The Economic Effects of Migration in Source and Destination Countries

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Contents

Introduction

In 2015, 244 million people were living outside their country of birth. While the stock of international migrants is at an all time high, it keeps increasing by 4.4 million each year. The majority of these migrants made the choice to move to another country for economic or family related reasons. However, a non-negligible number of almost 20 million people has been forcefully displaced internationally. A majority (58 percent) of migrants are living in developed countries, while 42 percent are hosted by developing countries. Of those migrants that live in a developed country, 39 percent originate from another developed country, whereas 61 percent come from a developing country.[1] This global movement of people has, among others, broad political, cultural, sociological and economic consequences.

This thesis analyses the economic effects of migration in source and destination countries. We first focus on the source countries and investigate the consequences of emigration. This literature is mainly concerned with with brain drain at a macroeconomic or sectoral level (Clemens, 2013; Docquier and Rapoport, 2012; Freeman, 2006). However, researchers have argued that emigration has countervailing positive effects due to remittances (Russell, 1986) and incentives to invest in education (Beine et al., 2001). It is thus an unresolved question, whether emigration has adverse or positive effects on the source country.

One element that is mostly missing in the emigration literature is the role of firms.[2] Firms are affected by emigration as they lose their workers. However, they might gain due to

[1]Source: Statistics are taken from the UN (2016).

[2]This is in many cases due to the unavailability of high quality firm level data in source countries.

the fact that their former employees are gaining new knowledge abroad and sending back some of this knowledge. Chapter 1 and 2 of this thesis are therefore investigating the effect of emigration on firms. We show that while firms in general are becoming less productive due to a loss in firm-specific human capital, not all firms are affected in the same way. Innovating firms are actually benefiting from knowledge flows and can increase patenting levels.

Besides the effect on source countries, migration also impacts destination countries. One has to differentiate between the effects on natives and on the migrants themselves; even though they are inherently inter-related. The economic literature has put a strong focus on the labour market consequences of immigration on natives. Butcher and Card (1991), Friedberg and Hunt (1995) and Hunt (1992) have shown that immigrants hardly compete with natives in the labour market. More recently, the evidence has become more ambiguous (Aydemir, 2011; Borjas, 2005; D'Amuri et al., 2010; Peri and Sparber, 2009) and has also taken into account other effects of immigration such as on innovation, voting behaviour or crime. The literature on immigrants' own labour market integration is relatively smaller and generally comes to the conclusion that immigrants perform worse on the labour market for a number of different reasons (Bevelander and Nielsen, 2001; Borjas, 1985).

In the third chapter, we focus on one particular group of migrants, namely refugees, who typically have the worst labour market performance among all migrants. We investigate to what extent frictions in the labour market pose a barrier to refugees' employment and ask, if these barriers can be overcome with specific matching services. Another aspect which has received little attention in the economic literature so far is the integration of refugees into society, and how this can be measured and improved. We aim at shedding some new light on this topic.

There are various reasons why migration has increased tremendously in recent decades. The migration literature differentiates between push and pull factors. Push factors are reasons that lie in the unattractiveness of source countries, while pull factors describe reasons that characterise the attractiveness of the destination. One recent and important push factor has been the Arab Spring, which started in December 2010 and has

destabilised a number of countries in the Middle East and North Africa. While it has led to destructive wars in Libya, Syria and Yemen, it also caused periods of political instability in Egypt and Tunisia, leading to the fall of long-lasting dictatorships. The fourth chapter is looking at the political instability in Egypt from 2011 until 2013 and its effect on household behaviour. While we are unable to analyse migration outcomes for these households, we can look at the effects on wages, savings, education investments and health expenditures. These outcomes, especially the reduction in income and the increase in savings might trigger emigration decisions. Indeed emigration from Egypt has surged in recent years and reached a peak in 2015, with 3 million Egyptians living abroad (UN, 2015).

One element that is common to all four chapters of this thesis is the use of identification strategies that focus on the estimation of causal effects. While trying to answer the questions posed in the four chapters, one immediately encounters endogeneity problems. Migration decisions are inherently endogenous, job finding probabilities are endogenous and political instability is endogenous. Therefore, it is vital to use methodologies that can overcome these challenges. We use three different strategies to estimate causal effects. The first two chapters exploit a natural experiment and use exogenous legislation changes as an instrument for emigration. In the third chapter, we conduct a randomised controlled trial to create a comparable control and treatment group. In the fourth chapter we use treatment variation across different governorates to implement a difference-in-difference strategy.

To sum up, this thesis contributes new ideas to investigate the causal effects of migration in source and destination countries. The following part describes the content and contribution of each chapter in more detail.

The first chapter of this thesis analyses the effects of skilled emigration on firm performance. Using firm-level data from ten Central and Eastern European countries, we show that firms in industries that were exposed to higher outflows of skilled workers experienced a drop in total factor productivity (TFP). The estimates are robust to different specifications and to various measures of TFP and firm profits. We further find evidence for a shorter tenure of workers in sectors that are strongest hit by emigration. However,

foreign owned and innovating firms, can circumvent these negative TFP effects by increasing training and personnel costs. To identify the causal relationship, we exploit changes in EU labour mobility legislation that have been introduced due to the accession of new member states. These transitional provisions applied by the old EU member states from 2004 to 2014 created a quasi-experimental setting by allowing a staggered introduction of free labour mobility for workers in certain sectors. While these transitional provisions were in force, emigration opportunities for citizens from new member countries varied, depending on their country of origin and the industry they were qualified to work in.

This chapter's contribution to the literature is threefold. The first contribution is to bring the brain drain discussion to the firm level. While the previous literature on the consequences of emigration has focused on macroeconomic or sectoral outcomes, we are the first to analyse various firm level consequences of emigration. This has the advantage of being able to dig deeper in terms of channels, heterogeneity and policy implications. The second contribution is the construction of a new instrument that solves the endogeneity problem of migration. It is difficult to estimate the effects of emigration on firm productivity as migrants might leave the worst performing firms or quit due to an unobservable third factor, for instance a bad manager, that drives both emigration and low productivity. Our instrumental variable, which builds on exogenous changes in labour mobility legislation is able to overcome this endogeneity challenge. Third, we contribute to the literature on the consequences of the EU enlargement. We complement previous research by showing that there are negative effects on firms.

This first chapter has important policy implications. On the firm level it shows that firms can benefit from active human resource strategies, focusing, for instance, on providing training and retention measures. On the government level, the prevalence of skill shortages can justify the need to invest in the skills of the local labour force and to mitigate search frictions. In the short term a skill upgrading of the local labour force can be addressed by providing specific training courses by public institutions and in the long term by adjusting the education system to labour market needs. Another way to mitigate the negative consequences of emigration is return migration. If companies and politicians in the new EU member states succeed in bringing back their skilled workers after some time

abroad, then firms could benefit from experienced returning workers. These workers can create knowledge spillovers and bring their firms closer to the technological frontier.

The second chapter uses a very similar setting and also investigates the consequences of emigration. The difference is that it focuses on innovation outcomes, in particular patenting levels, and on high-skilled migration. Using data on patent applications and migration flows from 32 European countries, we find that emigration of highly skilled people increases patenting in source countries. We argue that knowledge flows play a crucial role in the positive effect of emigration on patenting. Countries that experience the emigration of high-skilled workers start to cite patents from the emigrants' destinations more frequently than before and compared with other possible countries. The international mobility of high-skilled workers seems to enlarge R&D networks and promotes the transfer of tacit knowledge. In this way, migration enables a faster diffusion of knowledge from more to less developed countries and helps the latter to catch up. Similar to the first chapter, the identification strategy is based on the changes in EU labour mobility legislation and thus allows a causal interpretation of our results.

We make two main contributions to the literature. First, we provide causal evidence that emigration leads to an increase in patenting. We thereby confirm what Kerr (2008) and Choudhury (2015) have shown for China and India in a very different context and using another methodology. As we have comparable patenting data for source and destination countries, we can extend this result and show that emigration leads to convergence in patenting levels. Second, we expand the literature on knowledge flows to the European context using an identification strategy that allows for a causal interpretation. We build a unique dataset by merging comparable migration data for 32 European countries with European patent data and find evidence for knowledge flows. Due to our unique European enlargement setting, we are able to estimate causal effects of labour mobility independently of other integration events by exploiting different opening times for trade, foreign direct investment (FDI) and migration.

There are a number of policy implication that arise from our contributions. First, the EU could benefit from further facilitating high-skilled migration within Europe. As there are no more legal barriers to free labour mobility, hindering factors are mostly language and

administrative barriers. In this way, the EU could exploit the full potential of high-skilled migrants both for destination and source countries. These benefits of knowledge flows can be maximised by facilitating research networks with emigrated inventors, for example by organising conferences in the origin countries. Furthermore, governments can design programmes to actively keep the diaspora engaged and by encouraging and facilitating return migration. Return migrants bring back the newly gained knowledge and many times create their own start-ups which can foster development in the countries of origin.

The third chapter moves the focus from the source to the destination country and focuses on refugees in Germany as opposed to high skilled economic migrants from Central and Eastern Europe. The motivation of the paper arose following the large influx of refugees to Germany in 2015 and in anticipation of the challenge of their labour market integration. In this chapter, we design a field experiment to evaluate the role of matching frictions in the labour market integration of refugees. During CV writing sessions with refugees in Munich, we collect information from around 300 refugees that recently arrived in Munich and have a work permit. All participants receive a complete CV in German and basic job search information. We then randomly allocate half of the refugees to the treatment group. These participants are added to the database of an NGO that matches job candidates to suitable employers. This treatment can isolate the effect of matching frictions, while it has no effect on the underlying skill set of refugees. The experimental setting allows us to track both control and treatment groups over time and to compare their labour market outcomes six months later. Our survey data includes information on the background characteristics of refugees, their existing job-search strategies, and perceptions of integration. In a pilot follow up, we track 54 refugees that receive the treatment. While 39 percent found work, the jobs are mostly unskilled, poorly paid and temporary.

We believe that this chapter makes two main contributions to the existing literature. First, we provide a thorough evaluation of a job matching service for refugees through a randomized controlled trial. Using a clean identification strategy is important in this context, since comparing refugees who voluntarily decide to access services of an NGO with other refugees would create a selection problem. We show that refugees do not know

where to look for work and that this friction can be alleviated by a job matching service. This suggests that policies targeted at facilitating labour market entry may be effective. Second, we provide new data and descriptive statistics on newly arrived refugees and their short-term labour market and integration outcomes.

The feasibility of refugees' labour market integration is a large controversy in German and European politics and is likely to have severe consequences for politics (Dustmann et al., 2016b). This experiment shows that besides missing language skills, frictions in the labour market matter. Those frictions can be reduced by the provision of better support. Beside the better support that is needed to promote the labour market integration of refugees, there are several labour market regulations that need to be removed to guarantee a free and efficient labour market entry for refugees. These labour market regulations include the residency requirement, the priority rule, the prohibition of temporary employment agencies and the prohibition of self employment during the asylum process.

The fourth chapter studies one of the reasons for the large increase in migration from the Middle East and North Africa: the Arab Spring. Using representative household survey data, we study the short-term microeconomic effects of the Egyptian revolution on household behaviour in terms of education and health expenditure as well as income and savings. We construct a new measure of political instability by analysing the number of killed individuals during political protests throughout the country. Our findings show that affected households i.e. households living in particularly violent areas, increased spending on education, especially on their sons' higher education. Furthermore, households decreased spending on health and increased their savings. Our results are robust to placebo tests, excluding Cairo and alternative ways of measuring political instability. We also explore some channels to explain the results. We interpret the increased savings and lower health expenditure as precautionary behaviour due to an uncertain environment. The increase in education expenditure is particularly prominent in areas where households were in favour of a regime change. We argue that after the fall of Mubarak those households had a positive outlook towards the future, with better labour market prospects, and therefore invested more in their sons' education.

Our contribution to the literature is threefold. First, and most importantly, we analyse a major and unanticipated intense political crisis which had significant effects in many countries in the Middle East, including Egypt, a country that has not been extensively researched previously. While the literature has shown that civil wars have devastating effects on affected communities, our contribution is to show that violence and unrest, a milder and more common form of conflict, can also have important effects on the behaviour of households. Our unique dataset allows us to analyse the effects of violence on the governorate level with detailed information on the intensity of the events. Second, we add to the literature on the response of households to shocks by exploring the relation between violence and political change, education, health expenditure and savings. We offer a new interpretation of a surprising result - the increase in education expenditure of affected households - although this result needs to be treated with caution due to a small sample size. Third, this paper contributes to the large literature on risk-coping and decision making after large and traumatising aggregate shocks. We contribute to this literature by showing the effects of violent demonstrations and protests on savings behaviour in the context of post-revolution Egypt.

Our results suggest that political instability and change can affect long-term outcomes for households. Those consequences of political instability may be difficult to quantify, or even to recognise, and they have not yet been sufficiently integrated in a policy discussion on the consequences of the Egyptian revolution. Such a change in economic behaviour, however, requires policy responses that hedge the risks for individuals through targeted policies such as loans, insurances or risk pooling in order to keep the 'cost' of social unrest at a minimum. However, as this is often overlooked, we aim to contribute with our research to a better understanding of these consequences. Furthermore, our results can influence the decision to migrate if individuals feel desperate and think that they have better opportunities abroad.

Chapter 1

Firms Left Behind: Emigration and Firm Productivity*

1.1 Introduction

The emigration of high-skilled workers poses a challenge for many countries, not only in the developing world. As workers leave their firms to follow better opportunities abroad, policy-makers and managers complain about skill shortages and emphasise the negative effects of brain drain. However, whether there is a causal link from skilled emigration to firm productivity is not clear. Scarcity of firm-level data from emigrants' countries of origin and the endogeneity of migration flows inhibit from going beyond anecdotal evidence. The direction of causation could well go the other way with migrants leaving the least productive firms or a change in unobservable variables triggering both lower firm performance and higher emigration rates. Yet, identifying firm-level effects of emigration and thoroughly disentangling the mechanisms is indispensable for the design of appropriate policies in source countries.

Central and Eastern Europe is a region that has experienced particular high emigration rates in recent years. Following the EU accession of Central and Eastern European countries in 2004 and 2007, migration flows from new member states (NMS) to old

*This chapter is based on joint work with Nadzeya Laurentsyeva.

EU member states have increased considerably. In 2003, the number of NMS migrants residing in other EU countries amounted to 846,000 people and by 2014 this number had reached 3.95 million. Although the skill level of emigrants varies across destination countries, on average, NMS migrants have been positively selected. As of 2014, 25% of the post-accession NMS emigrants had tertiary education. To compare, among NMS non-migrants, people with university degree accounted for 13.5%.[1] Despite important positive consequences of free labour mobility in terms of lower unemployment and a better skill match, there have been growing concerns that the emigration of skilled workers has created a severe challenge for source countries (Kahanec, 2012; OECD, 2013; Zaiceva, 2014).

This paper investigates the causal effects of skilled emigration on firm performance. As 'skilled', we denote individuals with either tertiary education or a professional qualification. To identify the effect of interest, we exploit changes in EU labour mobility legislation from 2004 to 2014. The transitional provisions applied by old EU member states created a quasi-experimental setting by allowing earlier or later free labour mobility for certain categories of NMS workers. While these transitional provisions were in place, emigration opportunities for NMS citizens varied, depending on their country of origin and the industry they were qualified to work in. Using firm-level data from NMS countries, we show that firms in industries that were exposed to higher outflows of skilled workers experienced a drop in total factor productivity (TFP). The estimates are qualitatively robust to various measures of TFP and firm profits.

Apart from analysing the reduced-form effects of legislation changes on firm productivity, we also perform 2SLS regressions to estimate the effect for firms which effectively experienced skill shortages due to higher emigration rates. Changes in EU labour mobility laws strongly predict skill shortages as reported by firms in NMS. This allows us to use the legislation changes as an instrument. We argue for the validity of this instrument: detailed sector- and country-specific legislation changes had not been anticipated and are uncorrelated with other integration-related events, such as the free movement of goods or capital. Using annual data from the European Commission Business Survey, we find

[1] Source: Eurostat LFS Data. Only migrants, who entered the old EU countries after the EU accession are taken into account.

that a one percentage point increase in instrumented skill shortages leads to a 1.6 percent drop in firm TFP.

To analyse more thoroughly how emigration reduces firm productivity, we develop a simple theoretical framework that illustrates one plausible channel behind this result. Better emigration opportunities induce more skilled workers to quit their jobs. This results in higher job turnover rates that reduce the existing firm-specific human capital and lower firms' incentives to invest in firm-specific training of new employees. As turnover increases and more workers have to be trained, intensive training programmes become costlier. Consequently, the stock of firm-specific skills and knowledge decreases. The effect is captured by TFP, as this form of human capital is not fully accounted for in wages. Our results are consistent with this mechanism. We find evidence for higher turnover of workers in sectors that are strongest hit by emigration and document an increase in firms' personnel and training costs. This mechanism fits well into the previous literature. Konings and Vanormelingen (2015) find that the productivity of workers increases by more than their wage after they have participated in training. Consequently, if trained workers are leaving, this is captured by labour productivity and residual TFP. Jäger (2016) shows that longer-tenured workers are harder to replace with outsiders. For more studies on the relationship between job turnover, firm-specific human capital, and firm productivity we refer to Brown and Medoff (1978), Shaw (2011), Strober (1990), and Yanadori and Kato (2007). The firm has several ways to adapt to higher quitting rates of skilled workers. It can substitute labour with capital (see Dustmann and Glitz (2015) for the case of immigration), substitute high-skilled with low-skilled workers or improve training technology for new hires.

