgyzstan. The direction of the effect is not clear *ex-ante*. While elderly caretaking responsibilities might lead to lower labour force participation, child care support offered by grandparents might lead to the opposite effect. We find that co-residence has no effect on female labour force participation and the number of working hours. While other studies find positive impacts of co-residence on female labour force participation, we seek to analyze the channels that might link co-residence and female labour force participation. We find that intergenerational co-residence leads to around half an hour more spent per day on elder care, on average. We find that this is at the expense of the women's leisure time.

Chapter 4 analyses constraints to investments of micro and small enterprises. I find that in the overall estimation sample, savings and managerial constraints are associated with lower investments. Further, the paper identifies several subgroups that are subject to certain constraints. These results reflect that savings and managerial constraints are non-negligible factors for firm investments. The subsample analysis provides an attempt to identify firms with similar constraints prior to treatment assignment, which is important to correctly match client characteristics with the type of training that will be useful for them.

Chapter 5 evaluates two different financial education trainings. The first teaches simple rules of financial decision making (rule-of-thumb training) and the second training includes, in addition to the rule-of-thumb training, an add-on where entrepreneurs receive individual information (personalized training) about the financial situation of their business. Our estimates show that both trainings are generally effective. Evaluating the effect on each outcome family shows that the effect of personalized training on savings is strongest, which is 0.279 SD units and highly statistically significant.

**Keywords:** on-the-job training, intergenerational coresidence, constraints, microenterprises, financial education

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# Abbreviations

<b>ANCOVA</b>	Analysis of covariance
<b>ITT</b>	Intention-to-treat
<b>IV</b>	Instrumental variable
<b>LIK</b>	Life in Kyrgyzstan
<b>LoC</b>	Locus of Control
<b>MC</b>	Managerial constraint
<b>MDE</b>	Minimum detectable effect
<b>MSEs</b>	Micro and small enterprises
<b>OLS</b>	Ordinary least-squares
<b>PCA</b>	Principal component analysis
<b>PT</b>	Personalized training
<b>RCT</b>	Randomized controlled trial
<b>ROSCA</b>	Rotating savings and credit association
<b>RoT</b>	Rule-of-thumb training
<b>SACCO</b>	Savings and credit cooperative
<b>SC</b>	Savings constraint
<b>SD</b>	Standard deviation
<b>SOEP</b>	German Socio-Economic Panel





# Chapter 1

## Introduction

### 1.1 Research Area

This dissertation is concerned with research questions in the fields of labour economics and entrepreneurship. While the first chapter elaborates on the relationship between personality traits and on-the-job training, the second chapter evaluates the relationship between intergenerational co-residence and female labour force participation in Kyrgyzstan. The last two chapters examine entrepreneurship in developing countries and are concerned with the constraints of micro and small enterprises and the evaluation of a training intervention.

### 1.2 Motivation

#### 1.2.1 Essays in Labour Economics

**On-the-job Training.** The workplace is shaped by constant changes through globalization, new technologies, and markets. Working in such an environment requires workers to constantly adjust and develop their skills. Hence, lifelong education, beyond formal school education is an integral part of work-life. Due to the importance of continuous investments in human capital, both education and training are promoted and on the political agenda of the European Commission (2010), OECD (2014), and International Labour Organization (2010).

The economic implications of work-related training are well documented. Training participants are associated with higher job performance rating scores (Bartel, 1995), higher likelihood of promotion (Bishop, 1990), and have higher wages, as documented in a meta-analysis (Haelermans and Borghans, 2012). In light of these positive effects, several characteristics that coincide with training participation are identified. A higher formal education (Asplund, 2005), having union-coverage (Booth et al., 2003), being male (Lynch, 1992), and being employed by a larger company (Georgellis and Lange, 2007) are all characteristics associated with training participation. However, this does not explain why some groups decide to participate in training and others do not. This is especially interesting in light of high returns to training for groups with lower participation probability (e.g. for the less educated; see Blundell et al. (1996); Fourage et al. (2013)).

In light of the importance of lifelong learning and the economic effects of work-related training, it is crucial to understand how individual behavior leads to an underinvestment in training. This part of the dissertation contributes to the ongoing literature on training participation by adopting a behavioral perspective. This is done by incorporating individual's subjective beliefs about the return to training, which depends on their locus of control, a psychological concept about beliefs regarding an individual's control over the outcome of events in their life.

**Female Labour Force Participation.** The participation of women in the labour market matters in several respect for the individual woman and her household. Empirical evidence links female labour force participation to increased bargaining power in the household (Antman, 2014; Heath, 2014) and to beneficial effects for her children in terms of higher preschool enrolment rates (O'Connor, 1988) and improved health (Thomas, 1997).

With these beneficial effects in mind, an observed decrease in women's labour market participation in Kyrgyzstan since the dissolution of the Soviet Union in 1991 is worrisome. In 1990, around 83 percent of Kyrgyz women engaged in the labour market (Asian Development Bank, 2005). Since the independence of Kyrgyzstan female labour force participation declined, leading to a widening gender gap in the labour force participation rates. Against this background, it is important to study the women's behavior on the labour market and their decision

to work in Kyrgyzstan.

Keeping the cultural context in mind, there are many factors that may influence women's decisions to participate in the labour market. One factor are high rates of migrants working abroad. Estimates for 2008-2013 suggest around 200,000 labour migrants, which amounts to 10 percent of the Kyrgyz population (Yang, 2015). This might be relevant, as negative effects of labour migration on female labour force participation are documented in the literature (Acosta, 2006; Mendola and Carletto, 2012). Another potential influencing factor are intergenerational living arrangements. Hence, co-residence with parents(-in-law) may affect female labour force participation. The direction of the effect is not clear *ex-ante*. While elderly caretaking responsibilities might lead to lower labour force participation (Lilly et al., 2007), child care support offered by grandparents might lead to the opposite effect (Posadas and Vidal-Fernandez, 2013).

This paper contributes to the understanding of female labour force participation by focusing on the latter determinant of intergenerational co-residence. Kyrgyzstan is a patrilocal society, which means that women move in with their husband's parents or wider family upon marriage.

## 1.2.2 Essays in Entrepreneurship

Micro and small enterprises (MSEs) are an important part of the economy in developing countries. They contribute to a large extend to employment and job creation (Ayyagari, 2011). Many developing countries (e.g. Sub-Saharan Africa) will experience a steep increase in the labour force caused by demographic shifts in the next years. This employment challenge increases the need for a "job-rich economic growth," without it, unemployment rates will remain high and living standards cannot improve (G-20 Finance Ministers and Central Bank Governors Meeting, 2017). Hence, one key policy question that arises is if MSEs have the potential to grow and to create jobs.

Typically, micro and small enterprises either do not grow much or they disappear after a while. Around half of all small firms disappear within 6 years (McKenzie and Woodruff, 2017). Given these facts, it is not surprising that the distribution of firms is right skewed, with the majority of firms being small and the distribution declining in firm size (Hsieh and Olken, 2014). There are several potential reasons for the missing growth or development of MSEs. Above all are

financing constraints. This comprises, on the one hand, of credit constraints due to poorly functioning credit markets (Banerjee and Duflo, 2005). On the other hand, insufficient accumulation of own financial resources prevents individuals from making productive investments. The reasons for undersaving are manifold, comprising lack of information (e.g. low levels of financial literacy), social constraints, and behavioral biases (Karlan et al., 2014). Besides financial reasons, managerial skills are seen as crucial as they affect the production function of firms (Bruhn et al., 2010).

This dissertation contributes to the ongoing literature on the development of MSEs in two ways. First, it adds to the understanding on which of the aforementioned constraints are actually important for MSEs and for groups. Secondly, it contributes to the literature that aims to improve business performance through financial education interventions. Here, this dissertation probes whether personalized feedback can increase the effectiveness of a training compared to a benchmark training.

### 1.3 Dissertation Outline

This dissertation consists of four separate research papers. The papers in chapters 2, 3, and 5 are joint with co-authors. The work in Chapter 2 joint with Marco Caliendo, Deborah Cobb-Clark, and Arne Uhlenborff is currently in a revise and resubmit process at the *Journal of Human Resources*. Chapter 3 is based on a paper with Andreas Landmann and Susan Steiner and is published in *Demography*<sup>1</sup>. The paper in Chapter 5 is joint work with Antonia Grohmann and Lukas Menkhoff. The field experiment in Chapter 5 was pre-registered at the AEA RCT Registry on March 15, 2018.<sup>2</sup> The following gives a brief outline of each chapter.

**Chapter 2** incorporates individuals' beliefs about wage expectations in the decision to participate in on-the-job training. These beliefs depend on the worker's locus of control. Locus of control can be described as the "generalized attitude, belief or expectancy regarding the nature of the causal relationship between one's own behavior and its consequences" (Rotter, 1966). Those with internal control

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<sup>1</sup>Landmann, A., Seitz, H. & Steiner, S. *Demography* (2018). <https://doi.org/10.1007/s13524-018-0724-1>

<sup>2</sup>ID: AEARCTR-0002785; see: <https://www.socialscienceregistry.org/trials/2785>

tend to believe that much of what happens in life is influenced by their own behavior, whereas those with external control are more likely to believe that life's outcomes are driven by external factors. We develop a theoretical two-period model in which workers and firms participate in the decision to invest in training. We incorporate locus of control in the model by assuming that workers with an internal locus of control expect a higher wage return to their training investment. Further, our model takes into account the transferability of skills as highlighted by Becker (1962). The more general a training is, the more that the skills learned are transferable, while specific skills are less transferable. The following testable predictions are derived from the model: first, workers with an internal locus of control are more likely to participate in training (unless it is perfectly specific). Secondly, the more internal the higher are expectations about post-training wage increases (this relationship is predicted to be stronger for general training). Third and lastly, post-training wages are independent of their locus of control (as it is assumed that locus of control is unrelated to productivity). Each of these predictions is empirically validated using data from the German Socioeconomic Panel (SOEP), a representative household panel survey. Our empirical results suggest that having an internal locus of control is associated with higher participation in general but not in specific training. Specifically, general training is associated with greater expectations of future wage growth for those with an internal locus of control. There is no evidence of any link between locus of control and wage expectations or post-training wages in case of specific training.

**Chapter 3** analyzes the effect of co-residence with parents on female labour market outcomes in a society with a patrilocal residence rule. This rule prescribes that, upon marriage, married women move in with their husband's parents or, sometimes, the husband's wider family. However, the decision to co-reside with parents is likely endogenous. To obtain unbiased estimates, we exploit a Kyrgyz tradition where youngest sons are expected to live with their parents. We apply an instrumental variable approach where we instrument intergenerational co-residence with an indicator of whether a women is married to a youngest son of a family. The empirical analysis uses the Life in Kyrgyzstan (LiK) dataset, which is a nationally representative individual panel. We use the data wave of 2011 and data from a supplementary data collection that took place in 2014, which

has information on the birth order that is used for our instrument. We find that co-residence has no effect on female labour force participation and the number of working hours. While other studies find positive impacts of co-residence on female labour force participation, we seek to analyze the channels that might link co-residence and female labour force participation. We find that intergenerational co-residence leads to around half an hour more spent per day on elder care, on average. We find that this is at the expense of the women's leisure time. This study serves as an example of how culture matters for labour market outcomes. While studies in China, Japan, and the US find that parents(in-law) provide substantial assistance in housekeeping, this turns to be not the case in a patrilocal setting, such as Kyrgyzstan. Hence, intergenerational co-residence is less conducive to female activity on the labour market in our patrilocal society than in non-patrilocal settings.

**Chapter 4** analyses constraints to investments of micro and small enterprises. The core of this paper is first, to analyze which constraints are relevant for explaining financial investments in the overall sample and, secondly, to identify subgroups that share the same constraints. The focus is on the most important constraints discussed in the literature: credit, savings, and managerial constraints. Credit and savings constraints reflect insufficient access to external capital and insufficient accumulation of own financial resources, respectively. Apart from financial constraints, managerial constraints represent the lack of business skills (managerial capital). This chapter builds on five waves of a panel study on micro and small enterprises conducted in Kampala, Uganda. Estimating the effect of constraints on investment is not straightforward, as constraints are not directly observable. Therefore, this study relies on several proxy variables to measure each constraint. In a first step, the proxy variables are identified based on the literature, while the second step extracts those proxy variables that explain variation in the investment value. Based on the final selected proxy variables, an index is built for each constraint. I find that in the overall estimation sample, savings and managerial constraints are associated with lower investments. A one standard deviation (SD) increase in savings constraints is associated with a decrease in the investment value by approximately 15 percent. The magnitude of the effect of managerial constraints is of around 1 percentage point lower. Further, the

paper identifies several subgroups that are subject to certain constraints. There are three groups associated with savings constraints: unmarried entrepreneurs, those with 11 years of education, or firms operating in the services sector. For these subgroups, a one SD increase in savings constraints is associated with 24-43 percent lower investments. The impact of savings constraints in these subsamples is much stronger compared to the effect in the whole estimation sample (15 percent). For entrepreneurs with only a primary education, managerial constraints hamper investments by more than twice the magnitude as estimated in the overall sample. These results reflect that savings and managerial constraints are non-negligible factors for firm investments. The subsample analysis provides an attempt to identify firms with similar constraints prior to treatment assignment, which is important to correctly match client characteristics with the type of training that will be useful for them.

**Chapter 5** evaluates two different financial education trainings. The first teaches simple rules of financial decision making (rule-of-thumb training) following the approach introduced by (Drexler et al., 2014). The second training includes, in addition to the rule-of-thumb training, an add-on where entrepreneurs receive individual information (personalized training) about the financial situation of their business. To avoid Hawthorne-type effects, our control group receives health and safety information. In order to assess the causal effect of each training, we implement a randomized controlled trial in Kampala, Uganda. The intervention is implemented using a sample of approximately 500 micro and small enterprises, which are part of the panel study mentioned in Chapter 4. Given the sample size and three treatment arms, power calculations show that significant treatment effects cannot be expected from this setting. Our experiment has 80 percent power to detect effect sizes of 0.26 standard deviation units (at  $\alpha=0.05$ ). However, while the rule-of-thumb approach as, introduced by Drexler et al. (2014), is shown as high effective, we use this training as a benchmark. Both financial trainings cover topics that are related to six outcome families: investments, savings, profits, risk diversification, separation of finances between business and household, and record keeping. Our estimates show that both trainings are generally effective. To compensate our limited statistically power we form an index over all six outcome family indices, which yields that the rule-of-

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thumb training has a statistically significant effect of 0.178 standard deviation (SD) units. The personalized training, which adds personalized feedback to the rule-of-thumb training has a much higher effect of 0.248 standard deviation units, which is a 40 percent higher effect size. Evaluating the effect on each outcome family shows that the effect of personalized training on savings is strongest, which is 0.279 SD units and highly statistically significant.



## Chapter 2

# Locus of Control and Investment in Training<sup>1</sup>

*with:*

*Marco Caliendo*

*Deborah Cobb-Clark*

*Arne Uhlenborff*

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<sup>1</sup>This paper is in a revise and resubmit process at the *Journal of Human Resources*.

## 2.1 Introduction

Globalization and technological change are rapidly transforming the workplace, generating demand for new skills while rendering other skills obsolete. Equipping workers with the ability to thrive in this changing environment has become a strategic imperative. National governments are working hard to facilitate continuous, lifelong investment in worker training in order to ensure that workers' skills remain up-to-date, firms continue to be competitive, and living standards are maintained. Training systems are also being touted as mechanisms for achieving social goals including reduced inequality, active citizenship, and social cohesion. The International Labour Organisation, for example, has an explicit goal of promoting social inclusion through expanded access to education and training for those who are disadvantaged (International Labour Organization, 2008, p. vi).

Work-related training, however, often compounds, rather than mitigates, existing skill differentials – potentially increasing social and economic inequality. In particular, workers with higher ability (as measured by aptitude scores), more formal education, and higher occupational status receive more work-related training than do their less-skilled co-workers.<sup>2</sup> This disparity is puzzling since less educated workers, in fact, receive relatively high returns from training (see Blundell et al., 1999; Bassanini et al., 2007) and firms appear to be equally willing to train them (Leuven and Oosterbeek, 1999; Maximiano, 2012). Developing a deeper understanding of what leads some workers to under-invest in training is fundamental to ensuring that work-related training systems have the potential to deliver social as well as economic benefits.

The aim of this paper is to advance the literature by adopting a behavioral perspective on the training investment decision. Specifically, we draw inspiration from Becker (1962) in developing a stylized model of the decision by firms and workers to invest in work-related education and training. Firms are assumed to have perfect information about the productivity of training and its degree of generality, while workers are instead assumed to have subjective beliefs about the returns to training. These beliefs depend on their locus of control. We then use this simplified two-period model to derive testable predictions about the influence

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<sup>2</sup>For reviews of the work-related education and training literature see Asplund (2005); Bishop (1996); Blundell et al. (1999); Bassanini et al. (2007); Leuven (2005); Wolter and Ryan (2011); Haelermans and Borghans (2012); Frazis and Loewenstein (2006).

that the degree of training generality has on the role of locus of control in training decisions.

Locus of control is a psychological concept that is best described as a “generalized attitude, belief or expectancy regarding the nature of the causal relationship between one’s own behavior and its consequences” (Rotter, 1966). As people differ in the reinforcement that they have received in the past, Rotter argued that they will also differ in the degree to which they generally attribute reinforcement to their own actions and that these beliefs regarding the internal versus external nature of reinforcement constituted a personality trait.<sup>3</sup> Those with internal control tend to believe that much of what happens in life is influenced by their own behavior, whereas those with external control are more likely to believe that life’s outcomes are driven by external forces, e.g. luck, chance, fate or others. Given these psychological underpinnings, it is quite natural to link locus of control to human capital investments through the returns that individuals expect. Consequently, we allow locus of control to affect training participation through the influence it has on workers’ subjective expectations about the relationship between training and future wage growth. Our specific interest in locus of control is motivated by the growing literature demonstrating its importance in many other human capital investment decisions including health (Cobb-Clark et al., 2014), educational attainment (Coleman and Deleire, 2003; Jaik and Wolter, 2016), job search (Caliendo et al., 2015; McGee, 2015), internal migration (Caliendo et al., 2015), self-employment (Hansemark, 2003; Caliendo et al., 2016), self-reported willingness to train (Fourage et al., 2013) and job training (Offerhaus, 2013).

Our model predicts that internal workers will engage in more general training than their external co-workers because their subjective investment returns are higher. We expect little relationship between specific training and locus of control, however, because the returns to specific training largely accrue to firms rather than workers. We empirically test these predictions using data from the German Socioeconomic Panel (SOEP). Consistent with our model, we find that locus of control is related to participation in general but not specific training. Moreover, we find evidence that locus of control influences participation in general training through its effect on workers’ expectations about future wage growth. Specifi-

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<sup>3</sup>See also Ng et al. (2006) who note that “some people have a dispositional tendency to believe they have more control over the external environment than others” (p.1058)

cally, general training is associated with an increase in the expected likelihood of receiving a future pay raise that is much larger for those with an internal rather than external locus of control. However, we find no evidence that the wage returns to general training actually depend on locus of control when we analyze realized post-training wages. This suggests that workers are forming different subjective expectations – which depend on their locus of control – about the same underlying post-general-training wage distribution. Interestingly, locus of control is unrelated to realized wages and wage expectations in the case of specific training.

We make a substantial advance on the literature by formally incorporating locus of control into an economic model of work-related education and training, carefully accounting for the nature of training itself as well as for the role of firms and workers in the training decision. This allows us to analyze the channel through which locus of control operates and generate empirical predictions that can then be tested. We take a broad perspective on work-related education and training, considering both training that is offered by employers during work hours (i.e. on-the-job) and education taking place in external institutions outside work hours (off-the-job). This broad-brush approach demands that we consider the perspectives of both firms and workers in the training decision which adds complexity to our theoretical framework. At the same time, it also adds richness to the empirical analysis allowing us to assess the robustness of our results to alternative notions of general versus specific training.

Our research identifies a fundamental distinction – as yet unrecognized in the literature – in the role of locus of control in general versus specific training. Becker (1962) was the first to highlight the role of skill transferability in the allocation of training costs, arguing that, in competitive markets, firms are unwilling to pay for training that is completely transferable (“perfectly general”), while workers are unwilling to pay for training that is completely nontransferable (“perfectly specific”). Subsequent research demonstrates that this sharp bifurcation is blurred in the face of labor market rigidities, non-competitive market structures, and training that is both general and specific (see Acemoglu and Pischke, 1999a; Asplund, 2005; Frazis and Loewenstein, 2006, for reviews). Nonetheless, the conceptual link between skill transferability and the distribution of net training returns across workers and firms remains fundamental to understanding the incentives for training to occur. It is this conceptual link that is also at the heart of our finding that

workers' perceptions of control will have a more profound effect on training investments if training is relatively transferable (general) than if it is not (specific). In short, workers' differential responsiveness to investment returns matters more if they can capture those returns than if they cannot. Crucially, this result does not depend on our simplifying assumption that markets are perfectly competitive. Instead, it is easily generalized to a variety of non-competitive environments in which greater skill transferability increases workers' ability to benefit from the training they receive (see Section 2.2.3).

The remainder of the paper is structured as follows. Our model of training is developed in Section 2, while the data are described in Section 3. In Section 4, we provide empirical evidence for the testable implications of our theoretical model. Our conclusions and suggestions for future research can be found in Section 5.

## 2.2 Theoretical Framework

### 2.2.1 Modeling the Training Investment Decision

We begin with a conceptual framework in which both workers and firms participate in the decision to invest in work-related training. Workers have an incentive to participate in training if that investment yields positive future returns. Although the returns to training can be conceptualized as positive effects on labor market outcomes in general, e.g. wages, performance, promotions, occupational status, etc., we focus specifically on wage returns in our model. Firms' decisions to invest in worker training rest on whether or not the investment results in increased productivity, measured in value added per worker.

We make a number of simplifying assumptions. Firms and workers are assumed to be risk-neutral, to face no liquidity constraints, and to maximize expected discounted profit and income streams, respectively. Both the labor market and product market are perfectly competitive and output prices are normalized to 1. In the first period ( $t = 0$ ), the wage of worker  $i$ ,  $w_{i0}$ , corresponds to his or her marginal revenue product ( $mP_L$ ) which is the same in all firms. Training investments are joint decisions of worker  $i$  and firm  $f$ ; they take place if the net present value of the training is non-negative for both the worker and the firm and if it is positive for at least one of them.

Let  $K$  capture the increase in productivity associated with training. The degree of generality of the training is given by  $\gamma$  which takes a value between 0 and 1. When  $\gamma = 0$ , training increases the productivity of worker  $i$  only at the current firm  $f$ . Following Becker (1962) we will refer to this as “perfectly specific” training. If training is “perfectly general”,  $\gamma = 1$  and the human capital embodied in the training is fully transferable to other firms, that is, the productivity of trained workers increases by  $K$  in all firms. We account for firms’ asymmetric information with respect to production process and industry conditions, by assuming that the firm has perfect information about the training’s productivity returns ( $K$ ) and degree of generality ( $\gamma$ ). In contrast, workers form expectations about their own returns to training which is given by the product of these two parameters (see Section 2.2).

The cost of training  $C$  is constant across workers.<sup>4</sup> Training costs are known to both workers and firms in period  $t = 0$ . The worker and the firm share training costs  $C$  in proportion to  $\alpha$  which is exogenously given. In particular, the firm offers to pay  $(1 - \alpha)C$  while the worker is left to pay  $\alpha C$ .

In period  $t = 0$ , the worker and the firm decide whether or not to invest in training which has a given degree of generality  $\gamma$ . Let  $T_i$  take the value 1 if training occurs and 0 otherwise. Worker productivity in period  $t = 1$  is given by  $mP_L + KT_i$  in firm  $f$  and by  $mP_L + K\gamma T_i$  in every other firm. Worker  $i$  stays at the current firm  $f$  in period  $t = 1$  if his or her wage is equal to or greater than the potential wage offer at outside firms. Because the labor market is assumed to be perfectly competitive, there are no labor market frictions (e.g imperfect information, job changing costs, etc.) and workers can change employers without cost. In period  $t = 1$ , the worker will receive a wage offer of  $mP_L + K\gamma T_i$  which corresponds to his or her marginal revenue product at outside firms. The current firm  $f$  will pay this competitive market wage. This implies that the returns to the training investment are  $K\gamma T_i$  for the worker and  $K(1 - \gamma)T_i$  for the firm.

Thus, as in Becker (1962), the worker is the residual claimant – and bears the full cost of training ( $\alpha = 1$ ) – when training is perfectly general. If training is perfectly specific, on the other hand, the firm receives all returns from training and pays all training costs ( $\alpha = 0$ ). In reality, however, training is unlikely to

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<sup>4</sup>We consider the scenario in which training costs include a stochastic component that is related to workers’ characteristics, in particular their locus of control, in Section 2.2.3

be either perfectly-specific or perfectly-general. Work-related training typically includes some components which may be specific to the current employer as well as other components which increase productivity both inside and outside the current firm.<sup>5</sup> In what follows, we incorporate locus of control into the training investment decision, allowing the degree of training generality to vary.

### 2.2.2 The Role of Locus of Control in the Investment Decision

We have assumed that the firm knows both the relationship between the investment in training and the resulting increase in productivity,  $K$ , as well as the degree to which the training can be utilized by outside firms,  $\gamma$ . These seem to us to be reasonable assumptions given that firms are in a position to know much more than workers about both their own production technology and the aggregate economic conditions in the wider industry. Together, these assumptions imply that the firm has perfect information about the worker's productivity in period  $t = 1$ ,  $K\gamma T_i$ , if he or she undertakes training in period  $t = 0$ .

In contrast, workers do not have perfect information about the relationship between training investments and subsequent wage increases. We adopt a behavioral perspective on expectation formation by allowing workers' subjective beliefs about the return to training,  $(K\gamma)^*$ , to depend on their locus of control.<sup>6</sup> The concept of locus of control emerged out of social learning theory more than 50 years ago. In his seminal work, Rotter (1954) proposed a theory of learning in which reinforcing (i.e. rewarding or punishing) a behavior leads expectations of future reinforcement to be stronger when individuals believe reinforcement is causally related to their own behavior than when they do not. Because the history of reinforcement varies, Rotter argued that individuals will differ in the extent to which they generally attribute what happens to them to their own actions (Rotter, 1954). Individuals with an external locus of control do not perceive a

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<sup>5</sup>Lazear (2009) in fact argues that firm-specific training does not exist. Instead, he views all skills as general implying that it is only the skill mix and the weights attached to particular skills that are specific to each employer.

<sup>6</sup>Due to the multiplicative form of the returns to training, the predictions of our theoretical model are the same if we instead allow only  $K$  or only  $\gamma$  to depend on locus of control. With the data at hand, we cannot separately identify workers' expectations regarding  $K$  and  $\gamma$  making these models empirically equivalent.

strong link between their own behavior and future outcomes. Consequently, we argue that they are unlikely to believe that any training investments undertaken today will affect their productivity – and hence wages – tomorrow. Those with an internal locus of control, in contrast, see a direct causal link between their own choices (e.g. investment in training) and future outcomes (wages). Thus, although the true impact of training on future productivity and wages is assumed to be constant, more internal workers expect a higher wage return to their training investments.

We capture this dichotomy in our model by adopting the following multiplicative specification for the relationship between locus of control and subjective beliefs about investment returns:

$$(K\gamma)^* = K\gamma * f(loc) \quad (2.1)$$

where  $loc$  denotes locus of control;  $f(loc)$  is both positive and increasing in internal locus of control;  $\frac{\partial(K\gamma)^*}{\partial loc} > 0$ .

Firms and workers have an incentive to undertake training whenever that training is expected to yield benefits that exceed the costs. Thus, a training investment occurs if the expected net present value of training is positive for either the firm and/or the worker and is non-negative for both. The value function of the firm depends on the true increase in firm-specific productivity, while the value function of the worker depends on his or her subjective beliefs about the returns to the training. We can write the expected net present values of the training for the worker  $V_i(T)$  and the firm  $V_f(T)$  as follows:

$$V_i(T) = \gamma f(loc)K - (1 + \rho)\alpha C \quad (2.2)$$

$$V_f(T) = (1 - \gamma)K - (1 + \rho)(1 - \alpha)C \quad (2.3)$$

where  $\rho$  is the discount rate.

Our model predicts that when training is at least partially transferable to outside firms, workers with an internal locus of control have a higher expected net present value from training and, consequently, are more likely to participate



in training.

$$\frac{\partial V_i(T)}{\partial loc} = \gamma f'(loc)K > 0 \quad (2.4)$$

$$\frac{\partial V_f(T)}{\partial loc} = 0 \quad (2.5)$$

In contrast, firms' incentives to invest in training are unrelated to workers' locus of control.

Moreover, the effect of workers' locus of control on their incentives to invest in training depends on the degree of training generality. Specifically, an increase in the extent to which workers' have an internal locus of control results in a larger increase in their willingness to invest in training if that training is highly transferable (mainly general) than when it is not (mainly specific).

$$\frac{\partial^2 V_i(T)}{\partial loc \partial \gamma} = f'(loc)K > 0 \quad (2.6)$$

The intuition is straightforward. The more general the training, the larger the share of the training benefits that workers will be able to capture in the form of future wage increases. Thus, the more important are their expectations about those future benefits in driving their behavior. When training is largely firm-specific, workers will capture a much smaller share of the rents generated by training and their expectations regarding the benefits of training are less important.

In limit, when training is perfectly specific ( $\gamma = 0$ ), it is not transferable to outside firms and only the current firm benefits from the future increase in worker productivity. Therefore, as in Becker (1962), the firm will pay the full cost  $C$  of training the worker. The firm invests in training if the expected net present value of training to the firm is positive, i.e. if the discounted productivity gain in period  $t = 1$  exceeds the training costs incurred in the first period  $t = 0$ . Given this, our model results in the prediction that investments in perfectly specific training will be independent of workers' locus of control. The decision to invest in perfectly specific training is driven solely by firms that have perfect information about the costs and benefits of worker training. On the other hand, when training is perfectly general ( $\gamma = 1$ ), workers receive the full value of the productivity increase associated with training in the form of higher wages. Therefore, firms

will be unwilling to share the costs of general training and workers will have to pay all training costs  $C$ . In this case, the investment decision effectively lies in the hands of workers. Specifically, participation in training will depend on whether workers expect their post-training productivity (and hence wage) to increase in present value by more than the cost of training. This, in turn, depends on workers' locus of control.

**Empirical Predictions Baseline Model:** Taken together, our model results in several empirical predictions. First, unless training is perfectly-specific and cannot be transferred at all to outside firms, workers with an internal locus of control will be more likely to participate in training. This differential in the training propensities of internal versus external workers increases with the degree of training generality. Moreover, we have assumed that locus of control influences worker expectations about the returns to training. We therefore expect a positive relationship between workers' internal locus of control and their expectations about future post-training wage increases. This relationship is predicted to be stronger for more general as opposed to more specific training (see equation 6). At the same time, because we have assumed that locus of control is unrelated to productivity, workers' actual post-training wages are predicted to be independent of their locus of control.

### 2.2.3 Model Extensions

In what follows, we consider whether our empirical predictions continue to hold if the key assumptions of our baseline model are relaxed.

**Risk Aversion, and Biased Beliefs:** It is important to note that our predictions do not depend on workers being risk neutral. Risk aversion would result in workers choosing not to invest in some training – despite it delivering positive expected benefits. This under-investment in risky training is expected to be more extensive the more general training is, because workers' exposure to the costs and benefits of training increase the greater the degree of training generality. Expected wage gains are discounted because expected utility is lower as a result of the uncertainty (Stevens, 1999). Nonetheless, we still expect internal workers to

be more likely to invest in general training than their external co-workers because they are more responsive to the potential benefits of training when they exist.

It is also interesting to consider the implications of our model for training investments when the true productivity payoff to training differs from workers' subjective beliefs about those payoffs. Specifically, workers may believe the returns to training are below the true returns (i.e. that  $(K\gamma)^* < K\gamma$ ). In this case, our model implies that there will be under-investment in training. Moreover, the degree of under-investment is more severe the more general is the training because workers' beliefs weigh more heavily in the investment decision. Workers' beliefs thus constitute a form of asymmetric information which can result in less investment than is optimal. Chang and Wang (1996) reach similar conclusions when modeling the asymmetry in information between the current and outside employers regarding the productivity of training.<sup>7</sup> At the same time, workers may instead be overly optimistic regarding the value of training leading to an over-investment in training. As before, our model predicts that the degree of inefficiency will be greater the more transferable is the training.

### **Cost Sharing Rules, Labor Market Frictions and Market Structure:**

Becker's key insight regarding the role of skill transferability in driving the allocation of training benefits fundamentally relies on markets being perfectly competitive (Becker, 1962). Imperfect competition breaks the strict correspondence between wages and productivity; allowing firms to earn rents by paying wages that are lower than worker productivity. If the productivity-wage gap increases with the level of skills, a situation which Acemoglu and Pischke (1999a,b) refer to as a compressed wage structure, firms may find it profitable to pay for training even if it is general. Thus, in theory, a firm may pay for general training in a wide range of circumstances including if: i) it has monopsony or monopoly power (e.g. Stevens, 1994; Acemoglu and Pischke, 1999a); ii) matching and search frictions exist (e.g. Acemoglu, 1997; Acemoglu and Pischke, 1999b; Stevens, 1994); iii) information is asymmetric (e.g. Katz and Ziderman, 1990; Acemoglu and Pischke, 1998); iv) general and specific training are complementary (e.g. Stevens, 1994; Franz and Soskice, 1995; Acemoglu and Pischke, 1999b,a; Kessler and Lülfe-

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<sup>7</sup>See Bassanini and Ok (2004) who review a number of training and capital market imperfections and co-ordination failures that also may give rise to under investment in training.

mann, 2006); or v) worker productivity depends on coworker skill levels (Booth and Zoega, 2000).<sup>8</sup> In line with these model extensions, there exist a number of empirical studies providing evidence that employers pay at least partly for general training (Leuven and Oosterbeek, 1999; Booth and Bryan, 2007, see for example). At the same time, Hashimoto (1981) develops a model in which firms and workers share the costs and benefits of specific training as a form of long-term commitment device to prevent costly job separations.

In our model, this implies that the proportion of training costs paid by workers ( $\alpha$ ) will depend – among other things – on the degree of skill transferability ( $\gamma$ ). It is important to note, however, that although we assume  $\alpha$  to be exogenous, the predictions from our baseline model are not dependent on a specific sharing rule for the costs. Irrespective of the cost sharing rule, we expect there to be a positive relationship between internal locus of control and participating in training, because the expected returns from training increase the more internal workers are, making it more likely that the benefits of training outweigh the costs (see equation 4).

Labor market frictions and market imperfections drive a wedge between worker productivity and wages, implying that wages will be less than marginal revenue product. The key insights of our theoretical model remain unchanged in the face of noncompetitive markets, however, so long as wages continue to depend positively on worker productivity. In this case, human capital investments that raise productivity will also result in higher wages – although potentially to a lesser degree than when markets are perfectly competitive. Workers with a more internal locus of control will continue to have higher expected returns to their training investments than will their co-workers who are more external, leading them to be more willing to participate in training. Similarly, we expect the differential between internal and external workers to be apparent when we consider future wage expectations (consistent with our key model assumption), but not when we examine realized wage outcomes.

**Training Costs, Productivity, and Locus of Control:** Our model assumes that training costs ( $C$ ) are constant. In reality, however, there are many reasons

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<sup>8</sup>See Gersbach and Schmutzler (2012) for references on information asymmetries and complementarities.

to believe that training costs might differ across workers in ways that may be related to their locus of control. Suppose training costs are given by the following:  $C_i = c + \epsilon_i$  where  $\epsilon_i$  captures some element of the training cost that is relevant only to workers' training decisions. Well-known barriers to financing human capital investments, for example, may lead some workers to be credit constrained, resulting in suboptimal levels of training (Acemoglu and Pischke, 1999a). Credit constraints are likely to be less binding, and hence the cost of financing training lower, for those with an internal locus of control because these individuals tend to have higher earnings (e.g. Anger and Heineck, 2010; Semykina and Linz, 2007; Osborne Groves, 2005) as well as more savings and greater wealth (Cobb-Clark et al., 2016). If training costs are negatively related to locus of control, then it remains the case that we would expect workers with an internal locus of control to be more likely to invest in general training, but no more likely than their external co-workers to invest in specific training. Conditional on investing in training, expected and realized wage gains will be unrelated to locus of control because the increase in worker productivity is unrelated to locus of control.

We have also assumed that workers' locus of control affects their expectations about the returns to training rather than the returns themselves. However, there is evidence that internal workers have higher job turnover (Ahn, 2015). This shortens the period over which firms are able to re-coop their training costs and reduces the discounted present value of training investments for internal workers. At the same time, having an internal locus of control may be a form of "ability" which results in the productivity gains being larger for internal workers undertaking training. This implies that the relationship between training productivity and locus of control is theoretically ambiguous.

Nonetheless, we can investigate the plausibility of these alternative explanations by considering the way that training participation, future wage expectations, and realized wages depend on locus of control. Specifically, if the firm's returns to training are lower when training internal workers, perhaps because of increased job turnover, then we would expect those workers with an internal locus of control to be less likely to engage in training. On the other hand, if having an internal locus of control conveys a productivity advantage to workers, we would expect a positive relationship between the incidence of training and internal locus of control. Higher subjective returns and higher actual returns are observationally

equivalent with respect to training rates. However, we expect to see a link between locus of control and subjective returns reflected in expectations regarding future wage growth, while a link between locus of control and actual returns would be reflected in realized wage outcomes conditional on training.

**Summary:** The predictions of our baseline model continue to hold in the face of a range of model extensions. In effect, the link between skill transferability and the distribution of net training returns produces a positive interaction between workers' degree of internal control and the extent to which training is transferable. Internal workers will be more likely than their external co-workers to invest in training when it is transferable to other firms; they will make similar training investments when it is not. We will now test these predictions against our data.