Panel data allow us to account for firm heterogeneity and to explore the link between firms' characteristics and their sensitivity and adaptation to higher quitting rates of workers. We find that innovating and foreign-owned firms substantially increase their per-employee personnel costs. These firms are apparently able to (at least, partly) match wages offered abroad and provide more training, and therefore prevent the loss of firm-specific human capital.

This paper makes three key contributions to the literature. The first and main contribution is that we analyse the effects of emigration at the firm level. So far, the economic effects of emigration and brain drain have focused on the aggregate level (Clemens, 2013; Docquier and Rapoport, 2012; Freeman, 2006; Grossmann and Stadelmann, 2011, 2013). We expect that the migration literature can gain richer insights into the consequences of migration by investigating firm-level outcomes. Kerr et al. (2014), Kerr et al. (2013) and Kerr (2013), for instance, are encouraging the firm-level approach for the analysis of migration. Accounting for firm level outcomes, adaptation mechanisms and firm heterogeneity is important as it shapes the observable effect of migration on macro outcomes.

While there is an emerging migration literature that focuses on the firm as the unit of analysis, it has focused on immigration until now. Peri (2012), Kerr and Kerr (2013), Kerr et al. (2014), Paserman (2013), Mitaritonna et al. (2014) and Ottaviano et al. (2015) study the effects of immigration on firm productivity in the US, Israel, France and the UK respectively. They find that an increase in the supply of foreign-born workers positively affects firm productivity due to a faster growth of capital and the specialisation of natives in more complex tasks. Lewis (2013) furthermore finds that besides increased investment, firms also adapt new technology. Using firm-level German data, Dustmann and Glitz (2015) analyse how industries and firms respond to changes in the local labour supply. They find that immigration alters the local skill composition and investigate three adaptation mechanisms: a change in factor prices, a within-firm change in skill intensity, and an adjustment through the entry and exit of firms. Our research is complementary to this literature. While these authors look at the effects of immigration on firms, we focus on the consequences of emigration. Moreover, we propose a plausible mechanism that links the outflow of skilled workers to firms' total factor productivity. This mechanism emphasises the role of firm-specific human capital for firms' performance and allows drawing concrete policy recommendations for firms.

The second contribution is the creation of an instrument that circumvents the endogeneity of migration. To the best of our knowledge, this paper is the first to exploit industry-level variation in labour mobility laws to causally evaluate the effect of emigration on firm performance. Due to a lack of firm level data for source countries and the endogeneity

of migration, the causal analysis is not trivial. To address these issues, we create an extensive dataset that merges migration and firm level data on the country, year and industry level to exogenous labour mobility legislation changes. We are thus able to show that emigration imposes binding skill shortages for firms and lowers TFP via a loss of firm specific human capital.

Third, we add to the literature on the consequences of EU enlargement. This is of very high relevance to policy makers in Brussels, in accession countries, and in candidate countries, for instance Serbia. In particular, we complement the research that investigates the consequences of the recent emigration wave from the NMS. Mayr and Peri (2009) develop a model to study the consequences of European free labour mobility on human capital in the sending countries and differentiate between brain drain and brain gain due to return migration and increased incentives to invest in education. Dustmann et al. (2015) and Elsner (2013) estimate the effects of emigration on wages in Poland and Lithuania and find that wages increase for the stayers. Our contribution is to illustrate that, while firms in general experience a drop in TFP, there are various adaptation mechanisms for firms. Moreover, we suggest policies that concerned governments can implement to mitigate the negative effects.

The paper is organised as follows. The next section outlines a theoretical framework to motivate and structure our empirical analysis. Section 3 provides background information on the EU opening and transitional provisions regarding free labour mobility, which helps to understand our identification strategy. Section 4 describes the data, followed by Section 5 that presents the empirical specification. Section 6 discusses the results including heterogeneous effects, while Section 7 provides robustness checks. Section 8 concludes.

1.2 Theoretical Framework

1.2.1 General Setting

Our theoretical framework illustrates the consequences of skilled emigration at the firm level in the source country. Using a partial-equilibrium framework, we generate predictions about changes in firms' factor demand, training provision, and TFP.

We assume that there are frictions in the labour market: job separations occur at an exogenous rate and in order to fill vacant positions firms post costly vacancies. One trigger for job separations, for instance, is an easier access to foreign labour markets, which induces higher emigration. If the job separation rate increases, firms in source countries experience higher skill shortages. In this setting, skill shortages are not a disequilibrium phenomenon, but correspond to some measure of search frictions (for example, the number of posted vacancies for skilled employees).

We allow firm-specific human capital to explicitly enter the production function. A higher labour turnover destroys part of the firm-specific human capital. Since the latter is not fully captured by wages, this loss translates to a drop in TFP. In this way, we characterise one possible micro channel, through which skilled emigration directly affects firm productivity.[2]

The economy consists of a representative firm that produces output according to the production function:

$$Y = Af(K, L_s, L_u) \tag{1.1}$$

$Af()$ is a general production function, where K is the capital input and L_s and L_u are the skilled and unskilled labour inputs. $f()$ increases in the production factors K, L_s, L_u; exhibits diminishing marginal returns to K, L_s, L_u and is twice-differentiable. Each period L_s and L_u workers are involved in the production process. At the end of the period, a

[2]On a macro level, this problem was examined by Grossmann and Stadelmann (2011). In their overlapping generations model, the drop in TFP is attributed to less firm entry and, consequently, to the reduction in human capital externalities of skilled employees.

proportion δ_s (δ_u) of skilled (unskilled) job matches are destroyed. The total turnover rate δ is defined as the number of separations over the total number of employees. To fill the positions with new workers, a firm posts vacancies. For simplicity, we assume that vacancies are matched with probability one. In equilibrium, the number of job separations must equal the number of matched vacancies:

$$V_i = \delta_i L_i, i = s, u. \tag{1.2}$$

Posting vacancies creates a search cost of c_s (c_u) per period.

We represent TFP as $A = t^\gamma$. In our setting, the firm TFP consists entirely of firm-specific knowledge t. This tacit knowledge makes all the input factors more productive. It could be, for instance, a collection of the firm's best practices, a code of conduct, or tricks of an internal IT system. In order to employ this knowledge in the production, the firm has to train all skilled workers how to use it. We assume that there is no training needed for unskilled workers. If a skilled worker leaves and the firm hires a new worker as a replacement, it has to pay the training costs for the new worker, which are proportional to the amount of firm-specific knowledge to learn. Given a turnover rate δ_s, the total training costs per period would amount to $\delta_s L_s c_t t$, where $\delta_s L_s$ is the number of newly hired skilled workers. c_t denotes the marginal costs of training, which we set equal to 1. The total training costs can also be interpreted as the loss of firm-specific human capital due to worker turnover. We treat the amount of training per worker t as adjustable when the firm hires new skilled workers. For instance, if it becomes too expensive to teach a particular firm practice to all the new hires, the firm can drop this practice, thus reducing its knowledge t. If there is no turnover, $\delta_s = 0$, the firm-specific knowledge stays constant.

1.2.2 The Firm's Optimisation Problem

The firm chooses inputs K, L_s, L_u to maximise profits Π. In addition, when hiring skilled workers, the firm decides on t - the amount of firm-specific knowledge to teach. The

exogenous variables are the output price (P), wages (w_s, w_u), the interest rate (r), the job destruction rate (δ_s, δ_u), and the vacancy costs (c_s, c_u).

$$\Pi = PY - \sum_{i=s,u} (w_i L_i + c_i V_i) - rK - V_s t \tag{1.3}$$

s.t.

$$V_i = \delta_i L_i, i = s, u;$$

$$Y = t^{\gamma_\tau} f(K, L_s, L_u)$$

Using the constraint to substitute for V_i yields the total personnel costs of skilled workers: $L_s(w_s + c_s\delta_s + t\delta_s)$. These costs comprise wages, search costs, and training expenses. Similarly, the total personnel costs of unskilled workers are equal to $L_u(w_u + c_u\delta_u)$.

The emigration of skilled workers raises δ_s and results in a higher turnover ($\frac{\delta_s L_s}{L}$). The marginal hiring costs of a skilled worker ($\delta_s(c_s+t)$) increase.[3] Thus, emigration augments the marginal personnel costs of a skilled worker ($w_s+\delta_s(c_s+t)$) and affects the relative input demand of the firm. Further, the incentives for training change. The higher turnover rate makes training more expensive, which consequently reduces the optimal level of the firm-specific knowledge t. This result follows from the fact that the firm has to teach all its specific knowledge t to all newly hired skilled workers.[4] Therefore, when δ_s increases, it becomes more expensive for a firm to sustain its knowledge level due to higher training costs. We provide a proof of the comparative statics results for a general production function in the Appendix.

[3]The model is generalisable to the situation in which both skilled and unskilled workers emigrate. In this case turnover would increase for both groups but firm-specific human capital would only be lost for skilled workers.

[4]For instance, unless all of a firm's sales managers know how to use a Customer Relationship Management (CRM) system, there will be very poor coordination among them. This may lead to both the sales managers and the CRM system being unproductive.

1.2.3 Comparative Statics

We are interested in the effect of emigration on firm productivity. If workers obtain the possibility to emigrate to a country with higher wages, this results in a higher quitting probability. This can be triggered by exogenous political events such as the EU accession. In the model, the introduction of free labour mobility that resulted in higher emigration rates can thus be represented by higher job separation rates δ_s and δ_u. In the comparative statics, we focus on the effect of raising δ_s, because it has direct implications for firm TFP.

Proposition: *An increase in the job separation rate δ_s reduces the firm's TFP through the reduction in firm-specific knowledge t.*

1. *An increase in δ_s raises the marginal hiring costs of a skilled worker. This corresponds to an increase in the personnel costs $w_s + \delta_s(c_s + t)$. Depending on the elasticity of substitution between the inputs, firms might find it optimal to substitute high-skilled workers with low-skilled workers or with capital. The ratio $\frac{L_s}{L}$ decreases and/or the ratio $\frac{C}{L}$ increases.*
2. *An increase in δ leads to a lower provision of training (t) per hired skilled worker because higher turnover rates increase marginal training costs. This results in a negative effect on the firm's TFP. However, the total training costs $\delta_s L_s t$ might increase as, on the extensive margin, due to a higher δ_s, the firm has to train more workers.*

In our simple framework, we assume that wages are exogenously given, which is a realistic assumption if we consider an average small or medium-sized firm. Emigration lowers the available supply of skilled labour and should lead to a general increase of w_s. This will increase personnel costs $w_s + \delta_s(c_s + t)$ and thus lower the relative demand for skilled workers. Provided δ_s is now kept constant, the effect on the training provision t will be of a second order. Hence, if emigration leads only to the adjustment of wages, we would not observe a strong negative effect on firm TFP.

1.3 Transitional Provisions for the Free Movement of Workers from New Member States

Before testing the derived predictions with the data, we provide background information on the transitional provisions applied by old EU member states from 2004 to 2014. This section shows how the gradual opening of the EU labour markets created time, country, and industry-level variation in the emigration rates of NMS citizens.

In 2004, ten Eastern and Southern European Countries joined the EU: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. While free mobility of goods and capital was introduced either prior to or at the point of accession by all countries, free labour mobility was initially restricted. Some EU15 countries[5] feared an inflow of cheaper labour. The EU Commission thus allowed the old member states to unilaterally restrict their labour markets by national laws for a period of up to seven years. These transitional arrangements were applied to all new members in the same way, except Malta and Cyprus. We thus denote the remaining eight countries as NMS8. In 2007, Bulgaria and Romania (NMS2) joined the European Union, also facing the transitional agreement rules.

The option to unilaterally restrict labour markets generated different rules within the EU. While Ireland, Sweden, and the UK decided to open their labour markets immediately in 2004 without any restrictions, other countries delayed the access or applied special job schemes in certain industries. Denmark, Greece, Spain, and Portugal, for instance, removed restrictions only in 2009. France, Belgium, Netherlands, and Austria opened their labour markets gradually, allowing only workers in certain industries and introducing quotas. Germany kept the labour market almost completely closed until the expiration of the transitional agreements (2011 for NMS8; 2014 for NMS2). Other EFTA members, Iceland, Liechtenstein, Norway, and Switzerland, also applied transitional provisions and we thus include them in our analysis (EU15+4 denote all countries that applied tran-

[5] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom (EU15).

Table 1.1: Overview of the gradual opening of the EU15+4 labour markets

Country	NMS8 (2004 entry)	NMS2 (2007 entry)	Sectoral Exceptions
Austria	2011	2014	NMS8 (2007-2010), NMS2 (2007-2013): Construction, Manufacturing of Electronics and Metals, Food and beverage services (restaurant business), other sectors with labour shortages
Belgium	2009	2014	-
Denmark	2009	2009	-
Finland	2006	2007	-
France	2008	2014	NMS8 (2005-2007), NMS2 (2007-2013): Agriculture, Construction, Accommodation and food services (tourism and catering), other sectors with labour shortages
Germany	2011	2014	NMS8 (2004-2010), NMS2 (2007-2013): sectors with labour shortages
Greece	2006	2009	-
Iceland	2006	2012	-
Ireland	2004	2012	-
Italy	2006	2012	NMS8 (2004-2005): sectors with labour shortages; NMS2 (2007-2011): Agriculture, Construction, Engineering, Accommodation and food services (tourism and catering), Domestic work and care services, other sectors with labour shortages; Occupations: Managerial and professional occupations
Lichtenstein	2011	2016	-
Luxembourg	2008	2014	NMS2 (2007 - 2013): Agriculture, Viticulture, Accommodation and food services (tourism and catering)
Netherlands	2007	2014	NMS8 (2004-2006), NMS2 (2007-2013): International transport, Inland shipping, Health, Slaugther-house/meet-packaging, other sectors with labour shortages
Norway	2009	2012	NMS8 (2004-2008), NMS2 (2007-2011): sectors with labour shortages
Portugal	2006	2009	-
Spain	2006	2009	Reintroduction of restrictions for Romanians: 11/08/2011 - 31/12/2013
Sweden	2004	2007	-
Switzerland	2011	2014	-
United Kingdom	2004	2014	NMS2 (2007-2013): Agriculture, Food manufacturing

Notes: Column 2 shows the year of the labour market opening of the respective country for NMS8 countries, column 3 shows the year of the labour market opening of the respective country for the NMS2 countries. Column 4 shows, which sectors were exempt from restrictions.
Source: European Commission.

sitional provisions). Table 1.1 provides an overview of the precise opening dates and industry details per country.

This sequential opening by country, year and industry had a significant effect on migration rates. Constant (2011) and Kahanec (2012) provide descriptive evidence of EU migration flows following the enlargement. They show that the transitional agreements influenced the movement of migrants. The UK and Ireland, for example, have become the main EU destination country for Polish, Slovakian and Latvian workers. Kahanec et al. (2014) apply a difference-in-differences analysis and confirm that outward migration from the NMS increased with the EU entry, but its full potential was hampered by the presence of transitional arrangements.

One might argue that the restriction of a country's labour market is endogenous and related to local labour market conditions. Germany, for instance, experienced high unemployment rates during the mid-2000s and this was one of the reasons for its labour market restrictions. However, while the transitional arrangements are endogenous to labour market conditions and firm productivity in the *receiving* country, they are exogenous to firm outcomes in the *source* countries.

There are additional worries that concern the validity of the instrument. One possible identification problem could arise if the decisions to open a particular industry by EU15 countries were to some extent endogenous to conditions in the new member countries. For example, mobility restrictions might have been directed at the NMS citizens working in countries and industries with high volumes of EU15 FDIs. This is not the case for the following reasons. First, EU15 countries could not differentiate transitional provisions across countries in NMS8 and NMS2 groups. Second, this proposition is hard to reconcile with significant time-variation in the removal of provisions. One might further suggest that the industry-specific timing of labour market openings coincided with trade liberalization. Yet, all new EU member countries had signed and enforced Free Trade Agreements with the EU prior to their accession. It is plausible to conclude that the application of transitional provisions by the EU15 was driven mainly by their own economic conditions and is thus exogenous to firm outcomes in the NMS.

The transitional agreements have not only affected the employed people in the new member states, but have also given new opportunities to the unemployed. One might assume that the unemployed had the highest incentives to leave their countries and to look for work abroad. This would bias our estimated coefficient towards zero as the emigration of unemployed workers would not lead to the loss of firm-specific human capital and would leave firm productivity unaffected. Another concern is that people might change industries as they migrate. This will again bias our estimate towards zero. It is plausible to assume though that people have the smallest emigration costs if the industry they work in opens for immigration. If they eventually work in another industry after migration, this does not affect our results as we are only interested in the fact that they left and it does not matter in which industry they actually work in their destination country.

1.4 Data Description

For our analysis we use firm-level financial and survey data, aggregate industry- and country-level indicators, detailed migration data, and information from EU labour legislation.

We obtain firm-level data from Bureau Van Dijk's AMADEUS database that provides standardised annual balance-sheet and profit information for European public and private companies. We work with an unbalanced panel of about 110,000 firms located in NMS. The period covered ranges from 2000 to 2013, and there are five annual observations for each firm on average. The sample includes companies in manufacturing, construction, retail trade and services. Apart from financial reports, the dataset provides information on firms' patenting activities, ownership structures, export markets, and exit status (such as bankruptcy or liquidation).