## 2.3 Data

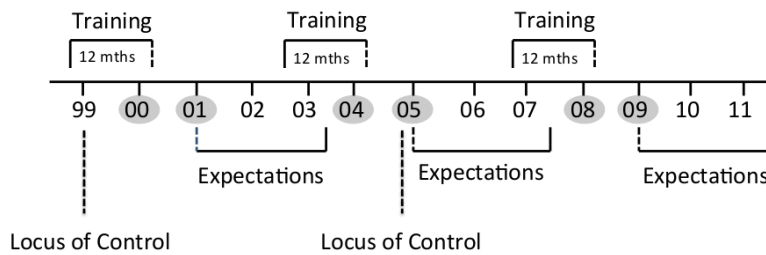
### 2.3.1 Estimation Sample

The data come from the German Socio-Economic Panel (SOEP), which is an annual representative household panel survey. The SOEP collects household- and individual-level information on topics such as demographic events, education, labor market behavior, earnings and economic preferences (e.g. risk, time, and social preferences). The first wave of the survey took place in 1984 with a sample size of approximately 6,000 households and 12,000 individuals. Over the subsequent 30 years, the SOEP sampling frame has been extended to the former German Democratic Republic and top-up samples of high-income and guest-worker households. The SOEP sample in 2013 comprised approximately 12,000 households and 22,000 individuals.

The SOEP data are perfectly suited for our purposes because in 2000, 2004 and 2008 detailed questions about training activities were included in the survey. Pre-determined measures of individuals' locus of control are also available. Moreover, in each subsequent year (2001, 2005 and 2009), the data contain information about individuals' subjective expectations regarding the likelihood of a future wage increase. Information about expected future wage growth conditional on training participation is helpful in assessing whether the link between

locus of control and training participation operates through expected returns or productivity differentials. Figure 2.1 provides an overview of the data structure.

Figure 2.1: Description of the Data Structure



*Source:* Own illustration.

*Notes:* The figure gives an overview of the variables used from which data waves in the present analysis. We use the data waves from the years 2000, 2004 and 2008 in our analysis, as they contain information about the characteristics of training participated in. The variable measuring the participation in *training* refers to the three years prior to the interview date. However, we defined individuals as training participants if they report participation in training within the 12 months prior to the date of interview. Information about locus of control and wage expectations were not observed in our three data waves and therefore had to be imputed from other years. Information about *locus of control* are available in the years 1999 and 2005. Locus of control observed in the year 1999 was imputed in the data waves of the years 2000 and 2004, and we use the locus of control measured in 2005 in our last data wave. Wage *expectations* referring to the next following years are observed one year after each data wave and had to be backward imputed.

We restrict our sample to the working-aged population between the ages of 25 and 60, pooling all three cross-sections. As we are interested in work-related training and not in training during phases of unemployment, we restrict our analysis to individuals who were employed at the time of training. We also exclude individuals who are self-employed at the time of interview. Finally, the sample is reduced by item non-response in the locus of control and other explanatory variables, leaving us with a sample of 10,972 person-year observations from 6,703 distinct individuals.

### 2.3.2 Training Measures

In 2000, 2004 and 2008, respondents under the age of 65 were asked about their engagement in further education over the three-year period prior to the interview. In particular, self-reports about the number of professionally-oriented courses undertaken along with detailed information (e.g. course duration, starting date, costs, etc.) about the three most recent courses are available. We define individuals to be training participants if they undertook at least one course within the 12 months prior to the respective SOEP interview.

Our theoretical framework highlights the importance of distinguishing between general training that is transferrable to other firms and training that is firm-specific. We do this using responses to the following question: *“To what extent could you use the newly acquired skills if you got a new job in a different company?”*. This allows us to construct a measure of general versus specific training that parallels the notion of skill transferability inherent in Becker (1962). Specifically, we categorize response categories *“For the most part”* and *“Completely”* as general training and response categories *“Not at all”* and *“Only to a limited extent”* as specific training. In 2004 and 2008, we have this information for up to three different courses, while in 2000 the skill-transferability question did not target a specific course. Consequently, we assume that in 2000 responses to this question pertain to the most recent training course undertaken. Using this definition, we identify 1,730 reports of general-only training, 961 reports of specific-only training, and 131 reports that both types of training occurred within the preceding 12 months. Each of these training events corresponds to a person-year observation in our data. For 8,150 person-year observations, neither general nor specific training is reported.<sup>9</sup>

Information about the nature of general versus specific training is reported in Table 2.1. The results in Panel A highlight the high degree of skill transferability embedded in the training that workers are undertaking. Fully, 42 percent of general training courses were rated by respondents as being completely transferable to jobs in different companies, while 58 percent were seen as being mostly transferable. In 73 percent of cases, respondents undertaking specific training believe that this training would have at least some limited transferability beyond their

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<sup>9</sup>Descriptive statistics for our dependent and independent variables are reported by training status in Appendix Table A.1.



Table 2.1: Descriptives Course Characteristics

	(1)	(2)
	General	Specific
	Training	Training
<b>A. All courses</b>		
Observations	1,730	961
To what extend could you use the newly acquired skills if you got a new job in a different company? <sup>a</sup>		
Not At All	0.00	0.27
Limited	0.00	0.73
To A Large Extent	0.58	0.00
Completely	0.42	0.00
<b>B. Most recent course undertaken</b>		
Total course duration (weeks) <sup>b</sup>	4.08	1.47 ***
Hours of Instruction every week	16.46	16.06
Correspondence course	0.04	0.04
Introduction to a new job	0.02	0.03
Qualification for professional advancement	0.13	0.07 ***
Adjustment to new demands in current job	0.74	0.77
Other	0.10	0.13 ***
Did the course take place during working hours		
During Working Time	0.66	0.76 ***
Some Of Both	0.12	0.11
Outside working time	0.21	0.13 ***
Did you receive a participation certificate?	0.80	0.63 ***
Who held the course:		
Employer	0.44	0.61 ***
Private Institute	0.19	0.10 ***
Did you receive financial support from your employer		
Yes, From The Employer	0.74	0.77
Yes, From another Source	0.08	0.06
Dummy for no own Costs	0.83	0.89 ***
Own costs	526.59	133.78 ***
Looking back, was this further education worth it for your professionally?		
Very Much	0.44	0.19 ***
A Little	0.39	0.56 ***
Not At All	0.07	0.16 ***
Do Not Know Yet	0.10	0.09

Source: Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29 , own calculations.

Notes: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Panel A refers to all courses of the estimation sample, whereas Panel B refers only to the most recent course participated in. Number of observations of the presented survey question vary slightly due to item non-response.

<sup>a</sup> In case individuals participated in more than one course within one cross-section, we took the information available of the most recent course.

<sup>b</sup> Own calculation, based on information of the length (days, weeks, months) of each course.

current employer. Only 27 percent view their newly-acquired skills as applicable only to their current firm and not at all useful in other companies.<sup>10</sup> At the same time, specific training is more likely to be convened by the employer, to be shorter, and to take place during work hours (see Panel B).

Consistent with the previous literature (e.g. Booth and Bryan, 2007), we also find that the vast majority of employers do provide financial support for general training. At the same time, workers undertaking general training are significantly less likely to receive any financial assistance and pay significantly more for their training than do their coworkers undertaking specific training.

### 2.3.3 Locus of Control

Locus of control is measured in 1999 and 2005 using a series of self-reported items from the Rotter (1966) scale. Item responses in 1999 are reported on a four-point Likert scale ranging from *Totally agree* (1) to *Totally disagree* (4), while in 2005 a seven-point Likert scale ranging from *Totally disagree* (1) to *Totally agree* (7) is used. We begin by harmonizing our 1999 and 2005 locus of control measures by both recoding and stretching the 1999 response scale so that the response scales correspond in both years.<sup>11</sup> A description of each item and its corresponding mean can be found in Table 2.2 for both 1999 and 2005.

Following the literature (Piatek and Pinger, 2016; Cobb-Clark et al., 2014), our measure of locus of control is constructed using a two-step process. First, factor analysis is used to identify two underlying latent variables (factors) interpretable as internal and external locus of control, respectively. This process isolates six items that load onto external locus of control and two items that load onto internal locus of control (see Figure A.1/A and A.1/B). Second, we reverse the coding of the response scale for the six external items so that higher values denote higher levels of disagreement. We then use all eight items to conduct a factor analysis, separately by year, in which a single latent factor is extracted. This process allows us to identify separate loadings (weights) for each item which are then applied in constructing a continuous index that is increasing in internal

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<sup>10</sup>We consider the robustness of our results to alternative definitions of general training as well as to the exclusion of the year 2000 in Section 2.4.4.

<sup>11</sup>Specifically, the original 1999 response scale is recoded as follows: 1 to 7; 2 to 5; 3 to 3; and 4 to 1.

locus of control. To facilitate the interpretation of our results, we use a standardized index (mean = 0; standard deviation = 1) in our estimation models.<sup>12</sup> The distribution of our continuous, standardized locus of control measure is shown in Figure A.1/C for the year 1999 and in Figure A.1/D for the year 2005.

Table 2.2: Locus of Control Items 1999 and 2005

Variable	Wave	
	1999 <sup>a</sup>	2005 <sup>b</sup>
Number of observations	6,954	4,018
Components of locus of control (Mean, 1999 Scale: 1-4, 2005 Scale: 1-7)		
I1: How my life goes depends on me (I)	3.30	5.55
I2: Compared to other people, I have not achieved what I deserve (E)	2.08	3.10
I3: What a person achieves in life is above all a question of fate or luck (E)	2.19	3.39
I5: I frequently have the experience that other people have a controlling influence over my life (E)	1.99	3.04
I6: One has to work hard in order to succeed (I)	3.46	6.03
I7: If I run up against difficulties in life, I often doubt my abilities (E)	2.02	3.28
I8: The opportunities that I have in life are determined by the social conditions (E)	2.67	4.47
I10: I have little control over the things that happen in my life (E)	1.77	2.52

*Source:* Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29, own calculations.

*Notes:*

In both years, item 4 “If a person is socially or politically active, he/she can have an effect on social conditions” and 9 “Inborn abilities are more important than any efforts one can make” are not included in the prediction of the latent factor. Items marked with (I)/(E) refer to internal/external items. External items are reversed prior to factor analysis in order to indicate an internal locus of control for high values.

<sup>a</sup> In 1999 the LoC was surveyed on a 4-point likert scale from 1 for “Totally Disagree” to 4 for “Totally Agree”. The scale was reversed in the data preparation in order to indicate agreement for high values as it is also the case in the other wave of 2005. For the later harmonization, the scale was stretched to the length of a 7-point likert scale.

<sup>b</sup> In 2005 the LoC was surveyed on a 7-point likert scale from 1 for “Disagree Completely” to 7 for “Agree completely”.

In order to minimize concerns about reverse causality, we rely on the most recent, pre-determined measure of locus of control in all of our analyses. That is, 1999 measures of locus of control are used when analyzing the training outcomes reported in 2000 and 2004, while the 2005 locus of control measure is utilized in analyzing 2008 training outcomes.

<sup>12</sup>We consider the sensitivity of our results to an alternative locus of control index which weights all items equally (see Section 2.4.4).

### 2.3.4 Wage Expectations, Realized Wages and Control Variables

In the survey waves immediately following the training module, i.e. in 2001, 2005, and 2009, the SOEP collected data on respondents' expectations regarding their future wage growth. Specifically, respondents were asked: “*How likely is it that you personally receive a pay raise above the rate negotiated by the union or staff in general in the next two years?*”. Responses are recorded in deciles, i.e. 0, 10, 20, ..., 100%. Those individuals who participated in general training in the previous wave have on average a higher expected probability of wage growth (22.3 percent) compared to their coworkers engaged in specific training (15.1 percent) or not participating in training at all (14.6 percent, see Table A.1). Moreover, those undertaking general training are more likely to expect at least some wage growth in the future. In Section 2.4.3, we analyze the relationship between training and subjective wage expectations for those respondents with an internal versus external locus of control in order to assess the potential for locus of control to influence training decisions through expectations about the returns to training. We also analyze the way that locus of control and training participation are related to realized gross wages in  $t + 1$  in Section 2.4.3. General training participants (17.15€) earn on average more per hour than participants in specific training (16.21€) and non-participants (13.71€) (see Table A.1).

Our analysis also includes an extensive set of controls for: i) socio-economic characteristics (age, gender, marital status, number of children, disability, educational attainment, household income and both employment and unemployment experience); ii) personality traits (i.e. the Big Five); iii) regional conditions (regional indicators, local unemployment rates, regional GDP, etc.); iv) job-specific characteristics (e.g. occupation, tenure, contract type, trade union/association membership, etc.); and v) firm-specific characteristics (firm size and industry). Most of our control variables are measured at the same time as training participation (2000, 2004, 2008). However, data on trade union/association membership and Big Five personality information is not collected in these years, requiring it to be imputed. Specifically, Big Five personality traits are imputed from 2005, while trade union/association membership data is imputed from 2001, 2003, and

2007.<sup>13</sup>

Many of these controls have been previously identified in the literature as important correlates of the decision to engage in training. The probability of receiving training increases with workers' educational level (Leuven and Oosterbeek, 1999; Oosterbeek, 1996, 1998; Bassanini et al., 2007; Lynch, 1992; Lynch and Black, 1998; Arulampalam and Booth, 1997), for example, while older workers are less likely to participate in training compared to their younger coworkers (Maximiano, 2012; Oosterbeek, 1996, 1998). The evidence for a gender differential in the uptake of training is more mixed. Lynch (1992) finds that women are less likely to participate in training, while Maximiano (2012) and Oosterbeek (1996) find no gender difference and Lynch and Black (1998) find that women are more likely to participate in training. Unsurprisingly, training is also related to both job and firm characteristics. Maximiano (2012) and Oosterbeek (1996) find that workers with a permanent contract are more likely to receive training. Leuven and Oosterbeek (1999) instead find no significant differences of the type of working contract on training incidence, though contract type is associated with training intensity. Finally, workers in smaller companies have a lower probability of receiving training (see Maximiano, 2012; Lynch and Black, 1998; Oosterbeek, 1996).

Appendix Table A.1 presents descriptive statistics – by training status – for all of the conditioning variables in our empirical analysis. Standard t-tests indicate that individuals engaging in either specific or general training are significantly different in many respects relative to their co-workers who do not participate in either form of training. In particular, training recipients are on average more educated, are less likely to be a blue collar worker, and have fewer years of unemployment experience.

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<sup>13</sup>Details about the construction of these variables are available from the authors upon request.

## 2.4 Results

### 2.4.1 Estimation Strategy

Our objective is to estimate the relationship between workers' locus of control and their participation in general or specific training. Our theoretical model predicts that workers with an internal locus of control will engage in general training more frequently than their external co-workers because their expected subjective investment returns are higher. In contrast, we expect little relationship between specific training and locus of control because training returns largely accrue to firms rather than workers.

In what follows, we conduct three separate empirical analyses. We first estimate the relationship between training participation and locus of control (see Section 2.4.2). We then examine whether the evidence suggests that locus of control affects the training decision by influencing the wage returns that workers expect. Finally, we assess whether realized wages after training differ with respect to the locus of control (see Section 2.4.3). In Section 2.4.4, we report the results of a number of robustness tests.

We specify the probability of participating in training ( $T_{it}^j$ ) as a logit model:

$$P(T^j)_{it} = \frac{\exp(\alpha_0 + \alpha_1 LoC_{i0} + \mathbf{X}'_{it} \boldsymbol{\alpha}_2)}{1 + \exp(\alpha_0 + \alpha_1 LoC_{i0} + \mathbf{X}'_{it} \boldsymbol{\alpha}_2)} \quad (2.7)$$

where  $i$  indexes individuals,  $t$  indexes time, and  $j = (A, G, S)$  indexes training type (i.e. any, general, and specific training respectively). Each model pools observations from the waves 2000, 2004, and 2008 and controls for internal locus of control ( $LoC$ ) as well as a vector ( $\mathbf{X}_{it}$ ) of detailed measures of i) socio-economic characteristics; ii) personality traits; iii) regional conditions; iv) job-specific characteristics; and v) firm-specific characteristics (firm size and industry) (see Section 2.3.4). Recall that our measure of locus of control is predetermined at the time training occurs, minimizing concerns about reverse causality, while we account for a detailed set of controls in order to reduce the potential for unobserved heterogeneity to confound our estimates. The parameter of interest is  $\alpha_1$  which captures the impact of locus of control on the probability of participating in different types of training.

In addition, we model expected wage growth ( $EWG_{it+1}$ ) and observed hourly wages ( $W_{it+1}$ ) in  $t + 1$  as functions of training status, i.e. general training ( $T_{it}^G$ ) or specific training ( $T_{it}^S$ ) versus the base case of no training, and the interaction of training status with locus of control. Our estimating equations are given by the following linear regressions:

$$EWG_{it+1} = \beta_0 + \beta_1 LoC_{i0} + \beta_2 T_{it}^G + \beta_3 T_{it}^S + \beta_4 LoC_{i0} \cdot T_{it}^G + \beta_5 LoC_{i0} \cdot T_{it}^S + \mathbf{X}'_{it} \boldsymbol{\beta}_6 + \epsilon_{it} \quad (2.8)$$

$$\ln W_{it+1} = \gamma_0 + \gamma_1 LoC_{i0} + \gamma_2 T_{it}^G + \gamma_3 T_{it}^S + \gamma_4 LoC_{i0} \cdot T_{it}^G + \gamma_5 LoC_{i0} \cdot T_{it}^S + \mathbf{X}'_{it} \boldsymbol{\gamma}_6 + e_{it} \quad (2.9)$$

We control for the same set of observed characteristics  $\mathbf{X}_{it}$  as in equation (6). Here  $\beta_4$  and  $\beta_5$  reflect the relationship between the locus of control and expected returns to different types of training, while  $\gamma_4$  and  $\gamma_5$  capture potential differences in hourly wages depending on the locus of control after general and specific training;  $e_{it}$  and  $\epsilon_{it} \sim N(0, \sigma^2)$  are i.i.d error terms.

## 2.4.2 Participation in Training

We begin by using a binomial logit model to estimate the relationship between internal locus of control and participation in training. The results, i.e. marginal effects and standard errors, are reported in Table 2.3 for three alternative training outcomes: i) any training irrespective of type (Panel A); ii) general training (Panel B); and iii) specific training (Panel C). In each case, we estimate a series of models increasing in controls. Column (1) reports the unconditional effect of locus of control on training participation while column (5) reports the effect of locus of control on training conditioning on our full set of controls (see Section 2.4.1).<sup>14</sup> Given the construction of our locus of control measure, the results can be interpreted as the percentage point (pp) change in training incidence associated with a one standard deviation change in internal locus of control.

Workers with an internal locus of control are more likely to engage in work-related education and training. Our unconditional estimate implies that each standard deviation increase in internal locus of control is associated with a 4.2 pp

<sup>14</sup>Full estimation results are available in Appendix Table A.2.

Table 2.3: Logit Estimation Results: Participation in Training (Marginal Effects)

	(1)	(2)	(3)	(4)	(5)
	b/se	b/se	b/se	b/se	b/se
<b>A. Training</b>					
Locus of Control (std.)	0.042*** (0.004)	0.041*** (0.004)	0.024*** (0.004)	0.015*** (0.004)	0.013*** (0.004)
<b>B. General Training</b>					
Locus of Control (std.)	0.039*** (0.004)	0.038*** (0.004)	0.027*** (0.004)	0.02*** (0.004)	0.016*** (0.004)
<b>C. Specific Training</b>					
Locus of Control (std.)	0.007** (0.003)	0.007** (0.003)	0.0003 (0.003)	-.002 (0.003)	-.001 (0.003)
Control Variables					
Locus of Control	✓	✓	✓	✓	✓
year, regional		✓	✓	✓	✓
socio-demographics			✓	✓	✓
job, firm				✓	✓
Big Five Personality					✓
Observations	10,972	10,972	10,972	10,972	10,972

*Source:* Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors are clustered on person-level. The full estimation results can be found in Table A.2 in the Appendix.

increase in the chances that a worker undertakes some form of training. Although the estimated marginal effect of locus of control on the incidence of training falls as we increasingly control for detailed individual-, regional-, job-, and firm-level characteristics, it remains statistically significant and economically meaningful. Specifically, in our full specification, we find that a one standard deviation increase in locus of control increases the probability of training taking place by 1.3 pp, which corresponds to an effect of almost 5.1 percent. This is consistent with previous evidence that having an internal locus of control is associated with both an increased willingness to engage in training (Fourage et al., 2013) and higher rates of training (Offerhaus, 2013).

Differentiating by training type, however, highlights the fact that much of this result is driven by the strong relationship between locus of control and general training. Unconditionally, workers are estimated to be 3.9 pp more likely to engage



in general training for every standard deviation increase in their internal locus of control. In our preferred specification, each standard deviation increase in locus of control is associated with an increased likelihood of engaging in general training of 1.6 pp. This corresponds to an effect size of 9.5 percent. This is nearly double that associated with training overall and is comparable to the effect of having an university degree (0.013) or a one standard deviation increase in extraversion (0.013) (see Table 2.3 in column (2)). In contrast, the link between locus of control and specific training is both economically unimportant and statistically insignificant once socio-demographic characteristics are controlled. Failing to distinguish between alternative types of training masks this crucial differentiation.

Taken together, these findings are consistent with the predictions of our theoretical model. A greater degree of internal control results in individuals being more likely to invest in training when it is transferable to other firms and having similar levels of investment when it is not.

### 2.4.3 Wage Expectations and Realized Wages

We turn now to investigating whether there is evidence that locus of control affects training decisions by influencing workers' subjective beliefs about training returns. Unfortunately, we do not have direct information about the a priori wage returns that workers would expect in the event they were and were not to undertake training. Instead we have data on workers' expectations regarding future wage growth post-training which we argue is an indirect measure of the returns that workers expect from training. Consequently, we estimate a series of models of expected future wage growth conditional on locus of control, participation in general or specific training and other control variables. The results are summarized in Table 2.4, while complete results are presented in Appendix Table A.3.

Workers who participated in general training in the previous wave have significantly higher expected future wage growth, whereas there is no relationship between specific training and wage expectations. These findings are not particularly surprising in light of Becker's (1962) argument that trainees largely capture the returns to general training, while the returns to specific training are captured predominately by firms. Future wage expectations are also related to the extent to which workers believe that what happens in life is under their control. The estimated effect of locus of control varies widely with model specification, how-

Table 2.4: OLS Estimation Results: Wage Expectations

	(1)	(2)	(3)	(4)	(5)
	b/se	b/se	b/se	b/se	b/se
Locus of Control (std.)	0.823*** (0.287)	0.831*** (0.289)	-.013 (0.273)	-.229 (0.269)	-.459* (0.279)
General Training	6.807*** (0.734)	6.966*** (0.73)	4.139*** (0.703)	3.445*** (0.687)	3.220*** (0.683)
Specific Training	0.292 (0.848)	0.764 (0.837)	-.794 (0.817)	0.003 (0.803)	-.108 (0.8)
General Training * Locus of Control (std.)	3.071*** (0.834)	2.795*** (0.817)	2.896*** (0.771)	2.793*** (0.741)	2.705*** (0.74)
Specific Training * Locus of Control (std.)	0.502 (0.882)	0.366 (0.871)	0.257 (0.843)	0.506 (0.833)	0.431 (0.829)
Control Variables					
Locus of Control, Training	✓	✓	✓	✓	✓
year, regional		✓	✓	✓	✓
socio-demographics			✓	✓	✓
job, firm				✓	✓
Big Five Personality					✓
Observations	10,972	10,972	10,972	10,972	10,972
$R^2$	0.018	0.038	0.128	0.173	0.179

*Source:* Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29, own calculations.

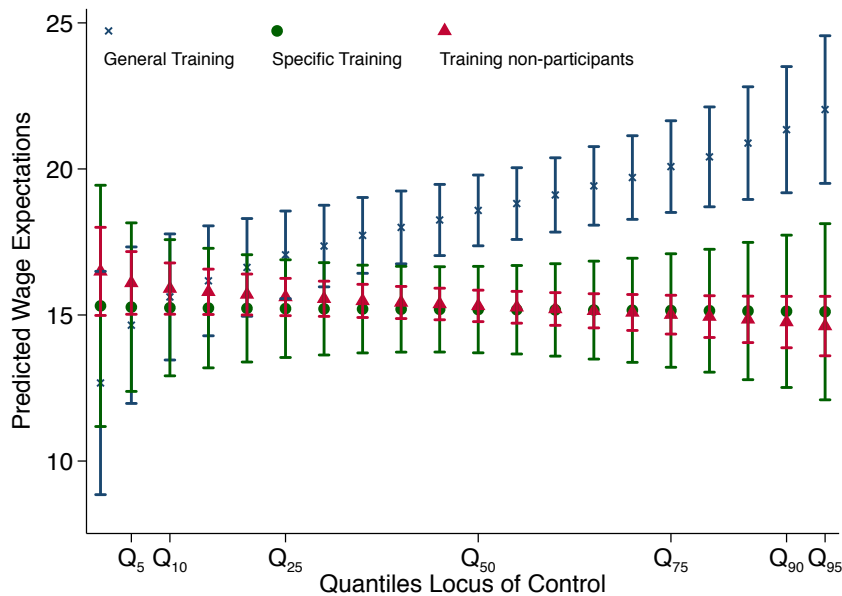
*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors are clustered on person-level. The full estimation results can be found in Table A.3 in the Appendix.

ever. In our preferred (full) specification, an internal locus of control is associated with a small, marginally significant (at the 10% level) decrease in expected future wage growth everything else equal.

We are particularly interested in the relationship between locus of control and expectations about future wage growth conditional on workers' previous training decisions. This effect is captured in the estimated interaction between locus of control and both general and specific training. Specifically, we find that there is a significant positive interaction between an internal locus of control and general training. That is, amongst those receiving general training, expected wage growth increases significantly with internal locus of control. In contrast, the subjective wage expectations of workers receiving specific training are independent of their locus of control. These results continue to hold in models with detailed controls for year and regional controls (column 2), socio-demographic characteristics (column 3), job and firm-characteristics (column 4) and Big Five Personality (column 5).

The relationship between locus of control, training participation, and wage expectations is shown graphically in Figure 2.2. Specifically, we plot predicted expectations regarding future wage growth (y-axis) at different quantiles of the locus of control distribution (x-axis), for general (blue, cross), specific (green, circle) and non-training participants (red, triangle). The crosses, circles and triangles in the middle of the vertical bars indicate the predicted means, while the horizontal lines indicate 95 percent confidence intervals. The more internal general training participants are, the higher is their wage growth expectation on average, ranging from a probability of about 13 percent in the lowest quintile to more than 23 percent in the highest. In contrast, those undertaking specific training have constant wage growth expectations throughout the locus of control distribution, while the expected likelihood of experiencing wage growth falls slightly as training non-participants become more internal.

Figure 2.2: Predicted Wage Expectations by Locus of Control



Source: Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29, own illustration.

Notes: The figure shows different locus of control quantiles plotted against the predicted wage expectations for non-training participants (red, triangle), and only general training participants (blue, cross). The triangles / crosses in the middle of the vertical bars show the predicted mean expectations for the respective training outcome. The horizontal ending points of the vertical bars denote the lower and upper end of the 95% confidence interval.

These results strongly suggest that locus of control is linked to training decisions through workers' expectations regarding the likely returns. In particular, there is a strong positive relationship between locus of control and expected wage increases for those workers who are most likely to capture the returns from training (i.e. those participating in general training) and either no or a negative relationship for those who are not (i.e. those participating in specific training or no training respectively).

Table 2.5: OLS Estimation Results: Gross Log Hourly Wage (t+1)

	(1)	(2)	(3)	(4)	(5)
	b/se	b/se	b/se	b/se	b/se
Locus of Control (std.)	0.057*** (0.006)	0.057*** (0.006)	0.024*** (0.005)	0.015*** (0.004)	0.015*** (0.004)
General Training	0.195*** (0.013)	0.195*** (0.013)	0.113*** (0.011)	0.044*** (0.009)	0.045*** (0.009)
Specific Training	0.178*** (0.014)	0.189*** (0.014)	0.094*** (0.012)	0.03*** (0.01)	0.03*** (0.01)
General Training * Locus of Control (std.)	0.022 (0.014)	0.01 (0.014)	-0.006 (0.012)	-0.003 (0.01)	-0.002 (0.01)
Specific Training * Locus of Control (std.)	-0.009 (0.016)	-0.018 (0.015)	-0.004 (0.012)	-0.013 (0.011)	-0.014 (0.011)
Control Variables					
Locus of Control, Training	✓	✓	✓	✓	✓
year, regional		✓	✓	✓	✓
socio-demographics			✓	✓	✓
job, firm				✓	✓
Big Five Personality					✓
Observations	10,234	10,234	10,234	10,234	10,234
$R^2$	0.057	0.135	0.414	0.54	0.54

Source: Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29, own calculations.

Notes: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard Errors are clustered on person-level.

The dependent variable is the gross log hourly wage income of period t+1. Period t is the period in which training participation is observed which is in our cross-sections of the years 2000, 2004 and 2008. The full estimation results can be found in Table A.4 in the Appendix.

Finally, we analyze the association of locus of control and training participation with realized wages in  $t + 1$ . Estimation results are summarized in Table 2.5; complete results are available in Table A.4. We assume that the decision to participate in training takes place in period  $t$  (which can be either in 2000,

2004 or 2008) and we estimate the relationship between training status in  $t$  and wages realized in period  $t + 1$ . We lose approximately 738 employed individuals from our sample due to missing wage or working hours information in  $t + 1$ . Column (1), Table 2.5 shows the unconditional effect of locus of control and training participation on hourly gross wage in  $t + 1$ .

We find that being internal is significantly positively related to wages. Moreover, participation in either general or specific training is associated with significantly higher wages, though the effect of general participation is slightly larger. There is an insignificant interaction between training (general or specific) and locus of control in determining realized wages which is robust as we increasingly add controls. In short, the post-training wages of training participants do not depend on their locus of control, suggesting that the return to training participation is independent of locus of control. This is inconsistent with the idea that workers with an internal locus of control engage in more training because they are more productive in training, i.e. because they receive larger productivity gains as a result.

#### 2.4.4 Robustness Analysis

We conduct a number of robustness checks in order to assess the sensitivity of our conclusions to sample choice, model specification, and the parameterization of our key variables of interest. The results for our model of training participation are reported in Panel (A) of Table 2.6, while results for our model of wage expectations are reported in Panel (B) and the results for the realized wage in  $t + 1$  in Panel (C). To facilitate comparisons, Column (1) reproduces the training results (logit marginal effects), wage expectations results (OLS coefficients) and realized wage results (OLS coefficients) from our preferred specifications (column (5)) in Tables 2.3, 2.4 and 2.5 respectively.

**Sample Choice:** Unlike the case in 2004 and 2008, the SOEP skill-transferability question in 2000 cannot be linked to a specific training course, requiring us to assume that individuals' responses refer to the latest course undertaken (see Section 2.3.2). In Column (2), we report results from a restricted estimation sample in which we drop the data from year 2000. In addition, a small number of respondents ( $n = 131$ ) participate in both general and specific training within a 12

month period. Column (3) reports the results we obtain when these individuals are excluded from the sample. In both cases, we find that our results are substantively the same indicating that our conclusions are robust to these two sampling choices.

**Definition of General and Specific Training:** We also consider the robustness of our results to the distinction we make between general versus specific training. Specifically, we narrow the definition of general training to include only training in which skills are “*Completely*” transferable to another company. All other categories of training are considered to be specific training. We find a somewhat weaker, though still statistically significant, relationship between locus of control and general training, while there continues to be no significant relationship between locus of control and specific training (see Column (4)). Thus, the conclusion that locus of control is related to general, but not specific, training continues to hold under this alternative definition. Moreover, the association between specific training and future wage expectations becomes larger and statistically significant which is unsurprising given that “specific training” now also encompasses training that is “to a large extent” transferable to other firms. In order to sharpen the distinction between general and specific training, we also considered an alternative definition which captures the extremes of the skill-transferability scale. That is, training is general only when it is “completely” transferable and specific only when it is “not at all transferable”. All other training events are dropped from the sample. These results are reported in Column (5). All of our results are virtually unchanged with the exception that the positive interaction between locus of control and specific training in influencing future wage expectations becomes much larger, though it remains statistically insignificant.

**Definition of Locus of Control:** Our locus of control index is constructed using the weights that result from a factor analysis conducted separately by each year. Our results are unchanged if we instead construct an alternative index in which all locus of control items are weighted equally (see Column (6)).

Table 2.6: Robustness Analysis for Training Participation and Wage Expectations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<b>A. Logit Estimation Results: Participation in Training (Marginal Effects)</b>									
<b>General and Specific Training</b>									
Locus of Control (std.)	0.013*** (0.004)	0.015*** (0.005)	0.013*** (0.005)	0.013*** (0.004)	0.012*** (0.003)	0.011** (0.004)	0.015*** (0.005)	0.024*** (0.005)	
<b>General Training</b>									
Locus of Control (std.)	0.016*** (0.004)	0.017*** (0.005)	0.016*** (0.004)	0.011*** (0.003)	0.013*** (0.003)	0.015*** (0.004)	0.017*** (0.005)	0.025*** (0.004)	
<b>Specific Training</b>									
Locus of Control (std.)	-0.001 (0.003)	-0.0004 (0.004)	-0.002 (0.003)	0.002 (0.004)	0.0002 (0.002)	-0.002 (0.003)	-0.0003 (0.004)	0.002 (0.003)	
Observations	10,972	7,387	10,841	10,972	9,002	10,972	7,423	10,972	
<b>B. OLS Estimation Results: Wage Expectations</b>									
Locus of Control (LoC) (std.)	-0.459* (0.279)	-0.783** (0.326)	-0.418 (0.298)	-0.452 (0.279)	-0.409 (0.282)	-0.453 (0.278)	-0.799** (0.326)	-0.125 (0.284)	-1.740*** (0.613)
General Training	3.220*** (0.683)	1.887** (0.773)	2.925*** (0.725)	2.768*** (1.046)	2.554** (1.090)	3.275*** (0.686)	1.854** (0.774)	4.604*** (0.698)	5.312*** (1.300)
Specific Training	-0.108 (0.8)	-0.342 (0.886)	-0.164 (0.828)	1.823*** (0.662)	-0.762 (1.497)	-0.107 (0.802)	-0.337 (0.888)	-0.122 (0.811)	-1.440 (1.727)
General Training * LoC (std.)	2.705*** (0.74)	2.531*** (0.794)	2.634*** (0.817)	3.514*** (1.178)	3.429*** (1.223)	2.515*** (0.726)	2.517*** (0.794)	2.775*** (0.777)	4.835*** (1.384)
Specific Training * LoC (std.)	0.431 (0.829)	-0.166 (0.886)	0.223 (0.916)	1.390** (0.657)	2.147 (0.849)	0.53 (1.395)	-0.135 (0.888)	0.21 (0.832)	1.295 (1.898)
Observations	10,972	7,436	10,841	10,972	9,085	10,972	7,423	10,972	10,972
<b>C. OLS Estimation Results: Gross Log Hourly Wage (t+1)</b>									
Locus of Control (LoC) (std.)	0.015*** (0.004)	0.016*** (0.005)	0.016*** (0.005)	0.015*** (0.004)	0.013*** (0.005)	0.014*** (0.004)	0.016*** (0.005)	0.032*** (0.005)	
General Training	0.045*** (0.009)	0.042*** (0.011)	0.05*** (0.01)	0.043*** (0.015)	0.039*** (0.015)	0.045*** (0.009)	0.042*** (0.011)	0.133*** (0.011)	
Specific Training	0.03*** (0.01)	0.024** (0.012)	0.039*** (0.011)	0.044*** (0.009)	0.038** (0.018)	0.03*** (0.01)	0.024* (0.012)	0.084*** (0.012)	
General Training * LoC (std.)	-0.002 (0.01)	-0.005 (0.012)	-0.003 (0.012)	-0.003 (0.017)	-0.004 (0.018)	-0.003 (0.01)	-0.005 (0.012)	-0.0007 (0.012)	
Specific Training * LoC (std.)	-0.014 (0.011)	-0.012 (0.013)	-0.013 (0.012)	-0.008 (0.009)	0.0008 (0.019)	-0.014 (0.011)	-0.011 (0.013)	-0.026** (0.012)	
Observations	10,234	6,925	10,107	10,234	8,436	10,234	6,916	10,234	
Control Variables: All	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29, own calculations.

Notes: \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard Errors are clustered on person-level. Sensitivity tests are presented in the different columns, we tested the following specifications: (1): Main results, from column (5) in Tables 2.3, 2.4 and 2.5 respectively; (2): Excluding year 2000; (3): Excluding individuals participating in general and specific training within one cross-section; (4): Changing definition of general training (general=completely; specific=for the most part, only to a limited extend, not at all); (5): Changing definition of general training (general=completely; specific=not at all); (6): Locus of Control index is average of items (all items equally weighted); (7): Including general risk attitudes (only available in 2004 and 2008); (8): Excluding potentially endogenous variables (education, blue/white collar worker, occupational autonomy, manager, ISCO, NACE) remaining Job + Firm control variables are: firm size, type of contract, member trade union/ association; (9): Tobit Model

**Risk Attitudes:** We additionally investigate whether our results are stable when controlling for individually reported risk attitudes. As briefly discussed in section 2.2.2, risk aversion might lead to an underinvestment in general training. If individual risk aversion is unobserved and correlated with locus of control, this might bias our results. In the SOEP we observe individual risk attitudes in the years 2004 and 2008. Column (7) presents estimation results including only the observations from these years and controlling for risk aversion. Our results are virtually the same as the results in column (2), which are based on the same years of observation without controlling for risk attitudes.

**Potentially Endogenous Variables:** Finally, we consider the sensitivity of our results to our choice of model specification. Specifically, Column (8) presents estimation results from a model which excludes potentially endogenous variables such as education, occupation type (blue, white collar), extent of occupational autonomy, ISCO-occupation and NACE-sector classification. The inclusion of these variables likely moderates the effect of locus of control. As expected, their exclusion strengthens the effect of locus of control on general training and sharpens the distinction between general and specific training in influencing future wage expectations.