We include firms with at least two years of available financial data to calculate the TFP index. As a note of caution, we might not capture companies at the lower tail of the productivity distribution if they are less likely to be included in the sample. Based on observables, though, firms in the regression samples are not statistically different from the full sample (see table A.1). We used the largest possible number of firms with non-missing observations. The number of firms across regression results slightly varies due to differences in the availability of variables.

To obtain data on the training of employees, we complement this data with firm-level information from the Business Environment and Enterprise Performance Surveys (BEEPS) administered by the European Bank for Reconstruction and Development (EBRD) in all NMS. The survey was conducted in 2002, 2005, 2009 and 2012 and contains an extensive questionnaire on firms' self-reported financial performance, workforce composition, management practices, innovation, and perceptions of the business environment (including the availability and quality of human capital). The survey data provides a representative sample of manufacturing, construction, service, and retail trade firms. In total, there are 13,972 firm-year observations, of which 2,556 (with 1,293 unique firms) make up an unbalanced panel.

Disaggregated emigration data by country and industry does not exist.[6] Therefore, we cannot perform a meaningful OLS or first-stage regression using migration data. For our baseline estimations, we thus conduct reduced-form regressions where the main explanatory variable Free Movement (FM) is constructed directly using the legislation information. To construct the FM variable, we use the Labour Reforms database (section on labour mobility) of the EU Commission and complement it with information from the national legislation of EU15+4.

To shed more light on one potential channel, we measure if the opening of labour markets predicts firms' labour shortages. The measure of skill shortages is taken from the EU Commission Business Survey, which is conducted quarterly in all EU member countries by the Directorate General for Economic and Financial Affairs (DG ECFIN). The survey addresses representatives of the manufacturing, service, retail trade, and construction sectors and asks for firms' assessment and expectations of the business development. Among other questions, the survey's participants are asked to evaluate factors limiting their production (such as labour, access to finance, demand, and equipment). The EU commission publishes information on a two-digit NACE industry level, thus the obtained measure is equal to the share of firms in a given industry reporting to be constrained by labour. To match the data to other datasets, we aggregated quarterly indicators to annual levels. As an alternative measure, we consider firms' replies from the BEEPS survey, which asks respondents to evaluate the importance of 'inadequately educated labour' as an obstacle for businesses. To make it more comparable with the EU Commission Survey, we aggregate individual firm responses on a two-digit industry level.

As additional covariates, we use aggregated (two- and four-digit NACE) industry level data, which is available for all EU member states and is harmonised by Eurostat. The structural business statistics database contains annual information on industries' performance, including output, investment, employment, and personnel costs. Macroeconomic

[6]The Eurostat Labour Force Survey provides information on the industry, education, and occupation of immigrants, but aggregates the country-of-origin information. While observing immigrants in EU15+4, we can only see if they come from NMS8 (2004 entry) or NMS2 (2007 entry). Even if the detailed origin information were available, though, it would likely be noisy and the labour force sample would have small numbers in the specific country-industry-year cell.

controls (GDP, FDI, unemployment, interest rates) come from the Worldbank statistical database.

1.5 Econometric Specification

The aim of the empirical analysis is to test the predictions of our model. We thus want to establish how the exogenous increase in the emigration influences TFP, personnel costs, training, and the capital/labour ratio of firms. For identification, we exploit legislation changes, which generate exogenous variation in emigration. In this section, we first present the baseline reduced-form regressions of firm outcomes on legislation changes. The latter are summarised by the Free Movement variable described in Section 1.5.3 below. We then present the specification for the 2SLS regression. As there is no disaggregated country- and industry-specific emigration data for Eastern Europe, we do not explicitly use the Free Movement variable as the instrument for emigration. Instead, to estimate the treatment effects (LATE), we conduct 2SLS regressions with a measure of skill shortages, which are reported on the industry level. The 2SLS coefficients thus capture the effect in industries, where emigration created *binding* skill shortages.

1.5.1 Baseline Model: Reduced Form

The reduced-form empirical specification is described below:

$$Y_{fict} = \beta_1 FM_{ict-l} + \beta_2 X_{fict} + \beta_3 I_{ict} + \beta_4 J_{it} + \beta_5 C_{ct} + \tau_t + \nu_f + \epsilon_{fict} \tag{1.4}$$

where Y_{fict} are different performance measures of a firm (f) in industry (i), country (c) and year (t). FM_{ict-l} indicates the Free Movement variable. We include it in equation (1.4) with a lag of length l. β_1 is the reduced-form effect of the legislation change on a firm-level outcome. X_{fict} is a set of time-varying firm controls, such as age and capacity utilization. I_{ict} includes country-specific industry controls such as total investment, average mark-up (ratio of revenues to costs), and inward FDI. These variables account for variation due to other shifters of labour demand within an industry of a particular country, namely,

technical change or higher competition. J_{it} are controls that are common to all countries such as industry-specific total sales and skill shortages. C_{ct} is a vector of macroeconomic covariates, accounting for country-wide changes: the GDP growth rate and FDI inflows. All monetary variables are in natural logarithms. τ_t are time dummies. ν_f represent firm fixed effects, and ϵ_{fict} is the error term. In the baseline empirical model, we consider only within-firm variation. Such a specification allows us to take care of firm unobserved time-invariant heterogeneity (as initial management ability or quality of business ideas) and other constant characteristics of a firm's location or industry-specific production technologies.

The focus of this project is to estimate the effect of emigration on firm total factor productivity. We compute firm productivity in several ways: using a TFP-index and a semi-parametric approach as in Levinsohn and Petrin (2003). The latter method allows us to overcome the simultaneity bias between firms' inputs and unobserved productivity shocks. For details regarding the TFP calculation, we refer to the Appendix A.3. As alternative measures of productivity, we consider firm profits: $\frac{EBIT}{Assets}$ calculated as the ratio of earnings before interest and tax over assets. Using a number of different productivity measures ensures that the effects we find are not driven by measurement issues.

To understand if our additional model predictions for firms' adjustment hold, we look at several other outcome variables and use the same regression equation. In particular, we are interested in the effects on the capital/labour ratio, the personnel costs, and training.

1.5.2 Two Stage Least Squares Model with Skill Shortages

Due to a lack of disaggregated migration data, we cannot directly test the relevance of the Free Movement variable for actual emigration rates from NMS. Instead we can go one step further in the causality chain and check if the EU15+4 labour mobility laws explain the increase in skill shortages as reported by NMS firms. The first-stage regression takes

the following form:

$$SH_{ict} = \gamma_1 FM_{ict-l} + \gamma_2 I_{ict} + \gamma_3 J_{it} + \gamma_4 C_{ct} + \tau_t + \kappa_{ic} + u_{ict} \tag{1.5}$$

SH_{ict} is the industry-country-year measure of skill shortages. γ_1 is the coefficient of interest and reflects the marginal contribution of the Free Movement variable, given industry- and country-specific time-varying covariates ($I_{ict}, \gamma_3 J_{it}, C_{ct}$), and time dummies ($\tau_t$). By including industry-country fixed effects κ_{ic}, we identify the Free Movement effect only from within-industry variation in the propensity to emigrate.

We run a second-stage regression, similar to (1.4), but instead of the Free Movement variable, use the instrumented measure of skill shortages. The coefficient $\hat{\beta}_1$ thus captures the productivity effect of skill shortages caused by the transitional provisions. It is identified only for industries where the legislation changes created binding skill constraints for firms.

1.5.3 Construction of the Free Movement Variable

In our model, we analyse an exogenous increase in the turnover rate due to emigration. In the data, this corresponds to the opening of the EU15+4 labour markets for NMS, which induced emigration and therefore increased the turnover rate. These openings are captured by the Free Movement (FM) variable. We construct it directly by aggregating information about EU15+4 labour mobility laws. We use it as the main explanatory variable in our baseline empirical specification and as the instrument for skill shortages in the 2SLS regression.

A country-industry-year cell makes up one observation. Industries are represented at the NACE two-digit level. The main period under consideration is from 2000 to 2014 (from the accession of NMS8 countries to the termination of all transitional provisions applied to NMS2). First, for each observation we construct a set of 15 dummies D_{cc_jit}, with each dummy corresponding to one of the EU15+4 countries, c_j. A dummy takes the value of 1 if according to the legislation of an old EU member, its corresponding industry i is open to labour migrants from a given new member state c. For example, the UK completely

opened up its labour market for the NMS8 group in 2004. Therefore UK dummies for all industries for all NMS8 countries equal 1 starting from 2004. In contrast, France held the transitional provisions for the 2004-entrants until 2008. Prior to 2008, the French government applied a special job scheme, which allowed for free labour market access only in construction, tourism, and catering. France dummies for NMS8 industries take a value of 0 until 2008, except for the three mentioned sectors. Figure A.1 in the Appendix shows how the legislation dummies enter our dataset.

One of the limitations of the legislation dummies is low industry-level variation. Austria, Germany, France, Italy, and the Netherlands, for instance, did not explicitly specify which industries are open to labour migrants from new member states, but rather allowed for special job schemes in sectors that experienced skill shortages. The dummies also do not capture different capacities of EU15+4 markets to absorb migrants. To account for this, we multiply the legislation dummies D_{cc_jit} by a measure of skill shortages in a given industry of a j_{th} EU15+4 country. For this, we use the share of firms (in destination industries) reporting to be constrained by the labour factor. These data are available from the EU Commission Business Survey. This modification controls for implicit legislation changes and for differences in labour market conditions across and within industries in old EU members.[7] Easiness to find a job, which increases in sectors experiencing skill shortages, can be another important criteria for worker mobility. A possible concern with such a modification is that skill shortages in the old EU member states might not be fully exogenous to firm productivity in NMS countries, due, for example, to common technology shocks. We can control for this by including industry-specific time dummies or an average measure of skill shortages in a given industry for all EU members. Another concern is that labour demand could increase in EU15+4 industries, which after the EU enlargement had become more competitive relative to their rivals from new member states. In this case, however, one would expect to see negative tendencies in NMS firm performance already prior to the outflow of workers. We can also control for higher product-market competition by including a mark-up measure.

[7]This allows to capture, for example, a decrease in demand for foreign labour force during and after the economic crisis in 2008-2009. At this time, many labour markets were already open for NMS citizens, but effective job possibilities were limited. De-jure, only Spain reacted to the worsening of economic conditions by reintroducing restrictions for Romanian citizens in 2011.

To summarise the set of 19 dummies in a single measure, we apply special weights that reflect how strongly the opening of a particular EU15+4 labour market affects the citizens of a given new member state. It is reasonable to assume that labour migrants, for example, from Estonia were more sensitive to the opening of the Finnish labour market than the Portuguese one. One approach is to use bilateral distances between the two largest cities of each source and destination country as a measure of proximity: the shorter the distance, the larger is the weight for a corresponding EU15+4 labour market.

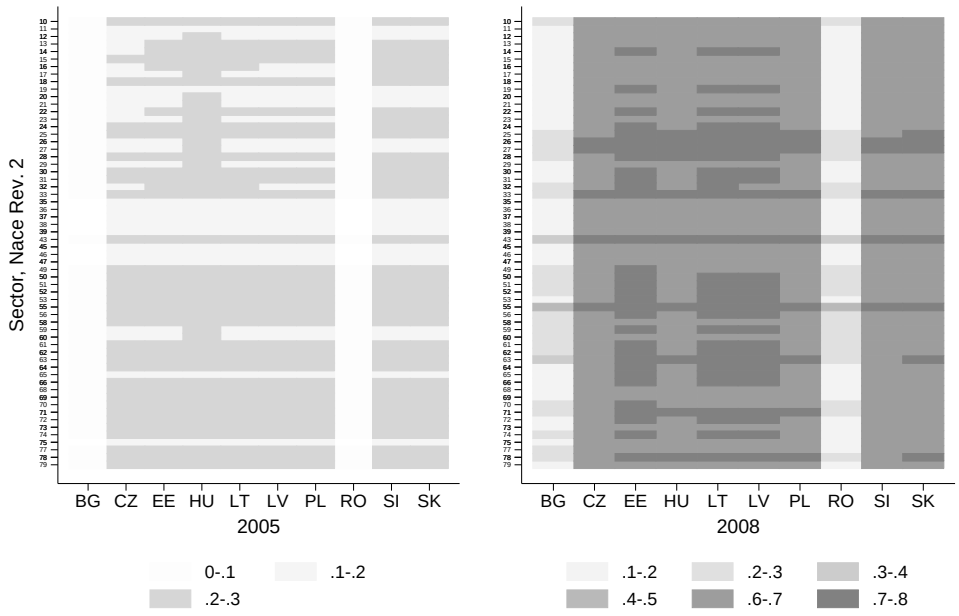
The legislation information is summarised in one variable:

$$FM_{cit} = \sum_{j=1}^{19} w_{c,c_j} \cdot D_{cc_jit} \tag{1.6}$$

FM_{cit} is the value for one observation (source country-industry-year). D_{cc_jit} denotes the legislation dummy for openness of the labour market in a j_{th} old EU member's corresponding industry for the citizens of a given source country in a given year and w_{c,c_j} denote the weights. To ensure the comparability of different versions of Free Movement variables, we standardise them to be in the range [0;1]. Figure 1.1 illustrates the variation in the Free Movement variable across industries of NMS.

To investigate the plausibility of our identifying assumption, we check if firms' outcomes prior to 2004 predict changes in the legislation over 2004-2014. We also run several placebo tests. We report the results in Section 1.7.

Figure 1.1: Variation in the Free Movement Variable



Notes: This graph shows the variation in the instrument. We compare different industries (y-Axis) in different countries (x-Axis) in 2005 and 2008. The darker the shading, the stronger these industries in these countries have been exposed to emigration.

1.6 Empirical Results

This section presents and discusses the empirical results and compares them with the model's predictions. All regressions include firm fixed effects and thus capture within-firm variation in performance as a response to changes in an industry's exposure to emigration.

1.6.1 Reduced Form Regressions

Table 1.2 presents the reduced form estimations: we regress firm outcomes directly on the Free Movement (FM) variable. We use a one-period lag for the Free Movement variable to account for some inertia between the legislation change and the migration decisions. All dependent variables are in natural logarithms, and the Free Movement variable is in the range from 0 to 1. The coefficients may be interpreted as the log point ($\simeq$ percent) change in dependent variables when the FM increases from 0 (no free labour mobility

Table 1.2: Free Movement Effect on Firm Performance, Reduced Form, Amadeus Data

	(1) TFP index	(2) TFP LP	(3) ROA	(4) Pers. costs	(5) C/L
$L.FM_{ict}$	-0.273***	-0.234***	-0.0344**	0.270***	0.172
	(0.0696)	(0.0619)	(0.0141)	(0.0628)	(0.106)
$Mark-up_{ict}$	0.212***	0.186***	0.0906***	-0.133***	-0.0824**
	(0.0526)	(0.0350)	(0.0165)	(0.0279)	(0.0404)
$L.log\_investment_{ict}$	0.00178	-0.00707	-0.00556***	0.00521	0.0243**
	(0.00680)	(0.00500)	(0.00203)	(0.00792)	(0.0106)
$L.log\_FDI\_inward_{ict}$	-0.00125	2.82e-05	-0.000435	0.00242	0.00502**
	(0.00143)	(0.00114)	(0.000509)	(0.00148)	(0.00219)
$Log\_total\_sales_{it}$	0.00350	-0.00910	0.000439	0.0516***	0.00880
	(0.0100)	(0.00913)	(0.00262)	(0.00851)	(0.0126)
$Mean\ skill\ sh._{it}$	0.0763	0.160	0.175***	0.0702	-0.0866
	(0.158)	(0.117)	(0.0384)	(0.115)	(0.169)
$L.log\_FDI_{ct}$	0.0123***	0.0108***	0.00231***	0.00819***	0.0113***
	(0.00248)	(0.00226)	(0.000617)	(0.00175)	(0.00229)
$D.log\_GDP_{ct}$	1.520***	1.301***	0.179***	0.397***	0.130
	(0.163)	(0.142)	(0.0443)	(0.0996)	(0.135)
Observations	546,661	322,938	542,500	529,567	529,567
Number of firms	108,413	71,652	107,585	105,572	105,572
R^2	0.074	0.040	0.053	0.105	0.122
Dummies	f y	f y	f y	f y	f y
Clusters	2660	2521	2630	2618	2618

Notes: The table presents reduced-form estimates of the free movement. All specifications are estimated with firm fixed effects and time dummies. Dependent variables: TFP index, TFP LP - TFP estimated with the Levinsohn and Petrin (2003) procedure, ROA - return on assets, Pers. costs - personnel costs per employee, C/L - capital-labour ratio. L.FM - Free Movement variable (distance-weighted, interacted with skill shortages in destination industries), 1 year lag. Standard errors (in parentheses) are clustered on country-industry (NACE 4-digit) level.
*** p<0.01, ** p<0.05, * p<0.1

within EU for workers qualified to work in a particular industry) to 1 (maximum exposure to free labour mobility in our sample).

For the main sample of firms, the effect of free movement on productivity is negative, which confirms the prediction of our model. The result is robust to different measures of productivity, to the exclusion of outliers (firms with sales below the 1st and above the 99th percentiles), and to the exclusion of firms that entered the market after 2002.

The maximum annual increase in the value of the FM variable in our sample is equal to 0.52 (for certain industries in Romania in 2007), while on average NMS industries experienced a maximum annual increase of 0.25. We can use this information to give a quantitative interpretation of our result. One year following the maximum increase in labour mobility, a firm's TFP drops by $0.25 \cdot 0.234 = 0.059$ or 5.9 log points. Given an

average TFP of 29,500 EUR (estimated with the Levinsohn and Petrin (2003) method), this translates to annual losses of 1,725 EUR per firm.