**Model Choice:** To account for the large number of individuals reporting that they have no expectation of receiving a future wage increase, we also estimate a Tobit model of wage expectations and find very similar results (see Column (9)).

## 2.5 Conclusions

Nations face enormous challenges in ensuring that the economic prosperity delivered by globalization and rapid technological change is enjoyed by all members of society. The risk is that many disadvantaged, under-educated and less-skilled individuals will struggle to remain competitive and may, as a result, fall even further behind. The European Commission has recently called for the integration of work and education “into a single lifelong learning process, open to innovation and open to all” (European Commission, 2010, p. 5). Whether this successfully allows marginalized groups to remain economically active and engaged in mean-



ingful employment depends largely on their willingness to take-up work-related training opportunities.

This paper adopts a behavioral perspective on the tendency for some workers to under-invest in their own training. Specifically, we account for the role of workers and firms in the training decision and allow workers' subjective beliefs about the investment returns to training to be influenced by their sense of control over what happens in life. A greater degree of internal control is predicted to make individuals more likely to invest in training when it is transferable to outside firms, but no more likely to invest in training when it is not. We then provide empirical evidence that, consistent with our theoretical model, having an internal locus of control is associated with higher participation in general but not specific training. Moreover, we argue that our results are consistent with locus of control affecting training investments through its influence on workers' expected investment returns, rather than through training costs or post-training productivity. Specifically, general training is associated with greater expectations of future wage growth for those with an internal rather than external locus of control, even though actual post-general-training wages – and presumably productivity – do not depend on locus of control. There is also no evidence of any link between locus of control and wage expectations or post-training wages in the case of specific training.

Crucially, it is the link between skill transferability and the allocation of training returns across firms and workers which leads workers' perceptions of control to have a more profound effect on their decisions regarding general rather than specific training. We formally demonstrate this using a stylized, two-period investment model with competitive markets and risk-neutral agents. However, this key result is also easily generalized to a variety of non-competitive market structures and to risk-averse workers so long as increased skill transferability ultimately enhances workers' ability to capture the benefits of the training they receive. When this is true, we expect workers with an internal locus of control to respond to these incentives by investing in training. In contrast, those with an external locus of control are expected to be much less responsive to investment returns even when they exist.

These insights about workers' differential responsiveness to general versus specific training also extend beyond their perceptions of control. Many things – for

example, cognitive biases, risk-aversion, impatience, etc. – can lead subjective expected investment returns to deviate from objective returns; vary across individuals; and matter for important economic decisions. In these circumstances, we would expect the disparity in workers’ responses to objective investment returns to be larger when those returns accrue to them than when they do not.

The relationship between workers’ investment decisions and their locus of control suggests that those with a more external sense of control are likely to require more intensive assistance in meeting their training goals. Moreover, as work-related training decisions appear to be linked to beliefs about training returns, there is also the potential for objective information regarding the returns to training to be useful in motivating external workers. Similar information interventions are being explored as a means of increasing disadvantaged students’ propensity to attend college (Peter and Zambre, 2017) and influencing students’ choice of college major (Wiswall and Zafar, 2015).

Future research will no doubt be useful in extending these results along several dimensions. There is a particular need for research that models the role of cognitive biases, risk and time preferences, and personality traits in work-related training investments. Training decisions are particularly interesting because – unlike other types of human capital decisions – they are not unilateral; training investments result from a joint decision making process between workers and firms. This implies that disparity in workers’ and firms’ expectations regarding training returns is potentially an important explanation for the apparent underinvestment in training that we observe. Developing models that have more realistic behavioral foundations is likely to have large payoffs in explaining why some individuals under-invest in training. In particular, it would be useful to analyze the joint decision process of workers and firms in more detail to shed light on the investment and bargaining strategy of firms facing workers with diverse subjective expectations about the returns to training.

## Chapter 3

# Patrilocal Residence and Female Labour Supply: Evidence from Kyrgyzstan<sup>1</sup>

*with:*

*Andreas Landmann*

*Susan Steiner*

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<sup>1</sup>Landmann, A., Seitz, H. & Steiner, S. Demography (2018) 55: 2181. <https://doi.org/10.1007/s13524-018-0724-1>

### 3.1 Introduction

Post-marital residence rules determine where newly wed couples should reside. A large share of the world population lives in societies with a patrilocal residence rule.<sup>2</sup> This rule prescribes that women move in with their husbands' parents, or sometimes the husband's wider family, upon marriage. When joining the new household, women are usually expected to relieve their in-laws from housework and to care for them in old age Grogan, 2013; Ebenstein, 2014. Such co-residence arrangements may have significant labour market consequences for the involved women. In this study, we therefore investigate how intergenerational co-residence affects female labour supply in a patrilocal setting. We focus on Kyrgyzstan where elderly parents traditionally reside with their youngest son and his wife.

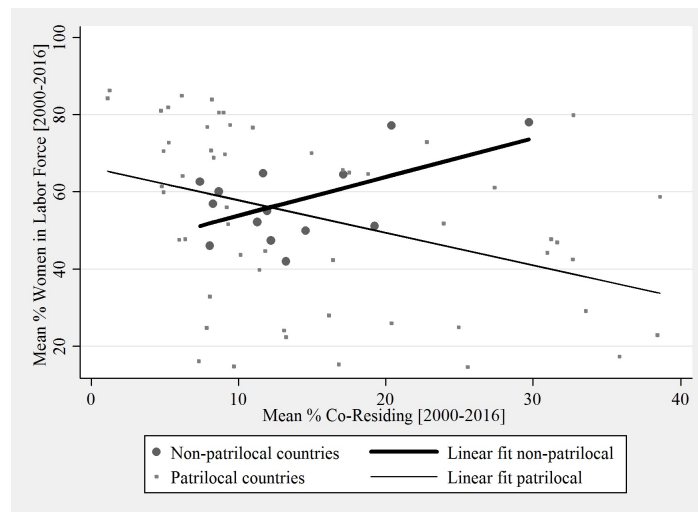
A priori, the impact of intergenerational co-residence on the labour supply of women is unclear because several channels can be at play and might counteract each other. The literature has elaborated on four channels through which the impact can principally work. First, co-residing parents or in-laws might contribute to household income or share housing and other assets (Maurer-Fazio et al., 2011). Any advantage in economic conditions (e.g. high non-labour income) is likely to make women reduce their labour supply. Second, co-residing parents or in-laws might require care. Women are typically the caregivers in the household. This responsibility increases their value of non-market time (their reservation wage) and reduces their labour supply (Lilly et al., 2007). Third, co-residing parents or in-laws might take care of women's children or take over housekeeping tasks. The reservation wage is reduced for the women, leading to an increase in labour supply (Compton and Pollak, 2014; García-Morán and Kuehn, 2017; Posadas and Vidal-Fernandez, 2013; Shen et al., 2016). Fourth, co-residing parents or in-laws might be better able to impose their preferences on a woman's labour market behaviour than distant parents or in-laws (Chu et al., 2014). Depending on the type of preferences, parents or in-laws can either induce an increase or a reduction in female labour supply. These four channels are plausible in patrilocal societies in the same way as in other societies - with one exception. Women who move in

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<sup>2</sup>74 percent of societies around the world were traditionally patrilocal (Murdock, 1967, cited in Baker and Jacobsen, 2007). Today, patrilocality is most common in the Caucasus, Central Asia, and South Asia. The share of elderly co-residing with a son and his wife is particularly high in these societies (Grogan (2013); Ebenstein (2014)).

with their in-laws are assumed to take over housekeeping tasks from them rather than the in-laws taking care of housekeeping for the women (Grogan, 2013). This distribution of tasks within the household should result in more adverse effects of co-residence on female labour supply in a patrilocal context than in a non-patrilocal context.

Figure 3.1: Co-Residence and Female Labour Force Participation Across Countries



*Source:* Data from Global Data Lab (co-residence) and World Development Indicators (female labour force participation). The Global Data Lab provides data on 104 countries, out of which 102 have co-residence measures between 1990 and 2016. For 101 countries, we can match female labour force participation. Our analysis focuses on 68 countries with a population greater than 5 million. Results hold when including smaller countries.

*Note:* Patrilocal countries are those in which more couples live with the husband's than the wife's parents; non-patrilocal countries are all others. The slope of the estimated lines is 1.01 ( $N=14$ ,  $p\text{-value}=0.036$ ) for non-patrilocal countries and  $-0.84$  ( $N=54$ ,  $p\text{-value}=0.004$ ) for patrilocal countries.

A simple cross-country analysis illustrates that patrilocal countries are different from non-patrilocal countries. Figure 3.1 shows the correlation between female labour force participation and intergenerational co-residence rates in patrilocal countries and non-patrilocal countries separately.<sup>3</sup> While co-residence is positively related to female labour force participation in the latter, the correlation is negative in patrilocal countries. This pattern suggests that the effect of intergenerational co-residence is distinct, and potentially negative, in patrilocal

<sup>3</sup>The list of countries used for this analysis can be found in Table B.1.

countries. Yet, cross-country analyses can hardly provide causal insights. Instead, micro-level investigations are needed.

There are only few micro-level studies on labour supply effects of living with the parent generation (Kolodinsky and Shirey, 2000; Sasaki, 2002; Oishi and Oshio, 2006; Maurer-Fazio et al., 2011; Shen et al., 2016).<sup>4</sup> All these studies find that co-residence increases female labour supply and claim that this is due to parental assistance with child care and housekeeping. Yet, most of the authors limit themselves to speculation; only Shen et al. (2016) explicitly test and confirm this claim for the case of housework. None of the other channels are analyzed.

In this study, we contribute to the literature by investigating all channels through which intergenerational co-residence can potentially affect women's supply of labour to the market: We analyze causal effects on time allocation of women. For parents' income and gender attitudes, we only provide suggestive evidence. We focus on Kyrgyzstan, which is a post-Soviet country in Central Asia with a population of 5.9 million and where patrilocality is common: 46 percent of married females in the age group 15-30 live with at least one parent-in-law and only 9 percent live with at least one own parent (Grogan, 2013). Young married women reportedly have the lowest status in their in-laws' household (Kuehnast, 2004). They are supposed to be obedient and to fulfill the demands of their husbands and his parents. Married couples tend to live with the husband's parents until the husband's younger brothers get married. At that point, they often move out and form their own household. According to tradition, the youngest son and his wife never move out and are responsible for the well-being of the parents (Bauer et al., 1997; Kuehnast, 2004; Thieme, 2014; Rubinov, 2014). As a way of compensation, the youngest son inherits the house and the land upon the death of his father.<sup>5</sup>

In contrast to the previous literature, we do not only measure the impact of living with the parent generation on female labour supply; we also shed light on the channels. With the help of time use data, we can draw conclusions on how time spent on child care, elder care and housekeeping differs between women who

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<sup>4</sup>Additionally, Compton (2015) evaluates the effect of proximity to parents on labour market outcomes of women. She finds that, when controlling for the endogeneity of distance to the parents, close proximity to parents increases the labour force participation of married women. Please note that this study is not fully comparable to the other studies, as it focuses on proximity to parents rather than co-residence with parents.

<sup>5</sup>All children traditionally get a share of the parents' wealth, though in different forms and at different times in their life cycle (Giovarelli et al., 2001).

co-reside and women who do not co-reside. Furthermore, we have information on income contributed to the household by co-residing parents as well as their attitudes on gender roles. We correlate this information with female labour supply.

Empirical analysis is not straightforward because co-residence is not exogenous. Even in patrilocal societies such as Kyrgyzstan, there is selection into co-residence. Couples that are expected to co-reside with the husband's parents do not always do so, while couples that are not necessarily expected to co-reside sometimes decide to live with the older generation. The reason is that co-residence and labour supply decisions are often made jointly (Sasaki, 2002). For example, young women with low ambition to work outside the home or with conservative attitudes on gender roles may be inclined to co-reside with their in-laws. Additionally, parents are likely to move in with their adult children when they need to be taken care of or when the adult children need them as caregivers for their own children, especially if formal care is not easily available or too costly. If there are several siblings, the co-residence decision could be the result of a bargaining process. The sibling with the lowest (highest) opportunity costs may be the one who co-resides with parents if elder (child) care is required (Ettner, 1996; Ma and Wen, 2016). Due to this endogeneity of co-residence, simple comparisons of co-residing and non-co-residing women are most likely subject to a bias.

To address the endogeneity of co-residence, we make use of the tradition that youngest sons are expected to live with their parents in Kyrgyzstan. This tradition stems from nomadic life style historically prevalent in much of Central Asia. It was due to the space restrictions in yurts (portable tents) but has no economic relevance today. Yet, our data show that all ethnic groups residing in the country, even those without nomadic roots, follow it today.<sup>6</sup> The tradition generates exogenous variation in the co-residence of women with the parent generation, driven by the birth order of husbands. We use being married to the youngest

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<sup>6</sup>According to information obtained in expert interviews, it was the parents' duty in Turkic and Mongolian nomadic cultures to allocate a certain number of livestock to their older sons when they got married and to separate them by giving them a yurt. Keeping the sons and their wives in the parents' yurt would have been impossible due to space restrictions. When parents died, it was the youngest son's duty to bury the parents. In return, he inherited the parents' yurt and their remaining livestock. This tradition has been adapted to what we see today in Kyrgyzstan: Married older sons form their own households (possibly after living with their parents for a certain time period) and youngest sons stay with the parents and take care of them in old age. It is an open question why we see the tradition being practiced even in ethnic groups that do not have nomadic roots, such as Tajiks or Russians.

son to construct an instrument for women's intergenerational co-residence. We show that wives of youngest sons are significantly and substantially more likely to co-reside than otherwise comparable wives of older sons. Several tests suggest plausibility of the instrument: Youngest sons do not seem to differ from older sons with regard to pre-marriage characteristics and divorce rates. The same holds for their wives.

We find that the patrilocal setting in Kyrgyzstan is different from the settings investigated in the previous literature, as reflected in the deviating overall effect of co-residence on female labour supply. In Kyrgyzstan, co-residence does not significantly affect the labour market outcomes of married females. Effects are negative and insignificant both when using OLS with a large set of control variables and when using an instrumental variable strategy. Our channel analysis suggests that co-residing women spend significantly more time on elder care compared with women who do not co-reside. This increase in elder care seems to coincide with a reduction in leisure. However, co-residence does not change time spent on either child care or housekeeping. Income contributed by co-residing parents and their gender attitudes also do not seem to be related with women's labour market outcomes.

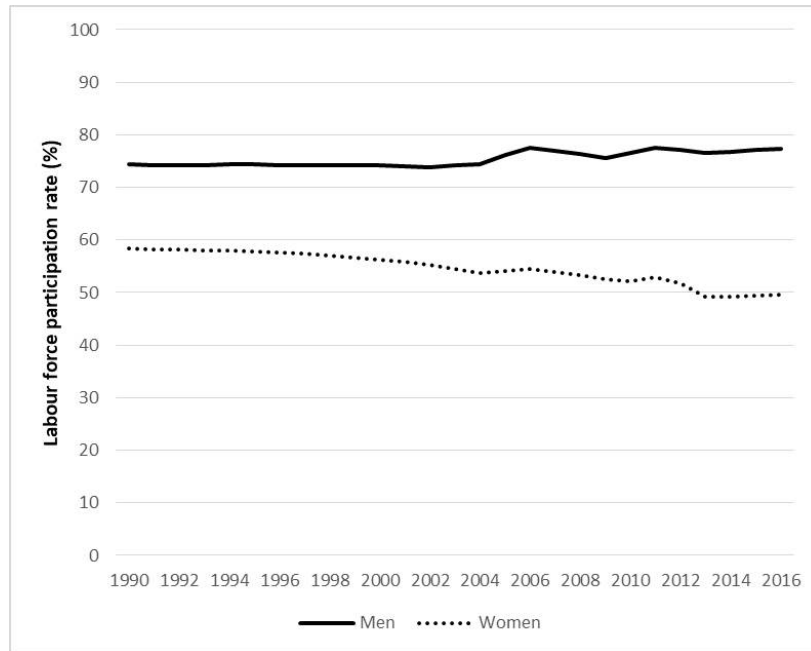
## **3.2 Background: Female Labour Supply in Kyrgyzstan**

Despite the political objective of the Soviet government to achieve gender equality on the labour market, the labour force participation rate of females (aged 15-64 years) always remained lower than that of males in what is today Kyrgyzstan. Just before the dissolution of the Soviet Union, female labour force participation amounted to 58 percent in 1990, compared with 74 percent for males (Figure 3.2). Since then, the distance between females and males has increased: while 50 percent of females participated in the labour force in 2016, 77 percent of males did so.

The provision of institutionalised care for children and the elderly remains low, which potentially keeps women from participating in the labour market. The enrolment rate in formal child care for children aged 3-6 years was as low as 31



Figure 3.2: Labour Force Participation in Kyrgyzstan, 1990-2016



Source: World Development Indicators, World Bank

percent in 1990, further decreased to 9 percent in 1998 (Giddings et al., 2007) and then increased again to 22 percent in 2013/14 (UNICEF, 2017). The Ministry of Labour and Social Development (2017) currently reports a total of six care homes for the elderly, with 750 residents and an additional 10,000 people receiving care from these homes in their own houses. Compared with around 550,000 pensioners in the country, these numbers are very low. Kyrgyzstani women have been and still are the main providers of care for the household (Akiner, 1997; Paci et al., 2002).

Women tend to be employed in sectors with relatively low pay. The share of females is highest in health care and social services, education, and hotels and restaurant services. The higher paid transportation and communication sector as well as public administration are in turn male-dominated (Ibraeva et al., 2011; Schwegler-Rohmeis et al., 2013). A sizable gender earnings gap is the consequence. In 2013, men earned approximately 26 percent more per month than women, but they also worked 6 percent more hours. The average hourly earnings gap was 25 percent (Anderson et al., 2015).

### 3.3 Data

We use data from the Life in Kyrgyzstan (LIK) survey, which is a nationally representative panel, conducted annually between 2010 and 2013 and again in 2016.<sup>7</sup> The LIK provides a wide range of individual and household level information on socio-demographic characteristics, employment, and many other topics. In contrast to household panels where only one member of the household is interviewed, the LIK is an individual panel, in which all adult individuals living in the originally sampled households are interviewed and tracked over time. The first wave of the survey included 8,160 adults living in 3,000 households.

In our empirical analysis, we use data from the 2011 wave of the LIK and restrict the estimation sample to married women in the age range 20-50. There are 2,043 such women. We further restrict the sample to those women with at least one living parent-in-law because women without any living parent-in-law do not have the opportunity to co-reside. Unfortunately, the core LIK questionnaire does not collect information about whether an individual's parents are still alive and also lacks other crucial information required for the below empirical analysis (namely, parents' age if still alive, an individual's birth order, and the number of brothers). We thus collected supplementary data from all women and their husbands in our target sample. The supplementary data collection took place in 2014, but we collected retrospective information referring to the year 2011. This approach allows us to merge the supplementary data to the 2011 LIK wave. At the same time, it makes the use of additional LIK waves problematic: For later years, we do not have up-to-date information about whether the husband's parents or any of his brothers had died since 2011.<sup>8</sup>

1,583 women and their husbands were successfully re-interviewed in 2014.<sup>9</sup>

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<sup>7</sup>The first three waves were collected by the German Institute of Economic Research, the fourth wave by the Stockholm International Peace Research Institute, and the fifth wave by the Leibniz Institute of Vegetable and Ornamental Crops. For detailed information on the survey, see Brück et al. (2014).

<sup>8</sup>Adding the 2010 wave to the analysis would be comparably easier because, if someone was alive in 2011, she or he must also have been alive in 2010. Yet, this wave was the first wave of the LIK and suffered from some problems during data collection, which were later removed. Importantly for us, the relationship to the household head was wrongly reported in a non-negligible number of cases.

<sup>9</sup>The supplementary data collection in 2014 was implemented by the same survey firm that also implements the data collection of all regular LIK waves. Failure to re-interview was higher in urban than in rural areas. The main reason for attrition is migration of the husband or wife

Our final sample is further reduced to 1,048 observations due to the following reasons: both parents of the husband are deceased (479 observations), the birth order of the husband could not clearly be identified (1 observation), and there are missing values on the variables used in the empirical analysis (55 observations).

### 3.3.1 Outcome Variables

We measure the labour market outcomes of women in two ways: first, the probability to engage in the labour market, i.e. labour force participation (extensive margin), and second, the number of weekly working hours (intensive margin). Women participate in the labour force if they actively engage in the labour market by working or if they are unemployed and seeking work. In contrast, women do not participate in the labour force if they do not work *and* do not seek work. In the LIK, engaging in the labour market is measured by (a) working for someone who is not a household member, (b) working for a farm or business owned or rented by the respondent or another household member, (c) engaging in farming, fishing, gathering fruits or other products or (d) being absent from a job to which one will return.<sup>10</sup> Women are identified as unemployed if they do not fall under any of these four categories but report that they look for work. For all working women, we observe the number of working hours. We use the total number of working hours per week in our analysis, which may be spent in up to two occupations.<sup>11</sup> Unemployed women and women who do not participate in the labour force are assumed to have zero working hours.

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outside Kyrgyzstan (about 40 percent of cases), followed by failure to meet an interviewee at home, migration within Kyrgyzstan, refusal to be interviewed, death of one of the partners, and end of marriage. As a consequence, our results are essentially restricted to non-migrants.

<sup>10</sup>Categories (a), (b) and (d) are defined in accordance with the Integrated Sample Household Budget and Labour Survey of the National Statistics Committee of the Kyrgyz Republic. Category (c) was added in the LIK because the other three categories missed an important part of self-employment activities. The resulting definition of labour force participation conforms to that of the International Labour Organization.

<sup>11</sup>1.7 percent of the women in our estimation sample have two occupations, which corresponds to 3.7 percent of all those with positive working hours.

Table 3.1: Summary Statistics on Female Labour Supply, Instrument and Explanatory Variables

	(1)	(2)	(3)	(4)	(5)	(6)
	All (n=1,048)		Co-residence			
	Mean	(SD)	Mean	(SD)	Mean	(SD)
			Yes (n=501)		No (n=547)	
<b>A. Female Labour Supply and Instrument</b>						
Labour force participation	0.48	(0.50)	0.39	(0.49)	0.56	(0.50)
Working hours <sup>a,c</sup>	35.97	(14.30)	35.32	(14.42)	36.38	(14.24)
Married to youngest son	0.35	(0.48)	0.50	(0.50)	0.21	(0.41)
<b>B. Explanatory Variables</b>						
<b>Conditioning Variables</b>						
Age (husband) <sup>c</sup>	36.46	(8.50)	40.83	(7.26)	31.67	(7.07)
Number of brothers (husband) <sup>c</sup>	2.09	(1.40)	2.32	(1.47)	1.83	(1.29)
Age oldest living parent (husband) <sup>c</sup>	65.85	(10.28)	69	(9.26)	62.41	(10.23)
<b>Wife Characteristics</b>						
Age <sup>c</sup>	32.83	(8.49)	37.31	(7.34)	27.95	(6.81)
Low school education <sup>b</sup>	0.10	(0.34)	0.10	(0.29)	0.10	(0.31)
Medium school education <sup>b</sup>	0.58	(0.49)	0.56	(0.5)	0.60	(0.49)
High school education <sup>b</sup>	0.32	(0.47)	0.34	(0.47)	0.30	(0.46)
Kyrgyz	0.70	(0.46)	0.72	(0.45)	0.67	(0.47)
Uzbek	0.16	(0.37)	0.16	(0.36)	0.17	(0.38)
Dungan	0.04	(0.20)	0.03	(0.17)	0.06	(0.23)
Russian	0.03	(0.18)	0.04	(0.19)	0.03	(0.17)
Other ethnicity	0.06	(0.25)	0.06	(0.23)	0.07	(0.26)
<b>Residence Characteristics</b>						
Chui	0.16	(0.36)	0.16	(0.36)	0.16	(0.37)
Issyk Kul	0.09	(0.28)	0.11	(0.31)	0.07	(0.26)
Jalal Abad	0.18	(0.38)	0.19	(0.40)	0.16	(0.36)
Naryn	0.04	(0.21)	0.03	(0.17)	0.06	(0.24)
Batken	0.08	(0.27)	0.08	(0.27)	0.09	(0.28)
Osh	0.27	(0.44)	0.20	(0.4)	0.34	(0.48)
Talas	0.05	(0.21)	0.06	(0.23)	0.03	(0.18)
Osh (City)	0.04	(0.20)	0.03	(0.17)	0.05	(0.22)
Bishkek (City)	0.10	(0.29)	0.15	(0.35)	0.04	(0.20)
Community in urban area	0.27	(0.45)	0.32	(0.47)	0.22	(0.42)
Kindergarten in Community	0.61	(0.49)	0.63	(0.48)	0.60	(0.49)
<b>Husband Characteristics</b>						
Low school education (husband) <sup>b</sup>	0.09	(0.28)	0.08	(0.27)	0.10	(0.30)
Medium school education (husband) <sup>b</sup>	0.58	(0.49)	0.57	(0.50)	0.60	(0.49)
High school education (husband) <sup>b</sup>	0.29	(0.45)	0.33	(0.47)	0.24	(0.43)

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: Standard deviation in parentheses.

Columns (1), (3), (5) provide the mean of continuous variables (denoted with <sup>c</sup>) and the share of dummy variables, respectively. Columns (2), (4), (6) provide the standard deviation of variables.

<sup>a</sup> Working hours are calculated based on the sample of employed women. <sup>b</sup> Education is defined based on the highest certificate / diploma / degree obtained so far. The categories are: Low education (illiterate, primary, basic), Medium education (secondary general, primary technical), High education (secondary technical, university).

Panel A of Table 3.1 illustrates that close to half of the sample participates in the labour force. Out of 1,048 women, 500 (48 percent) participate in the labour force and 548 (52 percent) do not. Among those participating, 483 are employed and 17 are unemployed. The average number of weekly working hours for employed women is 36 hours.

### 3.3.2 Co-residence and Youngest Son

Our main explanatory variable is co-residence. We define co-residence as a married woman - and her husband and children (if any) - living in one household with at least one parent. In principle, the parent can be a parent of the wife or the husband. Out of 1,048 women, 547 (52 percent) live in nuclear families and 501 (48 percent) co-reside with parents or parents-in-law. Among the co-residing women, 490 (98 percent) live with at least one of the husband's parents and 11 (2 percent) with at least one own parent.<sup>12</sup> These numbers illustrate the extent of patrilocality in Kyrgyzstan. Panel A of Table 3.1 shows that women who co-reside tend to supply less labour to the market. 39 percent of co-residing women and 56 percent of non-co-residing women participate in the labour market. Among employed women, co-residing women work 35 hours per week and non-co-residing women work 36 hours (difference insignificant).

Co-residence is likely endogenous. We create an indicator variable for whether a woman's husband is the youngest son in his family and use this as our instrument for co-residence. 35 percent of the women in our sample are married to a youngest son. Co-residence and marriage with a youngest son are strongly associated: Among the co-residing women, 50 percent are married to a youngest son; among the non-co-residing women, only 21 percent are married to a youngest son (Table 3.1, Panel A).

### 3.3.3 Other Covariates

In addition to co-residence, several other factors potentially drive labour market outcomes of females. We here describe the variables that we use as controls in our

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<sup>12</sup>Among women who co-reside with in-laws, 34 percent live with only the mother-in-law, 8 percent with only the father-in-law, and 58 percent with both mother-in-law and father-in-law. Among the few women who co-reside with own parents, 55 percent live with their mother and 45 percent with both parents.

analysis (descriptive statistics are reported in Panel B of Table 3.1). Note that we restrict ourselves to variables which are plausibly unaffected by individual co-residence decisions to avoid problems of endogenous controls.

Our first set of variables characterizes the woman. Following Mincer (1958), we include her educational attainment (dummies for different stages of education: low, medium, and high) and age (as a proxy for experience). We assume that education is exogenous to co-residence because most women complete their education before marriage. However, our results are stable to only controlling for basic education, which is definitely determined at pre-marriage age.<sup>13</sup> Kyrgyzstan is a multi-ethnic society with ethnicity-specific gender norms related to the labour market (Anderson et al., 2015; Fletcher and Sergeyev, 2002). We thus control for the ethnicity of the women. We account for the four main ethnic groups in our sample (Kyrgyz, Uzbek, Dungan, Russian) and summarize the remaining groups as “other ethnicity”.<sup>14</sup> Our second set of variables relates to the residence of the women. This set helps us account for geographic heterogeneity. Economic conditions, and with them labour markets, vary largely within the country. The North is historically more economically developed than the South and urban areas more than rural areas (Fletcher and Sergeyev, 2002; Anderson and Pomfret, 2002). We thus include dummy variables for provinces as well as urban areas.<sup>15</sup> We also have information on the local availability of child care facilities. As such facilities ease women’s integration in the labour market, we control for whether the community in which a woman lives has a kindergarten. Finally, a third set of variables relates to the husband. We control for the husband’s educational attainment, because determinants of the husband’s income might affect a woman’s decision to work. Education of the husband might furthermore capture attitudes on gender roles which are relevant for the woman’s labour market participation.

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<sup>13</sup>Basic education consists of four years of primary school and the first five years of secondary school. After basic education, women can continue with two more years of secondary school, potentially followed by tertiary education, or with technical school.

<sup>14</sup>“Other ethnicity” is mainly composed of Uigurs, Tajiks and Kazakhs, but contains a number of other small ethnic groups as well.

<sup>15</sup>Issyk-Kul, Naryn, Talas, Chui and the capital Bishkek are provinces in the North, and Jalal-Abad, Batken, Osh and the city Osh in the South.

## 3.4 Empirical Strategy and Results

### 3.4.1 Discussion of Instrument and Identifying Assumptions

Earlier studies on the effect of intergenerational co-residence on female labour market outcomes use a variety of instrumental variables to control for the endogeneity of co-residence. Sasaki (2002) uses sibling characteristics (number of siblings and birth order of husband and wife) and housing information (house owned or rented, detached house or apartment, house size) as instruments. Oishi and Oshio (2006) enrich this set of instruments with information on, for example, the husband's age and educational attainment. The instruments in the Maurer-Fazio et al. (2011) study are the percentage of households in the prefecture that have co-resident parents, husband's age, wife's age and provincial dummies. Shen et al. (2016) exploit a tradition about co-residence via sibling structures. They use the number of surviving brothers and sisters of a woman as well as her birth order as instruments for co-residing with the woman's parents. This identification strategy is the most similar to ours.

All of the instruments used in the previous literature are relevant and explain the co-residence decision well. However, some of them may not be valid instruments. For example, housing conditions, husband's educational attainment, living in a particular province, and the number of siblings are unlikely to affect female labour supply only through co-residence: housing conditions as well as the number of siblings reflect the wealth of a family, husband's education is a proxy for spousal income, and provincial dummies capture labour market differences across provinces, all of which may influence female labour supply. Thus, we consider it possible that the exclusion restriction is not fulfilled. Sasaki (2002), Oishi and Oshio (2006), Maurer-Fazio et al. (2011) and Shen et al. (2016) do not provide evidence to refute this possibility.

We argue that the instrument that we use in this paper is both relevant and plausibly valid. It is derived from a Central Asian tradition, according to which the youngest son of a family is supposed to stay with his parents and to ensure their well-being (Bauer et al., 1997; Thieme, 2014; Rubinov, 2014). Any woman who is married to a youngest son is thus substantially more likely to

co-reside with parents-in-law than a woman who is married to an older sibling. This could already be seen from our descriptive statistics in Panel A of Table 3.1; and our first-stage estimation results (see below) provide further support. A dummy variable that indicates whether a woman's husband is the youngest son thus provides a relevant instrument for co-residence. Different ethnic groups residing in Kyrgyzstan are likely to differ from each other with regard to co-residence decisions. In our data, the tendency of the youngest son to stay with his parents is prevalent among all ethnic groups (though in some groups, to a lesser extent than among Kyrgyz). We therefore decided to keep all ethnic groups in the sample. Restricting attention to the Kyrgyz population only does not substantially change our results.

In all of our estimations, we control for the age of the husband, the number of brothers of the husband, and the age of the oldest living parent of the husband. We refer to these variables as conditioning variables. They are included because they are, by construction, correlated with being the youngest son. Youngest sons are on average younger than older sons; the probability of being the youngest son decreases with the number of brothers; and conditional on son's age, parents of youngest sons tend to be older than parents of older sons. Given these relationships, being married to the youngest son may influence female labour supply through other channels than through co-residence. For example, younger sons who are of the same age as older sons tend to have older parents. Older parents, in turn, are likely to require more care, which potentially reduces female labour supply. Controlling for the conditioning variables blocks such channels, which may otherwise violate the exclusion restriction. In contrast to Sasaki (2002), Oishi and Oshio (2006) and Shen et al. (2016), we *control* for the number of siblings of the husband (the number of brothers, to be precise) rather than using it as a separate instrument.

Several threats to the crucial exclusion restriction remain. First, we need to assure that there is no selection on the marriage market in the sense that women with certain characteristics get married to youngest sons. One could think of anticipation effects: women who are willing to care for a parent-in-law and are less prone to participate in the labour force might be more likely to marry a youngest son, as this would result in co-residence with in-laws. Second, we need to rule out that youngest sons have low career ambitions or have a preference



for partners with low career ambitions. Youngest sons are likely aware of the responsibility for their parents and could look for a wife willing to share this responsibility with them. Third, we assume that being married to the youngest son has no effect on marital stability. If, for example, the wives of youngest sons are more likely to divorce (possibly due to the responsibility for parents-in-law), they might be more active on the labour market in anticipation of divorce.

In contrast to prior studies with an instrumental variable strategy - which all face these challenges - we explicitly test the plausibility of the exclusion restriction. This test cannot provide a final answer regarding the validity of the instrument, which is inherently untestable, but it could reveal clear violations. To address the first two assumptions, we compare pre-marriage characteristics between (a) women married to youngest sons and women married to older sons and (b) men who are the youngest son and men who are an older son. Panel A of Table 3.2 reports the results for women. We regress a number of pre-marriage characteristics on a dummy variable indicating whether a woman is married to a youngest son, controlling for our conditioning variables. The pre-marriage characteristics are socio-demographic characteristics (age at marriage, ethnicity, number of siblings), proxy variables for labour market affinity (years of education, an indicator for having more than 11 years of education, employment status one and two years prior to the marriage) and how the marriage was formed. With regard to the latter point, we distinguish between love marriage, arranged marriage, and bride capture with the latter two representing traditional values (Nedoluzhko and Agadjanian, 2015; Becker et al., 2017), which have potential implications for labour market outcomes of females.<sup>16</sup>

We estimate a Logit model if the pre-marriage characteristic is binary and an OLS model if it is continuous. Column (1) presents the coefficient for being married to the youngest son, column (2) the standard error and column (3) the t-statistic/z-statistic. As can be seen from the last column, we do not find differences at the 5 percent significance level. Panel B of Table 3.2 compares pre-marriage characteristics for youngest sons and older sons, and we find no differences in these characteristics at the 5 percent significance level. We conclude that couples involving a youngest son do not seem to self-select in terms of labour

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<sup>16</sup>Due to ethnicity-specific marriage practices (Nedoluzhko and Agadjanian, 2015; Becker et al., 2017), we also control for ethnicity when the outcome variable refers to how the marriage was formed.

Table 3.2: Differences in Pre-Marriage Characteristics

	(1)	(2)	(3)
	Coefficient/Marginal Effect	S.E.	Z-Stat/T-Stat
<b>A. Wife</b>			
Age at marriage <sup>c</sup>	0.47	0.24	1.93
Kyrgyz	-0.01	0.04	-0.14
Uzbek	-0.03	0.03	-1.01
Dungan	0.01	0.02	0.66
Russian	0.02	0.01	1.36
Other ethnicity	-.03	0.02	-1.34
Total number of siblings <sup>c</sup>	-0.07	0.16	-0.47
Years of education <sup>c</sup>	0.24	0.18	1.33
More than 11 years of education	0.05	0.04	1.28
Worked t-1 if t=year of marriage	0.01	0.04	0.34
Worked t-2 if t=year of marriage	0.02	0.03	0.61
Love marriage	0.02	0.04	0.43
Arranged marriage	0.004	0.03	0.12
Bride capture	-0.02	0.02	-0.76
<b>B. Husband</b>			
Age at marriage <sup>c</sup>	0.52	0.31	1.69
Kyrgyz	-0.01	0.04	-0.32
Uzbek	-0.04	0.03	-1.28
Dungan	0.01	0.02	0.46
Russian	0.02	0.01	1.31
Other ethnicity	-0.01	0.02	-0.38
Total number of siblings <sup>c</sup>	0.07	0.11	0.60
Years of education <sup>c</sup>	-0.03	0.18	-0.18
More than 11 years of education	-0.002	0.04	-0.07
Worked t-1 if t=year of marriage	0.04	0.04	0.93
Worked t-2 if t=year of marriage	0.01	0.04	0.33

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: <sup>c</sup> denotes continuous variable.

Panel A shows the effect of being married to the youngest son of a family on pre-marriage characteristics of the wife. Panel B shows the effect of being a youngest son of a family on pre-marriage characteristics of the husband. Results are based on Logit estimations for binary outcome variables and ordinary least-squares (OLS) estimations for continuous outcomes. Column (1) reports the Logit marginal effect or OLS coefficient of the variable *youngest son*, while further controlling for number of brothers of the husband, age of the husband and age of the oldest living parent of the husband (and for ethnicity, but only if the type of marriage is outcome variable). Column (2) reports the corresponding standard errors, column (3) the values of z-statistic (for Logit estimations) or t-statistic (for OLS estimations). Critical values of t-distribution:  $t_{\infty,0.95} = 1.645$ ,  $t_{\infty,0.975} = 1.96$ ,  $t_{\infty,0.995} = 2.576$ .

market characteristics at the time of marriage.<sup>17</sup> Possible negative aspects of marrying a youngest son, such as running the household or providing elder care for parents-in-law, and positive aspects, such as the prospect of receiving and inheriting resources, might cancel each other out.