We can also see that firms adjust to emigration by increasing personnel costs. In our dataset, personnel costs include wages and other employee-related costs. We are thus not able to compare this aggregate data directly with our model predictions. However, the observed increase in personnel costs is consistent with more hiring and training expenses due to worker turnover. The annual increase in the Free Movement value of 0.25 would lead to $0.25 \cdot 0.27 = 0.0675$ or 6.75 log point increase in personnel costs per employee. With average annual employee costs of 7,840 EUR, this leads to additional 530 EUR per worker. The change in the capital/labour ratio is positive, but imprecisely estimated.

To confirm our results and to analyse additional variables, we perform the same regression using firm-level data from the BEEPS survey. Table 1.3 presents the reduced form estimates. BEEPS contains only a limited number of firms with available panel data. Therefore, in the reported specification we pooled firm observations together, adding firm-level covariates: lagged sales, capital, quadratic terms for firm age and lagged number of employees, share of foreign capital, share of export in sales. All regressions are estimated with country·year (c·y), country·industry(c·i), and industry·year(i·y) fixed effects. The remaining variation in dependent variables should come from country-industry-year changes in the value of the Free Movement variable. As with the Amadeus data, we find a negative effect of the EU labour market opening on firm TFP. Furthermore, we report significant increases in the share of trained employees by firms in industries, which have potentially experienced higher labour emigration. Combining this with our model predictions, it suggests that firms train more people as they increase their hiring due to turnover.

One assumption we are making to bring the model to the data is that the Free Movement variable affected average turnover in NMS industries. Using Eurostat LSF data, the results in Table 1.4 are in line with our hypothesis: industries exposed to higher labour mobility experience a decrease in average tenure (which corresponds to higher turnover).[8] The estimates are robust to the inclusion of country-specific time trends. To check for

[8] $Tenure$ can be expressed as $1/Turnover$

Table 1.3: Free Movement Effect on Firm Performance, Reduced Form, BEEPS Data

	(1) TFP index	(2) Wage	(3) Train	(4) New product
$L.FM_{ict}$	-0.541***	0.772	1.706***	-3.589
	(0.083)	(0.620)	(0.577)	(2.772)
$log\_lag\_l_{fict}$	-0.0501	-0.211***	0.0630***	0.0201
	(0.118)	(0.0347)	(0.0170)	(0.0159)
$log\_lag\_sales_{fict}$	0.215**	0.225***	0.0218**	-0.0144*
	(0.107)	(0.0221)	(0.00945)	(0.00831)
$\%\ foreign_{fict}$	-0.187	0.462***	0.179***	0.115
	(0.207)	(0.118)	(0.0637)	(0.0717)
$export\_share_{fict}$	-0.0135	0.0620	-0.105*	-0.0681
	(0.198)	(0.100)	(0.0589)	(0.0707)
Observations	1,344	5,432	5,078	2,179
R^2	0.971	0.227	0.243	0.247
Dummies	cy ci iy	cy ci iy	cy ci iy	cy ci iy
Robust	yes	yes	yes	yes
Clusters	296	591	574	290

Notes: The table presents reduced-form estimates of free movement on firm performance using BEEPS data. All specifications are estimated with country·year (c·y), country·industry(c·i), and industry·year(i·y) fixed effects. The variable $Train$ represents the share of trained workers in the total workforce. Additional firm-level covariates include lagged sales, capital, quadratic terms for firm age and number of employees, share of foreign capital, share of export in sales. $L.FM_{ict}$ represents the sum of legislation dummies, weighted by distance to a given old EU member-country and interacted with skill shortages in destination industries. Standard errors (in parentheses) are clustered on country-industry level.
*** p<0.01, ** p<0.05, * p<0.1

the presence of pre-trends, we add a one-period forward of the Free Movement variable (column 3), which turns out to be insignificant, as expected.

Table 1.4: Free Movement Effect on Tenure, Reduced Form, Eurostat Data

	(1) Mean tenure	(2) Mean tenure	(3) Mean tenure
$F.FM_{ict}$			-0.268
			(0.320)
$L.FM_{ict}$	-0.858***	-1.052***	-1.842***
	(0.144)	(0.219)	(0.272)
$L.log\_investment_{ict}$	-0.110***	-0.0899**	-0.107**
	(0.0389)	(0.0390)	(0.0422)
$log\_total\_sales_{ict}$	0.0261	0.00509	-0.00460
	(0.0907)	(0.0883)	(0.0943)
$L.log\_FDI_{ct}$	-0.172***	-0.148***	-0.166***
	(0.0336)	(0.0320)	(0.0394)
$D.log\_GDP_{ct}$	-1.200	-0.141	-3.564**
	(0.904)	(0.870)	(1.424)
Observations	1,873	1,873	1,564
Number of idc	314	314	312
R^2	0.142	0.136	0.208
Dummies	ic y	ic y	ic y
Clusters	314	314	312

Notes: The table presents reduced-form estimates of free movement on average tenure. All specifications are estimated with industry·country fixed effects and time dummies. L.FM - Free Movement variable, 1 year lag. In specification 1, we use only distance-weighted FM dummies. In specifications 2 and 3, FM dummies are interacted with skill shortages in destination industries. In specification 3, we add a forward lag of the FM variable to check for the absence of pre-trends. Standard errors (in parentheses) are clustered on country-industry level.
*** p<0.01, ** p<0.05, * p<0.1

1.6.2 Heterogeneity

In the main specification, we analyse the effect of free movement for the full sample of firms. To check for heterogeneous effects, we estimate specification 1.4 for different sub-samples of firms.

Tables 1.5 and 1.6 show the results for foreign-owned and innovating firms. The estimated effect of free movement on firm TFP is smaller compared to the full sample and loses its statistical significance. At the same time, the estimated coefficients for personnel costs and capital/labour ratios suggest that these firms adjust much stronger to the increased emigration opportunities of their workforce. Foreign-owned firms increase their personnel costs significantly more. They might be able to offer wage increases to retain workers and training to newcomers to teach firm-specific human capital. Patenting firms seem to adapt in particular through increasing the capital/labour ratio. These firms might also be able to provide an interesting work environment and have retention initiatives to keep their essential research staff. There is also evidence that innovating firms benefit from

Table 1.5: Free Movement Effect on Firm Performance, Reduced Form, Foreign-Owned Companies

	(1) TFP index	(2) TFP LP	(3) ROA	(4) Pers. costs	(5) C/L
$L.FM_{ict}$	-0.0571	-0.124	0.0191	0.396***	0.395***
	(0.0796)	(0.0805)	(0.0269)	(0.0642)	(0.110)
$Mark-up_{ict}$	0.105***	0.143***	0.0480***	-0.0509	-0.0546
	(0.0339)	(0.0357)	(0.0136)	(0.0399)	(0.0446)
$L.log\_investment_{ict}$	0.0127*	-0.0108	-0.00692*	-0.0115	-0.0274**
	(0.00768)	(0.00798)	(0.00375)	(0.0110)	(0.0140)
$L.log\_FDI\_inward_{ict}$	4.88e-06	0.000242	-0.000519	0.00119	0.00414
	(0.00170)	(0.00182)	(0.000606)	(0.00139)	(0.00260)
$Log\_total\_sales_{it}$	-0.0114	-0.0245*	-0.00649	0.0509***	0.0302*
	(0.0119)	(0.0130)	(0.00538)	(0.0121)	(0.0171)
$Mean\ skill\ sh._{it}$	-0.103	0.178	0.0425	0.0712	0.0603
	(0.139)	(0.154)	(0.0647)	(0.149)	(0.204)
$L.log\_FDI_{ct}$	0.00938***	0.00639*	0.000382	-0.00195	-0.00690*
	(0.00292)	(0.00347)	(0.00165)	(0.00301)	(0.00394)
$D.log\_GDP_{ct}$	0.809***	0.791***	0.0941	0.196	0.200
	(0.145)	(0.172)	(0.0650)	(0.134)	(0.175)
Observations	56,960	34,354	56,580	55,730	55,730
Number of firms	10,415	6,846	10,361	10,308	10,308
R^2	0.021	0.019	0.016	0.088	0.044
Dummies	f y	f y	f y	f y	f y
Clusters	1683	1489	1668	1670	1670

Notes: The table presents reduced-form estimates of the free movement effect on firm performance. The sample is restricted to firms with foreign capital. All specifications are estimated with firm fixed effects and time dummies. Dependent variables: TFP index, TFP LP - tfp estimated with Levinsohn-Petrin procedure, ROA - return on assets, Pers. costs - personnel costs per employee, C/L - capital-labour ratio. L.FM - Free Movement variable (distance-weighted, interacted with skill shortages in destination industries), 1 year lag. Standard errors (in parentheses) are clustered on country-industry (NACE 4-digit) level.
*** p<0.01, ** p<0.05, * p<0.1

reverse knowledge flows and increased research networks through their former employees (Braunerhjelm et al., 2015; Kaiser et al., 2015).

Table 1.6: Free Movement Effect on Firm Performance, Reduced Form, Firms with Patents

	(1) TFP index	(2) TFP LP	(3) ROA	(4) Pers. costs	(5) C/L
FM	-0.0702	-0.0883	-0.104***	0.256*	0.604***
	(0.127)	(0.109)	(0.0363)	(0.144)	(0.132)
$Mark-up_{ict}$	0.0460	0.125***	0.0103	-0.0768	-0.0220
	(0.0380)	(0.0385)	(0.0126)	(0.0563)	(0.0638)
$L.log\_investment_{ict}$	-0.0156	-0.0245*	-0.00272	0.0251**	0.0440**
	(0.0121)	(0.0139)	(0.00479)	(0.0117)	(0.0184)
$L.log\_FDI\_inward_{ict}$	-0.000839	-0.00584***	-0.000692	0.000865	-0.000384
	(0.00184)	(0.00203)	(0.000740)	(0.00213)	(0.00277)
$Log\_total\_sales_{it}$	-0.0147	-0.0304	0.00435	0.00534	0.00906
	(0.0180)	(0.0189)	(0.00715)	(0.0162)	(0.0252)
$Mean\ skill\ sh._{it}$	0.0703	0.284	0.0201	0.239	-0.110
	(0.154)	(0.193)	(0.0644)	(0.166)	(0.226)
$L.log\_FDI_{ct}$	0.00130	0.00194	0.00176	0.0128***	0.0151***
	(0.00351)	(0.00450)	(0.00167)	(0.00292)	(0.00398)
$D.log\_GDP_{ct}$	0.383	0.263	0.0656	-0.00291	-0.474*
	(0.253)	(0.252)	(0.0700)	(0.250)	(0.274)
Observations	20,526	13,276	20,507	19,694	19,694
Number of firms	2,812	2,165	2,812	2,769	2,769
R^2	0.113	0.037	0.120	0.128	0.266
Dummies	f y	f y	f y	f y	f y
Clusters	843	729	843	832	832

Notes: The table presents reduced-form estimates of the free movement effect on firm performance. The sample is restricted to firms with patents. All specifications are estimated with firm fixed effects and time dummies. Dependent variables: TFP index, TFP LP - tfp estimated with Levinsohn-Petrin procedure, ROA - return on assets, Pers. costs - personnel costs per employee, C/L - capital-labour ratio. L.FM - Free Movement variable (distance-weighted, interacted with skill shortages in destination industries), 1 year lag. Standard errors (in parentheses) are clustered on country-industry (NACE 4-digit) level.
*** p<0.01, ** p<0.05, * p<0.1

1.6.3 Skill Shortages Due to Emigration: 2SLS Regressions

The reduced form regressions represent the "intention-to-treat" effect. Furthermore, it is of interest to estimate the effects for those firms that were effectively constrained by the outflow of skilled workers. We consider skill shortages as an indicator for this problem. If changes in EU15+4 labour mobility legislation indeed induce higher emigration rates of the qualified workforce, we will observe increasing skill shortages as reported by firms in NMS. The measure of skill shortages is described in Section 1.4.

Table 1.7 shows the OLS results of different firm outcomes regressed on skill shortages. We find that only one measure of TFP is significantly negative, while for other measures the association appears to be zero or even positive. We believe that these OLS results are upward biased due to reverse causality and omitted variable bias. For instance, those firms that experience a positive shock are likely to be more productive and thus need more labour. They are consequently more likely to report skill shortages. In the following, we perform a 2SLS analysis, which confirms the upward bias of the OLS regression.

Table 1.8 presents 2SLS estimates with the Free Movement variable serving as an instrument for skill shortages. Comparable to the reduced form estimations, we estimate the reported models using the distance-weighted instrument. The first-stage details (FM coefficient with the standard error) are presented below the main regression results.[9]

The measure of skill shortages (share of firms in an industry, reporting to be constrained by labour) ranges from 0 to 1. The coefficient of interest thus represents the log point change in the dependent variables when skill shortages increase by 1 unit (or 100%). A one percentage point increase in skill shortages caused by the EU15+4 labour market opening thus leads to a 1.6-3.1% drop in firm TFP (depending on the measure) and a 3.0% increase in personnel costs. Comparable to the reduced-form estimates, innovating and foreign-owned companies do not experience significant decreases in TFP, but raise their personnel costs and increase their capital intensity.

[9]The reported first-stage coefficients might differ slightly from those reported in Table A.2, since some industry-year observations were dropped due to missing firm-level data.

Table 1.7: Skill Shortages and Firm Performance, OLS Regressions

	(1) TFP index	(2) TFP LP	(3) ROA	(4) Pers. costs	(5) C/L
L.skill sh.	-0.0183	-0.0751***	0.0287***	0.0964***	-0.181***
	(0.0300)	(0.0258)	(0.00856)	(0.0323)	(0.0482)
$Mark-up_{ict}$	0.336***	0.302***	0.120***	-0.0254	0.0132
	(0.0817)	(0.0537)	(0.0205)	(0.0297)	(0.0474)
$L.log\_investment_{ict}$	0.00636	-0.00531	-0.00668***	0.00391	0.0238**
	(0.00698)	(0.00573)	(0.00198)	(0.00704)	(0.00955)
L.log_FDI)ct	-0.00158	-0.000693	-0.000471	0.000983	0.00242
	(0.00153)	(0.00119)	(0.000351)	(0.00128)	(0.00200)
$Log\_total\_sales_{it}$	-0.00339	-0.0161	-1.11e-06	0.0504***	0.00719
	(0.0109)	(0.0107)	(0.00232)	(0.00819)	(0.0123)
$Mean\ skill\ sh._{it}$	-0.0205	0.106	0.158***	0.128	0.0451
	(0.160)	(0.124)	(0.0365)	(0.110)	(0.167)
$L.log\_FDI_{ct}$	0.0141***	0.0130***	0.00213***	0.00772***	0.0117***
	(0.00269)	(0.00245)	(0.000669)	(0.00199)	(0.00246)
$D.log\_GDP_{ct}$	1.549***	1.294***	0.239***	-0.0605	-0.285*
	(0.171)	(0.148)	(0.0370)	(0.0940)	(0.163)
Observations	501,277	291,346	497,393	486,190	486,190
Number of firms	88,370	54,965	87,651	86,960	86,960
Dummies	y f	y f	y f	y f	y f
Robust	yes	yes	yes	yes	yes
Clusters	2377	2210	2345	2361	2361

Notes: The table presents estimations of the skill shortages effect on firm productivity. All specifications are estimated with firm fixed effects and time dummies. Dependent variables: TFP index, TFP LP - tfp estimated with Levinsohn-Petrin procedure, ROA - return on assets, Pers. costs - personnel costs per employee, C/L - capital-labour ratio. Standard errors (in parentheses) are clustered on country-industry (NACE 4-digit) level.
*** p<0.01, ** p<0.05, * p<0.1

Table 1.8: Skill Shortages as the Consequence of the Free Movement, 2SLS Regressions

	(1) TFP index	(2) TFP LP	(3) ROA	(4) Pers. costs	(5) C/L
L.skill sh.	-3.071*	-1.635***	-0.281	3.042**	2.127
	(1.631)	(0.595)	(0.187)	(1.315)	(1.872)
$Mark-up_{ict}$	0.330***	0.308***	0.119***	-0.0106	0.0247
	(0.106)	(0.0647)	(0.0230)	(0.0594)	(0.0670)
$L.log\_investment_{ict}$	0.0298	0.00582	-0.00426	-0.0161	0.00814
	(0.0216)	(0.0101)	(0.00263)	(0.0179)	(0.0224)
$L.log\_FDI\_inward_{ict}$	-0.00338	-0.00171	-0.000652	0.00275	0.00381
	(0.00331)	(0.00193)	(0.000475)	(0.00271)	(0.00362)
$Log\_total\_sales_{it}$	0.0102	-0.00712	0.00135	0.0361*	-0.00400
	(0.0226)	(0.0140)	(0.00370)	(0.0211)	(0.0200)
$Mean\ skill\ sh._{it}$	0.977*	0.654***	0.260***	-0.826**	-0.702
	(0.562)	(0.231)	(0.0665)	(0.403)	(0.706)
$L.log\_FDI_{ct}$	0.0311**	0.0238***	0.00384**	-0.0100	-0.00219
	(0.0136)	(0.00705)	(0.00150)	(0.0116)	(0.0147)
$D.log\_GDP_{ct}$	1.375***	1.236***	0.221***	0.211	-0.0718
	(0.237)	(0.162)	(0.0510)	(0.249)	(0.240)
Observations	501,277	291,346	497,393	486,190	486,190
Number of firms	88,370	54,965	87,651	86,960	86,960
Dummies	y f	y f	y f	y f	y f
Robust	yes	yes	yes	yes	yes
Clusters	2377	2210	2345	2361	2361
fs_coef	0.0988	0.147	0.0981	0.0985	0.0985
fs_se	0.0423	0.0463	0.0424	0.0435	0.0435

Notes: The table presents estimations of the skill shortages effect on firm productivity. All specifications are estimated with firm fixed effects and time dummies. Dependent variables: TFP index, TFP LP - tfp estimated with Levinsohn-Petrin procedure, ROA - return on assets, Pers. costs - personnel costs per employee, C/L - capital-labour ratio. L.FM - Free Movement variable (distance-weighted, interacted with skill shortages in destination industries), 1 year lag. Standard errors (in parentheses) are clustered on country-industry (NACE 4-digit) level. $Firststage\_coef$ is the first-stage coefficient of the instrument and $Firststage\_se$ is the standard error.
*** p<0.01, ** p<0.05, * p<0.1

We include a number of covariates to switch off demand-driven changes in the reported measure of skill shortages. Country GDP growth rates and FDI inflows (GDP_{ct}, FDI_{ct}) control for general country-specific shocks. Lagged investment ($investment_{ict}$) accounts for country-industry specific increases in skill shortages due to the expansion of existing companies or new entries. The measure of average skill shortages in a given industry in EU15 countries ($Mean\ skill\ sh_{it}$) controls for industry-specific labour demand shocks, which are common across all EU members.