Last, we want to rule out any effect of being married to a youngest son on marriage stability. More precisely, we would like to find out whether divorced women are significantly more likely to have been married to youngest sons compared with older sons.<sup>18</sup> We cannot test this assumption with our sample because all women in the sample are married. We instead use information on all brothers of the husband, including information of the husband himself, and all brothers of the women in our sample.<sup>19</sup> Their marital status and their birth order are known. We compare the likelihood of being divorced between male siblings who are the youngest son and those who are not the youngest son. We estimate a Logit model for the probability of divorce. Divorce is estimated as a function of the son's birth order and the conditioning variables. Based on a sample of 5,679 male siblings, the marginal effect of being the youngest son is -0.002; the corresponding z-statistic is -0.75. We conclude that couples involving a youngest son do not differ with respect to marriage stability from other couples.<sup>20</sup>

### 3.4.2 Estimation Results

We estimate the effect of co-residence with parents or in-laws on labour market outcomes of women using a two-stage least squares estimation.<sup>21</sup> For the effect

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<sup>17</sup>In addition we use a non-parametric matching method in order to test for differences in pre-marriage characteristics. We also do not find significant differences (see Table B.2 in the Appendix).

<sup>18</sup>Divorce is rare but exists in Kyrgyzstan. The divorce rate, according to the 2011 LIK, is 4%.

<sup>19</sup>The list of siblings of all wives and husbands was compiled during the supplementary data collection in 2014, with the aim to identify the youngest son in every family.

<sup>20</sup>As before, we additionally use a non-parametric matching method to test for differences in marriage stability between youngest and non-youngest sons. In accordance with our parametric result, we do not find a significant difference.

<sup>21</sup>Note that - as in every IV estimation - the treatment effect has a local interpretation, i.e. it is the effect for women who live with the parent generation only because they are married to a youngest son.

on labour force participation, the estimation equations for the two stages are:

$$Co-residence_i = \alpha_1 + \alpha_2 Youngest Son_i + X_i' \alpha_3 + \epsilon_i \quad (3.1)$$

$$LFP_i = \beta_1 + \beta_2 \hat{Co-residence}_i + X_i' \beta_3 + v_i \quad (3.2)$$

where  $i$  indexes individual women.  $Co-residence_i$  is a dummy variable that captures whether a woman lives with at least one parent or parent-in-law in the same household, and  $Youngest Son_i$  denotes whether she is married to a youngest son.<sup>22</sup>  $LFP_i$  is her labour force participation.  $X_i$  is a vector of control variables, including the characteristics of the woman (age, educational attainment, ethnicity), the residence (province, community is urban, availability of kindergarten) and the husband (educational attainment). We also control for the conditioning variables, i.e. the age, the number of brothers, and the age of the oldest living parent of the husband.

Unlike related papers (Sasaki, 2002; Oishi and Oshio, 2006; Maurer-Fazio et al., 2011; Shen et al., 2016), we do not control for the number of children in the household because this variable turns out to be a bad control in our context. The number of children is determined by being married to the youngest son. To illustrate this, we regress the number of children up to age five on being married to the youngest son, controlling for the conditioning variables. We restrict this exercise to the number of children up to age five because these children are not yet in school and are most likely to affect female labour supply. There is a positive and significant relationship between the number of children and being married to the youngest son (Table B.3 in the Appendix). We subsequently estimate the effect of co-residence on the number of children, instrumenting co-residence with being married to the youngest son. We find that, *ceteris paribus*, co-residing couples have 0.553 more children (Table B.4 in the Appendix). Since we are interested in establishing causality between co-residence and female labour supply, controlling for the number of children would be inappropriate.<sup>23</sup>

In the first stage of the estimation (equation (4.2)), the endogenous variable (co-residence) is treated as a linear function of the instrument (being married to

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<sup>22</sup>Only sons are defined as youngest sons, but we always control for the number of brothers. Deleting only son observations does not indicate a bias but decreases the precision of our estimates. We hence prefer the specification with all observations included.

<sup>23</sup>Controlling for the number of children does not change the results much, though.

the youngest son) and the remaining control variables ( $X_i$ ). In the second stage (equation (3.2)), we estimate a linear probability model and replace co-residence with the predicted values from the first stage ( $Co-residence_i$ ).  $\beta_2$  is the unbiased effect of co-residence on female labour force participation. The main two-stage estimation results are in Panel B of Table 3.3; the main OLS results are in Panel A. Full estimation results are reported in Tables B.5, B.6, and B.7 in the Appendix.

Table 3.3: Estimation Results: Labour Force Participation

	(1)	(2)	(3)	(4)	(5)
<b>A. OLS Estimation Results</b>					
<b>(Co-residence exogenous)</b>					
Co-residence	-.168*** (0.03)	-.057 (0.036)	-.023 (0.037)	-.054 (0.037)	-.055 (0.037)
<b>B. Two-stage Least-Squares Estimation Results</b>					
<b>First Stage</b>					
Married to youngest Son	0.316*** (0.031)	0.204*** (0.032)	0.21*** (0.031)	0.209*** (0.03)	0.207*** (0.03)
F-statistic	104.104	41.64	46.72	49.78	48.82
<b>Second Stage</b>					
Co-residence	-.196* (0.101)	-.084 (0.185)	-.105 (0.175)	-.045 (0.17)	-.048 (0.172)
Observations	1,048	1,048	1,048	1,048	1,048
Conditioning Variables		✓	✓	✓	✓
Wife Characteristics			✓	✓	✓
Residence Characteristics				✓	✓
Husband Characteristics					✓

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Conditioning variables: age of the husband, number of brothers of the husband, age of the oldest living parent of the husband.

Wife characteristics: age, educational attainment, ethnicity.

Residence characteristics: province, community is urban, availability of kindergarten.

Husband characteristics: educational attainment.

The estimation equations for the effect of co-residence on hours of work are:

$$Co-residence_i = \alpha_1 + \alpha_2 Youngest Son_i + X_i' \alpha_3 + \epsilon_i \quad (3.3)$$

$$WH^*_i = \gamma_1 + \gamma_2 Co-residence_i + X_i' \gamma_3 + \mu_i \quad (3.4)$$

where  $WH^*_i$  is the linear index determining working hours  $WH_i$  ( $WH_i = 0$  if  $WH^*_i \leq 0$ ,  $WH_i = WH^*_i$  if  $WH^*_i > 0$ ). All other variables are defined as above.

The first stage is identical to equation (4.2). We slightly adapt our approach for the second stage and employ an IV Tobit model to account for the censored nature of the dependent variable. The main IV Tobit estimation results are presented in Panel B of Table 3.4. The main Tobit results are shown in Panel A. Full estimation results are reported in Tables B.8 and B.9 in the Appendix.

Table 3.4: Estimation Results: Working Hours

	(1)	(2)	(3)	(4)	(5)
<b>A. Tobit Estimation Results</b>					
<b>(Co-residence exogenous)</b>					
Co-residence	-14.241*** (2.672)	-4.388 (3.131)	-1.241 (3.180)	-3.220 (3.218)	-3.319 (3.228)
<b>B. IV Tobit Estimation Results</b>					
<b>(Co-residence endogenous)</b>					
<b>First Stage<sup>a</sup></b>					
Married to youngest Son	0.316*** (0.031)	0.204*** (0.032)	0.21*** (0.031)	0.209*** (0.03)	0.207*** (0.03)
F-statistic	104.104	41.64	46.72	49.78	48.82
<b>Second Stage</b>					
Co-residence	-19.731** (8.874)	-12.161 (16.120)	-15.009 (15.528)	-9.023 (14.982)	-9.193 (15.136)
Observations	1,048	1,048	1,048	1,048	1,048
Conditioning Variables		✓	✓	✓	✓
Wife Characteristics			✓	✓	✓
Residence Characteristics				✓	✓
Husband Characteristics					✓

*Source:* Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Conditioning variables: age of the husband, number of brothers of the husband, age of the oldest living parent of the husband.

Wife characteristics: age, educational attainment, ethnicity.

Residence characteristics: province, community is urban, availability of kindergarten.

Husband characteristics: educational attainment.

<sup>a</sup> The first stage is identical to the first stage in Table 3.3.

The first stage results show that being married to the youngest son has a positive and highly significant effect on intergenerational co-residence. Women who married a youngest son are 21 percentage points more likely to co-reside compared with women who married an older son (Table 3.3 and 3.4, column (5)). We test for strength of the instrument and report the relevant F-statistics in Tables 3.3 and 3.4. The F-statistic is  $> 40$  in all specifications and hence sufficiently large to rule out weak instrument problems (Staiger and Stock, 1997).

Instrumenting co-residence with being married to the youngest son in all specifications yields a negative effect. When we compare the OLS and IV regressions with a Hausman test, we cannot reject the consistency of OLS; both OLS and IV models produce consistent parameter estimates. In column (1) of Table 3.3, we estimate a significant effect of -20 percentage points on female labour force participation (-17 percentage points in the OLS). Including the control variables in columns (2)-(5) reduces the effect to between -5 to -11 percentage points (-2 to -6 percentage points in the OLS) and makes it insignificant. A similar picture emerges when we analyze the effect of co-residence on working hours (Tables 3.4). In column (1), co-residence significantly reduces the number of women's working hours by 20 hours (14 hours in the Tobit) per week. Adding control variables reduces the effect to between -9 and -15 hours (-1 to -4 hours in the Tobit) per week (columns (2)-(5)) and this effect is again insignificant.<sup>24</sup> The effect sizes - though insignificant - are not negligible.

We observe that, once we control for the conditioning variables in column (2) in Tables 3.3 and 3.4, the estimated effects do not change much with the inclusion of the additional control variables in columns (3)-(5). The key variable is the age of the husband, which proxies the age of the woman. Younger women are more likely to co-reside (Table B.6), are less likely to participate in the labour force (Tables B.5 and B.7), and work fewer hours (Tables B.8 and B.9). Controlling for the age of the woman, either explicitly in columns (3)-(5) or implicitly in column (2), therefore reduces the stark difference in labour force participation and working hours between co-residing and non-co-residing women.

We tested for heterogeneity in the effect of intergenerational co-residence on female labour supply among different groups of women. To do so, we interacted the co-residence variable with a number of characteristics of the woman or her family (Tables B.10 and B.11 in the Appendix). These characteristics are residence in an urban area (column (1)), the woman's educational attainment (column (2)), her age cohort (column (3)), the age of the oldest living parent of her husband (column (4)), an indicator whether this oldest living parent is in retirement age (column (5)), the woman's number of children up to the age of 5 (column (6)), and an indicator whether there are other young women living in the same household

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<sup>24</sup>We also ran an IV estimation for the impact of co-residence on the number of working hours of only those women with positive working hours. The results are again negative but statistically insignificant.

with whom duties could potentially be shared (we call them substitute women) (column (7)). We compute both OLS and IV estimates, but the latter are only shown if our instrument is sufficiently strong in each respective sub-sample.

Few of the interaction terms turn out to be statistically significant. OLS estimates suggest that the effect of co-residence on female labour supply is negative for women in the age cohort 40-50, while it is close to zero for women in the age cohorts 20-29 and 30-39 (column (3)). Although the respective IV estimates are insignificant, they are qualitatively in line with the OLS results. In addition, women without small children appear to be negatively affected by co-residence, but the effect turns positive with the second small child - possibly because co-residing parents and in-laws participate in care giving (OLS estimates in column (6)). IV estimates are again insignificant and they are much smaller in magnitude but, as before, they reflect the OLS estimates.

### 3.4.3 Comparison of Estimated Effects with Other Countries

Previous empirical studies on the labour market effects of intergenerational co-residence invariably find a positive impact. These studies use data from the US (Kolodinsky and Shirey, 2000), Japan (Sasaki, 2002; Oishi and Oshio, 2006), and China (Maurer-Fazio et al., 2011; Shen et al., 2016). Among these countries, patrilocality is common in China (Ebenstein, 2014) and, to a lesser extent, in Japan (Takagi et al., 2007). Yet, the studies on China do not capture the full extent of patrilocality. Maurer-Fazio et al. (2011) focus on urban China, where patrilocality is much less practised than in rural China<sup>25</sup>, and Shen et al. (2016) fully exclude patrilocality by restricting their analysis to women's co-residence with own parents.

Interestingly, the magnitude of the estimated impacts is smaller in settings with a higher prevalence of patrilocality. Living with parents or in-laws increases the probability of female labour force participation by 56 percentage points in

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<sup>25</sup>The Global Data Lab database (Institute for Management Research, Radboud University, 2017) reports a patrilocality index of 0.81 for urban China and of 2.55 for rural China. The patrilocality index is the log of the percentage of patrilocal residence divided by the percentage of matrilocal residence. This means the larger the value the more patrilocal is the setting. For comparison, Kyrgyzstan has a mean patrilocality index of 2.31 at the national level in the period 2000-2016.



the US (Kolodinsky and Shirey, 2000), by 28 percentage points in China when analysis is limited to co-residence with own parents (Shen et al., 2016), by 19-24 percentage points in Japan (Oishi and Oshio, 2006), and by 7 percentage points in urban China (Maurer-Fazio et al., 2011). We compare our estimated effects for Kyrgyzstan to these numbers. Taking the full model (column (5) of Table 3.3) as a reference point, we can reject at the 1 percent significance level that our OLS estimate is larger or equal to the smallest effect that had previously been estimated (0.07 in Maurer-Fazio et al. (2011)). For the IV estimate, which has a much larger variance, we can still reject at the 10 percent significance level that it is larger or equal to the second smallest effect (0.19 in Oishi and Oshio (2006)). Our estimates hence appear to be less positive than what most previous findings suggest. Since Kyrgyzstan has the highest prevalence of patrilocality among these samples, this finding fits well into the pattern.

### 3.4.4 Channels

We find that co-residence with parents or in-laws does not significantly affect female labour supply in Kyrgyzstan. In the following, we examine all channels mentioned in Section 5.1, through which co-residence may influence the labour market outcomes of women. For three channels, we can conduct a causal analysis; for the other two channels, we can only provide descriptive evidence.<sup>26</sup>

First, we exploit information on the time use of the women in our estimation sample. We run an instrumental variable estimation in which hours spent on elder care, housekeeping, and child care are outcome variables. We expect that co-residence leads to more time spent on elder care and housekeeping (Grogan, 2013; Ebenstein, 2014) and less time spent on child care. Grandparents - and especially grandmothers - are known to be heavily involved in child care in Kyrgyzstan (Kuehnast, 2004). Among all women in our sample, 10 percent spend time on elder care (if any, 1.2 hours per day on average), 96 percent spend time on housekeeping (if any, 5.6 hours per day on average), and 64 percent spend time on child care (if any, 2.8 hours per day on average).

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<sup>26</sup>Descriptive statistics of the channel variables can be found in Table B.12 in the Appendix.

Table 3.5: Channel Analysis I: Time Use Woman

	(1)	(2)	(3)	(4)
	<b>Hypothesized Channels</b>			<b>Supplementary</b>
	<b>Elder Care</b>	<b>House-keeping</b>	<b>Child Care</b>	<b>Leisure</b>
	<b>(in hours)</b>	<b>(in hours)</b>	<b>(in hours)</b>	<b>(in hours)</b>
<b>A. OLS Estimation Results</b>				
<b>(Co-residence exogenous)</b>				
Co-residence	0.189*** (0.036)	0.377* (0.203)	0.104 (0.146)	-.260** (0.131)
<b>B. Two-stage Least-Squares Estimation Results</b>				
<b>(Co-residence endogenous)</b>				
<b>Second Stage</b>				
Co-residence	0.45*** (0.171)	-.659 (0.95)	1.071 (0.689)	-.691 (0.611)
Observations	1,048	1,048	1,048	1,048
Conditioning Variables	✓	✓	✓	✓
Wife Characteristics	✓	✓	✓	✓
Residence Characteristics	✓	✓	✓	✓
Husband Characteristics	✓	✓	✓	✓

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

(1) Elder Care (in hours per day): Total time of woman spent for elder care.

(2) Housekeeping (in hours per day): Total time of woman spent for housekeeping (e.g. cooking, washing, laundry, cleaning, shopping, repairs, other household tasks).

(3) Child Care (in hours per day): Total time of woman spent for child care.

(4) Leisure (in hours per day): Total time of woman spent for leisure (reading, TV, radio, computer, internet, cinema, theater, concert, physical exercise, conversations with friends/family/on the phone, social reunion, religious activity, community work).

Table 3.5 reports the results. Co-residence with parents or in-laws leads to between 11 minutes (OLS estimate) and 27 minutes (IV estimate) more spent per day on elder care, on average (column (1)). To see whether this time commitment comes at the cost of leisure, we also run an estimation with time spent on leisure as the outcome variable (column (4)). Co-residing women indeed seem to have less time for leisure; namely, between 16 minutes (OLS estimate) and 41 minutes (IV estimate). These numbers match well with those in column (1), indicating that elder care reduces leisure time. However, only the OLS estimate is statistically significant in column (4) leading us to regard this as suggestive evidence only.

The finding of higher elder care among co-residing women fits well into the previous literature on patrilocal societies. This literature argues that sons are much more valued by parents than daughters because parents of sons enjoy elder care within the house provided by the daughter-in-law whereas parents of daughters have no caretakers (Ebenstein, 2014). This differential valuation leads to the fact that women in patrilocal societies tend to have fewer children if the first born was a male (Grogan, 2013). Ebenstein (2014) argues that parents are even willing to abort daughters because daughters will not be able to provide elder care.

In contrast, co-residence does not significantly influence the time spent by women on housekeeping or child care (columns (2) and (3)). The point estimates for child care are positive for both OLS and IV estimation but they are statistically insignificant. Hence, co-residing women do not provide significantly more child care although they have more small children than women who do not co-reside. This finding may indicate that parents or in-laws who live in the same household take care of small children.<sup>27</sup> For housekeeping, the point estimates are positive and significant in the OLS estimation but negative and insignificant (with large standard errors) in the IV estimation, which makes it hard to detect a tendency. In any case, we cannot confirm substantial parental assistance related to housekeeping in Kyrgyzstan, in contrast to what was suggested by the previous literature for the US, Japan and China.

Second, we exploit variation in income provided to the household by the parent generation and in gender attitudes of parents and in-laws. Because we rely on information provided by the parents or in-laws themselves, we here need to restrict our sample to those households where women are co-resident. Instead of a causal analysis, we therefore investigate whether parents' or in-laws' income and gender attitudes are related with female labour force participation and the number of working hours. We control for the same variables as above, except for the conditioning variables.<sup>28</sup> This exercise serves as a plausibility check for the income and gender attitudes channels mentioned in Section 5.1; the results

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<sup>27</sup>In the 2013 LIK, respondents were asked to report the main caretaker (if not institutionalized child care) of children aged 0-5. For our sample of women who co-reside with their in-laws, grandparents are the main caretakers of small children in 15 percent of the cases. Other relatives do not play a major role for child care.

<sup>28</sup>The conditioning variables are neglected because we restrict the analysis to only co-residing households and do not use information on being married to the youngest son.

have no causal interpretation. Estimation results are found in Table 3.6 (OLS for labour force participation and Tobit for working hours).

Table 3.6: Channel Analysis II: Parents' Financial Contributions and Gender Preferences

	(1)	(2)	(3)	(4)
	<b>Labour Force Participation</b>		<b>Working Hours</b>	
<b>Financial contribution to the Household</b>				
Income parents (in 1000 Som) <sup>a</sup>	-0.004 (0.004)		-0.555 (0.53)	
<b>Preferences of Parents</b>				
Gender attitudes (std.) <sup>b</sup>		0.00008 (0.022)		0.571 (2.155)
Observations	501	490	501	490
Wife Characteristics	✓	✓	✓	✓
Residence Characteristics	✓	✓	✓	✓
Husband Characteristics	✓	✓	✓	✓

*Source:* Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

The analysis is restricted to only co-residing women.

<sup>a</sup> Income parents (in 1000 Som): Includes income of all co-residing parents earned as employees and received as pension contributions.

<sup>b</sup> Gender Attitudes (std.): Average gender attitudes of co-residing parents in the household. We define preferences as the parents' attitude towards the role of females in society. Gender attitudes are measured using seven self-reported items. Item responses are reported on a four-point Likert scale ranging from *Strongly disagree* (1) to *Strongly agree* (4). We identify two liberal and five traditional items. We then use all items to conduct a factor analysis and to extract one single latent factor. To facilitate the interpretation, we use a standardized index ranging from lower traditional attitudes (lower index values) to stronger traditional attitudes (higher values).

In terms of parents income, we restrict attention to wage income and pension income, because we are interested in the pure income effect and want to rule out effects on female labour supply from family-owned businesses that may provide employment to women. Among all intergenerational households, 86 (17%) benefit from labour income of the parents or in-laws; and 316 (63%) from pension income. In households with labour income, the average earned per month is 7,992 Som (approx. 173 US\$). In households with pension income, the average monthly pension is 4,453 Som (approx. 96 US\$). As expected, we observe a negative correlation between parents' or in-laws' income and the labour supply

of the co-residing women (columns (1) and (3)). However, the estimates are not statistically significant.

We measure the gender attitudes of parents or in-laws in terms of their expressed attitudes towards the role of females in society. LIK respondents reported their level of agreement on a four-point Likert scale ranging from *Strongly disagree* (1) to *Strongly agree* (4) on seven statements. A list of these statements can be found in Table B.13 in the Appendix. We conduct a factor analysis to extract one single latent factor from the seven statements. To facilitate interpretation, we use a standardized index ranging from lower traditional attitudes (lower index values) to stronger traditional attitudes (higher index values). Our estimation results suggest that the gender attitudes of parents or in-laws are unrelated to female labour force participation and working hours (columns (2) and (4)).

### 3.5 Conclusion

We investigate the role of co-residence with the parent generation for labour market outcomes of married women in Kyrgyzstan. We find that co-residence has no significant effect on labour force participation and the number of working hours of females. Given that extended family members usually live at short distances from each other, this finding might suggest that female labour supply is treated as a family optimization problem. When a woman receives an attractive work opportunity, the parental generation, possibly in addition to other extended family members, finds ways to accommodate her increased work-time demands regardless of whether she is co-resident or lives in a separate household nearby. When parents or in-laws require care in old age, however, co-residence does matter: Co-residing women spend significantly more time on elder care, apparently at the cost of having less time for leisure, than women who do not co-reside. Despite the fact that we cannot detect effects on labour market exposure of women overall, this additional burden - on average half an hour per day - seems non-negligible.

The analysis in our paper provides an illustrative example for how culture matters for economic outcomes. Kyrgyzstan is a patrilocal society, in which co-resident women are not only expected to take care for their in-laws in old age but also to do housekeeping for them once they move into the household after marriage. We find that women who co-reside do not differ significantly from women

who do not co-reside in terms of time spent on housekeeping. This fact makes the patrilocal setting different from the prior evidence, as parents and in-laws in China, Japan and the US are assumed to provide substantial assistance with housekeeping. Due to this particularity, living with the parent generation turns out to be less conducive to female activity on the labor market in our patrilocal setup than in prior non-patrilocal settings.

## Chapter 4

# How do Investment Constraints and Business Characteristics Coincide? Evidence from Ugandan Microenterprises

## 4.1 Introduction

Many developing countries face the enormous challenge of demographic shifts that require increased job creation. Increasing infant survival rates and life expectancies will lead to the rapid growth of the working age population over the next decades. While micro and small enterprises (MSEs) account for a large fraction of employment in developing countries, they tend to remain small as entrepreneurs typically face various obstacles (Dalton et al., 2018; Campos et al., 2017). One key policy question that arises is if interventions aiming to alleviate constraints can foster growth and job creation by micro and small enterprises, thus contributing to the employment challenge.

The most prominent constraints correlated with low firm growth that are discussed in the literature are those related to credit, savings and managerial constraints. Being credit constrained means having insufficient access to external capital, like formal and informal loans (Banerjee and Duflo, 2014; De Mel and McKenzie, 2011; McKenzie and Woodruff, 2008). In addition, entrepreneurs can be savings constrained as they often undersave, that is, the insufficient accumulation of own resources (Dupas and Robinson, 2013; Banerjee and Duflo, 2007). Lastly, managerial constraints represent the lack of business skills (managerial capital) that are seen as an inherent part of firm performance (Bruhn and Zia, 2013; McKenzie and Woodruff, 2013; Bloom et al., 2010; Bruhn et al., 2010).

Several studies analyzing implemented randomized interventions aiming to relax one of the afore-mentioned constraints find heterogeneous treatment effects. These effects are, for example, with respect to *gender* (Gine and Mansuri, 2014; Dupas and Robinson, 2013; De Mel et al., 2008)<sup>1</sup> or *skill-level* (Drexler et al., 2014).<sup>2</sup> These findings support doubts that a “one-size-fits all training program” (Fischer and Karlan, 2015, p.296) is suitable for all firms. Therefore, Drexler et al. (2014) and Nichter and Goldmark (2009) point out that it is essential to correctly match client characteristics with the type of training that will be useful for them.

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<sup>1</sup>Gine and Mansuri (2014), implementing business training, find positive effects for males on business knowledge, business practices, and household expenditures. Dupas and Robinson (2013) provide access to bank accounts and find that only female market vendors save and invest more in contrast to male bicycle drivers. De Mel et al. (2008) provide grants and find significant returns for male-owned business.

<sup>2</sup>Drexler et al. (2014) find that participants starting from lower levels of skills benefit from less complex training (rule-of-thumb training) than from standard accounting training.



Consequently, Fischer and Karlan (2015) suggest identifying firms with similar constraints prior to assigning treatment.

This study contributes to the literature by investigating whether credit, savings, or managerial constraints are associated with lower business investments. Based on the findings of heterogeneous treatment effects in the extant literature, this study identifies businesses with similar constraints. Therefore, the study combines the findings of two analyses. *Firstly*, the determinants associated with each constraint are identified. These are either characteristics of the entrepreneur or the firm. *Secondly*, it is analyzed whether the aforementioned constraints are associated with lower investments for specific subgroups. One challenge is the measurement of each constraint. As these are neither directly observable nor measurable, the study relies on proxy variables that are selected based on the literature. The analyses are based on a rich five-year panel dataset of MSEs in Kampala, Uganda. Studying the development of MSEs is relevant for the case of Uganda, as around 80 percent of the labor force primarily works as own-account or as an unpaid family worker (The Republic of Uganda, 2014). Further, the employment challenge mentioned above is especially pressing in Uganda, a country with high fertility rates (5.6 births per woman in 2016), decreasing infant mortality rates, and increasing life expectancy.<sup>3</sup> While the number of people entering the labor market in 2013 was around 700,000, it will amount to approximately 1,500,000 in 2040 (The Republic of Uganda, 2014).

As they are crucial for business growth, several studies analyze the importance of different constraints.<sup>4</sup> In contrast to the existing studies, this paper focuses on a narrow and pre-defined set of obstacles based on the literature of micro and small enterprise development: credit, savings and managerial constraints. Undoubtedly, these three constraints are not the only obstacles for micro and small businesses. However, I argue that these constraints are among the most important and frequent ones studied in the literature as motivated in the following.

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<sup>3</sup>Life expectancy at birth increased from 53.7 to 59.6 to between 2006 and 2016, while at the same time the infant mortality rate (the number of infants dying before reaching one year of age, per 1,000 live births) decreased from 64 to 37 (all data from World Development Indicators, The World Bank).

<sup>4</sup>Among these constraints, are for example, financing constraints (Ayyagari et al., 2017; Dinh and Clarke, 2012), environmental factors, such as crime and policy instability (Ayyagari et al., 2008), and country-specific factors, such as road infrastructure or cell phone communication, as identified in a case-study of Tanzanian enterprises (Kinda, 2008).

This study finds that in the overall estimation sample, savings and managerial constraints are associated with lower firm investments. Based on the determinants of constraints and a heterogeneity analysis regarding investments, this study clearly identifies that *unmarried, lower educated* entrepreneurs and firms operating in the *services sector* are associated with specific constraints. While unmarried entrepreneurs, entrepreneurs with 11 years of education, or businesses operating in the services sector are associated with being savings constrained, savings constraints significantly reduce the investment levels for these groups. Entrepreneurs with primary education are associated with being managerial constrained, which in turn reduces the investment levels of this group.

However, when interpreting the results of the present study and discussing the policy implications, it should be kept in mind that the results provided are correlations and not causal findings. Hence, there are limitations when drawing conclusions. Furthermore, some methodological caveats warrant mentioning: firstly, the majority of information used in the analysis is self-reported. However, regarding the outcome variable, I argue that measurement error is low, as discussed in Section 4.3.2. Secondly, potential reverse causality concerns cannot be ruled out.

The remainder of this paper is as follows. Section 4.2 provides a literature overview of the aforementioned constraints. The data, sample, measurement of constraints, and explanatory variables are described in Section 5.3. Section 4.4 provides an empirical answer to the research questions and Section 4.5 concludes.

## 4.2 Literature Review

This analysis builds on the literature that studies the constraints of micro and small businesses in developing countries. The literature provides ample empirical evidence for the presence of these constraints among micro and small enterprises. In addition, several interventions have been implemented to overcome these constraints.

*Credit Constraints.* Being credit constrained describes the insufficient access to capital that stems from outside the business. Capital can be borrowed from formal (e.g. banks, microfinance institutions, savings and credit cooperatives) and informal (e.g. friends, relatives, business partners, moneylenders) sources or insti-

tutions. The literature provides ample evidence that micro and small enterprises are severely credit constrained. Basic evidence is provided from survey responses on the desire for capital (Sleuwaegen and Goedhuys, 2002). Further evidence stems from studies that analyze the use of provided capital or that compare estimated returns to capital with market interest rates. Banerjee and Duflo (2014), for example, evaluate the provision of microcredits to entrepreneurs. They make use of a policy reform that changes the eligibility for credits. Their results show that firms use access to credit to finance more production, which hints at credit constraints. In contrast, unconstrained firms would not expand production but rather substitute for other borrowing. Other studies apply a similar experimental design and provide microentrepreneurs with cash and in-kind grants (De Mel et al., 2008; McKenzie and Woodruff, 2008). Their estimations of monthly returns to capital are large, ranging between 4.6 percent (De Mel et al., 2008) and 20 percent (McKenzie and Woodruff, 2008). Returns to capital exceeding market interest rates hint at severe credit constraints, as the optimal level of capital would result in returns to capital that equal market interest rates.

Further, several supply and demand sided reasons why businesses are credit constrained are discussed. When comparing access to banks between industrial and developing countries, a large gap can be observed. While 81 percent of adults are estimated to be banked in industrial countries, it is 28 percent in developing countries (Kendall et al., 2010).<sup>5</sup>

One supply-sided reason for being credit constrained is the insufficient physical access to banks, which results in long distances to the nearest bank branch. A state led expansion of banks to rural unbanked areas in India sought to overcome this limiting factor. As a result of the expansion, it can be shown that rural poverty fell in these areas, as household were able to accumulate more savings and to obtain capital for investments (Burgess and Pande, 2005; Burgess et al., 2005).<sup>6</sup> While this research addresses how supply sided credit constraints can be overcome, it is not obvious that households or businesses who have physical access to banks require such credit. Hence, it is also possible that there are multiple factors: not

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<sup>5</sup>These numbers reflect a lower level of financial inclusion in developing countries. While the numbers are based on individual data, the general problem also translates to own-account worker and microenterprises.

<sup>6</sup>While this literature focuses on beneficial effects of a bank expansion on households, it is plausible to assume that businesses also profit from improved access to savings and borrowing opportunities.

only could people lack the financial literacy to understand credit (e.g. incurred costs of borrowing), but even if they do understand it, they might not know how to actually apply for it. De Mel and McKenzie (2011) conduct an intervention providing information about the availability of loans (at market interest rates) and the procedure on how to apply for one. While the intervention doubled the proportion of firms receiving credits, only 10 percent of invited business owners received a loan. The study also shows that while the lack of information on loans could be reduced, other practical limiting factors still play a role; such as the inability to find guarantors or bureaucratic procedures.

*Savings Constraints.* Another way of being financially constrained is the inability to accumulate sufficient amounts of savings (savings constraint). While credit constraints reflect insufficient access to capital, which stems from outside the business, *savings constraints* indicate a lack of accumulating capital through own savings from business profits or other labor income from the business owner or other household members. One tempting explanation of why individuals under-save in developing countries is that people are simply too poor to save. However, Banerjee and Duflo (2007) argue that people could (simply) save more without cutting spending on subsistence consumption by spending less on temptation goods. However simply saving more is not easy to implement in practice as people might lack a safe place to store their savings (Banerjee and Duflo, 2007). Karlan et al. (2014) discuss several other factors that lead to undersaving, such as transaction costs, lack of trust, information and knowledge gaps, social constraints, and behavioral biases.<sup>7</sup> One typical factor that leads to undersavings is the aforementioned lack of access to a formal saving account (Banerjee and Duflo, 2007). Bank accounts are a means to secure money and might prevent loss of savings in cases of lower bargaining within the household and also makes it easier to withstand temptation as the money is not immediately accessible. Dupas and Robinson (2013) study an intervention that provides self-employed Kenyans with bank accounts. They show that a substantial share used the bank accounts,

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<sup>7</sup>The summarized reasons for savings constraints mostly rely on the literature that focuses on individuals or households. However, household related reasons for savings constraints are likely directly transferable to the savings constraints of microenterprises or own-account workers. The reason is that business and household finances are closely interrelated and not clearly separated. A typical example is that a majority of business owners do not pay themselves a salary but instead use business sales to finance household expenditures or consumption.

resulting in greater savings and greater investments in their business.<sup>8</sup> A similar study providing bank accounts finds evidence supporting that households make frequent use of savings account once offered (Prina, 2015). A meta-study on interventions that promote savings confirms the effectiveness of this approach. The study finds positive effects on total savings, investments, and incomes (Steinert et al., 2018).

*Managerial Constraints.* A third constraint receiving increased attention is managerial constraints, sometimes referred to as managerial capital (Bruhn et al., 2010; Bloom et al., 2010). Managerial capital is the “organizational and managerial abilities” of the business owner. The early literature discusses two important channels through which managerial capital might influence firm performance (Bruhn et al., 2010, p.630). Firstly, by influencing the productivity of input factors (e.g. the way business owners motivate and retain workers), and secondly, by influencing the amount and type of physical and labor inputs (e.g. the decision to hire labor) (Bruhn et al., 2010). To equip businesses owners with the organizational and managerial abilities needed to successfully manage their business, several business training programs have been implemented. Classroom training result in improved business knowledge (Karlan and Valdivia, 2011), business practices, and investments (Bruhn and Zia, 2013). Several studies specifically tailor trainings to the specific needs of businesses by providing consulting services and find results in the intended direction (Bloom et al., 2013; Bruhn et al., 2018). To foster the efficiency of training programs, some studies examine the complexity of the training program (Drexler et al., 2014) or its content (Campos et al., 2017). A meta-analysis on financial education programs confirms improvements in financial behavior and financial literacy (Kaiser and Menkhoff, 2017).

## 4.3 Data

### 4.3.1 Estimation Sample

The study uses panel data from a survey of micro and small enterprises in Kampala, Uganda, conducted annually between 2012 and 2017.<sup>9</sup> The survey collected

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<sup>8</sup>However, they find heterogeneous treatment effects by gender.

<sup>9</sup>All waves were collected by the German Institute of Global and Area Studies (GIGA).

detailed information on the enterprise, including finances (sales, costs, savings, borrowing), labor and business equipment. In addition, a wide range of business owner information were collected, including socio-economic characteristics, financial knowledge, cognitive abilities, non-cognitive abilities, and household information.

As part of the sampling process, administrative areas (zones) with predominant business activity were identified based on interviews with the local administration. Out of these 220 identified business zones, 21 were randomly selected for a door-to-door screening, which resulted in 5,800 enterprises.<sup>10</sup> The screening survey identified enterprises with up to 10 employees and with a fix location. Finally, a baseline sample of 450 enterprises was drawn with 200 enterprises in each the retail and the manufacturing sectors and 50 enterprises in the services sector.<sup>11</sup>

The following empirical analysis is based on a firm panel covering 2013 through 2017.<sup>12</sup> The estimation sample is restricted to firms that had no change in firm ownership (2 firms dropped). After a further reduction in observations due to missing values on the variables used in the empirical analysis, the final estimation sample comprises 1,498 observations. The number of firms in the estimation sample is 383 in 2013, ultimately falling to 219 in 2017.<sup>13</sup> An estimation that accounts for attrition is presented in Section 4.4.3. An overview of the attrition rates for each wave is in Appendix Table C.1.

### 4.3.2 Outcome Variable: Investments

The outcome variable in the following analysis is firm investments, which are investments in business equipment. As part of the survey, the entire business equipment of each firm is listed in each wave. During this procedure, the business

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<sup>10</sup>In 2015, a second door-to-door listing was implemented.

<sup>11</sup>While the zones selected for the door-to-door screening were selected randomly, the final sample is not representative for micro and small businesses. The reason is that the number of businesses sampled from each industry sector was predetermined.

<sup>12</sup>The panel used in the analysis is unbalanced. The sample is based on all firms that were in the sample in 2013. The panel is unbalanced as some businesses drop out because (i) they refuse to participate in the survey; (ii) they are not trackable; or (iii) because the business ceased existing. The baseline of 2012 was omitted because the listing procedure of business equipment changed between 2012 and 2013. In 2012, up to 5 pieces of equipment per category were listed, whereas from 2013 onwards, 15 equipment types per category were listed.

<sup>13</sup>The total number of firms interviewed in 2013 was 429.

equipment is systematically listed according to the categories of tools, furniture, machines, vehicles, land, and other.<sup>14</sup> Based on this listing, the total value of business equipment (capital stock) of a firm in a given period can be calculated.<sup>15</sup> Further, it can then easily be distinguished which business equipment has already been in the firm in previous waves and which business equipment is new and, hence, an investment in a particular wave.