For all the specifications, we report the coefficients from the first-stage regressions (where we regress skill shortages on the Free Movement variable). A complete opening (from FM=0 to FM=1) of one industry in all EU15+4 labour markets results in a 10% increase in skill shortages for firms in the corresponding industry in the NMS. The free movement coefficient is statistically significant, and the F-test rejects the null hypothesis of insignificance.

1.7 Robustness

1.7.1 Exogeneity Assumption

The identification of the skill shortages effect builds on the exogeneity assumption of the constructed instrumental variable. Variation in the Free Movement variable comes from changes in legislation, bilateral distances, and skill shortages in destinations. All three components are determined on the industry level for *old* EU member states and hence should be exogenous to country-industry-year productivity shocks or changes in other unobservables in *new* EU member countries. As a robustness check for the validity of our IV approach, we ran the first-stage regression (1.5) on another variable, which also varies at the country-industry-year level, but, in contrast to skill shortages, should not systematically react to changes in EU labour mobility legislation. In the EU Business Survey, apart from skill shortages, firms also report on financial constraints. Table A.3 presents first-stage regression results with financial constraints as a dependent variable. While for skill shortages all four IV modifications returned statistically significant coef-

ficients, only one of them is weakly correlated with reported financial constraints. This, however, is not the modification we use in our regressions. This result reassures that the constructed IV captures labour supply shrinking due to emigration instead of other contemporaneous shocks.

1.7.2 Using Different Lags of the Instrument

In our main specification, we have looked at the effects of emigration on firm performance one year after the respective labour market opening. We have chosen a one-year lag because we expect the effects appear with a certain delay, for instance due to the decision making process to migrate, the migration preparation process and the notice period. In the following, we are looking at simultaneous effects as well as the effects up to three years before and after the sector opening.

Figure 1.2 shows firm TFP that is regressed on lagged (1, 2 and 3 year lag), simultaneous and forwarded (1, 2 and three year forward) FM values. One can see that the forwarded values are always insignificantly different from zero. This is reassuring for us, as we do not want the future sector openings to affect current firm outcomes (for instance due to anticipation). The Free Movement variable gains significance during the year of the opening but is only borderline significant. The effect becomes stronger and more significant after one year and then remains at this lower level during the following two years.

Figure A.2 in the appendix shows other firm outcomes that are regressed on lagged (1, 2 and 3 year lag), simultaneous and forwarded (1, 2 and three year forward) FM values.

Figure 1.2: Annual Treatment Effects of Free Movement on Firm TFP

Notes: Dependent variable - firm TFP, estimated with Levinsohn-Petrin procedure. The displayed coefficients correspond to the number of years before and after the largest increase in the Free Movement variable for a given industry. Year, industry, and country-fixed effects are included. Errors are clustered at the country-industry level.

1.8 Conclusion

This paper uses firm- and industry-level panel data to evaluate the effect of skilled emigration on firm productivity. To overcome the endogeneity problem, we exploit the natural experiment of the EU enlargements in 2004 and 2007. We argue that the gradual and industry-specific opening of the EU and EFTA labour markets to citizens from new member states throughout 2004-2014 has created exogenous variation in the emigration rates experienced by NMS. We show that an emigration-driven reduction in labour supply resulted in lower total factor productivity for firms in NMS. We also document an increase in personnel costs and training expenditures. This confirms the predictions of our model. Furthermore, we find that innovating and foreign-owned firms increased their personnel costs by more and experienced smaller drops in productivity. These firms have been more successful in circumventing the loss in TFP.

Our results are important both for firms and for policy-makers. Being aware of the problem helps firms to react timely and in an adequate way. Firms can benefit from active human resource strategies, focusing, for instance, on providing training and retention

measures. For policy makers, the effects of migration 'are not a matter of fate, [but] to a large extent, they depend on the public policies adopted in the receiving and sending countries'[10]. The prevalence of skill shortages, for instance, justifies the need to invest in the skills of their local labour force and to mitigate search frictions. A skill upgrading of the local labour force can in the short term be addressed by providing specific training courses by public institutions and in the long term by adjusting the education system to labour market needs. Knowing that those skilled people are needed can justify the investment. An increase in local human capital might also happen in the long term due to increased incentives to invest in education, which rise with the prospect to emigrate (Beine et al. (2001)).

While the outflow of skilled workers leads to deteriorating firm performance in the short term, emigration can also create opportunities and countries can experience brain gain if they put the right policies in place. One possibility for brain gain is return migration. If companies and politicians in the new EU member states succeed in bringing back their skilled workers after some time abroad, then firms could benefit from even more experienced workers. These workers can create knowledge spillovers and bring their firms closer to the technological frontier. Another opportunity is to attract workers from other EU member states. An efficient labour agency, and especially harmonised EU-wide labour agencies, could inform workers within the EU of all EU-wide job vacancies. This might encourage unemployed workers in other EU states to search for a job in countries and industries that experience shortages. By attracting workers from other EU countries and incentivising return migration, firms in new member states could also reap the benefits of labour migration in an enlarged Europe.

This paper does not take General Equilibrium effects or aggregate effects at the European level into consideration. It might well be that while emigration reduces firm productivity in the source country, the better allocation of workers and jobs increases efficiency and welfare at the European level. We leave these questions for further research.

[10]Docquier and Rapoport (2012).

Chapter 2

Knowledge Remittances: Does Emigration Foster Innovation?*

2.1 Introduction

Remittances, the money international migrant workers are sending back from the country of employment to their home country, represent an important source of income for developing countries and hence constitute a direct benefit of emigration.[1] Furthermore, apart from financial contributions, skilled migrants can "send" back the knowledge they have acquired while working in other countries. This remittance of knowledge has the potential to increase innovation in the origin countries and bring them closer to the technology frontier, thus mitigating the negative effects of the loss of human capital due to emigration.

The number of highly educated foreigners in the OECD area now exceeds 31 million, accounting for 45 percent of the increase in the foreign born population over the last decade (OECD Database on Immigrants in OECD Countries, 2016). The number of skilled migrants has especially increased within Europe since many members of the European Union (EU) and the European Free Trade Association (EFTA) have introduced

*This chapter is based on joint work with Thomas Fackler und Nadzeya Laurentsyeva.

[1]Russell (1986).

free movement for citizens of the partner countries. Given the strong increase in labour mobility and raising concerns in countries experiencing net outflows of skilled people, it is important to understand the consequences of migration. Should firms and policy-makers think and act in the context of a "global war for talent" or can the international mobility of skilled individuals make everyone better off, in particular, by stimulating cross-border knowledge flows?

In this project, we establish a causal link between labour mobility, knowledge flows, and innovation activities. By exploiting changes in the European labour mobility legislation as a quasi-experimental setting, we evaluate the effect of skilled emigration on innovation. We find that the emigration of skilled individuals increases patenting in source countries and argue that knowledge remittances can explain this positive effect. Using data on patent citations and migration flows from 32 European countries, we find that emigration increases cross-border knowledge flows. Industries that are exposed to a higher mobility of their workers start to cite patents from the emigrants' destinations more frequently than before. The international mobility of skilled workers seems to enlarge R&D networks and promote the transfer of tacit knowledge. In this way, migration enables a faster diffusion of knowledge from more to less technologically advanced countries and helps the latter to catch up.

We embed these results within the following conceptual framework. We assume a knowledge production function, where innovation (measured by the number of patents) is produced with the inputs of capital and labour and a certain production technology. Emigration leads to a reduction in labour and thus has a direct negative effect on innovation production. However, there might also be an indirect effect, which has often been overlooked in this discussion. International migration can increase the flow of ideas and knowledge across borders. Migrants might share knowledge about new technologies, processes, and products with their former colleagues and friends at home. This increases the stock of knowledge in the source countries and, through the recombination of ideas, positively affects innovation. The production technology thus improves and patent production can grow even if the available skilled labour is reduced. Our conceptual considerations thus suggest that migration has a negative direct and a positive

indirect effect on patenting levels in source countries. Although we cannot disentangle these effects with our data, we provide empirical evidence on the total effect.

The main challenge in the empirical analysis is the endogeneity of migration flows. This could be due to reverse causality or omitted variables. To establish causality, we construct an instrumental variable (IV) for migration, using changes in labour mobility laws within Europe. These laws are adopted and enforced by the destination countries and hence can be treated as exogenous to economic conditions in migrants' source countries.

The aim of our estimations are twofold. Combining several data sources, we do not only establish a link between emigration and innovation in the source country, but also shed light on the effect on knowledge remittances, potentially driving innovation. We start by analysing the effects of international labour mobility on total patenting activity in source countries. The IV estimate suggests that a one percent increase in the number of emigrants increases patent applications by 0.64 percent in the following two years. This result is statistically significant at the one percent level and robust to controls, fixed effects, and varying lags. The effect is quantitatively more pronounced when we consider only the flows of migrants with patenting potential.

We complement the analysis of innovation activity by looking at the convergence in patenting between migrants' origin and destination industries. We limit the sample to pairs where the destination is more technologically advanced than the origin and analyse whether the difference in patenting levels changes with migration flows. This is a highly policy-relevant question, especially in the context of the European Union: Some countries may block the initiatives aimed at enhancing within-EU labour mobility by arguing that the outflow of skilled people will further augment the asymmetries between richer and poorer member states. Contrary to this argument, though, our results show that patenting differences between origins and destinations decrease in the number of emigrants. Hence, emigration can promote convergence to the innovation level of more advanced economies.

To establish the channel for the positive impact of emigration on innovation, we link emigration to reverse knowledge flows, that is the transfer of knowledge from migrants' destinations back to their origins. While skilled emigrants do not patent in their home

country anymore, they can stimulate knowledge and technology diffusion, thus improving the production technology in the origin country. Common to the innovation literature, we use cross-border patent citations as a proxy for knowledge flows. The regression analysis relates the number of citations to a particular destination country with the number of migrants that currently work there. We find evidence that knowledge flows from destination to origin indeed increase with migration: the 2SLS regressions yield an elasticity of knowledge flows to emigration equal to 0.59.

Our project relates to two broad strands of the literature. The first one investigates the effects of labour mobility on innovation. Several papers have established a positive effect of migration on patenting in destination countries. Kerr and Lincoln (2010) use random visa allocations to find causal effects for the US. Bosetti et al. (2015), Parrotta et al. (2014), Ozgen et al. (2014) and Niebuhr (2010) focus on European countries and establish cultural diversity as one of the main channels to generate new ideas and innovation. The effect of migration on source countries received less attention. Kerr (2008) and Choudhury (2015) find that source countries benefit from knowledge flows and return migration and consequently increase patenting and innovation. Kaiser et al. (2015) provide firm-level evidence by looking at worker mobility within Denmark. They find that hiring new knowledge workers increases a firm's patenting activity. Interestingly, the former employers of these workers also increase patenting, which can be explained by reverse knowledge flows. Braunerhjelm et al. (2015) conduct a similar analysis with a matched employer-employee dataset from Sweden and also show that both the receiving and the sending firms benefit from the mobility of knowledge workers. The effects are stronger for interregional mobility. We contribute to this literature by providing causal evidence that emigration leads to an increase in patenting. We thereby confirm what Kerr (2008) and Choudhury (2015) showed for China and India in a very different context and using another methodology. As we have comparable patenting data for source and destination countries, we can extend this result and show that emigration leads to a catch-up process.

The second strand of the literature analyses the determinants of knowledge flows. Starting with the seminal contribution by Jaffe et al. (1993), these studies have established that knowledge is localised beyond the effects of agglomeration. Later studies focused on

international knowledge spillovers (Hu and Jaffe, 2003; Jaffe and Trajtenberg, 1999), showing that knowledge takes time to cross country borders. Thompson and Fox-Kean (2005) challenge the approach by Jaffe et al. (1993) and point out that intra-national localization effects are not robust to a finer technology classification. However, even with their more conservative estimations, the international localization remains significant. Singh and Marx (2013) investigate whether advances in communication technologies and lower costs of travelling reduce the localisation of knowledge over time. While they find evidence for a reduction in the significance of state borders in the US, their results show that the effect of international borders has even strengthened over time. Few studies so far analysed the impact of international migration on cross-border knowledge flows.[2] Kerr (2008), for instance, studies the role of skilled immigrants in the U.S. and finds that immigrants form ethnic scientific networks that enhance the technology transfer to source countries.

We extend this literature on knowledge flows to the European context using an identification strategy that allows for a causal interpretation. We build a unique dataset by merging comparable migration data for 32 European countries with European patent data and find evidence for knowledge flows. Due to our unique European enlargement setting, we are able to estimate causal effects of labour mobility independently of other integration events by exploiting different opening times for trade, FDI and migration. We find that the positive effect of mobility on knowledge remittances is particularly high for migrants with patenting potential and is robust to a variety of specifications and samples.

The paper is organised as follows. The next section describes a conceptual framework to guide our empirical analysis. Section 3 outlines the data, followed by Section 4 that presents the empirical specification and describes the instrument. Section 5 discusses the results. Section 6 suggests knowledge flows as the channel. Section 7 provides robustness checks and Section 8 concludes.

[2]Prior literature on the international knowledge flows has focused on trade, foreign direct investment and R&D accessibility (MacGarvie, 2005, 2006; Peri, 2005).

2.2 Conceptual Considerations

This paper analyses the effects of emigration on innovation in source countries. As there are two opposing effects, our storyline becomes clearer if we support it with some conceptual considerations. The considerations are based on a classical knowledge production function as introduced by Griliches (1979) and further developed by Jaffe (1986) and Jaffe (1989). We augment the knowledge production function with emigration. The concept illustrates two opposing effects: a reduction in knowledge production due to a decreasing skilled labour force vs. an increase due to a better production technology induced by knowledge flows and technological spillovers.

We assume a simplified knowledge production function of the form

$$Y = Af(K, L_s). \tag{2.1}$$

K is a measure of relevant capital available for research and development such as laboratories and equipment. L_s stands for skilled labour and A measures total factor productivity (efficiency of knowledge production). In our case A describes how well labour and capital can be combined to produce the knowledge output Y and captures factors that are not explicitly modelled, such as the knowledge stock on which researchers can build. To measure the output Y, we refer to patents, as is common to the literature.

The direct effect of emigration, in this setting, is a reduction in L_s. Due to the outmigration of skilled people, less workers are available for the production of innovation in the source country. The innovation output Y should thus decrease.

However, there is a second indirect effect of emigration that works through the total factor productivity A. After emigration, workers send back knowledge to their home countries. For instance they may transmit technological information and ideas back to their previous employer through communication with former colleagues. This employer becomes better at producing innovation, which is reflected in an increasing A.

Theoretically, it is unclear whether the negative direct or the positive indirect effect prevails. This depends on several other characteristics such as the industry, the technol-

ogy, and the innovation process. Consequently, it is even more important to gain this knowledge from a rigorous empirical assessment of the question. Using patent data as a measure of innovation output Y and controlling for various other factors corresponding to K and components of A that are unrelated to the stock of knowledge, our empirical specification is able to identify this net effect.

2.3 Data Description

We create a unique dataset by merging comparable migration data for 32 European countries with European patent data. The dataset has four dimensions: origin region[3], destination country, industry (two-digit, NACE Rev. 2), and year. The dependent variables of interest are the number of patent applications (by origin-industry-year) as a proxy for innovation and the number of cross-border citations (by origin-destination-industry-year) as a proxy for knowledge flows. The main explanatory variable is the annual number of emigrants from a given origin currently employed in a given destination industry.

The ideal migration dataset would contain precise data on migration flows, disaggregated by origin and destination (countries and employing industries), skill level, and occupation. In the absence of such a dataset, we use the second-best data from Eurostat Labour Force Surveys (2000 - 2014). These are harmonised surveys, which take place annually in all EU countries, Iceland, Norway and Switzerland and cover around 5% of national populations. The surveys provide demographic information on individuals, including their current country of residence, region of origin (EU15+4, NMS10, NMS2 or Other),

[3]Here and in the following text "region" refers to the region to which Eurostat's LFS data aggregate migrants' origin countries: EU15+4 (EU15 and EFTA), NMS10 (new member states in 2004), NMS3 (Bulgaria, Romania and Croatia) and all other countries. The fact that the EU3 region consists of Bulgaria and Romania, which joined the EU in 2007, and Croatia, which followed only in 2013, adds further imprecision, as we cannot tell from the data how many emigrants from this region came from Bulgaria and Romania and were able to take advantage of the EU's right to free movement already.)

education level, occupation, and currently employing industry.[4] We thus obtain the stock of migrants by year, region of origin, destination country, and destination industry. In addition, we can use the information by education level (university degree, vocational degree, or below) and by occupation (two-digit, ISCO) to identify the stock of migrants with patenting potential.[5] The available dataset has several limitations. We can only observe the region of migrants' origin instead of the country. This means that we cannot differentiate between different 2004 accession countries but have to treat them as one region (NMS10). Similarly we have to treat Romania and Bulgaria as one region (NMS2). Furthermore, as we do not observe the origin industry of a migrant, we assume that it is the same as the current industry at the destination. Besides, we cannot identify flows of return migrants. These limitations result in high observational noise and might bias our estimations towards zero.

To construct the instrument for migration flows we use changes in the European labour mobility legislation. We obtain the relevant information from the Labour Reforms database, prepared by the European Commission, which we complement with information from national legislations of the destination countries. Our baseline dataset covers the years from 2000 to 2012, this period encompassed several changes to European labour mobility as described in more detail in Subsection 2.4.2.

The data on innovative activity and knowledge flows come from the EPO's Worldwide Patent Statistical Database (PATSTAT, 2014 Autumn Edition).[6] We are able to assign patents to industries (two-digit NACE Rev. 2) via the International Patent Classification

[4]EU15+4 include 15 pre-2004 EU member countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom) + 4 EFTA countries (Iceland, Liechtenstein, Norway, Switzerland). NMS10 include countries that joined the EU in 2004 (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Malta, and Cyprus) and NMS2 include countries that joined the EU in 2007 (Bulgaria and Romania).

[5]We assign a dummy called *patenting potential* to migrants working in occupations "Managers" and "Professionals" (ISCO codes: 11, 13, 21, 22, 23, 25, 31, 32, 35).

[6]Patents and patent citations are imperfect measures for innovation and knowledge flows and have been criticised for example by Duguet and MacGarvie (2005). Yet, these are the best proxies, which are available over long periods of time and comparable across the countries we study.

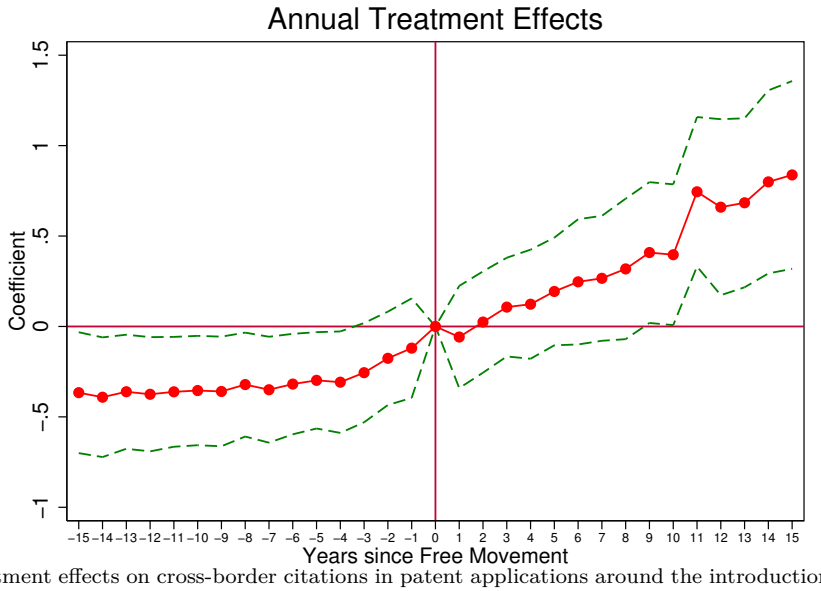
(IPC) of patents.[7]. We then aggregate patent applications by country, industry, and year and patent citations by patenting country, cited country, industry, and year. In our dataset, *patenting country* corresponds to the origin country of migrants, while cited country corresponds to their current destination. To assign patents to countries, we use the PATSTAT information about the location of patent inventors and applicants, which are usually the organisations employing the inventors. Since a patent can have several inventors, it may be assigned to multiple countries if it is the result of an international collaboration. In these cases, we assign a share of the patent to each country that is proportional to the share of co-inventors from that country. The causes and consequences of such collaborations have been studied by Kerr and Kerr (2015). Through this assignment of patents to the inventors' countries it is possible to link a patent with the location of all the patents that cite it.

Figure 2.1 motivates the subsequent econometric analysis: cross-border patent citations (a proxy for knowledge flows) significantly increase following the introduction of free labour mobility between a pair of countries. This figure mirrors the response of migration flows to changes in labour mobility regulation within Europe (Figure B.1 in the Appendix).

We complement the dataset with several important control variables: bilateral industry-specific FDI flows (provided by Eurostat), GDP and bilateral trade flows (from CEPII). By combining these different data sources, we can draw conclusions about the effects of international migration on patenting in the origin countries and establish reverse knowledge flows as the channel, while controlling for possible fixed and time-varying confounders.

[7]In order to assign four-digit IPC classes to industries, we use the concordance table provided by Eurostat in Appendix 1 of the publication "Patent Statistics: Concordance IPC V8 - NACE REV.2", published in October 2014 and last accessed on 21 November 2016.
`https://circabc.europa.eu/sd/a/d1475596-1568-408a-9191-426629047e31/2014-10-16-Final%20IPC_NACE2_2014.pdf`

Figure 2.1: Cross-Border Patent Citations, Annual Treatment Effects of Free Labour Mobility



Notes: Annual treatment effects on cross-border citations in patent applications around the introduction of free movement (1965-2014). The regression includes year and country-pair fixed effects. Standard errors are clustered at the citing country level.
Source: PATSTAT, European Commission, own calculations.

2.4 Econometric Specification

In our empirical analysis we first provide causal evidence for the effect of emigration on patenting in origin countries. Second, we link this effect to the increase in knowledge flows. We obtain the elasticities of patenting and cross-border citations to migration using OLS and 2SLS approaches. In the latter, the variation in migration flows is generated only by the exogenous changes in labour mobility laws over 2000-2012. Our baseline regressions include the sample of all patenting European countries. Besides, we provide separate estimates for a sub-sample of Eastern European countries, which were affected the most by the changes in labour mobility over the analysed period.

2.4.1 Baseline Regressions

Patenting in Origin Countries

We start by analysing the effects of emigration on total patenting in the origin countries. For this, we aggregate the data at the origin, industry, and year level. Because we do

not have detailed country-of-origin data, we use the region of migrants' origin: EU15+4, NMS10 and NMS2. The dependent variable is the number of patent application in a specific origin, industry, and year. The explanatory variable is the number of emigrants from a specific region that work in the same industry but in other European countries. We estimate the following fixed-effects regression:

$$Y_{oiy} = \beta_1 M_{oiy-l} + \beta_2 X_{oiy} + \phi_y + \phi_{oi} + \epsilon_{oiy} \tag{2.2}$$

where o denotes the region of origin, i the two-digit industry, and y the year. Y_{oiy} is the log number of patent applications in a given region and industry. M_{oiy-l} is the log number of emigrants from an origin region, currently working in a given industry.[8] l stands for the lag between migration and patenting. The coefficient β_1 captures the elasticity of patenting to migration. X_{oiy} contains time-varying controls: a dummy for EU membership, trade inflows, and FDI inflows. ϕ_y and ϕ_{oi} denote time and origin-industry fixed effects. ϵ_{oiy} is the error term. The identifying variation thus comes from the within origin-industry changes in the number of emigrants and patent applications. To account for a possible endogeneity bias, we complement the OLS estimations with the 2SLS results, where we instrument migration with changes in labour mobility legislation. We describe the instrument in more detail in Section 2.4.2 below.

Patenting Asymmetries between More and Less Advanced Countries

We go one step further and analyse whether migration increases or, on the contrary, lowers patenting asymmetries between more and less advanced economies. On the one hand, agglomeration effects and the resources available for research could lead to richer destinations specializing even more on their comparative advantage, thus hindering convergence. If we assume that skilled migrants move from less innovative to more innovative places, labour mobility can increase patenting asymmetries despite some positive effects on the origin. On the other hand, through the migrants working abroad, industries at origins can get access to the frontier knowledge from more advanced economies. This can

[8]Here and in all other specifications, before taking logs we add 1 to each observation. This transformation ensures that we do not lose observations with zero values.

increase innovation efficiency in origin industries and can allow a faster catch-up process with the technology leaders. Hence, patenting asymmetries between destinations and origins of migrants might decrease. We empirically evaluate the effect of migration on patenting asymmetries with the following regression:

$$log(\frac{P_{diy}}{P_{oiy}}) = \beta_1 M_{odiy-l} + \beta_2 X_{1oy} + \beta_3 X_{2dy} + \beta_4 X_{3odiy} + \phi_y + \phi_{odi} + \epsilon_{odiy} \tag{2.3}$$

The level of observation is origin-destination (od) pair, industry (i), and year (y). The dependent variable $log(\frac{P_{diy}}{P_{oiy}})$ is the log difference in patent applications between the destination and origin industries. The main explanatory variable is M_{odiy-l} - the log number of migrants from origin o working in industry i in destination d. l stands for the lag between migration flows and patenting. The coefficient β_1 shows whether the patenting asymmetries increase or decrease in migration. In this specification we can also control for time-varying origin- and destination-specific effects ($X_{1oy}, X_{2dy}, X_{3odiy}$): the total number of patents at origin, the total number of patents at destination, the total number of patents in a given industry, a within EU dummy (equals one when both origin and destination are EU members), the ratio of GDP per capita between destination and origin, bilateral industry-level FDI, and trade flows. ϕ_y and ϕ_{odi} denote time and origin-destination-industry fixed effects. ϵ_{doiy} is the error term. The coefficient β_1 is thus identified solely through the variation in the number of emigrants within an origin-destination-industry. General changes in patenting at origin and destination cannot confound the results. As with specification 2.2, we estimate OLS and 2SLS regressions.

Knowledge Flows

Further, we investigate one potential channel behind the effect of migration on innovation: knowledge flows. One speaks of knowledge flows whenever a researcher or an inventor builds on the work done by others to create ideas or to solve a specific technological problem. A common way to track knowledge flows is to use citations data (Jaffe et al., 1993). This approach assumes that a citation to a particular patent or a publication

reflects the usefulness of the knowledge contained therein for further work. To determine the effect of migration on knowledge flows we estimate the following empirical model:

$$Y_{odiy} = \beta_1 M_{odiy-l} + \beta_2 X_{1oiy} + \beta_3 X_{2diy-l} + \beta_4 X_{3odiy} + \phi_y + \phi_{odi} + \epsilon_{odiy} \tag{2.4}$$

As in specification 2.3, the level of observation is origin-destination (od) pair, industry (i), and year (y). The outcome of interest Y_{odiy} represents the log number of cross-border citations. M_{odiy-l} is the log number of migrants from origin o working in industry i at destination d. l stands for the lag between migration flows and patenting. We focus on reverse knowledge flows, i.e. knowledge flowing from destination to origin countries of migrants. Hence, Y_{odiy} represents citations to patents from destination countries by new patents at origin.[9] For example, $Y_{PL/BEiy}$ counts citations by Polish patents in industry i, filed in year y, to existing Belgian patents. It proxies the knowledge flows from Belgium to Poland. $M_{PL/BEiy-l}$ represents the number of Polish migrants in Belgium, currently working in industry i. The coefficient β_1 captures the elasticity of citations to migration. In our example, it shows the percent change in the number of citations from Poland to Belgium if the number of emigrants from Poland to Belgium increased by 1 percent.

To avoid mechanic effects from the general increase in patenting at origin or destination industries, we control for the number of patent applications in the origin industry (X_{1oiy}) and for the lagged number of patent applications in a destination industry X_{2diy-l}. X_{3odiy} denote other controls: a within EU dummy (equals one when both origin and destination countries are EU members), the total number of patents in a given industry, the bilateral FDI, and trade flows. ϕ_y and ϕ_{odi} denote time and origin-destination-industry fixed effects. ϵ_{doiy} is the error term. We again run both OLS and 2SLS regressions.

2.4.2 Instrument for Migration Flows

Even though we control for many observable factors and have a number of fixed effects in the baseline OLS regressions, an endogeneity problem might still arise. Estimates could be biased, for instance, if reduced patenting at the origin forces inventors to leave. To

[9] We consider citations in patent publications and date patents with their application filing date.

avoid this problem, we use changes in the labour mobility laws in Europe as a source of exogenous variation for migration flows.

The freedom of movement for workers is a policy chapter of the acquis communautaire of the European Union and represents one of the four economic freedoms: free movement of goods, services, labour and capital. According to the Article 45 of the Treaty on the Functioning of the EU, "freedom of movement shall entail the abolition of any discrimination based on nationality between workers of the Member States as regards employment, remuneration and other conditions of work and employment." In practice, it means that there are no restrictions (such as quotas on foreign workers) or additional bureaucratic procedures (such as obtaining a work permit or a permission from the local authorities) related to the employment of foreign citizens. This right primarily concerns the citizens of the EU and EEA member states who, starting from 1958, have gradually introduced free labour mobility towards their partner countries.[10]

In our project, we exploit two episodes of changes in the free labour mobility in Europe. First, in 2004 all EEA countries introduced free movement for the citizens of Switzerland. Switzerland responded with a symmetric measure in 2007.[11] Second, a special scheme has been in force following the EU enlargements in 2004 and 2007. For up to seven years after the accession, old EU members could restrict the access to their labour markets for citizens of new member states. While some countries kept the restrictions for the whole period, some provided easier labour market access only in certain industries, and some opened up their entire labour markets directly upon the accession. When imposing restrictions the countries had to apply them to the whole group of NMS from the same entry year. Therefore, they could not target labour mobility laws at the citizens of some particular states. Iceland, Liechtenstein, Norway, and Switzerland applied the transitional provisions towards the accession countries in the same way. These labour mobility laws created variation in the migration flows between European countries on the country, industry, and year level. Table B.1 in the Appendix provides an overview of the

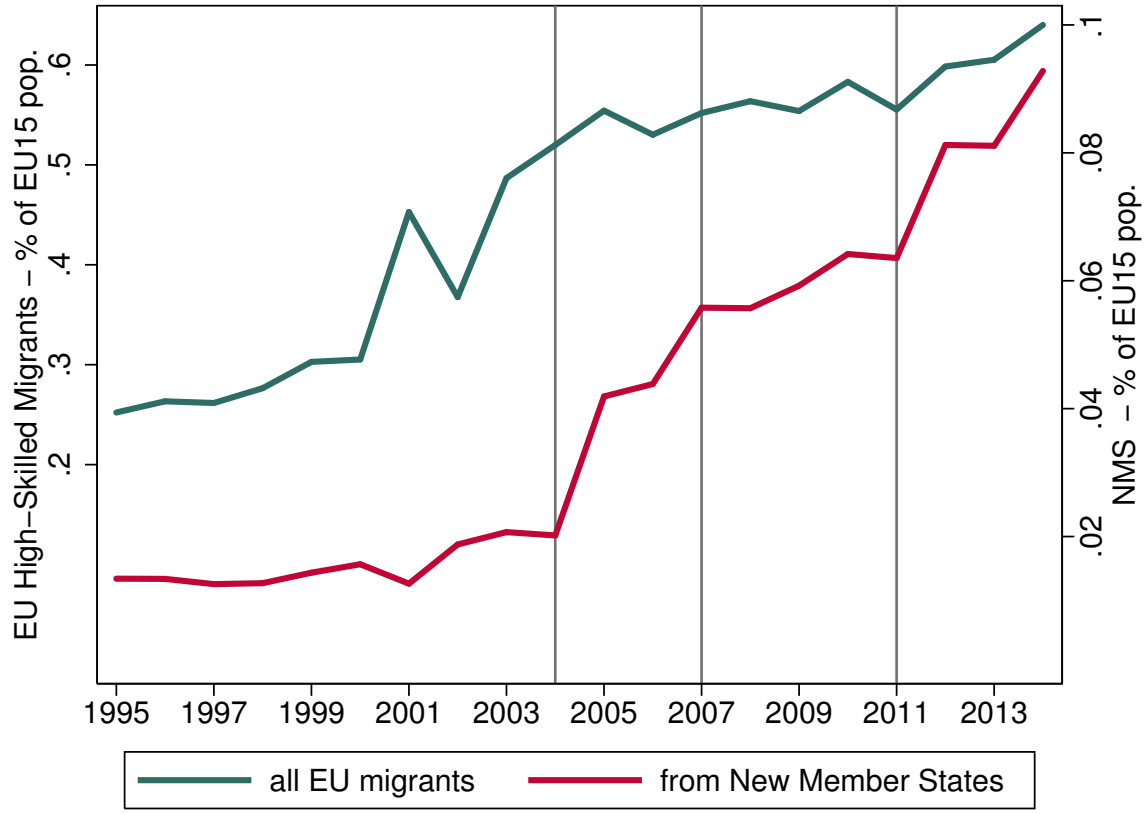
[10]Norway and Iceland exert this right since 1994. Liechtenstein exerts this right since 1995, but imposes a permanent quota for all EEA citizens.

[11]However, as a result of the "Against mass immigration" initiative, Switzerland is scheduled to impose permanent quotas on residence/work permits for citizens of all EEA countries except Liechtenstein, starting from 2017.

precise opening dates of countries and industries. Importantly for the identification, these changes to labour mobility did not coincide with other integration events (free movement of capital and goods).