The listing of business equipment is very costly in terms of time. However, there are several reasons to believe that this procedure leads to a quite accurate measurement of the value of firm investments. Firstly, the survey enumerators are equipped with a list of a firm's business equipment compiled based on the previous wave. They go through this list with the business owner and compare each item with the actual equipment that is present in the business. This approach is supportive in ensuring that all *new investments* are *identified*. Secondly, the total value of investments is not based on an estimate of the overall value of all investments purchased since the last round of interviews. Based on observations in the field, it seems easier for respondents to estimate costs for single items than for a bunch of items. Therefore, the survey asks for the value of each single investment that is newly listed with the purpose on obtaining an *accurate estimate of the total investment value*. Thirdly, any errors in the equipment lists that happened during data collection in time period t-1, which are detected in time period t, are corrected *ex-post*. This procedure aims at reducing errors made by enumerators during the listing of equipment to further ensure *high data quality*.<sup>16</sup> With this procedure in mind, the measurement of the investment value is done as thoroughly and accurately as possible and concerns due to measurement error in the investment variable can hopefully be limited to a minimum.

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<sup>14</sup>The listing includes information on: year and reason of acquisition, quantity, and replacement value.

<sup>15</sup>The total value of business equipment is defined as the total cost of business equipment less accumulated depreciation. During the listing of business equipment, the business owner is asked for the replacement value, which is defined as the value of replacing a specific item considering its actual quality. Hence, the replacement value given by the business owner considers the value loss due to depreciation.

<sup>16</sup>This *ex-post* correction is critical as recall errors regarding the amount of investments can occur. However, as this system also detects items that were not previously listed, I argue, that the gain of listing these missed items outweighs the potential recall error of the investment amount.

Table 4.1: Summary Statistics on Capital Stock and Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	2013		2014		2015		2016		2017	
	n	mean	n	mean	n	mean	n	mean	n	mean
Capital Stock	383	2633.26	347	2079.36	292	2368.38	257	1988.71	219	1817.93
Investment	383	163.38	347	195.81	292	183.12	257	119.32	219	257.68
Investment (share=0)	200	0.52	107	0.31	114	0.39	98	0.38	54	0.25
Investment	183	341.95	240	283.11	178	300.39	159	192.86	165	342.01
Additional	172	342.12	217	255.4	169	297.48	145	194.09	120	321.86
Replacement	23	162.26	48	260.92	27	118.37	40	63.04	101	176.31

*Source:* Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations. Summary statistics refer to the estimation sample.

*Notes:* All values are in USD. The *first row* gives the average capital stock, which is the total value of business equipment at the time of the survey. *Row two* gives the total amount of investments conducted in the last 12 months and *row three* shows the share of businesses that did not conduct any investment in a given wave.

*Row four* shows the total investment value of strictly positive investments only and the last two rows show the total investment amount separate by additional and replacement investments. Additional investments are investments that extend the number of products in a business and replacement investments are new items that replace old items which are not part of the capital stock any more.

Table 4.1 provides an overview of the development of the value of the entire business equipment (capital stock) and value of investment over time. The average value of the capital stock ranges between 2,633 and 1,817 USD between 2013 and 2017, whereas the average investment value ranges between 119 and 258 USD between 2013 and 2017 (row 2). These numbers show that despite investments, the average capital stock depreciates over time.<sup>17</sup> The table further shows the share of firms making zero investments in a given period.<sup>18</sup> which ranges between 25 and 52 percent.

<sup>17</sup>The reasons for this pattern are speculative. Potential explanations could be that: (i) business owners overestimate the depreciation of their business equipment; (ii) business equipment is not renewed frequently but rather used as long as possible; (iii) only a few businesses increase their capital stock; and (iv) that the number of decreasing businesses outweighs the number of growing businesses. The last reason is supported by the argument that only a small percentage of firms in developing countries grow and by the finding that firm death is extremely common among micro and small enterprises (the estimated annual death rate is 8.3, which translates to a death rate of 50 percent within 6 years (McKenzie and Woodruff, 2017)). The pattern of a decreasing capital stock is also found in a balanced sample, therefore I conclude that it is not driven by sample attrition.

<sup>18</sup>Throughout the entire sample period, from 2013 to 2017, the share of firms making no investments is 15%. Further, 20% of all firms made investments in 1 wave, 21% in 2 waves, 14% in 3 waves, 19% in 4 waves and 12% in all five waves.



Another effect of the detailed listing of business equipment is that it contributes to understanding reasons why firms purchase business equipment. It can be distinguished between investments that replace old items (replacement investments) and investments that extend the number of products of the business (additional investments).<sup>19</sup> The lower part of Table 4.1 shows for each year the average investment value of additional and replacement investments. As can be seen, additional investments outweigh replacement investments in terms of number of investments conducted but also in terms of total investment value.

### 4.3.3 Measurement of Constraints

The explanatory variables of main interest are the three different types of constraints: credit, savings and managerial. As the constraints cannot be measured directly, the study relies on proxy variables ('items') associated with each constraint. This section describes the measurement of each respective constraint.

*Credit Constraints.* Regarding the measurement of financial access to credits, I adopt a classification applied by Dinh and Clarke (2012) and Bigsten et al. (2003) that indicates whether an entrepreneur has an unmet demand for credit. In addition, the data allow for distinguishing between being credit (un)constrained with regard to formal (banks, microfinance institutions, savings and credit cooperatives (SACCOs)) or informal (friends, relatives, business partners, moneylenders) institutions. According to the definition by Dinh and Clarke (2012) and Bigsten et al. (2003), the group of *constrained* consists of entrepreneurs who do report need for credit but did not apply for one. The reasons for not applying are expected rejection (e.g. because of no collateral), unfamiliarity with the application process, lack of knowledge about a source that can provide credit, feeling uncomfortable, no formal registration of the business, unable to pay back, or religious reasons. The category of constrained also comprises business owners who applied for a credit but were rejected or did not receive the full amount. The group of

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<sup>19</sup>These categorizations are identified based on the listing of business equipment. An investment is defined as replacement investment in a specific period, if a new item (e.g. table) is purchased whereby at the same time another item with the same function or purpose that was purchased in a previous year, is no longer listed. Additional investments mean that they are purchased in addition to already existing items of the same functioning or purpose or that they extend the range of products meaning that no such item has been in the business before.

*unconstrained* consists of those who actually obtained the full amount of credit, those with no need for credit, and those who did not apply as interest rates are too high. The assignment of the latter reason to the group of unconstrained can be questioned and is handled differently in the two studies. Whereas Bigsten et al. (2003) assigned this reason to the group of unconstrained, Dinh and Clarke (2012) does the opposite.<sup>20</sup> However, the results are not sensitive to assigning this group to constrained or unconstrained.

The share of credit constrained entrepreneurs is found in Panel A of Table 4.2. Detailed reasons for being categorized as (un)constrained are found in the Appendix Table C.2. The share of credit constrained entrepreneurs ranges between 28 percent for formal and 35 percent for informal credit constrained (Table 4.2, Panel A). Among the credit constrained, the top three most frequently listed reasons are 'feeling uncomfortable' (54 percent formal credit, 69 percent informal credit), followed by 'expected rejection' (21 percent formal credit, 9 percent informal credit), and 'unfamiliar with process' (10 percent for formal credit) or 'does not know source' (8 percent for informal credit), (Table C.2, Panel A). In contrast, among those classified as unconstrained, 33 percent (27 percent) received the full credit amount if applied at a formal (informal) institution, and 36 percent (57 percent) have no need for a formal (informal) loan (Table C.2, Panel B).

*Saving Constraints.* To find suitable proxy variables that measure the concept of savings constraints, I take into account the works of Dupas and Robinson (2013) and Beck et al. (2017) that directly relate the usage of saving devices to business investments. Dupas and Robinson (2013) evaluate the expansion of bank accounts and find positive effects on total saving amounts and business investments. They argue that formal savings is a device that helps protect money both from the temptation to spend money as well as from demands made by relatives and neighbours, thus resulting in an increase in total savings. I use an indicator whether the respondent has access to a bank account as one proxy to assess whether someone is savings constrained.

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<sup>20</sup>Bigsten et al. (2003) argue that entrepreneurs who lack the willingness to pay current prices are not rationed. However, they claim that it cannot be ruled out that credits are too expensive.

Table 4.2: Summary Statistics on Items measuring Constraints

	share
<b>A. Credit Constrained<sup>a</sup></b>	
Formal	0.28
Informal	0.35
<b>B. Saving Constrained<sup>b</sup></b>	
No bank account	0.26
Unprotected savings	0.36
<b>C. Managerial Constrained<sup>c</sup></b>	
<b>Financial Literacy</b>	
Gift sharing (s2)	0.06
Inflation (s3)	0.35
Zero interest (s4)	0.02
Interest (s5a)	0.55
Compound interest (s5b)	0.36
Statement: high return (s6a)	0.19
Statement: inflation (s6b)	0.10
Statement: risk diversification (s6c)	0.22
Statement: agreement (s6d)	0.05
Discount (s7)	0.22
<b>Business Practice</b>	
No keeping records	0.27
No salary	0.53

*Source:* Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations. Summary statistics refer to the estimation sample.

*Notes:*

<sup>a</sup> Detailed information on reasons for being credit (un)constrained can be found in Table C.2 in the Appendix.

<sup>b</sup> *No bank account* gives the share of businesses not having access to a bank account. *Unprotected savings* gives the share of people that need to protect their savings from consumption commitments of other household members. The higher these numbers the more are constrained.

<sup>c</sup> Being managerial constrained is measured using items on financial literacy and items reflecting good business practices. The survey questions of the financial literacy items can be found in Table C.3.

Panel B in Table 4.2 shows that around 26 percent of the estimation sample have no access to a bank account. Beck et al. (2017) directly address the question whether people invest less if they need to protect their savings from consumption commitments of other household members. They find that people who save with others (i.e. if people who have 'unprotected savings') are less likely to invest into their business compared to people who save individually (either formally or informally). Based on these findings, an index for unprotected savings is constructed taking the value of 1 if the majority of savings are held with a rotating savings

and credit association (ROSCA), at home, or with friends and neighbors.<sup>21</sup> This would be people in need to protect their savings from others. In contrast, people who keep most of their savings in a bank account, who save with a savings and credit cooperative (SACCO), or who save using their mobile money account are considered as not having to protect their savings. Panel B in Table 4.2 shows that around 36 percent do have unprotected savings.

*Managerial Constraints.* As previously noted, the term managerial capital comprises different concepts, such as business practices implemented or the financial literacy level of entrepreneurs.<sup>22</sup> To cover aspects of business practices, indicators for whether the entrepreneur keeps business records or pays himself a salary are included (McKenzie and Paffhausen, 2017; Drexler et al., 2014; Karlan and Valdivia, 2011). Further, the survey includes several questions to measure the level of the financial literacy of the respondent. Among these items are also the items used by Lusardi and Mitchell (2014). Table 4.2 gives the share of incorrectly answered financial literacy questions or not implemented business practices. As can be seen from Panel C in Table 4.2, there are some financial literacy questions that are answered correctly by the majority of the sample (questions s2, s4 and s6d; see Table C.3 for the detailed survey questions), while the remaining questions provide more answer heterogeneity. The bottom of the Table shows, that 27 percent do not keep any records and that 53 do not pay themselves a salary.

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<sup>21</sup>The function of a ROSCA is a self-help group for saving and borrowing money. Savings of a group are pooled and are returned to members in rotation, until each member got the same amount of money (Bouman, 1995). Keeping the savings with a ROSCA is categorized as unprotected savings. The argument is that the literature links keeping money with a ROSCA to intra-household bargaining problems. This means that individuals rather save with a ROSCA to protect their money, as it would otherwise be unprotected (Anderson and Pomfret, 2002). One reason why keeping money using this informal saving product reduces investments is that the money saved with a ROSCA cannot be accessed until it is the respondent's turn to receive money.

<sup>22</sup>In general, the term managerial capital is representative for a myriad of skills or abilities that are addressed in different business training programs. McKenzie and Woodruff (2013) provide an overview of the 16 typical topics addressed in business training programs. Among these are topics like 'separating household and business finances,' 'inventory management,' and 'employee management.' As the survey does not cover information on all topics, the managerial constraint measured here is limited to selected topics.

### 4.3.4 Generating Indices for each Constraint

As described in the previous section, each of the three constraints is measured by a specific set of items that serve as proxy variables. Each item is coded in a way that values of 1 indicated higher constraints and 0 otherwise.<sup>23</sup> In order to analyze the relationship between these constraints and the investment value, this section aims at building an index for each constraint based on relevant items. Therefore, in a first step, all relevant items are identified. The index for each constraint is constructed in a second step.

The first step is to identify items that are relevant for explaining variation in the investment value. This is done by estimating a random effects model using the following equation:<sup>24</sup>

$$I_{it} = \alpha_1 + \alpha_2 Item_{it} + \epsilon_i + u_{it} \quad (4.1)$$

whereas  $I$  is the value of total investment and  $Item$  represents each single item used to measure each of the three constraints. An item is relevant in the present equation if it is associated with poor firm performance, meaning if it has a negative sign and significant effect. Figure 4.1 shows the point estimates ( $\alpha_2$ ) and the corresponding confidence intervals for the item in each simple regression model. The estimates show that the items measuring being formal and informal credit constrained are not significant in explaining variation in the investment value. This finding holds regardless of assigning those not applying for credit because of high interest rates to the group of constrained or unconstrained. Further, both proxy variables that measure savings constraints, which is whether someone has a bank account or unprotected savings, are relevant. Regarding managerial constraints, items s6c, s5b, and no record keeping are relevant.

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<sup>23</sup>For example the answers on financial literacy questions are defined as 1 if the respondent gave the wrong answer as this is associated with being more managerial constrained and 0 if the answer is correct.

<sup>24</sup>A similar approach is applied by Dinh and Clarke (2012) and Ayyagari et al. (2008), both seeking to identify relevant or binding constraints.

Figure 4.1: Relevance of Items



Source: Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations.

Notes: The figure shows which items (that are used as proxy variables to measure credit, saving or managerial constraints) are *relevant* in explaining variation in the investment value. The horizontal bars in the figure are based on a random effects model, whereby the estimation equation is as follows:  $I_{it} = \alpha_1 + \alpha_2 Item_{it} + \epsilon_i + u_{it}$ , whereas  $I_{it}$  is the investment value and  $Item_{it}$  are the different proxy measures which are displayed on the y-axis. The dots in the middle of the horizontal bars show the point estimates ( $\alpha_2$ ), and the vertical endings of the bars denote the lower and upper end of the 95 percent confidence interval. The *relevant* items are associated with lower investments if (i) the estimated coefficient ( $\alpha_2$ ) is negative (dot in the middle of the horizontal line is on the left side of the dashed vertical line) and (ii) if the coefficient is significantly different from zero (the horizontal bar does not overlap with the dashed vertical bar). The following items are identified as being relevant: no bank account, unprotected savings, 'Statement: risk diversification' (s6c), 'compound interest' (s5b) and no record keeping. The survey questions of the managerial items can be found in Table C.3.

Based on these identified relevant items an index for savings and managerial constraints is constructed. As both items that measure credit constraints are not significant, this constraint is neglected in the following analyses. There are  $k = 1, \dots, K$  relevant items belonging to one specific constraint. Each relevant item is converted to a z-score such that  $z_{ki} = (y_{ki} - \mu_k) / \sigma_k$  where  $\mu$  and  $\sigma$  are the mean and standard deviation of item  $y_k$ . Thus, each component of the index has

mean 0 and standard deviation 1. For each category of constraints a summary measure is constructed as follows  $z = \sum_k z_{ki}/K$  (see Kling et al., 2007).<sup>25</sup> Finally, the constraint index ( $z$ ) is standardized so that coefficients of constraints in the following estimation can be interpreted as changes in standard deviations.

### 4.3.5 Other Covariates

In addition to savings and managerial constraints, several other factors potentially drive a firms' investment value. Table 4.3 provides descriptive information on the control variables used in the following analyses. The first set of variables characterizes the business owner (Panel A). Because of potential differences in preferences of spending money for business investments or household needs, or because of different levels of pressure from household members to share income, a control is included for whether the respondent is female (Fiala, 2017; Jakiela and Ozier, 2016). To account for intra-household decision making, a control for being married is included (Ashraf, 2009). Further, I control for the age of the business owner. To account for correlations between the level of human capital and business investments, indicators for the highest educational degree obtained are included. Education controls include whether the respondent did not complete primary education, completed primary (7 years of education), O-level (11 years of education), A-level (13 years of education), or completed university (additional 3-5 years of education); the last is the reference category. To control for skills and knowledge gathered on-the-job, I control for working experience defined as the years worked in the current business. In addition a cognitive ability measure (raven score) is included. Further, a control for planned business investment as a proxy for whether the business owner wants his business to grow is included (Dalton et al., 2018).

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<sup>25</sup>The index proposed by Kling et al. (2007) is prominently used in the literature evaluating randomized controlled trials. In this context, the index is used as a measure for families of outcomes that comprise several components. The index is also used if components of one outcome family consist only of binary variables. See, for example the 'business practices index' used in Drexler et al. (2014) or the 'aggregated financial numeracy score' constructed in Carpena et al. (2011).

Table 4.3: Summary Statistics on Explanatory Variables

	(1)	(2)	(3)	(4)	(5)
	mean	sd	median	min	max
<b>A. Socio-economic characteristics</b>					
Female	0.42	(0.49)	[0.00]	0.00	1.00
Married	0.62	(0.49)	[1.00]	0.00	1.00
Age	36.83	(9.39)	[35.00]	19.00	74.00
No education	0.12	(0.32)	[0.00]	0.00	1.00
Completed primary school	0.30	(0.46)	[0.00]	0.00	1.00
Completed O-level	0.26	(0.44)	[0.00]	0.00	1.00
Completed A-level	0.17	(0.38)	[0.00]	0.00	1.00
Completed University (ref.)	0.15	(0.35)	[0.00]	0.00	1.00
Business experience	9.33	(6.78)	[7.00]	0.00	42.00
Cognitive ability (raven score)	6.09	(2.56)	[6.00]	0.00	10.00
Planned investment	0.84	(0.37)	[1.00]	0.00	1.00
<b>B. Firm characteristics</b>					
Age of firm	9.66	(6.91)	[8.00]	0.00	42.00
Initial capital (USD)	4389.81	(54349.53)	[618.39]	2.32	2.05e+06
Own-account worker	0.45	(0.50)	[0.00]	0.00	1.00
Registered with Revenue Authority	0.18	(0.39)	[0.00]	0.00	1.00
Services	0.13	(0.33)	[0.00]	0.00	1.00
Manufacturing (printing, paper) (ref.)	0.13	(0.34)	[0.00]	0.00	1.00
Manufacturing (textile)	0.13	(0.33)	[0.00]	0.00	1.00
Manufacturing (remaining)	0.23	(0.42)	[0.00]	0.00	1.00
Retail and Wholesale (remaining)	0.19	(0.39)	[0.00]	0.00	1.00
Retail and Wholesale (retail, clothing)	0.09	(0.29)	[0.00]	0.00	1.00
Retail and Wholesale (electric, phones)	0.07	(0.25)	[0.00]	0.00	1.00
Remaining sectors	0.03	(0.18)	[0.00]	0.00	1.00

*Source:* Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations. Summary statistics refer to the estimation sample.

*Notes:* Variables indicated with (*ref.*) are reference categories in the estimations.

Another set of control variables relates to characteristics of the firm (Panel B). As theory predicts an inverse relationship between firm age, size, and growth, controls for age and initial firm size are included (Evans, 1987; Jovanovic, 1982).<sup>26</sup> Further, whether the business is run by the owner alone or if the business has

<sup>26</sup>To reduce the noise in financial variables, e.g. initial capital stock, the variable is winsorized at the 99<sup>th</sup> percentile, which means that the top 1 percent values of this variable are replaced with the 99 percentile value of this variable (see Bruhn et al. (2018); Drexler et al. (2014) who apply the same approach). Further, the variable is deflated to 2012 values given in USD.



employees is also controlled for. As formalization of the business might influence access to finance or training programs and, thus, foster business investments, I control for whether the business is registered with the Ugandan revenue authority. Lastly, controls for the different industry sectors are included. The industries are manufacturing<sup>27</sup>, retail and wholesale<sup>28</sup>, as well as services<sup>29, 30</sup>.

## 4.4 Empirical Analysis

### 4.4.1 Relation of Constraints on Investment

This section examines whether savings or managerial constraints are associated with lower investments. The estimation equation is given by the following random effects panel data model:

$$\text{Log}(I_{it}) = \alpha_1 + \alpha_2 SC_{it} + \alpha_3 MC_{it} + X'_{it}\alpha_4 + \epsilon_i + u_{it} \quad (4.2)$$

where  $i$  indexes the enterprise and  $t$  indicates the wave. The dependent variable  $I_{it}$  is the value of total investment. The different types of constraints, which are standardized indices for savings ( $SC_{it}$ ) and managerial constraints ( $MC_{it}$ )<sup>31</sup> are controlled for.  $X_{it}$  is a vector of other control variables including the characteristics of the business owner (gender, age, married, highest educational level, cognitive ability, business experience, planned investment) and firm characteristics (years since establishment of the business, initial capital, own-account worker, registered with revenue authority, and industry sector).  $\epsilon_i$  is the business-specific error and  $u_{it}$  is the idiosyncratic error.

<sup>27</sup>The manufacturing industry comprises of the following sectors: manufacture of printing and paper products, textiles and wearing apparel and remaining manufacturing sectors.

<sup>28</sup>The retail and wholesale industry comprises of the following sectors: retail and wholesale of electric, phones, household appliances; clothing, footwear and leather; and remaining retail sectors.

<sup>29</sup>The services sector mainly covers businesses operating in the hair dressing and beauty business.

<sup>30</sup>There is one additional category that covers businesses not falling in one of the aforementioned industry sectors. This category covers between 17 and 6 businesses per wave. The industry sector of Manufacturing (printing, paper) is used as the reference category.

<sup>31</sup>Credit constraints are not controlled for in this estimation. The reason is that both items used to measure credit constraints (formal and informal credit constraints) are not significant in explaining variation in the investment value (see Section 4.3.4).

A random effects model is used to estimate the relationship between investments and constraints.<sup>32</sup> The main estimation results are reported in Table 4.4: Column (1) reports the unconditional effect of constraints on investment, while column (4) reports the effect of constraints with the full set of control variables. Given the construction of the indices for each category of constraints, the results can be interpreted as the percentage change in investment value associated with a one standard deviation change in the respective constraint index. Full estimation results are presented in Appendix Table C.4.

Table 4.4: Random Effects Estimation Results: Log Investments

	(1)	(2)	(3)	(4)
Saving Constraint Index	-.273*** (0.078)	-.160** (0.079)	-.128 (0.081)	-.153* (0.081)
Managerial Constraint Index	-.260*** (0.073)	-.235*** (0.074)	-.202*** (0.073)	-.142* (0.075)
Obs.	1498	1498	1498	1498
Control Variables				
Socio-economic characteristics		✓	✓	✓
Firm characteristics			✓	✓
Year dummies				✓

*Source:* Survey on micro and small enterprises in Uganda, own calculations.

*Notes:* Standard errors in parentheses. Standard errors clustered at firm level. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . University and Manufacturing (printing, paper) are the reference groups for education and industry sector, respectively. The full estimation results can be found in Table C.4.

The results indicate that business owners subject to savings or managerial constraints invest significantly less in their business. The unconditional estimates imply that each standard deviation increase in savings constraints (being more savings constrained) or managerial constraints (lacking more managerial skills) is associated with a decrease in the investment value by 27 percent and 26 percent, respectively (Column 1, Table 4.4). Stepwise including the remaining control variables for socio-economic and firm characteristics and year dummies in columns (2)-(4) shows that the coefficients of savings and managerial constraints remain significant at the 10 percent level but decrease slightly in magnitude. Specifically, in the full specification, a one standard deviation increase in savings constraints

<sup>32</sup>The consideration of preferring a random-effects model over a fixed effects model stems from the fact that almost all control variables are time invariant.

reduces the investment value by approximately 15 percent. In contrast, a one standard deviation increase in managerial constraints, decrease investments by 14 percent.

To summarize the results, based on the whole estimation sample, savings and managerial constraints are correlated with investments. The result in Section 4.3.4 shows that both proxy variables for credit constraints did not explain variation in the investment value.

## 4.4.2 Coincidence of Constraints and Characteristics

The aim of this paper is to identify businesses with similar investment constraints. In order to do so, the results of two analyses are combined. Firstly, I identify groups that are at risk of being either savings or managerial constrained. For this purpose, Section 4.4.2 explores which characteristics are associated with each specific constraint. Secondly, I analyze if these constraints identified for specific subgroups are indeed associated with lower investments. Therefore, the estimation sample is restricted to subgroups in Section 4.4.2.

### Determinants of Constraints

This section provides a brief overview of the characteristics of each previously discussed constraint. Relevant socio-economic or firm characteristics associated with the constraints are identified based on the following estimation equation:

$$Constraint_{it} = \beta_1 + X'_{it}\beta_2 + \epsilon_i + u_{it} \quad (4.3)$$

where  $Constraint_{it}$  represents either savings or managerial constraints.  $X_{it}$  is again the vector of other control variables. Full estimation results are in Table 4.5, with characteristics of savings constraints in Column (1) and managerial constraints in Column (2).

Starting with the influence of socio-economic characteristics, the results suggest that females are significantly associated with being increasingly savings constrained. Savings constraints decrease with age and are lower for married entre-

Table 4.5: Random Effects Estimation Results: Constraints

	(1) Saving Constraints	(2) Managerial Constraints
Female	0.198** (0.081)	0.023 (0.075)
Married	-.128** (0.057)	0.082 (0.06)
Age	-.048** (0.024)	0.008 (0.022)
Age squared	0.0005* (0.0003)	-.0002 (0.0003)
No education	0.675*** (0.137)	0.118 (0.144)
Primary school	0.448*** (0.1)	0.206* (0.109)
Completed O-level	0.375*** (0.086)	0.127 (0.102)
Completed A-level	0.018 (0.074)	0.049 (0.102)
Cognitive ability (raven score)	-.025* (0.015)	-.040*** (0.013)
Business experience	-.035** (0.016)	-.006 (0.018)
Planned investment	-.040 (0.057)	-.147** (0.07)
Age of firm	0.023 (0.022)	0.014 (0.021)
Age of firm squared	0.0001 (0.0005)	-.0001 (0.0004)
Initial capital stock (USD)	1.06e-06*** (2.10e-07)	-1.30e-07 (1.25e-07)
Own-account worker	0.128** (0.055)	0.221*** (0.058)
Registered with revenue authority	-.032 (0.053)	-.112 (0.07)
Services	0.279** (0.134)	-.085 (0.134)
Manufacturing (textile)	0.447*** (0.136)	-.113 (0.134)
Manufacturing (remaining)	0.177 (0.114)	-.315** (0.124)
Retail and Wholesale (remaining)	0.383*** (0.12)	-.123 (0.128)
Retail and Wholesale (retail, clothing)	-.052 (0.13)	-.274* (0.141)
Retail and Wholesale (electric, phones)	0.182 (0.129)	-.129 (0.157)
Remaining sectors	-.032 (0.14)	-.045 (0.161)
Treatment April 2016	0.144 (0.09)	0.032 (0.09)
Treatment April 2013	-.203*** (0.071)	-.031 (0.064)
Year 2014	-.022 (0.05)	-.429*** (0.068)
Year 2015	0.005 (0.063)	-.178** (0.079)
Year 2016	0.013 (0.081)	-.541*** (0.092)
Year 2017	0.058 (0.086)	-.415*** (0.095)
Const.	0.778 (0.479)	0.438 (0.435)
Obs.	1498	1498

*Source:* Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations.

*Notes:* Standard errors in parentheses. Standard errors clustered at firm level.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . University and Manufacturing (printing, paper) are the reference groups for education and industry sector, respectively.

preneurs. Comparing the magnitudes of the coefficients of the educational variables shows that low levels of human capital are associated with higher savings constraints. For respondents with higher educational levels, this positive effect decrease in magnitude and fades out for respondents with A-level degrees. Further, it is found that increased cognitive ability and business experience are associated with lower saving constraints. Moving to the determinants of managerial constraints in Column (2) shows the less educated, such as people with only primary education, exhibit higher managerial constraints. Interestingly, entrepreneurs who plan to invest in their business, in terms of either purchasing business equipment or hiring additional employees, show lower levels in managerial skills.

The lower part of Table 4.5 provides firm-characteristics. Businesses with no employees (own-account worker) are associated with being savings and managerial constrained (Columns (1) and (2)). The comparison of industry sectors shows that businesses operating in the services sector or in the retail and wholesale sector are more savings constrained compared to businesses operating in the manufacturing of printing products, which is the reference category.

### **Subsample Analysis**

The results for the overall sample indicate that savings and managerial constraints are associated with lower investments (Section 4.4.1). In order to identify which respondent or business characteristics are associated with specific constraints, this section provides a detailed subsample analysis. It tests for heterogeneous effects with respect to socio-economic and firm specific characteristics. Regarding socio-economic characteristics, the sample is split based on four variables: married, age, education and gender. The results are shown in Table 4.6. For easier comparison of effect sizes, Column (1) provides the results of the main estimation presented previously in Column (4) of Table 4.4.

Table 4.6: Heterogeneity Analysis: Socio-economic Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	All	Married	Unmarried	17-29	30-39	40-49	50+	None	Primary	O-level	A-level	Uni	Female	Male
<b>A. Dependent Variable: Log Investments</b>														
Saving Constraint Index	-1.53* (0.081)	-0.85 (0.107)	-2.38** (0.119)	-0.59 (0.181)	-2.36* (0.14)	-1.32 (0.162)	-1.17 (0.218)	0.013 (0.227)	-0.55 (0.12)	-4.28*** (0.153)	-1.43 (0.286)	0.363 (0.363)	-1.10 (0.107)	-2.42* (0.125)
Managerial Constraint Index	-1.42* (0.075)	-1.48 (0.096)	-1.45 (0.124)	-0.65 (0.135)	-1.91 (0.126)	-2.46* (0.139)	-0.02 (0.335)	-1.96 (0.207)	-2.92** (0.122)	-3.01** (0.153)	0.011 (0.184)	0.048 (0.26)	-2.04* (0.116)	-1.06 (0.104)
Obs.	1498	927	571	370	590	389	149	178	445	389	255	220	625	873
Control Variables														
Socio-economic characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Firm characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations.

Notes: Standard errors in parentheses. Standard errors clustered at firm level. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Comparing the effects of each single constraint of the main estimation (Column (1)) to the results of the different subsamples shows that the negative effect of the savings constraints among *unmarried* entrepreneurs is especially pronounced. The results by *age groups* show that investments are influenced by managerial constraints for entrepreneurs age 40-49 and by savings constraints for entrepreneurs age 30-39. Differentiating by the level of *education* shows that entrepreneurs with O-level education are savings constraints. For managerial constraints, the tendency is that lower educational levels are correlated with lower investments. This is especially the case for entrepreneurs with only primary or O-level education. The negative effect of savings constraints in the subsample of males is more pronounced than the estimate of the sample average. In addition, the investment value of females shows a negative correlation with managerial skills.

The estimation results by firm-specific characteristics are shown in Table 4.7. Estimation results are provided with respect to different industry sectors, whether the business owner is an own-account worker, age of the firm, and whether the firm is registered with the Ugandan revenue authority. The effects by industry sector show that constraints play a role in only a few sectors. For example in the services sector (Column (2)), where 63 percent of business owners are female, savings and managerial constraints are associated with lower investments. The latter constraint also matters for businesses operating in specific manufacturing (Column (5)) or retail sectors (Columns (7) and (9)). When comparing the subsample of firms without employees (Column (10)) to firms with employees (Column (11)), only in the latter does savings and managerial constraints play a role. The first constraint could reflect the greater capital intensity of the group with employees, where the average capital stock is around four times higher compared to the own-account group. The latter finding might be surprising at first glance, as one might expect own-account workers are more vulnerable and less well skilled compared to firms with employees. However, the finding could also reflect that decisions and managerial skills might be more complex or diverse in larger companies. Lastly, Columns (14) and (15) compare firms that are registered with the Ugandan revenue authority with those that are not. For the unregistered group, savings and managerial constraints are associated with lower investment levels.

Table 4.7: Heterogeneity Analysis: Business Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	All	Services	M-print	M-text	M-rem	O	R-rem	R-cloth	R-elec	Ovrn-account Yes	No	0-7	8+	Registered yes	no
<b>A. Dependent Variable: Log Investments</b>															
Saving Constraint Index	-1.53* (0.081)	-418* (0.217)	0.127 (0.407)	-108 (0.138)	-132 (0.183)	0.061 (1.106)	-032 (0.166)	0.131 (0.304)	-615 (0.58)	-115 (0.104)	-215* (0.129)	-179 (0.123)	-145 (0.11)	0.129 (0.279)	-175** (0.083)
Managerial Constraint Index	-142* (0.075)	-397* (0.235)	0.058 (0.245)	-189 (0.182)	-292* (0.167)	0.478 (0.713)	-320** (0.152)	0.657*** (0.228)	-521* (0.277)	-093 (0.098)	-191* (0.114)	-102 (0.105)	-228** (0.108)	0.261 (0.275)	-182** (0.078)
Obs.	1498	192	195	192	352	51	278	140	98	678	820	728	770	272	1226
Control Variables															
Socio-economic characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Firm characteristics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations.

Notes: Standard errors in parentheses. Standard errors clustered at firm level. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .



## Results

Drawing conclusions about which characteristics are subject to similar investment constraints is only possible to a limited extent. The reason is that exogenous variation in the constraints is missing, which means that the results present correlations from which causal conclusions cannot be inferred. Therefore, I focus on the most consistent findings by combining the results of both analyses. The most consistent findings are if a specific characteristic is associated with a certain constraint (results from Section 4.4.2) *and* if this constraint is associated with lower investments (when the sample is restricted to this characteristic as in Section 4.4.2). Figure 4.2 illustrates the most consistent findings.

Figure 4.2: Coincidence of Constraints and Characteristics

Subsample	Characteristics of Constraints (4.2.1)			Heterogeneity Analysis (4.2.2)
	Credit Constraints			Investment
		Saving Constraints		↓
			Managerial Constraints	↓
Unmarried		↑		
Primary education			↑	
O-level education		↑		
Services sector		↑		

*Notes:* The figure illustrates the summarized findings on the coincidence of constraints and characteristics. The figure should be interpreted from the left to the right side. Focusing on the left column ('Subsample') shows that characteristics such as being unmarried, having olevel education or businesses in the services sector are associated with being saving constrained (arrow pointing upwards). Being primary educated is associated with managerial constraints. This summarizes the findings in Section 4.2.1.. Proceeding from the middle column ('Characteristics of Constraints'), the figure shows that if the sample is restricted to unmarried, olevel educated entrepreneurs or businesses in the services sector, saving constraints are associated with lower investments (column 'Heterogeneity Analysis', arrow pointing downwards). Restricted to the subsample of primary educated, it is found that managerial constraints are associated with lower investments.

The combined findings of both analyses suggest that savings constraints should be considered as relevant for entrepreneurs with medium education (O-level, 11 years of education), for unmarried entrepreneurs, or for businesses operating in the services sector. Further, for entrepreneurs with lower educational level (max.

7 years of education), managerial constraints play a role. The analyses show that these characteristics are associated with the respective constraint and that this constraint is associated with lower investments for each subgroup.

Some of these results are in line or are compatible with findings of the extant literature. Lower educational levels are likely correlated with lower managerial capital. This assumption is supported by the findings of heterogeneous treatment effect of business trainings for lower educated, as they likely have more scope for improvement than the higher educated. (Drexler et al., 2014; Karlan and Valdivia, 2011) Further, the findings suggest that the unmarried are savings constrained. Comparing the share of bank account holders for the estimation sample shows that 79 percent and 65 percent of the married and unmarried, respectively, have a bank account. While the data does not show a mean difference in total savings between the groups, there are significant differences when comparing household wealth and business investments with married respondents having higher levels.<sup>33</sup> Higher wealth levels of the married might explain a higher share of bank account ownership.

### 4.4.3 Robustness Checks

This section probes the sensitivity of the results to changes in the empirical specification and inclusion of further control variables. The following issues are addressed: (i) selective attrition; (ii) pooled ordinary least squares model as alternative to the random effects model; (iii) controlling for past randomized controlled trials; (iv) restriction to a sample with strictly positive investment values; and (v) estimation explaining the incidence of investments.

The first issue addressed in Table 4.8 is the sensitivity of the main results with respect to selective attrition in the sample. In order to do so, the determinants of attrition are estimated using a logit model (Column (1)). Based on this, the main results are corrected for differential attrition through inverse probability weighting of selection into the different waves. The results in Column (2) show that the effects of both constraints are still significant. While the coefficient of saving constraints is almost of same magnitude, the coefficient of managerial constraints increases slightly in magnitude. Secondly, I re-estimate the model

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<sup>33</sup>The same pattern is found for differences between the married and unmarried in the US (Waite, 1995).