Figure 2.2 shows the spikes in migration from NMS during the initial opening in 2004, when countries such as the UK, Sweden, and Ireland opened their labour markets and in 2011 when all transitional provisions for the 2004 accession countries where abolished and Germany, for instance, fully opened its labour market.

Figure 2.2: High-skilled Migration in Europe



Notes: The graph shows the share of high-skill migrants (born in other European countries) in the EU15 population. Source: Eurostat.

We can thus instrument real migration with exogenous labour mobility legislation. The first-stage regression takes the following form:

$$M_{odiy} = \gamma_1 FM_{odiy-1} + \gamma_2 FM_{odiy-2} + \gamma_3 FM_{odiy-3} + \gamma_4 X_{odiy} + \nu_y + \nu_{odi} + u_{odiy} \qquad (2.5)$$

FM_{odiy-l} is an indicator variable, which is equal to one if a specific industry i in a destination country d is open for labour migrants from a country o in a given year y. We include a one, two and three year lag to allow for the delayed effect. In our sample this indicator changes only for origin and destination pairs with either Switzerland or new EU member states. As these migration flows might be different, we show separate results for migration from only Eastern Europe in every case. X_{odiy}, ν_y, and ν_{odi} are the same controls and fixed effects as used in the baseline OLS specifications. When using the instrument for the patenting regressions (specification 2.2), we aggregate the values of the free movement variable by origin, industry, and year.[12] In this case, the FM variable can be interpreted as the exposure of a given origin-industry (oi) to free labour mobility of its workers.

When constructing the free movement dummies, we take into account the fact that many old EU members did not explicitly specify which industries are open to migrants from the NMS, but rather allowed for special job schemes in sectors that experienced labour shortages. In case of such implicit exceptions, we set the free movement dummy equal to 1 and multiply it by a measure of labour shortages in a given industry of an old EU member state. As such measure, we use the share of firms (in the destination industries) reporting to be constrained by the factor labour. These data are available from the European Commission Business Survey. To account for possible endogeneity (arising, for instance, when labour shortages are reported in industries that grow faster in all EU countries), we control for the overall number of patent applications in a given two-digit industry (aggregate over all European countries).

2.5 Results

In this Section, we first show the effects of migration on total patenting at the origin. Second, we provide evidence that emigration can reduce patenting asymmetries between less and more advanced economies. We show OLS as well as 2SLS results. First-stage and

[12]For each origin region we have 31 free movement indicators corresponding to 31 possible destinations. We aggregate them to one measure by using proximity weights (the inverse log distances between the two largest cities of two countries.)

reduced form regressions are provided in the Appendix. Our baseline sample includes all patenting European countries. In addition, we show separate estimations for the sub-sample of Eastern European countries.

2.5.1 Migration and Patenting

This Section shows that the emigration of labour increases overall innovation, measured by the number of patent applications per year in a region. As the migration data only allow us to estimate the effect of emigration at the region level, we aggregate the free movement variable by industry and region of origin: EU15+4, NMS10, and NMS2. The aggregated FM measure approximates the number of countries to whose labour markets an inventor in a certain industry and region of origin had access to and is normalised to be between 0 and 1, where 1 corresponds to full access to all EU15+4 countries.

The first three columns of table 2.1 show the baseline OLS regressions and the last three columns show 2SLS regressions, which use the labour mobility legislation as an instrument for migration.[13] Columns 1 and 4 estimate the relationship between the overall number of emigrants and the number of patent applications from inventors in that region. These regressions show that workers' migration to other EU member states has a significant and positive effect on patenting in the regions of origin. As both variables are measured in logarithms, the coefficient can be interpreted as the elasticity: the effect in the IV estimation in column 4 suggests that a one percent increase in the number of emigrants in an industry causes patent applications in the region of origin to increase by 0.6 percent. The 95% confidence interval for the elasticity is between 0.37 and 0.91. If we consider the average number of emigrants in the year 2004 (2459 emigrants) and the average number of patent applications 2 years later (255 applications) for new EU member states per industry, this implies that about 1 to 2 additional applications result from 25 additional

[13]Note that the right to free movement was not symmetric due to a one-sided transition period, e.g. workers of old EU member states have been able to move to new EU member states as a rule earlier than the other way round. Thus the instrument varies also with the direction of migration and we observe variation in emigration and patenting over time for pairs of origin region and industry. We cluster on the origin-industry level to account for autocorrelation in the regressions in table 2.1. When we consider asymmetries and citations, there is additional variation depending on the destination country, such that we cluster on the origin-destination-industry level.

Table 2.1: Patent Applications and Migration, OLS and 2SLS

	(1) OLS Patents	(2) OLS cit. weighted	(3) OLS Patents	(4) 2SLS Patents	(5) 2SLS cit. weighted	(6) 2SLS Patents
L2.Migrants	0.0994***	0.0949**		0.637***	0.903***	
	(0.0259)	(0.0420)		(0.139)	(0.199)	
L2.Migr.pat.potential			0.0572			1.175***
			(0.0420)			(0.332)
in EU	-0.262***	-0.298***	-0.296***	-0.112	-0.0729	-0.406**
	(0.0903)	(0.0752)	(0.0844)	(0.157)	(0.205)	(0.164)
L2.Trade flow	1.634***	2.535***	2.124***	-0.679	-0.945	3.325***
	(0.348)	(0.432)	(0.342)	(0.607)	(0.877)	(0.724)
L2.FDI inflow	2.03e-05**	3.15e-05**	2.10e-05**	1.16e-05	1.84e-05	2.34e-06
	(9.82e-06)	(1.22e-05)	(8.06e-06)	(2.07e-05)	(2.90e-05)	(1.12e-05)
Observations	383	383	383	383	383	383
Region industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	53	53	53	53	53	53
F				6.517	11.29	7.285

Notes: The regressions in this table estimate the relationship between the migration flow out of a country and innovation in that country. The first three columns are estimated with OLS and the last three column use a 2SLS estimation with our instrument based on free movement legislation. The dependent variables are the number of patent applications in an industry and origin region in a year or, in columns 2 and 5, the citation-weighted patent applications (i.e. patent applications + forward citations to these patents). Patent application numbers and citation-weighted counts, number of migrants and trade flows are taken in natural logarithms (more precisely, for variable x we use $\log(x+1)$ to include observations where $x = 0$). The sample includes all EU members and countries in the European Free Trade Association. All specifications include year and region-industry fixed effects. Robust standard errors are clustered at the region-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

emigrants.[14] Note however, that this number only includes migrants in industries that were matched to the patent data, i.e. in which there is patenting. Furthermore, the number of patent applications in 2006 we have used for this calculation already includes the additional applications, such that the number of additional patents is likely to be lower. Despite the noise and the level of aggregation in our data the regressions are able to reject that there is a negative effect.

The second and fifth columns of table 2.1 use citation-weighted patents as the treatment variable, i.e. the number of patent applications plus the number of citations to these patents in a region, industry, and year. The number of later patents building on and therefore citing a patent is often used as a measure of quality.[15] The citations for more recent cohorts in our sample are subject to truncation, which is controlled for through

[14]One percent of 2459 emigrants is about 25 and 0.37% (0.91%) of 255 applications is 0.94 (2.32).

[15]The relationship between citations and the social value of an invention has been documented in a case study on Computed Tomography scanners in Trajtenberg (1990). A more recent study by Moser et al. (2016) finds a robust correlation between citations of hybrid corn patents and the improvement in yield reported in field trial data.

year fixed effects. As the coefficients are similar, we conclude that the quality of patenting has not deteriorated. Thus, merely a higher propensity of inventors in origin regions to file patents as a result of European integration does not seem to be the driver of the effect. Of course, the number of later patents citing a patent (forward citations) is only a rough measure of quality and may be affected by emigrants spreading information about their home countries' latest technologies abroad as well. Nonetheless, a higher number of forward citations would likely be associated with a greater benefit of source countries' innovations, since they indicate that more follow-on innovation built on them.

Columns 3 and 6 differ from the other regressions in table 2.1 in the migration variable, which here includes only emigrants with patenting potential. Whereas the OLS regression shows a smaller and insignificant partial correlation, the coefficient in the IV regression is larger than the corresponding coefficient for all migrants in column 4.

The OLS estimate is likely to be downward biased due to omitted variables and reverse causality. If there is an omitted variable bias in the OLS regressions that is negatively correlated with emigration and positively with patenting levels, then the OLS estimate is downward biased. This is very likely and could be driven, for instance, by management quality. A good manager might lead to a good work and research environment. This results both in high patenting levels and low emigration from this firm and consequently biases the OLS estimate downward. Moreover, we might encounter reverse causality in the OLS regressions. If higher patenting levels lead to less migration, then we observe a negative relationship between the two variables that goes in the other direction. As a consequence, the OLS estimator is smaller than it should be and thus downward biased.

Tables B.2 and B.3 in the Appendix provide the first stage results and the reduced form that complement the 2SLS results analysis. One can see that the instrument is highly relevant in the first stage and that the overall effect of the three lags for the free movement variables sum up to a positive effect.

Table B.4 in the Appendix provides the same table with the restricted sample of NMS10 countries (2004 accession years). Due to the level of aggregation in the migration data, the 2SLS effects are not significant. Importantly we find no evidence of a significant negative effect, which would be expected if the loss of human capital dominated.

2.5.2 Migration and Convergence

While the results of the previous Section suggest that emigration can positively affect innovation at the origin, this Section investigates whether this positive effect is enough to reduce patenting asymmetries between less and more advanced economies or whether international migration still benefits knowledge production at destination countries more. This analysis is relevant for policy discussions about benefits and costs of free labour mobility in Europe. Furthermore, the results in this Section serve as a robustness check for the effects found above. When analysing asymmetries we use all four dimensions of our dataset: origin, destination, industry, and year, and can therefore control for unobserved origin- and destination-specific time-varying changes, which could bias our estimates of patenting elasticity to migration in Section 2.5.1.

To have a clear direction of migration flows from less to more advanced economies, we restrict the sample to the origin-destination pairs, where destinations are EU15+4 countries and origins are new EU member states. In addition, in our baseline sample we consider origin and destination pairs with Switzerland as a destination and other EU15+4 countries as origins. We also show the results for migration from Eastern Europe only, and the results are consistent. For each industry and year, we construct an asymmetry measure as the log difference between the amount of patent applications at destinations and origins.

On average, destination industries file more than three times the amount of patent applications compared to origins. As expected, the patent quality of the former is also higher. We then regress the asymmetry measure on the number of migrants. Table 2.2 presents OLS (columns 1-3) and 2SLS (columns 4-6) results. The OLS coefficient of migration is slightly positive, but is not statistically significant. This may be caused by the bias due to higher migration outflows from more problematic industries. Another reason is that once we move to the more disaggregated level, we introduce more noise in the migration data (more missing and zero observations). This especially concerns already disaggregated migration data by skill and occupation. 2SLS estimates, however, suggest that emigration allows origin industries to catch up to the patenting level of destinations: a one percent increase in the number of migrants reduces patenting asymmetries by 0.30

percent (column 4 and 5 in 2.2). The coefficient for migrants with patenting potential is much larger in magnitude, but is imprecisely estimated (see column 6). Overall, the regressions' results fit the framework of a patent production function with decreasing returns to skilled labour: a marginal increase in patent production at destination (due to the immigration of skilled labour) is smaller than the marginal increase in patenting at origins (due to the increase in patenting efficiency).

Table B.6 in the Appendix presents the results from the same specifications but estimated on a restricted sample with new EU member states as origins and EU15+4 as destinations (thus excluding emigration from EU15+4 to Switzerland). The obtained coefficients are slightly smaller in magnitude, but still significant. Table B.7 in the Appendix shows the reduced form results, where instead of migration figures we use the bilateral free movement dummies. One of the drawbacks of our migration data is the large amount of missing observations, which could be either due to the effective absence of migrants or to misreporting.[16] This raises external validity issues to our estimations in terms of a generalisation to all European countries. Therefore, the most interesting results of Table B.7 are in columns 5 and 6 where we present the coefficients from the regressions over the whole sample of origin and destination pairs. The number of observations increases multiple times, yet the coefficients for the free movement dummies are very close to the estimates from the baseline sample. Moreover, most coefficients are more precisely estimated due to improved power: we note that EU membership, higher bilateral trade flows and FDI also help the convergence.

While interpreting the regression coefficients, we implicitly assume that migrants stay within the same industry. This is reasonable, as for skilled migrants the losses associated with changing the industry are substantial. Hence, they are more likely to seek employment in the same sector in the destination countries. If the assumption would not hold for some industries, how would this affect our estimations?[17] Suppose there are two industries: L and M in Poland and Belgium. The Polish migrants from industry L move

[16]For example, due to missing migration data we have to drop all observations with Germany as a destination country.

[17]There are pairs of NACE industries, between which inventors may indeed be likely to move, for example between "26 Manufacture of computer, electronic and optical products" and "27 Manufacture of electrical equipment".

Table 2.2: Convergence in Patenting Levels and Migration, OLS and 2SLS

	(1) OLS $log(\frac{P_{diy}}{P_{oiy}})$ Patents	(2) OLS $log(\frac{P_{diy}}{P_{oiy}})$ cit. weighted	(3) OLS $log(\frac{P_{diy}}{P_{oiy}})$ Patents	(4) 2SLS $log(\frac{P_{diy}}{P_{oiy}})$ Patents	(5) 2SLS $log(\frac{P_{diy}}{P_{oiy}})$ cit. weighted	(6) 2SLS $log(\frac{P_{diy}}{P_{oiy}})$ Patents
L2.Migrants	0.0319	0.0376		-0.305**	-0.334**	
	(0.0223)	(0.0276)		(0.146)	(0.158)	
L2.Migr.pat.potential			0.117**			-1.831
			(0.0575)			(2.212)
Patents, origin	-1.220***	-1.391***	-1.206***	-1.207***	-1.376***	-1.419***
	(0.0762)	(0.0817)	(0.0753)	(0.0883)	(0.0946)	(0.281)
Patents, dest	1.066***	1.105***	1.069***	1.058***	1.096***	1.021***
	(0.0713)	(0.0908)	(0.0717)	(0.0777)	(0.0978)	(0.0894)
Within EU	0.00806	-0.0884*	0.0109	0.0194	-0.0759	-0.0180
	(0.0483)	(0.0531)	(0.0487)	(0.0520)	(0.0572)	(0.0635)
GDP_d/GDP_o	-0.173	0.400	-0.197	-0.188	0.384	0.173
	(0.316)	(0.367)	(0.319)	(0.338)	(0.394)	(0.530)
L3.Trade flow	-0.0791	-0.0236	-0.0718	-0.0281	0.0326	-0.113
	(0.0629)	(0.0799)	(0.0622)	(0.0679)	(0.0867)	(0.0827)
L3.FDI flow	0.000575	-0.000443	0.000380	-0.000116	-0.00120	0.00254
	(0.00668)	(0.00668)	(0.00671)	(0.00783)	(0.00786)	(0.00926)
Observations	2,946	2,946	2,946	2,864	2,864	2,864
R-squared	0.486	0.551	0.486	0.424	0.500	0.325
Origin-dest-industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	582	582	582	500	500	500
F				83.92	122.8	76.50

Notes: The dependent variable is the natural logarithm of $Patents_{dest}/Patents_{origin}$. Number of migrants, number of patents (in origin and destination countries), GDP ratio between destination and origin, FDI, and trade flows are in natural logarithms. The sample includes all EU and EFTA members. All specifications include year and origin-destination-industry fixed effects. Robust standard errors are clustered at the origin-destination-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

to Belgium to work in industry M. Empirically, we observe $M_{BE/PL/M/y}$ to increase. The inflow of the skilled Polish workers in the Belgian industry M raises its innovation activities (or in the worst case, does not affect them). The performance of the Polish industry M is likely to remain unchanged. The asymmetry measure $log(\frac{P_{BE/M/y}}{P_{PL/M/y}})$ either increases or at most stays the same, which goes in the opposite direction of the reported effect. We thus might underestimate the magnitude of the effect.

2.6 The Channel: Knowledge Flows

Having established that emigration leads to an increase in patenting, we want to analyse one potential channel in more detail: knowledge flows. This Section shows that migrants stimulate knowledge flows from their new destinations to their countries of origin.

Table 2.3 presents the baseline OLS and 2SLS results. The dependent variable is the log count of citations by patents in the origin to the destination country. This dependent variable proxies the knowledge flows due to emigration. In the baseline estimations, we allow for two-year lags between the time of migration and the citations in the patent applications. The results are similar for a one-year lag but slightly weaker. Importantly, given the structure of the dataset, we can account for origin-industry and destination-industry shocks. A possible threat to identifying the coefficient of interest would arise if destination industries, which experienced a positive patenting shock, started to attract more workers from other countries. A higher supply of patents from this destination would also mechanically increase the amount of citations to this country. We can control for such an effect by including the number of patent applications in the destination industry (with a three year lag).[18] In a similar way, we control for the number of patent applications in the source country. The migration effect is identified from the within origin-destination variation in the migration stocks and the count of cross-border citations. Since both dependent and explanatory variables are in natural logs, the coefficient represents the elasticity of cross-border citations to the number of migrants.

[18] As a rule of thumb, it takes about three years for a patent to be granted.