Table 4.8: Random Effects Estimation Results: Log Investments

	(1)	(2)	(3)	(4)	(5)	(6)
<b>Dependent Variable:</b>	Attrition Attriter	RE-Model (ipw) Investment	POLS Investment	Past RCT's Investment	Investment > 0 Investment	Dummy Investments
Saving Constraint Index	0.156* (0.094)	-.161* (0.096)	-.155** (0.079)	-.189** (0.085)	-.157** (0.079)	-.010 (0.014)
Managerial Constraint Index	0.105 (0.073)	-.197** (0.089)	-.139* (0.077)	-.153** (0.075)	-.123* (0.069)	-.013 (0.013)
Female	0.07 (0.27)	-.347 (0.333)	-.228 (0.183)	-.279 (0.191)	-.276 (0.192)	-.028 (0.035)
Married	0.015 (0.182)	0.128 (0.274)	0.076 (0.156)	0.029 (0.16)	-.089 (0.142)	0.027 (0.027)
Age	-.025 (0.089)	-.096 (0.082)	-.062 (0.066)	-.065 (0.068)	0.018 (0.076)	-.013 (0.011)
Age squared	0.0004 (0.001)	0.0009 (0.0009)	0.0004 (0.0008)	0.0004 (0.0008)	-.0003 (0.001)	0.00009 (0.0001)
No education	-.610 (0.512)	-.604 (0.495)	-.593 (0.37)	-.511 (0.373)	-.855** (0.405)	-.004 (0.063)
Primary school	-.060 (0.401)	-.246 (0.486)	-.095 (0.31)	-.053 (0.321)	-.171 (0.322)	0.025 (0.05)
Completed O-level	-.106 (0.354)	-.503 (0.388)	-.259 (0.296)	-.210 (0.308)	-.222 (0.321)	-.014 (0.047)
Completed A-level	0.031 (0.353)	-.493 (0.308)	-.305 (0.317)	-.334 (0.319)	-.118 (0.298)	-.048 (0.047)
Cognitive ability (raven score)	0.023 (0.049)	0.043 (0.049)	0.016 (0.034)	0.025 (0.036)	0.013 (0.035)	0.003 (0.006)
Business experience	-.065 (0.064)	0.056 (0.05)	0.011 (0.052)	0.014 (0.046)	-.046 (0.039)	0.008 (0.007)
Planned investment	0.025 (0.185)	0.385 (0.283)	0.52*** (0.202)	0.512** (0.206)	0.263 (0.18)	0.077** (0.037)
Age of firm	0.026 (0.077)	-.044 (0.062)	-.007 (0.063)	-.023 (0.062)	0.007 (0.056)	-.003 (0.009)
Age of firm squared	0.0006 (0.002)	-.00004 (0.002)	-.0002 (0.001)	0.0003 (0.001)	0.001 (0.001)	-.0002 (0.0002)
Initial capital stock (USD)	0.00002 (1.00e-05)	1.19e-06* (6.44e-07)	1.64e-06*** (5.43e-07)	1.46e-06*** (4.58e-07)	-3.17e-07 (3.85e-07)	3.70e-07*** (7.34e-08)
Own-account worker	0.013 (0.184)	-.114 (0.26)	-.505*** (0.157)	-.519*** (0.164)	-.705*** (0.161)	-.001 (0.027)
Registered with revenue authority	-.104 (0.21)	0.277 (0.309)	0.512** (0.221)	0.407* (0.225)	0.32* (0.181)	0.031 (0.034)
Manufacturing (printing, paper)	-.164 (0.483)	-.181 (0.623)	-.238 (0.367)	-.319 (0.377)	0.754** (0.32)	-.116** (0.057)
Manufacturing (textile)	0.246 (0.459)	-1.113*** (0.346)	-.761*** (0.259)	-.681** (0.275)	-.978*** (0.263)	0.008 (0.048)
Manufacturing (remaining)	-.061 (0.451)	0.127 (0.294)	-.354 (0.301)	-.319 (0.313)	-.199 (0.265)	-.051 (0.049)
Retail and Wholesale (remaining)	0.628 (0.405)	-1.495*** (0.29)	-1.383*** (0.269)	-1.352*** (0.285)	-.484 (0.316)	-.224*** (0.051)
Retail and Wholesale (retail, clothing)	0.976** (0.456)	-1.179*** (0.381)	-1.017*** (0.333)	-1.002*** (0.336)	-.296 (0.31)	-.141** (0.062)
Retail and Wholesale (electric, phones)	0.754 (0.558)	-.575 (0.387)	-.570 (0.405)	-.520 (0.429)	0.086 (0.347)	-.126* (0.065)
Remaining sectors	0.754 (0.644)	-1.045** (0.508)	-1.199** (0.502)	-1.042* (0.536)	0.193 (0.458)	-.233*** (0.086)
Treatment April 2016				0.452* (0.255)		
Treatment April 2013				-.443** (0.178)		
Const.	-.167 (1.662)	5.153*** (1.543)	4.676*** (1.323)	4.963*** (1.338)	5.477*** (1.383)	0.811*** (0.215)
Obs.	1498	1498	1498	1436	925	1498

*Source:* Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations.

*Notes:* Standard errors in parentheses. Standard errors clustered at firm level. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . University and Services & Beauty are the reference groups for education and industry sector, respectively. Sensitivity tests are presented in the different columns, the following specifications are tested:

Column (1): The dependent variable is being attriter, meaning not being observed in a specific wave.

Column (2): Random effects model estimated with inverse probability weighting (based on Column (1)).

Column (3): Pooled ordinary least-squares (POLS) estimation.

Column (4): Estimation controls for past RCTs conducted in April 2013 and April 2016.

Column (5): Estimation is restricted to strictly positive investments in a given wave.

Column (6): Dependent variable is dichotomous indicating whether someone made an investment in a specific wave or not.

using a pooled ordinary least-squares (OLS) estimation (Column (3)). Results of the pooled OLS model are very similar to the initial specification in Column (4) of Table 4.4. Thirdly, in April 2013 and 2016, randomized controlled trials were conducted with respondents of the present sample.<sup>34</sup> To show that these interventions do not alter the estimation results, an estimation that controls for these interventions is conducted. Comparing results in Column (4) with the main estimation results in Column (4) of Table 4.4 shows that the magnitude as well as the significance of the coefficients is very similar. Fourthly, as there are some businesses that do not conduct any investments in a given period, I restrict the sample to only positive investments in a given period. Column (5) shows that the estimated coefficients for savings and managerial constraints do not change significantly. Lastly, Column (6) shows an estimation of constraints on the incidence of investment, meaning the decision to make an investment in a specific period. The results show that the constraints are important in explaining the investment value but no relationship between constraints and the decision to invest are found.

## 4.5 Conclusion

Micro and small enterprises (MSEs) are currently the main employers outside of agriculture in developing countries. Against the backdrop of considerable expected population growth and a dearth of formal jobs, especially in Africa, studying the growth performance and growth constraints of MSEs is of prime policy importance.

This paper analyses if the major constraints of micro and small enterprises discussed in the extant literature - credit, savings and managerial constraints - hamper investments. I find that savings constraints and the lack of managerial skills are significantly and negatively associated with firm investment in the overall sample. In contrast, no correlation between credit constraints and investment are found. After controlling for a large set of entrepreneur- and firm-characteristics, the results suggest that a one standard deviation increase in savings constraints is associated with approx. 15 percent lower investments and that a one standard

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<sup>34</sup>In April 2013, 245 entrepreneurs received a money transfer of 300,000 UGX (116 USD) and, in April 2016, respondents received information about the importance of marketing.

deviation increase in managerial constraints is associated with approximately 14 percent lower investments.

A further aim is to identify characteristics of businesses with similar investment constraints. For this, I combine the findings of analyses of (i) the determinants of constraints and (ii) a subsample analysis. These analyses hint at characteristics associated with savings and managerial constraints. Results based on correlation analyses imply that medium educated (11 years of schooling), unmarried entrepreneurs or businesses operating in the services sector are saving constrained. Further, I find correlations between being lower educated (7 years of schooling) and being managerial constrained.

The present analysis is based on a selected sample of micro and small enterprises in Kampala, Uganda which likely shares many characteristics with other micro and small businesses in Uganda and other low-income countries in Africa. However, more research is needed to confirm if these results also hold in other settings.

The motivation of the present analysis is to select businesses with similar constraints that then can be targeted by the type of training that is useful to them. This analysis selects businesses by combining criteria defined in the extant literature and statistical methods, but how can the procedure of *preselecting* businesses be applied *in practice*? One option is to select micro and small businesses owners based on the identified characteristics found in this study. However, if the assumption is that different characteristics might face different constraints in a different setting (e.g. different country or culture, specific industry branch), one alternative could be to collect information on the proxy variables used in the present study and to rerun the analysis. This is less time and cost intensive than collecting an entire in-depth survey.



## Chapter 5

# The Effects of a Personalized Finance Training on Small Enterprises

*with:*

*Antonia Grohmann*

*Lukas Menkhoff*

## 5.1 Introduction

Small entrepreneurs form an important part of the economy in developing countries. It is estimated that the majority of the work force is either self-employed or works in small businesses. Despite this importance of small entrepreneurs for the economy it becomes obvious by just visiting such shops, and is known from studies, that small entrepreneurs lack capital (e.g., Banerjee and Duflo (2014); McKenzie and Woodruff (2008); De Mel et al. (2008)) and knowledge (e.g., Bruhn and Zia (2013); Bruhn et al. (2010); Bloom et al. (2010)) in order to upgrade their business. Accordingly, there are manifold initiatives providing business trainings of various kinds. The evidence on the impact of these trainings is encouraging overall (McKenzie and Woodruff, 2013) as they mostly generate statistically significant effects. However, the result of an average effectiveness may mask the often very limited effect sizes. These limitations mean that many interventions do not show any intended effects and thus question the usefulness of business trainings. At the same time, there are very successful trainings from which others can learn (Dalton et al., 2018; Drexler et al., 2014).

Given this state of the literature it is our motivation to contribute towards an improvement in the effectiveness of business trainings for small enterprises. While it is known that individual counseling is more successful than a general and standardized training of a group of entrepreneurs (Carpena et al., 2017), counseling is of course very costly. Thus we are interested in testing a new form of training that is in between a conventional training of a group and an individual one-to-one counseling. We call this training form the “personalized” training. Personalization means that elements of a short standard training are combined with concrete information about the individual entrepreneur (and her small business) which refers to elements of the training. Inspired by the overall effectiveness of feedback in the field of energy conservation (Karlin et al., 2015), feedback may stimulate the entrepreneurs’ attention and involvement. We find indeed that the personalized feedback increases effectiveness of the standard training by 45 percent.

In order to assess such a personalized training and compare it to the effects of a non-personalized training we conduct a randomized controlled trial (RCT) in Kampala, the capital city of Uganda. We rely on a survey study with about 500 micro and small businesses who are randomly sampled based on several strat-



ification criteria, such as area and industry (details are provided in Section 3 below). This sample is divided into three groups: we have two groups with different finance trainings and a control group. To rule out that effects may be driven through contact and time spent with our training staff, the control groups receive a health training which has nothing to do with business practices. Regarding the finance trainings, we have to consider two limitations of our study, i.e. the relatively small sample plus the constrained resources which allow for roughly a half hour training. Power calculations show that significant treatment effects cannot be expected in this setting from conventional training approaches. Our experiment has 80 percent power to precisely detect (at  $\alpha=0.05$ ) effect sizes as small as 0.2667. Therefore, the reference treatment is based on lessons learned from the rule-of-thumb approach as introduced by Drexler et al. (2014) which has been shown relatively high effectiveness. Thus we get an ambitious benchmark for the second treatment group which receives a personalized training: this is the rule-of-thumb training from the other treatment plus an add-on, i.e. additionally provided information about the situation of the entrepreneur and her small business.

The finance training covers six outcome families: first, and also the core of the training, is about an increase of investment in order to expand the business in the longer run. Second, and related to this is the discussion of additional savings as the easiest way to increase investments. Then sources of profits are discussed and, fourth, diversification of business in order to reduce riskiness. Finally, the last quarter of the training is, fifth, about separating finances between business and household and, sixth, about keeping financial records. Certain parts of the short training end with concrete rules, such as “make a savings plan to reach your savings goal” or “start saving now” etc. In addition to these rules, the personalized feedback uses information from the baseline survey and informs, for example, that “your savings goal is: to invest in my current business” or “you already saved XY to reach your saving goal”. Thus the feedback relates the abstract rules more concrete to the specific entrepreneur and reminds him of earlier plans and actions. While the overall treatments are intensive because they take place at the entrepreneur’s business, they are easy to take part in as they last on average just 28 minutes and 32 minutes, respectively.

We find that both financial trainings generate several desired changes in behavior. In order to compensate the limited power of our study, we form an index over all six outcome family indices and find that both treatments have a statistically significant effect: the pure rule-of-thumb training has an effect of 0.178 standard deviations of the control group which is large relative to financial education trainings in general as they realize rather 0.08 SDs (Kaiser and Menkhoff, 2017). However, the additional personalized feedback increases this average effect to 0.258 SDs and thus by 45 percent relative to the rule-of-thumb training. While this difference is not statistically significant it is large in economic terms.

Turning to outcome families, the strongest effect of the twelve combinations (two treatments times six outcomes) is for the personalized treatment on savings: the effect is 0.279 SDs strong and also highly statistically significant. Also most other coefficients are larger than the benchmark of 0.08 cited, thus proving the effectiveness of this training. When the sample is disaggregated we find particularly large effects among those entrepreneurs who follow savings goals, indicating their entrepreneurial ambition: they also increase savings which goes along with higher inventory investments and tentatively higher profits, suggesting that this group is activating their business.

This paper is embedded in a larger literature on trainings of small businesses. Many of these trainings focus on financial concepts as we do. Typically, they succeed but the degree of success differs and overall there seems room for improvement. Several classroom training interventions find effects on business knowledge or business practices, but muted or no effects on key business performance measures like revenues or profits (Gine and Mansuri, 2014; Bruhn and Zia, 2013; Karlan and Valdivia, 2011; Bjorvatn, 2010). A classroom training is the most general way to provide information. The training content is standardized and not adjusted to the particularities of specific firms. Interventions that take into account individual challenges of firms are those providing consulting services, where the content is tailored to the businesses' needs. Karlan et al. (2015) provide consulting service to tailors in Ghana and find changes in business practices and increases in investment. However, effects are not persistent and in the long-run, firms who receive consulting perform similar to control firms. A more promising consulting intervention was conducted among Mexican enterprises by Bruhn et al. (2018). They find effects on productivity in the short run and employment

in the long run. However, it should be noted that their sample is not entirely comparable to ours, as they target micro, small and medium enterprises.

A rule-of-thumb training is among the promising avenues to follow. Our innovation is to combine this training with a personalized feedback and our evidence suggests that this may be a most promising way to go. However, this requires that information about the treatment groups is available or will be collected in advance.

This paper is structured into four more sections: Section 2 describes the experimental setting and Section 3 the data. Results are presented in Section 4, while Section 5 concludes.

## 5.2 Experimental Setting

In this section we describe the implementation of our training programs (Section 5.2.1) and our empirical strategy (Section 5.2.2).

### 5.2.1 Experimental Design

To foster financial knowledge among micro and small enterprises, we develop two financial education training programs: a rule-of-thumb training and a personalized training. As micro and small enterprises typically remain small, the trainings are designed to match the needs of business owners and focus on investment and growth strategies. The participants of both training groups receive the same standard training which covers key topics of typical business training programs which are (i) financial management, (ii) business investment and growth strategies and (iii) separating business and household finances (a more detailed training curriculum can be found in Table D.1 in the Appendix).

Based on this standard training, the *rule-of-thumb* training group in addition receives simple rules of financial behavior. Here, we follow the idea of (Drexler et al., 2014) who compare a training that teaches simple rules for financial decision making with a standard accounting training. To ensure that the content of our training is in line with the national financial inclusion strategy, our rule of thumbs are in accordance with the core messages regarding financial literacy by

the bank of Uganda.<sup>1</sup> The *personalized training* contains one more components in addition to the standard training. It contains the same rules for financial education as the rule-of-thumb training group. Secondly it also contains elements of personalization. The entrepreneur receives individual feedback regarding the past financial performance of the business and the respondents financial behavior, which adds a personalized element to the training. While the rule-of-thumb training, for example, explains the general concept of how to calculate profits, the business owner in addition to this general information receives feedback on the calculation of his actual profits based on the baseline data. Hence, whenever our data allow, the second training group receives a personalized feedback which is directly related to the rule-of-thumb that where taught. The control group receives health and safety information in a comparable amount of time to avoid estimation bias from Hawthorne-type effects.

Both financial education trainings and the information provided for the control group are delivered and taught in face-to-face sessions with local instructors. All instructors have a university degree and are experienced with field surveys. Prior to treatment implementation the instructors completed an intensive five-day training and an additional two-day pilot. During the personal meetings between instructor and respondent, the training contents are delivered using a presentation on tablet PCs. After the presentation, each respondent receives a booklet which includes a detailed description of the contents that are presented. The booklet also includes the rule-of-thumb or in addition the personalized information. To ensure that all respondents could follow the contents of the training, the presentation and booklet are either in English or Luganda depending on the preferences and skills of the business owner.

The presentation of all types of trainings takes between 25 and 40 minutes.<sup>2</sup> To encourage respondents to actively listen to the presentation and to foster interaction between instructor and respondent we include several pedagogical tools such as a presentation, a booklet and individual exercises. We design a presentation and a detailed booklet to deliver the training content. Besides written

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<sup>1</sup>See: [https://www.bou.or.ug/opencms/bou/bou-downloads/Financial\\_Inclusion/Core-Messages-Financial-Literacy\\_August-2013.pdf](https://www.bou.or.ug/opencms/bou/bou-downloads/Financial_Inclusion/Core-Messages-Financial-Literacy_August-2013.pdf), last checked on August 17th, 2018.

<sup>2</sup>On average, 28 minutes are spent for the rule-of-thumb training and 32 minutes for the personalized training. The time spent for training is not different at any conventional significance level.

explanations of training contents, we include graphs and figures to illustrate concepts. The individual exercises include reflections about business investments and household budget. These reflections are noted down in the booklet. Another exercise is a discussion on the advantages and disadvantages of savings and borrowing for investments.

Our intervention was implemented in late 2017. Prior to implementation, we piloted all three trainings on a local market in July 2017 in Kampala. Baseline information was collected among 503 MSEs beginning of September. Of these, 166 were assigned to the rule-of-thumb training, 168 to the personalized training and 169 to the control group. The intervention was implemented during another round of business visits immediately after the baseline survey. The endline data was collected six months after treatment implementation. We successfully treated 491 people and interviewed 459 entrepreneurs during our endline survey in April 2018.

## 5.2.2 Empirical Strategy

We estimate causal treatment effects by comparing both treatment groups (rule-of-thumb and personalized training) to our control group. As entrepreneurs were randomly assigned to one of the treatments, we obtain unbiased estimates by estimating the effect of being assigned to one training by the following equation:

$$y_i = \alpha + \beta_1 \text{RoT}_i + \beta_2 \text{PT}_i + \theta y_{i(t-1)} + \epsilon_i \quad (5.1)$$

where  $y_i$  is the outcome variable,  $\text{RoT}_i$  is an indicator for being assigned to the rule-of-thumb training,  $\text{PT}_i$  is an indicator for being assigned to the personalized training and  $y_{i(t-1)}$  is the pre-treatment measure of the outcome variable. The parameters  $\beta_1$  and  $\beta_2$  give the intention-to-treat (ITT) effect, which is the effect of being assigned to one of the trainings. In case  $y_i$  is binary we estimate a linear probability model.

In our analysis, we are interested in the overall effectiveness of each training. Hence, we test whether the effect of personalized or rule-of-thumb training on families of related outcomes is significantly different from zero (Duflo et al., 2007). We aggregate these variables to a standardized index following (Kling et al.,

2007). The index  $z$  is the average of all  $i=1, \dots, I$  standardized variables belonging to a family of outcomes. Specifically,  $z = \sum_{i=1}^I z_i^*$  where  $z_i^* = \frac{y_i - \mu_i}{\sigma_i}$ , where  $y_i$  is an outcome variable, and  $\mu_i$  and  $\sigma_i$  are the mean and standard deviation of the respective outcome variable of the control group.

## 5.3 Data

This section describes the sampling process of our study and the major differences between the different industry sectors represented in the sample (Section 5.3.1), the outcome variables (Section 5.3.2) and baseline data (Section A.1).

### 5.3.1 Sample

Our intervention is conducted among a sample of micro and small enterprises (MSEs) in Kampala, Uganda. As part of the sampling process, 220 administrative areas (zones) with predominant business activity were identified. Subsequently, 21 zones were randomly selected for a door-to-door screening. Based on this a sample of 450 enterprises were drawn in 2012. The sample contains 200 enterprises in each the retail and the manufacturing sectors and 50 enterprises in the services sector. The annual sample was expanded to around 500 MSEs in 2015.

The three industry sectors covered in the sample have quite distinct characteristics.<sup>3</sup> Table 5.1 shows descriptive differences between the industry sectors at our baseline of the intervention in 2017. The share of female owned enterprises is highest in the services sector (60 percent). This is not surprising as most of this businesses operate in the field of hairdressing and beauty which are mostly owned by women. The sectors are also quite heterogeneous with respect to the educational level of the entrepreneur. While the overall share of entrepreneurs with upper secondary degree and higher (high skilled) is 34 percent in the overall sample, this share is 15 percentage points lower among businesses in the services sector and 8 percentage points higher in the retail sector. The average capital stock is highest in the manufacturing sector, whereas the average amount in inventory is highest in the retail sector (whereby 89 percent is stock in finished

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<sup>3</sup>There are some businesses which change their industry sector to one which is different from manufacturing, retail and services sector. This are 17 businesses. Due to this low number, the descriptives are neglected for this group.

goods and 11 percent in raw materials). Accompanied with high levels of capital stock and inventory in these groups, the number of sales in both groups outnumber the sales of the services sector by far.

Table 5.1: Pre-Intervention Descriptive Statistics of Industry Sectors

	All		Services Sector		Manufacturing Sector		Retail Sector	
	n	mean	n	mean	n	mean	n	mean
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female	460	0.40	53	0.60	225	0.31	165	0.46
High skilled	460	0.34	53	0.19	225	0.29	165	0.42
Capital stock	458	5195.53	53	2613.72	224	8033.18	164	2109.68
Inventory	460	3935.41	53	1389.94	225	1723.42	165	7249.16
Sales	459	7179.37	53	1824.92	225	7791.31	164	7774.15

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* The table shows baseline descriptive statistics for the services sector, manufacturing and retail sector.

### 5.3.2 Outcome Variables

In the following analysis we present treatment effects for variables which are related to investments, savings, profit, diversification, separation of finances and record keeping.

Among the *investment* related outcomes are variables which reflect the physical capital and the inventories. We use the variable whether the respondent has any new physical capital and the total value of physical capital purchased since the last interview wave. By physical capital we mean capital invested in tools, machines, furniture or other items which are used in the production process. Further, we use the amount of the current stock of inventory, which are either raw materials or finished goods. We use several outcomes related to *savings*. We use an indicator whether someone has any savings and the total amount of savings held on any savings device. Further, we divide savings into formal savings (held on bank accounts or with savings and credit cooperatives (SACCOs)) and informal savings (held with a rotating savings and credit association (ROSCA), money collector, at home, with friends or neighbours, and on a mobile money account).

We use several variables related to the *profit* of the firm. A survey question that directly asks for the firms' profit in the last four weeks as suggested by De Mel et al. (2009) is included. In addition, we use the value added which is calculated as revenues minus costs. For the calculation of value added we directly ask the entrepreneur for the total revenues (sales) and costs in the last month. The intervention includes a training module on business investment and growth strategies. To prevent that entrepreneurs blindly invest, we include a section on *risk diversification*. We use two proxy variables to measure risk diversification. First, we included the number of investments in business equipment since the last interview. Secondly, we included a measure for the number of different categories in which goods have been purchased (the potential categories are machines, tools, furniture or other equipment).

We estimate the effect of training on several statements related to *separating finances between business and household*. The answer category of each statement is based on a four point Likert scale ranking from 1="never", 2="rarely", 3="sometimes" to 4="almost always". For the analysis, an indicator variable is used whereby the value of 1 comprises the answer categories "sometimes and almost always" and of "never and rarely". The first two statements refer to whether the respondent keeps accounts and cash separate between the business and household. Another two questions refer to whether money or goods which are taken from the business for household purposes are paid back. We use a question whether the respondent makes a household budget. Lastly, we use a statement which asks how often money which is set aside for the business is used for the household. For this item, the indicator is reversed so that lower answer categories are associated with improved behavior (Table D.2 provides an overview on the exact statements). Lastly, we use an item that captures whether the entrepreneur *keeps records* in the business.

### 5.3.3 Descriptive Statistics

Table 5.2 provides pre-intervention characteristics for the baseline by treatment status along with p-values for differences between the control and both treatment groups. As the entrepreneurs were randomly assigned to each group, we expect them to be similar at baseline. The p-values indicate, that there are no significant



Table 5.2: Pre-Intervention Descriptive Statistics

	Obs.	Full Sample Control (C)	Rule-of-Thumb Training	Personalized Training			
		mean (sd)	mean (sd)	mean (sd)	Diff. from C	mean (sd)	Diff. from C
					[p-value]		[p-value]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>A. Entrepreneur Characteristics</b>							
Age	455	37.57 (9.98)	37.80 (9.97)	37.13 (9.70)	-0.67 [0.55]	37.78 (10.32)	-0.02 [0.99]
HH size	460	4.38 (2.36)	4.50 (2.26)	4.23 (2.41)	-0.27 [0.32]	4.42 (2.42)	-0.07 [0.79]
Female	460	0.40 (0.49)	0.42 (0.50)	0.39 (0.49)	-0.03 [0.56]	0.40 (0.49)	-0.03 [0.66]
High Skilled	460	0.34 (0.47)	0.31 (0.46)	0.37 (0.48)	0.05 [0.32]	0.34 (0.48)	0.03 [0.60]
<b>B. Business Characteristics</b>							
Own-account	458	0.50 (0.50)	0.49 (0.50)	0.50 (0.50)	0.02 [0.77]	0.50 (0.50)	0.01 [0.86]
Capital stock	458	5,195.53 (20,964.71)	3,976.03 (11,257.80)	4,709.12 (10,859.18)	733.09 [0.56]	6,917.54 (32,950.72)	2,941.51 [0.30]
Inventory	460	3,935.41 (9,111.99)	3,161.66 (6,731.71)	4,253.80 (10,762.94)	1,092.14 [0.29]	4,374.39 (9,326.52)	1,212.73 [0.20]
Sales	459	7,179.37 (15,596.33)	5,593.36 (8,701.98)	8,417.63 (19,815.10)	2,824.27 [0.11]	7,471.73 (15,942.95)	1,878.37 [0.21]
Profit	451	718.38 (1,114.19)	596.71 (987.22)	787.83 (1,208.25)	191.11 [0.13]	766.33 (1,128.40)	169.62 [0.17]
Saving	460	1,316.99 (2,643.26)	1,248.86 (2,588.04)	1,418.35 (2,923.83)	169.49 [0.59]	1,280.88 (2,398.86)	32.02 [0.91]
Investment	460	640.85 (2,099.80)	597.18 (1,973.92)	674.85 (2,283.09)	77.67 [0.75]	649.29 (2,037.37)	52.11 [0.82]
<b>C. Business Outcomes Indices</b>							
Investment index	460	0.05 (1.13)	0.00 (1.00)	0.11 (1.17)	0.11 [0.37]	0.05 (1.22)	0.05 [0.69]
Saving index	460	0.07 (1.03)	0.00 (1.00)	0.15 (1.14)	0.15 [0.22]	0.06 (0.94)	0.06 [0.57]
Profit index	441	0.07 (1.31)	0.00 (1.00)	0.17 (1.73)	0.17 [0.29]	0.03 (1.08)	0.03 [0.78]
Separation index	446	-0.05 (1.04)	0.00 (1.00)	-0.04 (0.99)	-0.04 [0.72]	-0.11 (1.12)	-0.11 [0.38]
Diversification index	460	0.00 (0.99)	0.00 (1.00)	0.02 (0.96)	0.02 [0.88]	-0.03 (1.01)	-0.03 [0.81]
Record keeping	460	0.31 (0.46)	0.34 (0.48)	0.32 (0.47)	-0.02 [0.66]	0.27 (0.45)	-0.07 [0.19]

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* Standard deviations are in parenthesis, p-values for differences of means appear in square brackets. The table provides summary statistics of baseline data and mean comparisons between rule-of-thumb training and control group (Column (5)) and personalized feedback and control group (Column (7)).

differences between the groups regarding entrepreneurial, business characteristics or the indices aggregated over families of outcomes. Panel (A) provides socio-economic background characteristics of the entrepreneur in our sample. The table shows that respondents are on average 38 years old, share a household with 4 other persons, 40 percent of the businesses are run by a women and 34 percent are high skilled, meaning they have a upper secondary school degree (A-level) or higher. Panel (B) characterizes the businesses which operate in 50 percent of the cases without employees as own-account workers. The average business operates with capital that is on the one hand invested in physical capital (5,195,000 UGX, approx. 1,400 USD).<sup>4</sup> This is capital invested in machines, tools, furniture or other equipment used in production. On the other hand the businesses have capital invested in inventory which comprises of raw materials used in production and finished goods which are ready for sale to customers (3,935,000 UGX, approx. 1,000 USD). The average monthly sales are of around 7,170,000 UGX, which after taking into account all costs yields to self-reported profits of 718,000 UGX. The accumulated savings are almost twice the monthly profits and average investments conducted in the last 12 months are around 12 percent of the total capital stock.

## 5.4 Results

This section describes the causal treatment effects on different families of outcome variables. While Section 5.4.1 summarizes the effects on aggregated outcomes measured as indices, Section 5.4.2 sheds light on the effect of the single components belonging to each outcome family with economically meaningful results. Finally, Section 5.4.3 further examines one group of entrepreneurs which seems to be of particular interest, i.e. those with savings goals.

### 5.4.1 Main Treatment Effects

We show the effects of the personalized feedback (PT) training and the rule-of-thumb (RoT) training on business outcomes. The relationship between both

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<sup>4</sup>To account for enumeration errors, financial outcomes used in our analysis are winsorized at the 99<sup>th</sup> percentile, see Campos et al. (2017); Karlan et al. (2015); Blattman et al. (2014); Bruhn et al. (2018) who apply the same approach.

trainings and the outcome measures is estimated using an analysis of covariance (ANCOVA) estimation (McKenzie, 2012). The reported results, i.e. average intent-to-treat (ITT) effects and respective standard errors are reported in Table 5.3 for all six different families of business outcomes: investment, savings, profits, risk diversification, separation of finances, and lastly an indicator for record keeping. While results on these outcomes are shown in columns (1) to (6), column (7) shows the result on the index of all other six outcome indices. The presented coefficients can be interpreted as the standardized mean difference compared to the control group. For example, the personalized feedback training increases the investment index by 0.170 standard deviation units of the control group.

Table 5.3: Main Treatment Effects

	Investment Index (1)	Savings Index (2)	Profits Index (3)	Risk Div. Index (4)	Separating Finances Index (5)	Record keeping all Indices (6)	Index over all Indices (7)
Personalized Training	0.17 (0.114)	0.279** (0.115)	0.217 (0.141)	0.197 (0.121)	-.028 (0.113)	0.019 (0.05)	0.258** (0.117)
Rule-of-Thumb Training	0.117 (0.124)	0.08 (0.121)	0.027 (0.108)	0.099 (0.114)	0.127 (0.103)	0.032 (0.051)	0.178* (0.107)
PT-RoT=0 (p-value)	0.69	0.14	0.22	0.42	0.13	0.78	0.49
R <sup>2</sup>	0.14	0.18	0.31	0.06	0.06	0.19	0.21
Mean (SD) of control group	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.34 (0.47)	0.00 (1.00)
Observations	460	460	441	460	446	460	429
Control for $y_{t-1}$	yes	yes	yes	yes	yes	yes	yes
Control for industry strata	yes	yes	yes	yes	yes	yes	yes

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Detailed treatment effects on variables belonging to the “separating finances index” can be found in Appendix Table D.4.

Overall we find that the coefficients of both types of trainings are positive, indicating that business outcomes develop in the intended direction due to the training intervention. The only exception is the separation of finances index, where the estimated coefficient of the personalized feedback training has a negative sign. However, this coefficient is close to zero and not significant. Beyond the expected coefficient signs we find that their sizes are indeed quite large given the short training intervention of about half an hour.

Given the mentioned limited statistical power of our study we form an index of all six indices (henceforth overall index) to test whether the treatments do have an effect overall, and indeed, this is the case: The effect size of the personalized treatment is 0.258 and highly significant, while the effect of the RoT-treatment is also sizeable 0.178 and marginally significant. To probe these estimates, we conduct a robustness analysis with regard to the construction of the overall index. The alternative summary indices are found in Appendix Table D.3. For better comparison, Column (1) shows again the overall index (from Table 5.3, Column (7)). In Column 2 of Table D.3, we provide an alternative summary measure which is an average index over all 20 (standardized) variables used as outcome variables in this analysis. Compared to the overall index, the effect of the personalized training is similar in magnitude and significance. The effect of the rule-of-thumb training, however, reduces slightly in magnitude and significance. Both average indices in Columns (1) and (2) simply weight each component of the index equally. An alternative option is to assign weights to each variable. Hence, we construct alternative summary indices using the method of principal components to determine the weight of each single variable (Filmer and Pritchett, 2001). Typically, a principal component analysis (PCA) is used to reduce the numbers of correlated variables to a smaller number of “dimension”. Column (3) shows estimates when the indices are aggregated using PCA. While PCA was initially constructed for variables that are multivariate normal distributed, Column (4) reports an PCA index that allows for ordinal variables and does not rely on a multivariate normal distribution (Kolenikov and Angeles, 2004). Our results underpin the overall effectiveness of our intervention. The effect of the personalized training on aggregated indices is relatively robust to the specification of the index.

Next we look at the effects on the six outcome families presented in Columns (1) to (6) in Table 5.3. The results show, that the first four outcomes quite consistently have been affected by an effect size of 0.08 and more (with just one exception in eight cases). In remarkable contrast to these positive results, the effect of the treatments on “separating finances” (into business and private purposes) and “record keeping” are negligible with one exception, i.e. the RoT-treatment on separating finance. This is a bit surprising as generally such elements of business practices have larger effects due to financial education (Kaiser and Menkhoff (2017)). The reason for this difference across outcomes may be either

a decline in attention over the training, as the order of columns in Table 5.3 repeats the order during trainings; however, there is no statistically significant decline in coefficients across the six outcomes. An alternative interpretation may be that the outcomes of separating finances and record keeping need more time for a successful training, in particular some exercises may be necessary.

Turning to the four outcome families with more encouraging results, we find a significant effect of the personalized training on the savings index. This ITT effect is large with 0.279, i.e. more than one fourth of a standard deviation for the control group. For the investment, profit, and risk diversification index we find medium to large effect sizes ranging between 0.170 and 0.217 standard deviation units. As the estimated minimum detectable effect (MDE) size is 0.26, we are not powered to detect effect sizes below. Hence, we cannot rule out a non-zero effect of the personalized training on these indices.

Coefficients are smaller when we turn to the RoT-training. Still, three coefficients are around 0.1 and only the coefficient regrading “profits” is really small with 0.027. Finally, we want to mention that also an index of financial literacy has been measured in both waves, i.e. before and after the treatments. However, as the training does not teach anything regarding financial literacy, it does not seem to be surprising that we do not find effects.

## 5.4.2 Treatment Effects on Single Components

In this section we present the causal effect of each training on the components that belong to one family of outcome measures. We cover the first four outcomes from Table 5.3, because the outcomes of business practices were not affected by either treatments. In the order of presentation from above, we start with the effects on investment variables.

**Investment.** The investment index is made up by three variables, i.e. the decision to purchase physical capital, the amount invested in physical capital since the baseline survey (without land and vehicles) and the change in inventory amount. Based on the fact of investments in physical capital by 66 percent of the control group, the treatments increase this ratio by about 2-3 percent, i.e. not by very much (see Table 5.4, column 2). Accordingly, this effect is not significant. While also investment amounts do not change to a statistically significant degree, the effects seem to be economically important: the personalized treatment leads

to 17 percent higher physical capital and to even more than 22 percent higher inventories, the respective numbers for the RoT-treatment are 0 and 22.6 percent.

Table 5.4: Investment

	Invest Index (1)	Invest yes/no (2)	Invest Amount (3)	Inventory Amount (4)
Personalized Training (PT)	0.17 (0.114)	0.015 (0.056)	75.554 (102.994)	937.746 (859.862)
Rule-of-Thumb Training (RoT)	0.117 (0.124)	0.037 (0.057)	-10.646 (93.257)	905.266 (940.642)
PT-RoT=0 (p-value)	0.69	0.70	0.39	0.98
R <sup>2</sup>	0.14	0.02	0.09	0.35
Mean (SD) of control group	0.00 (1.00)	0.66 (0.48)	440.09 (1523.04)	4192.62 (11798.13)
Observations	460	460	460	460
Control for $y_{t-1}$	yes	yes	yes	yes
Control for industry strata	yes	yes	yes	yes

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Savings.** The effects on the components belonging to the savings index are reported in Table 5.5. We find no evidence, that any of the trainings changed the extensive margin, meaning the number of business owners who save (Column (2)). However, we find that the assignment to personalized feedback training significantly increases the overall savings (column (3)). This group increased their savings by 381,000 UGX (100 USD), which is around 32 percent of the savings of the control group. Distinguishing between the effect of training on formal and informal savings (columns (4) and (5)) shows that the magnitude of the overall increase in total savings (column (3)) is driven by both forms of savings, although only the effect on informal savings is significant. As with investments, the effects of the RoT-trainings are smaller and do not indicate significant changes in our relatively small sample.

Table 5.5: Savings

	Savings Index (1)	Savings (yes/no) (2)	Savings Total (3)	Savings Formal (4)	Savings Informal (5)
Personalized Training (PT)	0.279** (0.115)	0.023 (0.034)	381.796* (220.381)	262.798 (211.544)	162.008*** (56.485)
Rule-of-Thumb Training (RoT)	0.08 (0.121)	-.010 (0.036)	237.160 (241.787)	279.123 (250.938)	27.393 (54.969)
PT-RoT=0 (p-value)	0.14	0.33	0.58	0.95	0.05
R <sup>2</sup>	0.18	0.05	0.22	0.23	0.11
Mean (SD) of control group	0.00 (1.00)	0.88 (0.33)	1195.49 (2145.50)	953.60 (2121.08)	254.47 (335.76)
Observations	460	460	460	460	460
Control for $y_{t-1}$	yes	yes	yes	yes	yes
Control for industry strata	yes	yes	yes	yes	yes

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Profits.** Further, we look at profits and their potential components and find that the personalized feedback training has a significant effect on the change in sales. Table 5.6 shows that the personalized feedback training has positive effects on

Table 5.6: Profits

	Profit Index (1)	Profit (2)	Value added (3)	Sales (4)	Costs (5)
Personalized Training (PT)	0.217 (0.141)	26.285 (81.195)	489.389 (439.134)	2141.606* (1246.624)	844.071 (863.891)
Rule-of-Thumb Training (RoT)	0.027 (0.108)	119.600 (91.587)	-281.833 (638.359)	-170.905 (737.082)	-42.370 (770.022)
PT-RoT=0 (p-value)	0.22	0.30	0.19	0.08	0.31
R <sup>2</sup>	0.31	0.16	0.03	0.31	0.44
Mean (SD) of control group	0.00 (1.00)	514.23 (731.50)	710.43 (4414.15)	4653.39 (7503.99)	3874.38 (7950.07)
Observations	441	441	441	441	441
Control for $y_{t-1}$	yes	yes	yes	yes	yes
Control for industry strata	yes	yes	yes	yes	yes

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

profits, value added, sales and costs. However, only the effect on sales is significant. While the average sales of the control group are 4,653,000 (1,226 USD), the sales of the personalized training are of 46 percent larger. Surprisingly, the average treatment effect of the rule-of-thumb group on sales is negative, which leads to a significant difference between the effects of both treatment groups. Overall, the RoT-trainings does not have much impact on the profit variables.

**Risk diversification.** Table 5.7 shows the effect of both trainings on two items related to risk diversification. All four coefficients are positive and quite sizable. In particular, we find that the personalized feedback significantly increases the number physical capital items the business owner invests in.

Table 5.7: Diversication

	Diversification Index	Number Investments	Number Investment Categories
	(1)	(2)	
Personalized Training (PT)	0.197 (0.121)	0.308* (0.185)	0.137 (0.098)
Rule-of-Thumb Training (RoT)	0.099 (0.114)	0.118 (0.171)	0.091 (0.092)
PT-RoT=0 (p-value)	0.42	0.29	0.64
R <sup>2</sup>	0.06	0.08	0.04
Mean(SD)of control group	0.00 (1.00)	1.17 (1.56)	0.76 (0.79)
Observations	460	460	460
Control for $y_{t-1}$	yes	yes	yes
Control for industry strata	yes	yes	yes

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

### 5.4.3 Analysis of Entrepreneurs with Savings Goals

In order to better understand potential mechanisms that lead to the observed effects, we analyze one group relative to the sample average. We focus on a group



where we expect more openness towards the trainings due to their *ex-ante* shown commitment as entrepreneurs. As proxy variable for an entrepreneurial spirit we take those who report before the treatments that they follow business savings goals, around 60 percent of the sample say so. We motivate this proxy variable by early studies that show a positive relationship between goal setting and performance (Locke, 1968).

Table 5.8: Pre-Intervention Descriptive Statistics for Savings Goal Group

	All		Saving Goal	
	n	mean	n	mean
	(1)	(2)	(3)	(4)
Age	455	38.57	310	38.1
HH size	465	0.98	314	0.99
Female	458	0.41	312	0.42
High skilled	460	0.34	314	0.38
Own-account worker	464	0.51	314	0.49
Savings	465	1424.82	314	1649.3
Investment	465	290.92	314	339.71
Sales	465	6368.83	314	6418.92
Profit	460	598.22	311	631.17
Capital stock	465	5224.73	314	6117.81
Inventory	465	4447.4	314	4850.55

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* The table shows baseline descriptive statistics for the overall sample (Columns (1) and (2)) and the group that specifies an *ex-ante* intervention saving goal (Columns (3) and (4)).

Table 5.8 shows characteristics of the average sample and the savings goal group. Both groups are similar *ex-ante* in terms of age, the share of females, and own-account workers. The share of high skilled entrepreneurs is 4 percentage points higher for the group that sets goals. Descriptive statistics also show, that the savings goal group has slightly better business outcomes: their savings, investments, sales, and inventories are higher on average. Despite slightly better business outcomes, there is no evidence that the goal setting group outperforms the average sample by much. However, if the savings goal group gets stimulated by our intervention, they increase their savings, this can be used as working capital in order to increase inventory and sales.

Table 5.9: Main Treatment Effects for Entrepreneurs with Business related Saving Goal

	Investment Index	Savings Index	Profit Index	Risk Index	Separation Div. Finances	Record keeping all Indices	Index over all Indices
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Personalized Training	0.266* (0.143)	0.312** (0.15)	0.205 (0.165)	0.152 (0.147)	0.015 (0.137)	0.02 (0.061)	0.333** (0.148)
Rule-of-Thumb Training	0.216 (0.154)	0.069 (0.147)	-0.083 (0.116)	0.099 (0.139)	0.126 (0.125)	0.075 (0.061)	0.21 (0.13)
PT-RoT=0 (p-value)	0.76	0.15	0.09	0.70	0.34	0.34	0.42
R <sup>2</sup>	0.17	0.15	0.28	0.07	0.05	0.15	0.13
Mean (SD) of control group	0.00 1.00	0.00 1.00	0.00 1.00	0.00 1.00	0.00 1.00	0.29 0.46	0.00 1.00
Observations	314	314	300	314	305	314	292
Control for $y_{t-1}$	yes	yes	yes	yes	yes	yes	yes
Control for industry strata	yes	yes	yes	yes	yes	yes	yes

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Next, we examine the treatment effects for those stating an *ex-ante* savings goals only. Table 5.9 shows that treatment effects improve in 3 out of 7 categories (including the index over all indices). It is noteworthy, that the personalized treatment performs much better than the rule-of-thumb training. In particular, the outcome families of investment and savings increase, with effect sizes between 0.266 and 0.312. Looking at the effect of personalized training on single treatment components underpins that the saving goal group benefits from this training. While the savings increase in the total sample is 63 percent, the savings goal group increased their savings by 71 percent. Even stronger is the effect for this group on inventories, which is 64 percent, 42 percentage points higher than in the overall sample. In addition, the ITT effect of personalized training on profit and sales is larger for the savings goal group than for the overall sample. This picture fits to the example given by Banerjee and Duflo (2012) (Chapter 11), the shopkeeper with (almost) empty shelves, where an increase in capital may help to fill shelves and thus to increase sales, although only to a limited extent. The

increase in capital here, comes from the ex-ante specified savings goals, whereby the personalized training helps in pursuing these goals.

## 5.5 Conclusion

Financial education is a standard tool in upgrading small entrepreneurs as their deficits in financial understanding are obvious and obviously limit the development of their businesses. In order to best use scarce training resources various proposals on training design have been made, among which a “rule-of-thumb” training seems to deliver. Another way to improve the effectiveness of financial education is counseling, i.e. basically an individualized training. While this also works well, it is obviously costly. Thus we here follow an approach in between conventional class size training and fully individualized training which we call “personalized feedback”.

This treatment proceeds as follows: we design a training that covers the topics of financial management, business investment and growth, and separating business and household finances. The length is reduced to about half an hour to keep it cost effective. We apply the rule-of-thumb approach. Then trainers visit entrepreneurs at their business, teach them and afterwards leave a small booklet which contains the training content. This is rule-of-thumb training at the workplace and is provided to one treatment group. Another treatment group receives the personalized training which is exactly the same rule-of-thumb training plus the personalized add-on, i.e. information from the baseline on how the individual entrepreneur behaves and the firm financially performs.

We find that rule-of-thumb succeeds as expected but that the personalized feedback has a surprisingly large additional impact. Simplifying results it seems fair to say that the add-on does not change the structure of impacts across outcomes but that it mainly amplifies the effectiveness. The effect is not driven by more input as the rule-of-thumb training needs on average 28 minutes and the add-on another 4 minutes, i.e. 14 percent longer, while the effect is 45 percent larger.

This raises the question where do these large effects come from? First of all, it is known that financial education trainings work in general, that a rule-of-thumb training tentatively works even better and that savings are typically

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the most successful outcome area. All this is confirmed by our study, so that neither effect size nor structure of effects is surprising. However, the size effect of the personalized feedback is a new result. Obviously this information supports a change in behavior, probably as entrepreneurs get more involved and better recognize that the training is directly related to their own business. Of course, this result creates new questions which may be addressed in later research: first, what about the external validity of this single RCT? Second, which elements of the personalized feedback are crucial for its success? Third, and related to the question before, can we say more about the mechanisms which make the personalized feedback so successful? This would help to use this kind of treatment specifically for those groups and situations where it provides the most benefit.

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# Appendix A - Appendix for Chapter 2

Table A.1: Summary Statistics of Explanatory Variables

	(1)	(2)	(3)
	No Training	General Training	Specific Training
Number of Observations <sup>a</sup>	8,150	1,730	961
Locus of Control <sup>b,c</sup>	4.40	4.59 ***	4.46 **
Wage Expectations <sup>d,c</sup>	14.60	22.34 ***	15.05
Share with Expectation of 0%	0.58	0.48	0.61
Realized Gross Wage (per hour) in t+1 (in €) <sup>c,e</sup>	13.71	17.15 ***	16.21 ***
<b>Socio-Economic Variables</b>			
Age <sup>c</sup>	42.92	41.74 ***	43.24
Female	0.48	0.45 *	0.44 **
Married	0.74	0.71 ***	0.74
Number of Children <sup>c</sup>	0.69	0.70	0.64
Disabled	0.06	0.05 *	0.06
German Nationality	0.90	0.97 ***	0.96 ***
Owner of House/Dwelling	0.53	0.58 ***	0.58 ***
No School Degree	0.02	0.00 ***	0.00 ***
Lower/Intermediate School Degree	0.76	0.56 ***	0.63 ***
Highschool Degree	0.22	0.44 ***	0.36 ***
No Vocational Training	0.27	0.27	0.23 **
Apprenticeship	0.47	0.38 ***	0.38 ***
Vocational School	0.26	0.35 ***	0.38 ***
University Degree	0.19	0.38 ***	0.36 ***
Work Experience (FT + PT) (in years) <sup>c</sup>	18.69	16.93 ***	18.94
Unemployment Experience (in years) <sup>c</sup>	0.65	0.41 ***	0.35 ***
Real Net HH income last month of 2 years ago (in 1000 €) <sup>c</sup>	2.76	3.03 ***	3.02 ***
<b>Regional Information</b>			
East Germany	0.26	0.28 *	0.33 ***
South Germany	0.28	0.25 ***	0.21 ***
North Germany	0.11	0.11	0.11
City States	0.05	0.06 ***	0.06 *
Unemployment Rate <sup>c</sup>	9.73	9.78	10.36 ***
GDP <sup>c</sup>	26.69	27.29 ***	26.24 *
<b>Job-Specific Characteristics</b>			
White-collar Worker	0.53	0.75 ***	0.65 ***
Blue-collar Worker	0.42	0.13 ***	0.16 ***
Member Tradeunion	0.19	0.20	0.27 ***
Member Tradeassociation	0.05	0.12 ***	0.11 ***
High Occupational Autonomy	0.19	0.44 ***	0.36 ***
Manager	0.14	0.32 ***	0.22 ***
Tenure (in years) <sup>c</sup>	11.09	11.32	13.96 ***
Contract - Permanent	0.34	0.40 ***	0.40 ***
Contract - Temporary	0.60	0.56 ***	0.56 **
Contract - Other	0.06	0.04 ***	0.05 *



	<i>Table continued from previous page</i>		
	(1)	(2)	(3)
	No	General	Specific
	Training	Training	Training
Managers (ISCO88)	0.05	0.09 ***	0.06
Professionals (ISCO88)	0.12	0.28 ***	0.25 ***
Technicians and associate professionals (ISCO88)	0.21	0.32 ***	0.31 ***
Clerical support workers (ISCO88)	0.12	0.09 ***	0.13
Service and sales workers (ISCO88)	0.11	0.08 ***	0.09 ***
Skilled agricultural, forestry and fishery workers (ISCO88)	0.01	0.01	0.01
Craft and related trades workers (ISCO88)	0.17	0.10 ***	0.10 ***
Plant and machine operators, and assemblers (ISCO88)	0.10	0.03 ***	0.04 ***
<b>Firm-Specific Characteristics</b>			
Small Firmsize	0.57	0.46 ***	0.36 ***
Medium Firmsize	0.22	0.24 **	0.26 ***
Large Firmsize	0.21	0.30 ***	0.38 ***
NACE - Manufacturing	0.13	0.13	0.10 **
NACE - Agriculture	0.01	0.01 *	0.02 *
NACE - Mining, Quarrying, Energy, Water	0.01	0.02 ***	0.02 ***
NACE - Chemicals/Pulp/Paper	0.07	0.04 ***	0.04 ***
NACE - Construction	0.07	0.04 ***	0.03 ***
NACE - Iron/Steel	0.06	0.03 ***	0.03 ***
NACE - Textile/Apparel	0.01	0.00 ***	0.00 ***
NACE - Wholesale/Retail	0.14	0.08 ***	0.07 ***
NACE - Transportation/Communication	0.05	0.04 **	0.05
NACE - Public Service	0.26	0.42 ***	0.45 ***
NACE - Financials/Private Services	0.12	0.13	0.13
<b>Personality Characteristics</b>			
Big Five Factor Openness <sup>c</sup>	4.35	4.62 ***	4.49 ***
Big Five Factor Conscientiousness <sup>c</sup>	6.01	5.98	5.88 ***
Big Five Factor Extraversion <sup>c</sup>	4.77	4.95 ***	4.82
Big Five Factor Agreeableness <sup>c</sup>	5.36	5.35	5.26 ***
Big Five Factor Neuroticism <sup>c</sup>	3.88	3.69 ***	3.81 *

*Source:* Socio-Economic Panel (SOEP), waves 1999-2011, version 29, doi:10.5684/soep.v29, own calculations. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

*Notes:* Table shows mean values of explanatory variables by training status. Result of mean comparison tests are indicated by asterisks. The test compared non-training participants to specific and general training participants. The summary statistics in columns (2) and (3) refer to those people who exclusively participate in general or specific training.

<sup>a</sup> The number of non-training, general and specific training participants does not add up to the estimation sample size as 131 people participate in general and specific training which are excluded from the descriptives.

<sup>b</sup> The locus of control index in the descriptives table is the average sum over all internal and reversed external items.

<sup>c</sup> Denotes continuous variable.

<sup>d</sup> Wage expectations refer to the perceived likelihood of receiving a pay raise above the rate negotiated by the union of staff in general in the next two years.

<sup>e</sup> The number of observations for non-training participants are 7,548, for general 1,640 and for specific 919.

Table A.2: Logit Estimation Results: Participation in Training, General Training, Specific Training

	(1) Training	(2) General Training	(3) Specific Training
Locus of Control (std.)	0.013*** (0.004)	0.016*** (0.004)	-.001 (0.003)
Age	-.001 (0.001)	-.001 (0.001)	0.00002 (0.0008)
Female	-.026** (0.011)	-.014 (0.009)	-.013* (0.007)
Married	0.0007 (0.011)	-.003 (0.009)	-.0004 (0.008)
Number of Children	-.001 (0.005)	0.0004 (0.005)	0.0009 (0.004)
Disabled	-.028 (0.019)	-.013 (0.016)	-.027* (0.014)
German Nationality	0.069*** (0.021)	0.06*** (0.02)	0.023 (0.016)
Owner of House/Dwelling	0.013 (0.009)	0.012 (0.008)	0.0004 (0.007)
School Degree (Ref.: Low/Intermed. School)			
No Degree	-.113 (0.077)	-.104 (0.095)	-.048 (0.05)
Highschool Degree	0.015 (0.013)	0.02* (0.011)	-.007 (0.008)
Vocational Education (Ref.: Non)			
Apprenticeship	0.065*** (0.013)	0.04*** (0.011)	0.031*** (0.009)
Vocational School	0.088*** (0.013)	0.051*** (0.011)	0.039*** (0.009)
University or College Degree	0.042*** (0.014)	0.013 (0.012)	0.031*** (0.009)
Work Experience (FT + PT)	-.002 (0.001)	-.002 (0.001)	-.0008 (0.0008)
Unemployment Experience	-.006 (0.005)	-.001 (0.004)	-.005 (0.003)
Real Net HH income last month of 2 years ago (in 1000 €)	-.008** (0.003)	-.005 (0.003)	-.002 (0.002)
East Germany	0.035 (0.021)	0.025 (0.018)	0.016 (0.015)
South Germany	-.020 (0.014)	-.013 (0.012)	-.010 (0.01)
North Germany	-.013 (0.015)	-.005 (0.013)	-.004 (0.01)
City States	-.003 (0.021)	0.002 (0.018)	-.007 (0.014)

	<i>Table continued from previous page</i>		
	(1)	(2)	(3)
	Training	General Training	Specific Training
Unemployment Rate	-.0005 (0.002)	-.001 (0.002)	0.0003 (0.002)
GDP	0.0009 (0.0009)	0.001* (0.0008)	-.0002 (0.0007)
Dummy for year 2000	-.014 (0.017)	-.020 (0.015)	-.008 (0.012)
Dummy for year 2004	-.014 (0.017)	-.015 (0.015)	0.002 (0.013)
White-collar Worker	-.065*** (0.023)	0.006 (0.019)	-.051*** (0.014)
Blue-collar Worker	-.217*** (0.027)	-.126*** (0.024)	-.097*** (0.018)
Member Trade Union	0.031*** (0.011)	0.014 (0.01)	0.016** (0.007)
Member Trade Association	0.039** (0.015)	0.034*** (0.013)	0.009 (0.01)
High Occupational Autonomy	0.059*** (0.021)	0.065*** (0.019)	-.004 (0.015)
Manager	-.003 (0.023)	-.009 (0.02)	0.00006 (0.016)
Tenure	0.0009 (0.0006)	-.0002 (0.0005)	0.001*** (0.0004)
Contract - Permanent	0.02 (0.016)	0.006 (0.013)	0.017 (0.011)
Contract - Other	-.048** (0.021)	-.028 (0.019)	-.008 (0.014)
Managers (ISCO88)	0.181*** (0.031)	0.133*** (0.029)	0.08*** (0.025)
Professionals (ISCO88)	0.178*** (0.029)	0.124*** (0.028)	0.096*** (0.022)
Technicians and associate professionals (ISCO88)	0.189*** (0.027)	0.13*** (0.026)	0.093*** (0.021)
Clerical support workers (ISCO88)	0.136*** (0.028)	0.078*** (0.027)	0.09*** (0.022)
Service and sales workers (ISCO88)	0.148*** (0.028)	0.099*** (0.027)	0.077*** (0.023)
Skilled agricultural, forestry and fishery workers (ISCO88)	0.218*** (0.068)	0.174*** (0.066)	0.078 (0.049)
Craft and related trades workers (ISCO88)	0.199*** (0.029)	0.152*** (0.027)	0.084*** (0.022)
Plant and machine operators, and assemblers (ISCO88)	0.107*** (0.034)	0.067** (0.032)	0.052** (0.025)
Firm size small	-.074*** (0.01)	-.025*** (0.009)	-.058*** (0.007)

	<i>Table continued from previous page</i>		
	(1)	(2)	(3)
	Training	General Training	Specific Training
Firm size medium	-.024** (0.012)	-.008 (0.01)	-.021*** (0.008)
Manufacturing (NACE)	0.019 (0.021)	0.035* (0.018)	-.018 (0.015)
Agriculture (NACE)	0.051 (0.052)	-.032 (0.046)	0.063* (0.036)
Mining, Quarring, Energy, Water (NACE)	0.077** (0.034)	0.06* (0.031)	0.025 (0.023)
Chemicals/Pulp/Paper (NACE)	-.035 (0.027)	-.022 (0.024)	-.026 (0.019)
Construction (NACE)	-.051* (0.027)	-.018 (0.024)	-.051** (0.022)
Iron/Steel (NACE)	-.030 (0.027)	-.003 (0.024)	-.030 (0.02)
Textile/Apparel (NACE)	-.179** (0.075)	-.091 (0.063)	-.155* (0.086)
Wholesale/Retail (NACE)	-.075*** (0.022)	-.046** (0.02)	-.045*** (0.016)
Transportation/Communication (NACE)	-.007 (0.026)	0.008 (0.024)	-.017 (0.018)
Public Service (NACE)	0.029 (0.018)	0.03* (0.017)	-.0008 (0.013)
Financials/Private Services (NACE)	0.017 (0.02)	0.013 (0.019)	-.004 (0.015)
Big Five Factor Openness	0.01** (0.005)	0.009** (0.004)	0.0003 (0.003)
Big Five Factor Conscientiousness	-.006 (0.006)	0.003 (0.006)	-.011*** (0.004)
Big Five Factor Extraversion	0.014*** (0.005)	0.013*** (0.004)	0.002 (0.003)
Big Five Factor Agreeableness	-.007 (0.006)	-.002 (0.005)	-.005 (0.004)
Big Five Factor Neuroticism	-.004 (0.004)	-.005 (0.004)	-.001 (0.003)
Obs.	10,972	10,972	10,972

*Source:* Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29, own calculations.

*Notes:* \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors are clustered on person-level.

Table A.3: OLS Estimation Results: Wage Expectations, controlling for General and Specific Training

	(1)	(2)	(3)	(4)	(5)
Locus of Control (std.)	0.823*** (0.287)	0.831*** (0.289)	-.013 (0.273)	-.229 (0.269)	-.459* (0.279)
General Training	6.807*** (0.734)	6.966*** (0.73)	4.139*** (0.703)	3.445*** (0.687)	3.220*** (0.683)
Specific Training	0.292 (0.848)	0.764 (0.837)	-.794 (0.817)	0.003 (0.803)	-.108 (0.8)
General Training * Locus of Control (std.)	3.071*** (0.834)	2.795*** (0.817)	2.896*** (0.771)	2.793*** (0.741)	2.705*** (0.74)
Specific Training * Locus of Control (std.)	0.502 (0.882)	0.366 (0.871)	0.257 (0.843)	0.506 (0.833)	0.431 (0.829)
East Germany		1.653 (1.242)	2.017* (1.196)	0.891 (1.178)	1.233 (1.175)
South Germany		-1.969** (0.868)	-1.994** (0.81)	-2.137*** (0.774)	-2.325*** (0.771)
North Germany		-2.583*** (0.962)	-3.093*** (0.92)	-3.274*** (0.874)	-3.275*** (0.869)
City States		1.909 (1.396)	1.127 (1.324)	1.314 (1.289)	1.250 (1.281)
Unemployment Rate		-.824*** (0.134)	-.822*** (0.127)	-.787*** (0.125)	-.828*** (0.125)
GDP		0.111* (0.058)	0.074 (0.054)	-.023 (0.053)	-.019 (0.052)
Dummy for year 2000		5.520*** (0.675)	4.394*** (0.653)	2.003** (1.006)	2.237** (1.005)
Dummy for year 2004		2.628*** (0.671)	1.862*** (0.645)	-.387 (0.999)	-.178 (0.999)
Age			-.519*** (0.059)	-.508*** (0.058)	-.484*** (0.058)
Female			-6.344*** (0.543)	-6.276*** (0.625)	-5.971*** (0.642)
Married			-2.102*** (0.664)	-1.781*** (0.645)	-1.583** (0.641)
Number of Children			-.231 (0.314)	-.438 (0.302)	-.381 (0.3)
Disabled			-2.032** (0.952)	-1.392 (0.921)	-1.191 (0.914)
German Nationality			2.647*** (0.925)	1.691* (0.883)	1.853** (0.883)
Owner of House/Dwelling			0.387 (0.533)	0.457 (0.517)	0.48 (0.513)

		<i>Table continued from previous page</i>				
		(1)	(2)	(3)	(4)	(5)
School	Degree (Ref.: Low/Intermed. School)					
	No Degree			-2.842*	-2.015	-1.374
				(1.512)	(1.575)	(1.568)
	Highschool Degree			5.336***	2.842***	2.914***
				(0.849)	(0.847)	(0.846)
Vocational Education (Ref.: Non)						
	Apprenticeship			1.863**	0.891	0.747
				(0.726)	(0.719)	(0.712)
	Vocational School			-.196	0.176	-.049
				(0.745)	(0.75)	(0.745)
	University or College Degree			2.656***	0.383	0.272
				(0.866)	(0.905)	(0.899)
	Work Experience (FT + PT)			-.094*	-.007	-.014
				(0.054)	(0.055)	(0.055)
	Unemployment Experience			-.136	-.314*	-.293*
				(0.168)	(0.174)	(0.174)
	Real Net HH income last month of 2 years ago (in 1000 €)			1.004***	0.743***	0.668***
				(0.228)	(0.224)	(0.223)
	White-collar Worker				6.358***	6.625***
					(1.384)	(1.383)
	Blue-collar Worker				4.484***	5.007***
					(1.545)	(1.541)
	Member Trade Union				-.946	-1.110*
					(0.623)	(0.621)
	Member Trade Association				-1.023	-1.298
					(1.025)	(1.020)
	High Occupational Autonomy				2.426*	2.381*
					(1.401)	(1.401)
	Manager				5.155***	4.894***
					(1.534)	(1.533)
	Tenure				-.191***	-.184***
					(0.03)	(0.03)
	Contract - Permanent				-1.929**	-1.923**
					(0.915)	(0.915)
	Contract - Other				-.895	-.842
					(0.985)	(0.98)
	Managers (ISCO88)				5.884***	5.550***
					(1.647)	(1.639)
	Professionals (ISCO88)				2.513*	2.542*
					(1.382)	(1.375)

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*Table continued from previous page*

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	(1)	(2)	(3)	(4)	(5)
Technicians and associate professionals (ISCO88)				2.745**	2.758***
				(1.072)	(1.067)
Clerical support workers (ISCO88)				2.862**	2.895**
				(1.173)	(1.165)
Service and sales workers (ISCO88)				0.983	0.936
				(1.064)	(1.059)
Skilled agricultural, forestry and fishery workers (ISCO88)				-288	-230
				(2.575)	(2.555)
Craft and related trades workers (ISCO88)				-1.010	-1.139
				(1.013)	(1.010)
Plant and machine operators, and assemblers (ISCO88)				-2.006*	-2.049*
				(1.079)	(1.072)
Firm size small				-.925	-.814
				(0.664)	(0.662)
Firm size medium				-.790	-.709
				(0.717)	(0.714)
Manufacturing (NACE)				3.092***	3.361***
				(1.149)	(1.144)
Agriculture (NACE)				-.680	-.070
				(2.098)	(2.068)
Mining, Quarrying, Energy, Water (NACE)				1.168	1.008
				(1.981)	(1.974)
Chemicals/Pulp/Paper (NACE)				3.424***	3.581***
				(1.326)	(1.317)
Construction (NACE)				1.833	1.747
				(1.322)	(1.322)
Iron/Steel (NACE)				0.808	1.060
				(1.357)	(1.350)
Textile/Apparel (NACE)				2.458	2.962
				(2.191)	(2.214)
Wholesale/Retail (NACE)				0.743	0.992
				(1.126)	(1.120)
Transportation/Communication (NACE)				-.703	-.620
				(1.435)	(1.435)
Public Service (NACE)				-2.811***	-2.607***
				(1.011)	(1.003)
Financials/Private Services (NACE)				3.267***	3.387***
				(1.177)	(1.169)
Big Five Factor Openness					0.805***

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*Table continued from previous page*

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	(1)	(2)	(3)	(4)	(5)
					(0.257)
Big Five Factor Conscientiousness					-.086 (0.377)
Big Five Factor Extraversion					0.958*** (0.267)
Big Five Factor Agreeableness					-1.349*** (0.311)
Big Five Factor Neuroticism					-.869*** (0.251)
Const.	14.653*** (0.291)	17.358*** (2.204)	40.066*** (2.876)	40.382*** (3.476)	41.866*** (4.425)
Obs.	10972	10972	10972	10972	10972
$R^2$	0.018	0.038	0.128	0.173	0.179

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*Source:* Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013,  
doi: 10.5684/soep.v29, own calculations.

*Notes:* \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard errors are clustered on person-level.



Table A.4: OLS Estimation Results: Gross Log Hourly Wage Income ( $t+1$ )

	(1)	(2)	(3)	(4)	(5)
Locus of Control (std.)	0.057*** (0.006)	0.057*** (0.006)	0.024*** (0.005)	0.015*** (0.004)	0.015*** (0.004)
General Training	0.195*** (0.013)	0.195*** (0.013)	0.113*** (0.011)	0.044*** (0.009)	0.045*** (0.009)
Specific Training	0.178*** (0.014)	0.189*** (0.014)	0.094*** (0.012)	0.03*** (0.01)	0.03*** (0.01)
General Training * Locus of Control (std.)	0.022 (0.014)	0.01 (0.014)	-.006 (0.012)	-.003 (0.01)	-.002 (0.01)
Specific Training * Locus of Control (std.)	-.009 (0.016)	-.018 (0.015)	-.004 (0.012)	-.013 (0.011)	-.014 (0.011)
East Germany		-.176*** (0.027)	-.201*** (0.022)	-.173*** (0.019)	-.173*** (0.019)
South Germany		-.012 (0.016)	-.014 (0.013)	-.001 (0.012)	-.003 (0.012)
North Germany		0.021 (0.02)	0.009 (0.015)	0.007 (0.013)	0.007 (0.013)
City States		0.06** (0.027)	0.095*** (0.022)	0.072*** (0.018)	0.072*** (0.018)
Unemployment Rate		-.003 (0.003)	-.005** (0.002)	-.005** (0.002)	-.005** (0.002)
GDP		0.008*** (0.001)	0.005*** (0.0009)	0.003*** (0.0008)	0.003*** (0.0008)
Dummy for year 2000		0.045*** (0.012)	0.079*** (0.01)	0.086*** (0.018)	0.085*** (0.018)
Dummy for year 2004		0.073*** (0.013)	0.094*** (0.01)	0.102*** (0.018)	0.101*** (0.018)
Age			-.006*** (0.001)	-.004*** (0.001)	-.004*** (0.001)
Female			-.199*** (0.009)	-.154*** (0.009)	-.150*** (0.01)
Married			-.042*** (0.011)	-.012 (0.01)	-.011 (0.01)
Number of Children			0.032*** (0.005)	0.027*** (0.005)	0.028*** (0.005)
Disabled			0.004 (0.02)	-.022 (0.018)	-.021 (0.018)
German Nationality			0.012 (0.015)	-.006 (0.013)	-.007 (0.013)
Owner of House/Dwelling			0.011 (0.009)	0.0004 (0.008)	-.0004 (0.008)

		<i>Table continued from previous page</i>				
		(1)	(2)	(3)	(4)	(5)
School Degree (Ref.: School)	Low/Intermed.					
	No Degree			-.118** (0.049)	-.077* (0.043)	-.076* (0.043)
	Highschool Degree			0.179*** (0.014)	0.078*** (0.012)	0.077*** (0.012)
Vocational Education (Ref.: Non)						
	Apprenticeship			0.03** (0.013)	0.029** (0.011)	0.029*** (0.011)
	Vocational School			0.055*** (0.014)	0.021* (0.012)	0.021* (0.012)
	University or College Degree			0.223*** (0.015)	0.088*** (0.014)	0.089*** (0.014)
	Work Experience (FT + PT)			0.013*** (0.001)	0.007*** (0.001)	0.007*** (0.001)
	Unemployment Experience			-.043*** (0.004)	-.018*** (0.004)	-.018*** (0.004)
	White-collar Worker				0.032 (0.022)	0.032 (0.022)
	Blue-collar Worker				-.035 (0.023)	-.035 (0.023)
	Member Trade Union				0.038*** (0.008)	0.038*** (0.008)
	Member Trade Association				0.006 (0.015)	0.005 (0.015)
	High Occupational Autonomy				0.078*** (0.021)	0.078*** (0.021)
	Manager				0.103*** (0.023)	0.102*** (0.023)
	Tenure				0.005*** (0.0005)	0.005*** (0.0005)
	Contract - Permanent				0.022 (0.018)	0.021 (0.018)
	Contract - Other				-.168*** (0.022)	-.168*** (0.022)
	Managers (ISCO88)				0.262*** (0.024)	0.263*** (0.025)
	Professionals (ISCO88)				0.276*** (0.022)	0.276*** (0.022)
	Technicians and associate professionals (ISCO88)				0.235*** (0.019)	0.236*** (0.019)

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*Table continued from previous page*

	(1)	(2)	(3)	(4)	(5)
Clerical support workers (ISCO88)				0.164*** (0.02)	0.165*** (0.02)
Service and sales workers (ISCO88)				-.001 (0.02)	-.0004 (0.02)
Skilled agricultural, forestry and fishery workers (ISCO88)				0.067 (0.074)	0.071 (0.074)
Craft and related trades workers (ISCO88)				0.146*** (0.018)	0.145*** (0.018)
Plant and machine operators, and assemblers (ISCO88)				0.099*** (0.019)	0.099*** (0.019)
Firm size small				-.153*** (0.009)	-.153*** (0.009)
Firm size medium				-.037*** (0.009)	-.037*** (0.009)
Manufacturing (NACE)				0.075*** (0.018)	0.075*** (0.018)
Agriculture (NACE)				-.139*** (0.051)	-.142*** (0.051)
Mining, Quarring, Energy, Water (NACE)				0.111*** (0.03)	0.111*** (0.03)
Chemicals/Pulp/Paper (NACE)				0.093*** (0.021)	0.092*** (0.021)
Construction (NACE)				0.027 (0.02)	0.026 (0.02)
Iron/Steel (NACE)				0.085*** (0.021)	0.085*** (0.021)
Textile/Apparel (NACE)				-.051 (0.039)	-.048 (0.04)
Wholesale/Retail (NACE)				-.062*** (0.019)	-.062*** (0.019)
Transportation/Communication (NACE)				-.015 (0.023)	-.015 (0.023)
Public Service (NACE)				0.041** (0.017)	0.041** (0.017)
Financials/Private Services (NACE)				0.021 (0.019)	0.022 (0.019)
Big Five Factor Openness					0.0009 (0.004)
Big Five Factor Conscientiousness					0.003 (0.006)

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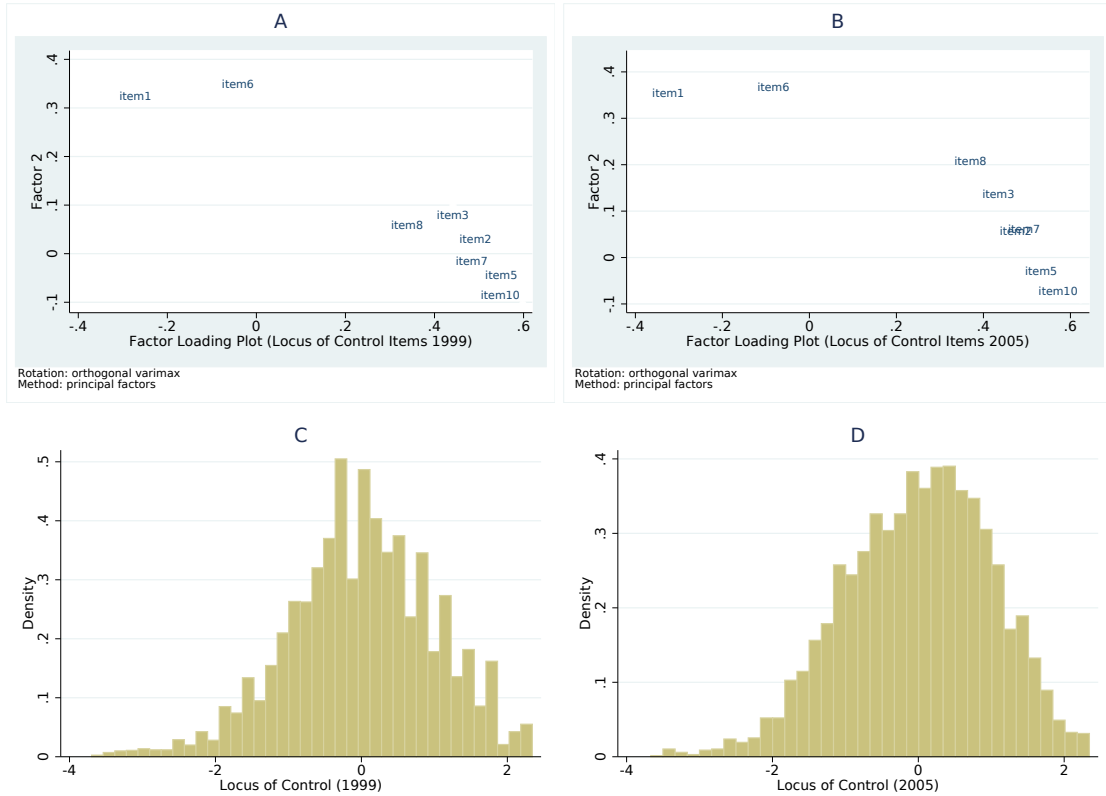
	(1)	(2)	(3)	(4)	(5)
Big Five Factor Extraversion					-.007 (0.004)
Big Five Factor Agreeableness					-.007 (0.005)
Big Five Factor Neuroticism					-.004 (0.004)
Const.	2.513*** (0.007)	2.324*** (0.043)	2.232*** (0.051)	2.195*** (0.057)	2.262*** (0.07)
Obs.	10234	10234	10234	10234	10234
$R^2$	0.057	0.135	0.414	0.54	0.54

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*Source:* Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29, own calculations.

*Notes:* \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Standard Errors are clustered on person-level.

Figure A.1: Locus of Control: Factor Analysis and Distribution



Source: Socio-Economic Panel (SOEP), data for years 1999 - 2008, version 29, SOEP, 2013, doi: 10.5684/soep.v29, own illustration.

Notes: Figure 2 A. (B.) shows the loading plot of a factor analysis of the locus of control items of the year 1999 (2005). We identify items 1 and 6 as loading on Factor 2 (interpretable as internal factor) and items 2, 3, 5, 7, 8, 10 as loading on Factor 1 (interpretable as external factor). Item 4 and 9 are not loading on any of the two factors and were therefore neglected in the analysis.

Figure 2 C. and 2 D. show the distribution of the continuous standardized locus of control index for the years 1999 and 2005, which is calculated by firstly reversing all external items and secondly by extracting a single factor by running a factor analysis for each year. Hence, higher scores reflect higher internality and lower scores reflect higher externality. The original item scale of the year 1999 was reversed (in order of higher scores reflecting higher internality) and was recoded in order to match the locus of control scale of the year 2005. The recoding is as follows: 2 to 3, 3 to 5 and 4 to 7.



# Appendix B - Appendix for Chapter 3

Table B.1: List of Countries Used for Cross-Country Analysis

(1) ISO Code	(2) Country	(3) % Couples Living with Wife's Parents  mean	(4) % Couples Living with Husband's Parents  mean
KHM	Cambodia	15.05	5.36
CUB	Cuba	8.22	5.02
COL	Colombia	7.08	4.87
CHL	Chile	4.75	3.29
PER	Peru	6.89	4.79
HTI	Haiti	5.02	3.63
THA	Thailand	9.79	7.31
BRA	Brazil	4.60	3.65
IDN	Indonesia	10.70	8.55
LAO	Lao PDR	16.40	13.30
PHL	Philippines	7.49	7.08
UKR	Ukraine	5.75	5.53
BOL	Bolivia	3.73	3.65
SLV	El Salvador	6.14	6.09
PRY	Paraguay	4.55	4.65
MWI	Malawi	2.44	2.78
ZMB	Zambia	2.23	2.69
MEX	Mexico	4.53	5.59
HND	Honduras	5.17	6.66
GHA	Ghana	2.10	3.16
RWA	Rwanda	0.39	0.86
COD	Congo, Dem. Rep.	3.29	4.84
BDI	Burundi	0.23	0.89
AGO	Angola	1.82	3.10

*Table continued from previous page*

(1)	(2)	(3)	(4)
ISO Code	Country	% Couples Living with Wife's Parents mean	% Couples Living with Husband's Parents mean
MDG	Madagascar	2.22	3.92
GTM	Guatemala	5.62	10.80
SOM	Somalia	2.42	5.65
ETH	Ethiopia	2.28	5.61
TCD	Chad	1.66	4.52
MOZ	Mozambique	2.11	6.09
SDN	Sudan	3.27	9.84
UGA	Uganda	1.09	3.66
TZA	Tanzania	2.11	6.89
SLE	Sierra Leone	3.78	13.75
CMR	Cameroon	1.95	7.14
KAZ	Kazakhstan	3.36	13.70
TGO	Togo	1.79	6.87
ZWE	Zimbabwe	1.92	7.49
BEN	Benin	1.47	6.85
VNM	Vietnam	3.83	18.95
CIV	Cote d'Ivoire	1.76	7.53
TUR	Turkey	2.48	13.65
KEN	Kenya	0.68	4.09
NGA	Nigeria	0.83	5.56
BGD	Bangladesh	3.97	26.98
MAR	Morocco	2.58	17.80
TUN	Tunisia	0.99	6.84
CHN	China	1.22	17.60
IRN	Iran, Islamic Rep.	0.82	6.48
YEM	Yemen, Rep.	2.73	22.20
JOR	Jordan	0.91	8.77
<b>KGZ</b>	<b>Kyrgyz Republic</b>	<b>2.29</b>	<b>21.65</b>
EGY	Egypt, Arab Rep.	1.12	12.11
GIN	Guinea	1.29	13.65
MLI	Mali	0.41	5.57
AZE	Azerbaijan	2.17	25.20
SEN	Senegal	2.54	30.16
IND	India	2.12	31.45
BFA	Burkina Faso	0.61	10.36
NPL	Nepal	1.98	30.73
NER	Niger	0.53	10.87
DZA	Algeria	0.81	16.00



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*Table continued from previous page*

(1)	(2)	(3)	(4)
ISO Code	Country	% Couples Living with Wife's Parents  mean	% Couples Living with Husband's Parents  mean
PAK	Pakistan	1.84	36.60
UZB	Uzbekistan	1.22	30.00
IRQ	Iraq	0.88	24.70
TKM	Turkmenistan	1.03	30.60
AFG	Afghanistan	1.17	34.70
TJK	Tajikistan	0.83	37.75

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*Source:* Data from Global Data Lab (<https://globaldatalab.org/areadata/patrilocal/>).

*Notes:* This table contains the 68 countries included in Figure 3.1. They have a population greater than 5 million and at least one data point on co-residence with parents between 2000 and 2016. We take the mean if there are several data points.

Table B.2: Non-Parametric Differences in Pre-Marriage Characteristics

	(1)	(2)	(3)	(4)	(5)
	Treated	Controls	Difference	S.E.	T-Stat
<b>A. Wife</b>					
Age at marriage <sup>c</sup>	21.35	20.84	0.51	0.82	0.62
Kyrgyz	0.64	0.69	-0.05	0.11	-0.45
Uzbek	0.15	0.18	-0.03	0.09	-0.33
Dungan	0.10	0.08	0.03	0.06	0.5
Russian	0.05	0.03	0.03	0.04	0.75
Other ethnicity	0.15	0.10	0.05	0.07	0.70
Total number of siblings <sup>c</sup>	3.36	3.88	-0.52	0.47	-1.11
Years of education <sup>c</sup>	11.00	10.97	0.03	0.49	0.06
More than 11 years of education	0.28	0.36	-0.08	0.11	-0.73
Worked in t-1 if t=year of marriage	0.23	0.26	-0.03	0.11	-0.27
Worked in t-2 if t=year of marriage	0.10	0.23	-0.13	0.10	-1.30
Love marriage	0.70	0.74	-0.04	0.14	-0.29
Arranged marriage	0.26	0.12	0.13	0.11	1.18
Bride capture	0.04	0.13	-0.09	0.09	-1.00
<b>B. Husband</b>					
Age at marriage <sup>c</sup>	25.32	25.49	-0.16	1.10	-0.15
Kyrgyz	0.64	0.69	-0.05	0.11	-0.45
Uzbek	0.15	0.18	-0.03	0.09	-0.33
Dungan	0.10	0.08	0.03	0.06	0.50
Russian	0.03	0.03	0.00	0.04	0.00
Other ethnicity	0.18	0.10	0.08	0.08	1.00
Total number of siblings <sup>c</sup>	3.64	3.85	-0.21	0.40	-0.52
Years of education <sup>c</sup>	10.92	10.78	0.14	0.45	0.31
More than 11 years of education	0.31	0.28	0.03	0.11	0.27
Worked in t-1 if t=year of marriage	0.82	0.82	0.00	0.1	0.00
Worked in t-2 if t=year of marriage	0.86	0.68	0.18	0.11	1.64

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: <sup>c</sup> denotes continuous variable.

Panel A compares pre-marriage characteristics of women married to youngest sons (treated) and not married to youngest sons (control). Panel B compares pre-marriage characteristics of husbands being youngest sons (treated) and not being youngest sons (control). Comparisons are based on matching results, whereby the variable *youngest son* is used as treatment. The following information are used for balancing: number of brothers of the husband, age of the husband and age of the oldest living parent of the husband (and ethnicity, but only if the type of marriage is outcome variable). Column (1) (column (2)) provides the average treatment effect of the treated (controls), column (3) their difference. Column (4) provides the standard error and column (5) the t-statistic. Critical values of t-distribution:  $t_{\infty,0.95} = 1.645$ ,  $t_{\infty,0.975} = 1.96$ ,  $t_{\infty,0.995} = 2.576$ .

Table B.3: Number Of Children Up To Age Five

<b>OLS Estimation Results</b>	
Married to youngest son	0.117** (0.059)
Age husband	-.040*** (0.004)
No. of brothers (husband)	0.039** (0.02)
Age oldest living parent (husband)	-.0006 (0.004)
Const.	2.201*** (0.154)
Observations	1,048

*Source:* Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table B.4: Estimation Results: Number of Children up to Age 5

	(1)	(2)	(3)	(4)	(5)
<b>A. OLS Estimation Results</b>					
<b>(Co-residence exogenous)</b>					
Co-residence	0.334*** (0.051)	-.046 (0.057)	-.032 (0.056)	-.013 (0.057)	-.017 (0.058)
<b>B. Two-stage Least-Squares Estimation Results</b>					
<b>(Co-residence endogenous)</b>					
<b>Second Stage</b>					
Co-residence	0.596*** (0.171)	0.573* (0.307)	0.567** (0.281)	0.558** (0.277)	0.553** (0.279)
Observations	1,048	1,048	1,048	1,048	1,048
Conditioning Variables		✓	✓	✓	✓
Wife Characteristics			✓	✓	✓
Residence Characteristics				✓	✓
Husband Characteristics					✓

*Source:* Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Conditioning variables: age of the husband, number of brothers of the husband, age of the oldest living parent of the husband.

Wife characteristics: age, educational attainment, ethnicity.

Residence characteristics: province, community is urban, availability of kindergarten.

Husband characteristics: educational attainment.

Table B.5: OLS Estimation Results: Labour Force Participation

	(1)	(2)	(3)	(4)	(5)
Co-residence	-.168*** (0.03)	-.057 (0.036)	-.023 (0.037)	-.054 (0.037)	-.055 (0.037)
Age husband		0.012*** (0.003)	-.003 (0.005)	-.005 (0.005)	-.005 (0.005)
No. of brothers (husband)		0.003 (0.011)	0.005 (0.011)	0.004 (0.011)	0.004 (0.011)
Age oldest living parent (husband)		-.0002 (0.002)	-.0007 (0.002)	0.0008 (0.002)	0.0008 (0.002)
Age woman			0.047*** (0.016)	0.043*** (0.016)	0.043*** (0.016)
Age woman <sup>2</sup>			-.0004** (0.0002)	-.0004* (0.0002)	-.0004* (0.0002)
Medium school education			0.175*** (0.054)	0.157*** (0.054)	0.168*** (0.056)
Higher school education			0.273*** (0.059)	0.282*** (0.059)	0.29*** (0.062)
Kyrgyz			0.068 (0.084)	-.008 (0.087)	-.008 (0.087)
Uzbek			0.105 (0.091)	0.047 (0.097)	0.045 (0.097)
Dungan			-.074 (0.109)	-.086 (0.111)	-.087 (0.111)
Other ethnicity			-.049 (0.1)	-.116 (0.099)	-.117 (0.099)
Issyk Kul				0.011 (0.067)	0.014 (0.067)
Jalalabad				0.003 (0.057)	0.005 (0.058)
Naryn				-.014 (0.081)	-.009 (0.082)
Batken				0.111 (0.069)	0.112 (0.069)
Osh				0.177*** (0.054)	0.177*** (0.054)
Talas				0.225*** (0.081)	0.228*** (0.082)
Osh (city)				-.068 (0.096)	-.066 (0.096)
Bishkek (city)				0.101 (0.073)	0.104 (0.073)
Community in urban area				-.113** (0.05)	-.116** (0.05)
Kindergarten in community				0.037 (0.035)	0.038 (0.036)
Medium school education (husband)					-.032 (0.048)
Higher school education (husband)					-.022 (0.055)
Const.	0.558*** (0.021)	0.07 (0.109)	-.638** (0.279)	-.576** (0.278)	-.560** (0.28)
Observations	1,048	1,048	1,048	1,048	1,048

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes:

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Russian and Chui are the reference groups for ethnicity and provinces, respectively.

Table B.6: Two-stage Least-Squares Estimation Results: Co-Residence (First Stage)

	(1)	(2)	(3)	(4)	(5)
Married to youngest son	0.316*** (0.031)	0.204*** (0.032)	0.21*** (0.031)	0.213*** (0.03)	0.211*** (0.03)
Age husband		-.033*** (0.002)	-.014*** (0.004)	-.014*** (0.004)	-.014*** (0.004)
No. of brothers (husband)		-.006 (0.011)	-.006 (0.01)	-.007 (0.01)	-.009 (0.01)
Age oldest living parent (husband)		0.004** (0.002)	0.004** (0.002)	0.005** (0.002)	0.005*** (0.002)
Age woman			-.104*** (0.013)	-.102*** (0.013)	-.103*** (0.013)
Age woman <sup>2</sup>			0.001*** (0.0002)	0.001*** (0.0002)	0.001*** (0.0002)
Medium school education			0.073 (0.045)	0.059 (0.044)	0.077* (0.046)
Higher school education			0.086* (0.049)	0.106** (0.048)	0.132*** (0.05)
Kyrgyz			0.081 (0.07)	-.050 (0.072)	-.055 (0.072)
Uzbek			0.143* (0.076)	-.045 (0.08)	-.057 (0.08)
Dungan			0.141 (0.091)	0.09 (0.091)	0.076 (0.091)
Other ethnicity			0.129 (0.083)	0.035 (0.082)	0.029 (0.082)
Issyk Kul				0.023 (0.055)	0.023 (0.055)
Jalalabad				0.095** (0.047)	0.093* (0.047)
Naryn				0.185*** (0.066)	0.182*** (0.067)
Batken				0.055 (0.057)	0.052 (0.057)
Osh				0.216*** (0.044)	0.211*** (0.044)
Talas				0.039 (0.067)	0.034 (0.068)
Osh (city)				0.118 (0.079)	0.117 (0.079)
Bishkek (city)				-.113* (0.06)	-.107* (0.06)
Community in urban area				-.025 (0.041)	-.025 (0.041)
Kindergarten in community				0.014 (0.029)	0.018 (0.029)
Medium school education (husband)					-.051 (0.04)
Higher school education (husband)					-.083* (0.045)
Const.	0.368*** (0.018)	1.358*** (0.082)	2.474*** (0.22)	2.458*** (0.216)	2.495*** (0.217)
Observations	1,048	1,048	1,048	1,048	1,048

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Russian and Chui are the reference groups for ethnicity and provinces, respectively.

Table B.7: Two-stage Least-Squares Estimation Results: Labour Force Participation (Second Stage)

	(1)	(2)	(3)	(4)	(5)
Co-residence	-.196*	-.084	-.105	-.045	-.048
	(0.101)	(0.185)	(0.175)	(0.17)	(0.172)
Age husband		0.011	-.005	-.005	-.005
		(0.008)	(0.006)	(0.006)	(0.006)
No. of brothers (husband)		0.002	0.002	0.005	0.004
		(0.013)	(0.013)	(0.013)	(0.013)
Age oldest living parent (husband)		0.00002	0.00007	0.0007	0.0008
		(0.003)	(0.003)	(0.003)	(0.003)
Age woman			0.039	0.044*	0.044*
			(0.024)	(0.023)	(0.023)
Age woman <sup>2</sup>			-.0003	-.0004	-.0004
			(0.0003)	(0.0003)	(0.0003)
Medium school education			0.182***	0.157***	0.167***
			(0.056)	(0.055)	(0.058)
Higher school education			0.281***	0.281***	0.289***
			(0.061)	(0.061)	(0.066)
Kyrgyz			0.071	-.007	-.008
			(0.084)	(0.087)	(0.087)
Uzbek			0.113	0.047	0.046
			(0.092)	(0.096)	(0.097)
Dungan			-.065	-.086	-.088
			(0.11)	(0.11)	(0.11)
Other ethnicities			-.043	-.116	-.117
			(0.1)	(0.098)	(0.098)
Issyk Kul				0.011	0.014
				(0.066)	(0.066)
Jalalabad				0.002	0.005
				(0.058)	(0.058)
Naryn				-.015	-.011
				(0.086)	(0.086)
Batken				0.11	0.111
				(0.068)	(0.068)
Osh				0.175***	0.176***
				(0.062)	(0.062)
Talas				0.225***	0.228***
				(0.08)	(0.081)
Osh (city)				-.068	-.067
				(0.096)	(0.096)
Bishkek (city)				0.102	0.104
				(0.076)	(0.076)
Community in urban area				-.112**	-.115**
				(0.05)	(0.05)
Kindergarten in community				0.037	0.037
				(0.035)	(0.035)
Medium school education (husband)					-.032
					(0.049)
Higher school education (husband)					-.022
					(0.056)
Const.	0.571***	0.106	-.436	-.598	-.577
	(0.051)	(0.267)	(0.508)	(0.493)	(0.503)
Observations	1,048	1,048	1,048	1,048	1,048

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Russian and Chui are the reference groups for ethnicity and provinces, respectively.

Table B.8: Tobit Estimation Results: Working Hours

	(1)	(2)	(3)	(4)	(5)
Co-residence	-14.241*** (2.672)	-4.388 (3.131)	-1.241 (3.180)	-3.220 (3.218)	-3.319 (3.228)
Age husband		1.118*** (0.258)	-0.004 (0.467)	-0.138 (0.462)	-0.136 (0.463)
No. of brothers (husband)		0.29 (0.964)	0.505 (0.974)	0.68 (0.96)	0.672 (0.963)
Age oldest living parent (husband)		-0.082 (0.195)	-0.125 (0.194)	0.021 (0.193)	0.023 (0.194)
Age woman			5.087*** (1.439)	4.721*** (1.414)	4.722*** (1.418)
Age woman <sup>2</sup>			-0.056*** (0.019)	-0.051*** (0.019)	-0.051*** (0.019)
Medium school education			14.336*** (5.214)	13.817*** (5.186)	14.767*** (5.429)
Higher school education			22.496*** (5.530)	22.935*** (5.542)	23.522*** (5.806)
Kyrgyz			1.777 (7.317)	-0.997 (7.466)	-0.997 (7.472)
Uzbek			7.275 (7.894)	4.384 (8.315)	4.293 (8.350)
Dungan			-14.548 (10.350)	-12.761 (10.358)	-12.704 (10.389)
Other ethnicity			-7.550 (8.833)	-11.423 (8.740)	-11.372 (8.752)
Issyk Kul				-6.762 (5.924)	-6.400 (5.944)
Jalalabad				-3.693 (5.105)	-3.414 (5.123)
Naryn				-3.674 (7.341)	-3.093 (7.385)
Batken				2.432 (6.058)	2.524 (6.064)
Osh				13.799*** (4.762)	13.898*** (4.769)
Talas				14.800** (6.801)	15.205** (6.836)
Osh (city)				-10.166 (8.848)	-9.901 (8.851)
Bishkek (city)				9.390 (6.315)	9.580 (6.324)
Community in urban area				-2.901 (4.357)	-3.207 (4.380)
Kindergarten in community				0.952 (3.076)	0.912 (3.083)
Medium school education (husband)					-2.796 (4.306)
Higher school education (husband)					-1.361 (4.774)
Const.	6.661*** (1.871)	-34.123*** (9.708)	-112.226*** (25.336)	-110.210*** (25.119)	-109.034*** (25.279)
Observations	1,048	1,048	1,048	1,048	1,048

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Russian and Chui are the reference groups for ethnicity and provinces, respectively.



Table B.9: IV Tobit Estimation Results: Working Hours (Second Stage)

	(1)	(2)	(3)	(4)	(5)
Co-residence	-19.731** (8.874)	-12.161 (16.120)	-15.009 (15.528)	-9.023 (14.982)	-9.193 (15.136)
Age husband		0.816 (0.666)	-.265 (0.552)	-.248 (0.54)	-.245 (0.538)
No. of brothers (husband)		0.003 (1.130)	0.0007 (1.130)	0.459 (1.112)	0.44 (1.128)
Age oldest living parent (husband)		-.009 (0.245)	0.01 (0.246)	0.08 (0.244)	0.084 (0.248)
Age woman			3.673* (2.127)	4.136** (2.044)	4.120** (2.074)
Age woman <sup>2</sup>			-.040 (0.027)	-.045* (0.026)	-.045* (0.026)
Medium school education			15.530*** (5.420)	14.246*** (5.306)	15.322*** (5.615)
Higher school education			23.906*** (5.793)	23.648*** (5.837)	24.420*** (6.242)
Kyrgyz			2.245 (7.399)	-1.513 (7.589)	-1.546 (7.610)
Uzbek			8.574 (8.093)	3.921 (8.409)	3.745 (8.475)
Dungan			-13.057 (10.552)	-12.449 (10.399)	-12.478 (10.416)
Other ethnicity			-6.443 (8.990)	-11.485 (8.754)	-11.474 (8.769)
Issyk Kul				-6.637 (5.941)	-6.277 (5.960)
Jalalabad				-3.235 (5.242)	-2.965 (5.254)
Naryn				-2.555 (7.874)	-1.977 (7.910)
Batken				2.682 (6.100)	2.756 (6.101)
Osh				14.954*** (5.592)	15.039*** (5.576)
Talas				14.767** (6.813)	15.141** (6.850)
Osh (city)				-9.678 (8.946)	-9.415 (8.947)
Bishkek (city)				8.643 (6.598)	8.862 (6.585)
Community in urban area				-3.024 (4.375)	-3.329 (4.397)
Kindergarten in community				1.050 (3.091)	1.034 (3.103)
Medium school education (husband)					-3.128 (4.393)
Higher school education (husband)					-1.905 (4.975)
Const.	9.289** (4.442)	-23.599 (23.480)	-78.151* (45.329)	-95.943** (43.840)	-94.348** (44.745)
Observations	1,048	1,048	1,048	1,048	1,048

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Russian and Chui are the reference groups for ethnicity and provinces, respectively.

Table B.10: Heterogeneity Analysis: Labour Force Participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>A. OLS Estimation Results</b>							
<b>(Co-residence exogenous)</b>							
Co-residence	-0.029 (0.041)	0.069 (0.096)	-0.224*** (0.082)	0.093 (0.212)	-0.077 (0.061)	-0.141*** (0.05)	-0.080 (0.075)
Co-residence * Community in urban area	-0.111 (0.071)						
Co-residence * Medium school education	-0.131 (0.1)						
Co-residence * Higher school education	-0.147 (0.107)						
Co-residence * Age woman 20-29	0.205** (0.099)						
Co-residence * Age woman 30-39	0.204** (0.096)						
Co-residence * Age oldest living parent (husband)	-0.002 (0.003)						
Co-residence * Oldest living parent (husband) retired	0.032 (0.07)						
Co-residence * Number of children up to age 5	0.09** (0.036)						
Co-residence * Substitute women	0.062 (0.145)						
<b>B. Two-Stage Least-Squares Estimation Results</b>							
<b>(Co-residence endogenous)</b>							
<b>Second Stage</b>							
Co-residence	-	-	-0.303 (0.228)	1.181 (1.618)	-0.153 (0.498)	-0.009 (0.192)	-
Co-residence * Community in urban area	-						
Co-residence * Medium school education	-						
Co-residence * Higher school education	-						
Co-residence * Age woman 20-29	0.344 (0.366)						
Co-residence * Age woman 30-39	0.411 (0.264)						
Co-residence * Age oldest living parent (husband)	-0.017 (0.021)						
Co-residence * Oldest living parent (husband) retired	0.12 (0.45)						
Co-residence * Number of children up to age 5	0.013 (0.134)						
Co-residence * Substitute women	-						
Observations	1,048	1,048	1,048	1,048	1,048	1,048	1,048
Conditioning Variables	✓	✓	✓	✓	✓	✓	✓
Wife Characteristics	✓	✓	✓	✓	✓	✓	✓
Residence Characteristics	✓	✓	✓	✓	✓	✓	✓
Husband Characteristics	✓	✓	✓	✓	✓	✓	✓

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Heterogeneity tests are presented in the different columns. IV estimates are only shown if our instrument is sufficiently strong in each respective sub-sample. We control for the same set of variables as in our main specifications. We test for heterogeneous results

with respect to the following variables:

(1) Community in urban area (reference category are communities in rural areas).

(2) Education of the women (reference category are women with low school education).

(3) Age of the women (reference category are women between age 40 and 50).

(4) Age of the oldest living parent of the husband.

(5) Oldest living parent of the husband is retired (reference category are husbands with the oldest living parent not being retired).

(6) Number of children up to age 5.

(7) Substitute women (reference category are households without substitute women).

Table B.11: Heterogeneity Analysis: Working Hours

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>A. Tobit Estimation Results</b>							
<b>(Co-residence exogenous)</b>							
Co-eesidence	-.243 (3.493)	5.823 (9.426)	-17.384** (6.974)	14.940 (18.764)	-5.194 (5.460)	-8.834** (4.185)	-7.758 (6.661)
Co-residence * Community in urban area	-14.282** (6.355)						
Co-residence * Medium school education	-7.787 (9.716)						
Co-residence * Higher school education	-12.948 (10.159)						
Co-residence * Age woman 20-29	18.350** (8.777)						
Co-residence * Age woman 30-39	15.999** (8.107)						
Co-residence * Age oldest living parent (husband)	-0.274 (0.278)						
Co-residence * Oldest living parent (husband) retired	2.587 (6.182)						
Co-residence * Number of children up to age 5	6.618** (3.254)						
Co-residence * Substitute women	7.754 (12.833)						
<b>B. IV Tobit Estimation Results</b>							
<b>(Co-residence endogenous)</b>							
<b>Second Stage</b>							
Co-residence	-	-	-29.124 (19.298)	58.064 (147.069)	-34.515 (47.582)	-4.760 (16.389)	-
Co-residence * Community in urban area	-						
Co-residence * Medium school education	-						
Co-residence * Higher school education	-						
Co-residence * Age woman 20-29	22.097 (33.650)						
Co-residence * Age woman 30-39	35.212 (22.193)						
Co-residence * Age oldest living parent (husband)	-0.911 (1.902)						
Co-residence * Oldest living parent (husband) retired	28.193 (43.178)						
Co-residence * Number of children up to age 5	2.340 (12.504)						
Co-residence * Substitute women	-						
Observations	1,048	1,048	1,048	1,048	1,048	1,048	1,048
Conditioning Variables	✓	✓	✓	✓	✓	✓	✓
Wife Characteristics	✓	✓	✓	✓	✓	✓	✓
Residence Characteristics	✓	✓	✓	✓	✓	✓	✓
Husband Characteristics	✓	✓	✓	✓	✓	✓	✓

Source: Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

Notes: Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Heterogeneity tests are presented in the different columns. IV estimates are only shown if our instrument is sufficiently strong in each respective sub-sample. We control for the same set of variables as in our main specifications. We test for heterogeneous results with respect to the following variables:

- (1) Community in urban area (reference category are communities in rural areas).
- (2) Education of the women (reference category are women with low school education).
- (3) Age of the women (reference category are women between age 40 and 50).
- (4) Age of the oldest living parent of the husband.
- (5) Oldest living parent of the husband is retired (reference category are husbands with the oldest living parent not being retired).
- (6) Number of children up to age 5.
- (7) Substitute women (reference category are households without substitute women).

Table B.12: Summary Statistics of Variables used in Channel Analysis

	(1)	(2)	(3)	(4)	(5)
	Observations	Mean	SD	Min	Max
<b>A. Woman</b>					
Elder care time (in hours)	1,048	0.13	(0.47)	0.00	6.50
Child care time (in hours)	1,048	1.76	(1.97)	0.00	12.00
Housekeeping time (in hours)	1,048	5.38	(2.69)	0.00	14.00
Leisure time (in hours)	1,048	2.44	(1.77)	0.00	11.00
<b>B. Parents or in-laws</b>					
Income parents (in 1000 Som)	501	4.18	(4.84)	0.00	60.00
Gender attitudes	490	-0.05	(0.98)	-2.86	1.52

*Source:* Life in Kyrgyzstan (LIK) Survey, wave 2011, own calculations.

*Notes:* Summary statistics of parents or in-laws are restricted to only co-residing women.

Table B.13: Gender Attitude Items

Gender Attitude Items (Scale 1-4)	Liberal/ Traditional
I1: Important decisions should be made by the husband rather than the wife	T
I2: A man's job is to earn money; a woman's job is to look after the home and family	T
I3: A women is really fulfilled only when she becomes a mother	T
I4: A working women can establish just as warm and secure of relationship with her children as a mother who does not work	L
I5: A husband's career should be more important to the wife than her own	T
I6: A university education is more important for a boy than for a girl	T
I7: Both the husband and the wife should contribute to the household income	L

*Source:* Life in Kyrgyzstan (LIK) Individual Questionnaire 2011.

*Notes:* Items marked with T/L refer to items which are categorized as traditional (T) or liberal (L), meaning the respondent has a rather traditional/liberal attitude towards the role of females in the society.

# Appendix C - Appendix for Chapter 4

Table C.1: Panel Attrition 2013-2017

	(1) 2013	(2) 2014	(3) 2015	(4) 2016	(5) 2017	(6) #firms
						220
						38
						42
						53
						47
# firms	383	347	292	257	219	
attrition rate		0.09	0.24	0.33	0.43	

*Source:* Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations. Numbers refer to the estimation sample.

*Notes:* The table provides an overview on how long firms stay in the sample, the number of firms in each year and on panel attrition. The shaded areas refer to the waves in which a firm is observed in the sample. Based on all firms in the estimation sample in 2013, 220 firms stay 5 consecutive waves in the panel (row 1), 38 for 4 waves (row 2), 42 for 3 waves (row 3), 53 for 2 waves (row 4) and 46 for 1 wave only (row 5). The row labelled with '#firms' gives the number of firms which are observed in the respective waves e.g. in 2013 there are 383 firms in the estimation sample. The last row gives the attrition rate. For example in 2014, 9 percent of firms observed in 2013 are not in the survey any more.

Table C.2: Number of Observations on Subitems: Credit Constraints

	(1)	(2)
	Formal share	Informal share
<b>A. Credit Constrained<sup>a</sup></b>		
Expected rejection	20.93	8.96
Unfamiliar with process	9.77	2.05
Does not know source	0.93	7.84
Uncomfortable	54.19	68.66
Not registered	2.09	0.56
Unable to pay back	2.79	2.80
Rejected	0.93	1.49
Not full amount	4.42	4.48
Religious reasons	3.95	3.17
<b>Sum</b>	<b>100</b>	<b>100</b>
<b>B. Credit Unconstrained<sup>b</sup></b>		
Interest rates too high	31.19	15.33
Received full amount	33.17	27.20
No need	35.64	57.47
<b>Sum</b>	<b>100</b>	<b>100</b>

*Source:* Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations. Summary statistics refer to the estimation sample.

*Notes:*

<sup>a</sup> Shares refer to the total number of credit constrained.

<sup>b</sup> Shares refer to the total number of credit unconstrained.

Table C.3: Managerial Constraint Items

(1) Item Abbreviation	(2)	(3) Item Survey Question
Gift sharing	s2	Imagine that five brothers are given a gift of 10,000,000 UGX. If the brothers have to share the money equally how much does each one get?
Inflation	s3	Imagine that you get a gift of 300,000 UGX, and you put it at home for 12 months. Inflation stays at 10%. After one year, how much could you buy for this money?
Zero interest	s4	You lend 100,000 UGX to a friend one evening and he gives you 100,000 UGX back the next month. How much interest has he paid on this loan?
Interest	s5a	Suppose you put 100,000 UGX into a savings account with a guaranteed interest rate of 2% per year. You do not have to pay fees, you don't make any further payments into this account and you don't withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made?
Compound interest	s5b	How much would be in the account at the end of five years?
	s6	I would like to ask you whether you think the following statements are true or false
Statement: high return	a	An investment with high return is likely to be of high risk
Statement: inflation	b	High inflation means that the cost of living is increasing sharply
Statement: risk diversification	c	It is less likely that you will lose all of your money if you save it in more than one place
Statement: agreement	d	A financial institution needs to get your agreement first before sharing your information with someone else
Discount	s7	Imagine the same cell-phone is on sale in two different shops at 200,000 UGX and one shop offered a discount of 30,000 UGX and the other shop offered a 10% discount: which one is the better bargain?

*Source:* Survey on micro and small enterprises in Uganda.

*Notes:* Column (1) shows the item label, Column (2) the item number as used in the survey, Column (3) gives the exact survey question.

Table C.4: Random Effects Estimation Results: Log Investments

	(1)	(2)	(3)	(4)
Saving Constraint Index	-0.273*** (0.078)	-0.160** (0.079)	-0.128 (0.081)	-0.153* (0.081)
Managerial Constraint Index	-0.260*** (0.073)	-0.235*** (0.074)	-0.202*** (0.073)	-0.142* (0.075)
Female		-0.577*** (0.175)	-0.238 (0.186)	-0.263 (0.187)
Married		0.11 (0.164)	0.018 (0.162)	0.045 (0.16)
Age		-0.002 (0.055)	-0.042 (0.066)	-0.056 (0.065)
Age squared		-0.0004 (0.0006)	0.0002 (0.0008)	0.0003 (0.0008)
No education		-1.107*** (0.35)	-0.721** (0.367)	-0.583 (0.369)
Primary school		-0.413 (0.288)	-0.223 (0.31)	-0.123 (0.313)
Completed O-level		-0.421 (0.292)	-0.372 (0.296)	-0.284 (0.302)
Completed A-level		-0.498 (0.311)	-0.417 (0.31)	-0.372 (0.31)
Cognitive ability (raven score)		0.029 (0.036)	0.015 (0.034)	0.022 (0.034)
Business experience		0.022 (0.016)	0.027 (0.052)	0.013 (0.051)
Planned investment		0.563*** (0.201)	0.519*** (0.199)	0.522** (0.204)
Age of firm			0.009 (0.063)	-0.015 (0.063)
Age of firm squared			-0.0008 (0.001)	0.00004 (0.001)
Initial capital stock (USD)			1.23e-06*** (4.62e-07)	1.59e-06*** (4.90e-07)
Own-account worker			-0.413*** (0.157)	-0.444*** (0.158)
Registered with revenue authority			0.535** (0.221)	0.433* (0.223)
Services			0.256 (0.367)	0.201 (0.369)
Manufacturing (textile)			-0.580 (0.356)	-0.573 (0.357)
Manufacturing (remaining)			-0.110 (0.385)	-0.115 (0.387)
Retail and Wholesale (remaining)			-1.161*** (0.368)	-1.142*** (0.368)
Retail and Wholesale (retail, clothing)			-0.856** (0.384)	-0.797** (0.386)
Retail and Wholesale (electric, phones)			-0.410 (0.438)	-0.393 (0.432)
Remaining sectors			-1.058* (0.559)	-0.991* (0.551)
Year 2014				0.706*** (0.186)
Year 2015				0.392* (0.203)
Year 2016				0.378* (0.225)
Year 2017				1.315*** (0.234)
Const.	2.890*** (0.091)	3.272*** (1.189)	4.380*** (1.318)	4.352*** (1.300)
Obs.	1498	1498	1498	1498

Source: Survey on micro and small enterprises in Uganda, waves 2013-2017, own calculations.

Notes: Standard errors in parentheses. Standard errors clustered at firm level.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . University and Manufacturing (printing, paper) are the reference groups for education and industry sector, respectively.



# Appendix D - Appendix for Chapter 5

Table D.1: Overview Training Program

<b>Topic 1</b>	<b>Financial management</b>
	Savings
	Borrowing
	Consumption
<b>Topic 2</b>	<b>Business investment and growth strategies</b>
	Profits
	Investments
	Risk Diversification
<b>Topic 2</b>	<b>Separating business and household finances</b>
	Importance of separating money
	Setting yourself a salary
	Repaying for money or goods
	Household budget

Table D.2: Statements on Separating Finances

Question	Indicator=1
(1) "How often do you keep the accounts or books for your business and home separate?"	1= sometimes/almost always
(2) "How often do you keep cash for your business and home physically separated?"	1= sometimes/almost always
(3) "How often do you set money aside for your business but is gets used for household/private expenses?"	1= never/rarely
(4) "If you take money out of your business (apart from the salary you take out) to pay household/private expenses, how often do you put it back?"	1= sometimes/almost always
(5) "If you take goods out of your business for your household/relatives/friends, does someone (you/relatives/friends) pay for it?"	1= sometimes/almost always
(6) "Writing down what you plan to do with your money for your family and household means you make a household budget. How often do you do that?"	1= sometimes/almost always

*Note:* This table provides all statements which are used as outcome variables in the "separating finances index".

Table D.3: Effect on Aggregates

	Average over all Indices	Average over all Variables	Principal component continuous	Principal component ordinal
	(1)	(2)	(3)	(4)
Personalized Training	0.26** (0.117)	0.255** (0.108)	0.217* (0.116)	0.156** (0.079)
Rule-of-Thumb Training	0.181* (0.106)	0.152 (0.094)	0.092 (0.106)	0.06 (0.071)

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table D.4: Separating Finances

	Separating Finances		Question				
	Index (1)	Separating of Accounts (2)	Cash (3)	Business Money used for hh (4)	Put money back if from business (5)	Paying for goods taken from business (6)	Budget Making (7)
Personalized Training (PT)	-0.028 (0.113)	0.002 (0.058)	-0.046 (0.056)	-0.087 (0.054)	0.005 (0.052)	-0.003 (0.055)	0.02 (0.058)
Rule-of-Thumb Training (RoT)	0.127 (0.103)	0.031 (0.057)	-0.005 (0.056)	-0.023 (0.055)	0.082* (0.049)	0.041 (0.054)	0.05 (0.057)
Const.	0.049 (0.143)	0.493*** (0.086)	0.599*** (0.078)	0.299*** (0.075)	0.628*** (0.078)	0.662*** (0.078)	0.545*** (0.082)
PT-RoT=0 (p-value)	0.13	0.61	0.47	0.23	0.12	0.42	0.60
R <sup>2</sup>	0.06	0.03	0.01	0.02	0.02	0.01	0.03
Mean (SD) of control group	0.00 (1.00)	0.60 (0.49)	0.00 (1.00)	0.35 (0.48)	0.71 (0.45)	0.63 (0.48)	0.50 (0.50)
Observations	446	446	446	446	446	446	446
Control for $y_{t-1}$	yes	yes	yes	yes	yes	yes	yes
Control for industry strata	yes	yes	yes	yes	yes	yes	yes

*Source:* Survey on micro and small enterprises in Uganda, waves 2017-2018, own calculations.

*Notes:* Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . An overview of all exact statements used as outcome variables in Columns (1)-(7) can be found in Table D.2.

## Publications

*Kapitel 2: Locus of Control and Investment in Training (with Marco Caliendo, Deboarah Cobb-Clark, Arne Uhlendorff)*

- SOEPpapers (2016), No. 890
- IZA Discussion Paper Series (2016), No. 10406

*Kapitel 3: Patrilocal Residence and Female Labour Supply: Evidence from Kyrgyzstan (with Andreas Landmann und Susan Steiner)*

- Landmann, A., Seitz, H. & Steiner, S. Demography (2018) 55: 2181. <https://doi.org/10.1007/s13524-018-0724-1>
- SOEPpapers (2017), No. 1705
- IZA Discussion Paper Series (2017), No. 10890