Table 2.3: Citations to Destination Industries, OLS and 2SLS

	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
L2.Migrants	0.0334*	0.0269		0.799***	0.588***	
	(0.0170)	(0.0167)		(0.213)	(0.225)	
L2.Migr.pat.potential			0.0638*			2.916
			(0.0348)			(2.302)
Patents, origin		0.191***	0.192***		0.174***	0.192***
		(0.0237)	(0.0238)		(0.0268)	(0.0310)
L3.Patents, dest		0.0435***	0.0431***		0.0427***	0.0219
		(0.0145)	(0.0145)		(0.0158)	(0.0236)
Within EU		-0.0501	-0.0471		-0.0698*	0.0468
		(0.0378)	(0.0379)		(0.0416)	(0.0845)
L3.Trade flow		0.00665	0.0119		-0.104*	0.00902
		(0.0392)	(0.0390)		(0.0617)	(0.0440)
L3.FDI flow		0.00780	0.00711		0.0126**	-0.0134
		(0.00493)	(0.00495)		(0.00570)	(0.0203)
Observations	7,299	7,287	7,287	7,136	7,124	7,124
R-squared	0.080	0.095	0.095			
Origin-dest-industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	1322	1320	1320	1159	1157	1157
F				20.29	22.20	14.98

Notes: The dependent variable is number of citations from a region and industry to another country per year. Citation counts, number of migrants, total number of patent application in origin and destination industries, FDI and trade flows are taken in natural logarithms. The sample includes all EU and EFTA members. All specifications include year and origin-destination-industry level fixed effects. Robust standard errors are clustered at the origin-destination-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

In the first column, we regress the citations on the overall number of migrants M_{odiy}, year, and origin-destination-industry fixed effects; in column 2 we add additional time-varying controls; in column 3 we use the number of migrants with patenting potential as the main independent variable. OLS results suggest a positive association between migration and cross-border citations. The estimated coefficient for migrants with patenting potential is robust to all controls and is twice as large compared to the overall migration stock.

Columns 4 to 6 of table 2.3 show the 2SLS results that yield quantitatively larger elasticities than the OLS. A one percent increase in emigrants induces a 0.59 percent growth in cross-border citations to their origins. Table B.8 in the Appendix summarises the results for the sub-sample where new EU member states are origins and EU15+4 are destinations. Despite the reduction in the sample size, the main 2SLS coefficients remain positive and significant. The reduced form regressions (Table B.9 in the Appendix) are also consistent. When we estimate the reduced form for the whole sample of origins and destinations, the free movement coefficients gain significance and quantitatively remain almost identical to those from the baseline sample. This indicates that some of the in-

significant results in the baseline regressions (as, for example, the imprecise coefficient for migrants with patenting potential) are mainly due to power problems with noisy migration data.

Previous research has emphasised the role of communication between moving researchers and their former colleagues at the previous employers (e.g. Braunerhjelm et al., 2015; Kaiser et al., 2015). To test whether the channel they have found for inventors moving between firms within a country is also the primary channel of international knowledge flows in our setting, we exclude the inventor's network. To do this, we exclude citations between inventors and all employers (applicants) and other inventors they are listed with on a patent application at any point in time. Table 2.4 reports the results for the restricted sample. While the coefficients change slightly, they remain positive and significant. Thus only a small part of the effect seems to be driven by the inventors' close network. Knowledge flows that this method could not capture include, for example, if a student at an Eastern European university moves on to work in Western Europe, filing patents for the first time and citing her professors' research. However, the sizable effect that remains suggests that wider spillovers play an important role.

Citations are not always added by the inventor himself but can also be added by the examiner. One worry might thus be that examiners become more aware of research done in other European countries and that they consequently are more likely to add citations from these countries. Alternatively, the effect might be driven by the fact that more patents are filed at the European Patent Office, where examiners may be more likely to add references to foreign patents than at the national offices.[19] This concern is addressed by Table B.11, which shows the results only with citations that were added by the applicant (rather than the examiner or a third party) according to PATSTAT and we can see that there are no qualitative changes.[20]

[19]The latter concern is also addressed in table B.10, where only citations among patents filed with the USPTO are included, such that European institutional changes should not affect the results.

[20]In unreported regressions, we limit citations further to only include those that are marked in PATSTAT as applicant-added and, additionally, where citing and cited patents are both priority patents filed at the USPTO. The results are qualitatively similar despite the fact that only less than 1% of citations remain.

Table 2.4: Citations to Inventor's Network Excluded

	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
L2.Migrants	0.0346**	0.0276*		0.797***	0.631***	
	(0.0171)	(0.0167)		(0.197)	(0.203)	
L2.Migr.pat.potential			0.0464			3.878*
			(0.0314)			(2.355)
Patents, origin		0.174***	0.175***		0.155***	0.177***
		(0.0226)	(0.0226)		(0.0262)	(0.0358)
L3.Patents, dest		0.0353***	0.0350***		0.0344**	0.00732
		(0.0134)	(0.0134)		(0.0150)	(0.0247)
Within EU		-0.0496	-0.0471		-0.0711*	0.0787
		(0.0355)	(0.0356)		(0.0403)	(0.0867)
L3.Trade flow		0.0296	0.0350		-0.0893	0.0312
		(0.0389)	(0.0387)		(0.0597)	(0.0484)
L3.FDI flow		0.00982**	0.00925*		0.0150***	-0.0179
		(0.00481)	(0.00482)		(0.00569)	(0.0224)
Observations	7,299	7,287	7,287	7,136	7,124	7,124
R-squared	0.077	0.091	0.091			
Origin-dest-industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	1322	1320	1320	1159	1157	1157
F				19.18	19.85	10.82

Notes: In this table, citations within the network of the inventor are excluded, i.e. citations from applicants and inventors with whom the cited inventor has patented at any point in time. The dependent variable is the number of citations from a region and industry to another country in a year. Citation counts, number of migrants, total number of patent application in origin and destination industries, FDI and trade flows are taken in natural logarithms. The sample includes all EU and EFTA members. All specifications include year and origin-destination-industry level. Robust standard errors are clustered at the origin-destination-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

There are a number of ways for the knowledge flows to occur in practice. One possibility is that emigrants increase the awareness of new knowledge or technologies. This could happen, for example, if emigrants inform their former colleagues or if they meet at conferences. Another possibility is that researchers in the source countries are aware of new knowledge or technologies but need to learn how to use the tacit knowledge embedded in them. A close contact among former colleagues might spur the transfer of tacit knowledge. Additionally return migration can increase innovation in source countries. Often, emigrants return to their home countries after several years abroad and create start-ups or contribute to innovation in other ways.[21]

[21] Our time frame of analysis is more likely to reflect the increasing awareness of new technologies or the transfer of tacit knowledge.

2.7 Robustness

To confirm the validity of the results, we conducted a number of robustness checks. We find that the increase in patenting activities as a result of emigration is not driven by different pre-trends or institutional changes in the European patenting system.

One way to check the validity of the results is to examine pre-trends. If our results are valid, the coefficient of interest should be zero if we regress citation patterns on future labour market openings. Figure 2.1 in Section 2.3 shows the annual treatment effects for the regression of cross-border citations on the free movement variable. We look specifically at bilateral citations during the time period 15 years before and 15 years after free movement between two countries has been established. The data we use for this graph are based on patent applications over the 50 year period from 1965 to 2014. The regression includes year dummies and country-pair fixed effects to take out trends. The figure shows that there is no significant change in cross-border citations in the years prior to the establishment of free labour mobility.[22] This is reassuring and increases the credibility of our results. It becomes clear that the effect only starts to gain momentum at the time of the introduction of free movement and builds up over the following years.

One might also worry that the institutional framework of registering patents has changed in the EU, especially in the context of EU enlargement and the European Patent Convention. We thus restrict the sample to patents that have been registered at the United States Patent and Trademark Office (USPTO). Table B.10 in the Appendix shows the results. While we have fewer observations, the qualitative results remain the same. The results thus do not seem to be driven by institutional changes in Europe.

[22]Note that this graph uses country-level data, such that the free movement indicator only switches to 1 once all sectors are open. Some of the (insignificant) increase before time 0 may thus be due to the partial openings during the transition periods, which we exploit in the main part of the paper for identification.

2.8 Conclusion and Policy Implications

This paper analyses the effects of emigration on patenting levels in source countries. We find that countries that experience emigration increase their level of patenting. We further suggest that this has led to a catch-up process that brought origin countries closer to the technology frontier. We also find that the international mobility of people has increased technology and knowledge spillovers as evidenced by cross-border patent citation in the respective countries. Specific channels that could have fostered the knowledge spillovers are the transfer of tacit knowledge, the increased and improved network of inventors and return migration.

One policy recommendation that directly follows from these findings is that the EU could benefit from further facilitating migration within Europe. As there are no more legal barriers to free labour mobility, hindering factors are mostly language and administrative barriers. The EU could reduce these barriers by ensuring the recognition of foreign qualifications and the promotion of language courses at all age levels. In this way, the EU can exploit the full potential of migrants both for destination and source countries.

Another policy implication is to ease skilled migration to Europe from outside the European Union. This could be achieved by easing the access to European labour markets and the recruitment of highly qualified foreign workers. While the Blue Card has been a step in this direction, its scope could be increased to obtain a higher impact and administrative barriers should be reduced. For those skilled migrants that are already in Europe, for instance skilled refugees, labour market restrictions should be lifted to ease labour market integration. If these people can be integrated fast into qualified positions without a loss in human capital, the innovation system would greatly benefit.

We have shown in this paper that source countries can benefit from emigration through knowledge flowing back into the country. These benefits of knowledge flows can be maximised by facilitating research networks with emigrated inventors, for example by organising conferences in the origin countries. Furthermore, governments can design programmes to actively keep the diaspora engaged and by encouraging and facilitating

return migration. Return migrants bring back the newly gained knowledge and many times create their own start-ups which can foster development in the countries of origin.

While this paper establishes that knowledge flows mitigate the negative consequences of emigration, further research is needed to shed light on the precise way these knowledge flows are created and characterised. Do migrants possess tacit knowledge that flows with people but cannot be transferred by other means? Or do migrants enlarge the R&D network and create better awareness of technologies in other countries? Do migrants have a competitive advantage in negotiating licensing fees with their country of origin? These open questions may guide further research in order to better understand how to increase knowledge flows and maximise their benefits.

Chapter 3

The Labour Market Integration of Refugees in Germany: Evidence from a Field Experiment

3.1 Introduction

The number of asylum seekers that arrived in OECD countries in 2015 is unprecedented since World War II (OECD, 2016). In Germany, the largest refugee receiving country in the EU in terms of absolute numbers, 890,000 refugees arrived in 2015 and a further 220,000 came between January 2016 and October 2016.[1] The vast majority applied for asylum (442,000 asylum requests in 2015, 665,000 from January until October 2016).[2] In 2015, on average fifty percent of asylum requests were accepted for asylum or temporary protection. Thus, around half of the refugees are likely to stay in Germany and are now seeking employment.[3] Their labour market integration is challenging due to at least

[1]Source: BAMF (2016)

[2]The application typically happens a few months later due to processing delays. Data on asylum requests and outcomes are from the German Federal Office for Migration and Refugees: BAMF (2015), BAMF (2016). Many people who arrived in 2015 only applied for asylum in 2016 due to delayed appointments. Only 60,000 refugees have left Germany voluntarily or forcefully in 2015.

[3]Around 300,000 asylum seekers or recognized refugees have registered as looking for work with the Federal Employment Agency. (Source: Federal Employment Agency 2016.) We denote asylum seekers as those refugees that have not yet finalized the asylum process.

two overarching reasons: a potential lack of skills and frictions in the labour market. A lack of job related skills, including language, qualifications, degrees and task specific human capital have hindered refugees' labour market integration. Additionally, matching frictions, a subobtimal network, residency requirements or legal barriers may be larger than for natives or other migrants. While both a lack of skills and frictions pose a barrier in practice, it is essential to separately investigate the role of each, as they lead to quite different policy implications.

In this paper, we design a randomized controlled trial to evaluate the role of matching frictions for the employment prospects of refugees. In a first step, we conduct personal interviews with approximately 300[4] job-seeking refugees in Munich and collect data on their job search behaviour, their job expectations and experiences, their education, skills and social integration. We then provide all participants with a German CV and basic job search information. In a second step, we randomly select half of the participants and add them to the database of an NGO, which sends CVs directly to employers. Preliminary results show that around 39 percent of refugees have indeed been able to find employment. However, most of them are doing internships or have low-skilled positions. Missing language skills and a lack of information about the application process seem to be important factors preventing a more successful and faster labour market integration.

The labour market success of refugees depends crucially on their education and qualification levels. In the public debate, two methods have been used to proxy the characteristics of refugees in order to predict their labour market integration. The first approach is to rely on previous migration inflows. This might be misleading, since both the refugees as well as the institutional environment are likely to be different for the most recent wave. For example, since 2014, asylum seekers are able to obtain a work permit three months after arrival, compared with at least nine months waiting time before 2014. A second approach commonly used is to proxy the education levels of refugees arriving in Germany with the average education level of their country of origin. This approach does not account for the fact that the refugees arriving in Germany are likely to be systematically different from those left behind. Additionally, representative education surveys have

[4]Simple power calculations have shown that we need at least a sample of 300 refugees if we want to detect a treatment effect of 10%.

typically been conducted before the war but current refugees have had several years of war exposure since the last education survey. Consequently, the characteristics of recent refugees and their labour market integration outcomes might be very different from past experiences or simple estimations, and it is hard to predict precisely how.

First survey results by Brücker et al. (2016) of 2,349 refugees in Germany show that the education and qualification levels vary strongly by country of origin. There is some indication that refugees from countries such as Syria, that until recently have been peaceful and allowed for an uninterrupted education path, typically have much higher education levels than refugees from enduring war countries such as Afghanistan, Somalia or Eritrea. Registration figures from BAMF (Rich, 2016) show that approximately 20 percent of refugees have university or college education, while a further 22 percent have completed upper secondary education. Less than seven percent have no schooling. These figures are in line with our descriptive results on refugee characteristics.

Bevelander (2016) provides an overview of the recent research dealing with the labour market integration of refugees. He finds that most studies agree that refugees' labour market integration lags behind that of other migrants both in terms of unemployment and wages. Using data from several countries, Chiswick and Miller (1994), Cortes (2004), Constant and Zimmermann (2005), Jaeger (2006), Aydemir (2011) and Dustmann et al. (2016b) compare short-term labour market outcomes of immigrants arriving with different visa types. They conclude that refugees perform worse than migrants that arrive via student, employment or family reunion visas. Yet, there is evidence that shows that refugees succeed in catching up in the long term. Keller (2016) finds that refugees in Germany catch up with other immigrants in terms of employment after approximately 12 years and in terms of wages after around 17 years. This might be due to the long-term residency perspective refugees take. As refugees often cannot return to their country of origin and can obtain permanent residency relatively fast, it is worthwhile to invest in human capital in the first years after arrival.[5] Cortes (2004) finds that refugees outperform other migrant groups in the United States due to initially higher investments in human capital. Dustmann and Görlach (2016) and Adda et al. (2014) also illustrate that the

[5]This is even exacerbated if refugees are not allowed to work directly upon arrival.

expected residency duration positively affects human capital investment decisions and thus labour market outcomes.

There are at least four additional reasons why refugees are different from other groups of migrants.[6] First, refugees entered the destination countries for humanitarian reasons in contrast to an employment, study or family reunification visa. They were not chosen by the immigration office due to their high skills, their study or employment prospects or family network. At the same time, refugees did not necessarily chose to leave their country or prepare for migration. While they may have chosen their particular country of destination, the movement was mostly due to so-called push factors. Second, refugees face stricter labour market regulation. In Germany, most refugees are allowed to work three months after arrival but in certain municipalities only with an additional priority review and an approval by the foreigners office. This restriction does not apply to migrants arriving on an employment, student or family reunification visa. Third, most refugees are randomly allocated to a specific municipality and are required to live there until they finish their asylum process and until they have a stable job that makes them independent of welfare benefits. In many cases this prevents them from connecting to immigrant networks.[7] Fourth, numerous refugees are suffering from war and flight related stress, trauma and/or depression. Depending on their war experiences and family ties to war zones, they might be psychologically unable to accept a job offer. For instance, Alpak et al. (2015) find that one third of Syrian refugees experience post-traumatic stress disorder, Couttenier et al. (2016) show that refugees in Switzerland who experienced war crimes are more likely to engage in violent behaviour. The above factors can explain why refugees face a lack of skills or matching frictions on the labour market.[8] Consequently, as suggested by Dustmann et al. (2016b), specific proactive policies could promote refugees labour market integration.

[6] Dustmann et al. (2016b) and Keller (2016) summarise several of those reasons.

[7] Battisti et al. (2016) show that 54 percent of migrants in Germany find their first job through their network.

[8] As mentioned above, in the long run, this might be different if refugees invest more in human capital and thus catch up.

Several studies, mainly in Scandinavia, have evaluated specific policies targeting the integration of asylum seekers into the labour market. Clausen et al. (2009) analyse the effect of different integration policies on the job search duration for refugees and family reunification migrants. Using administrative data from Denmark and a timing-of-events duration model, they find that wage subsidies are the most effective policy to integrate newly arrived refugees into the labour market. They further find that an improvement in language skills significantly improves refugees' labour market entry. Also using Danish data, Rosholm and Vejlin (2010) look at how incentives influence the extent to which refugees take up work. They find that lowering income transfers for refugees only increases their labour force participation two years after having obtained residency. They provide evidence which shows that during the first two years, refugees have very few job opportunities. After having learned the language for two years, however, they are more likely to enter the labour market if their benefits are cut. Andersson Joona et al. (2015) evaluate a Swedish labour market reform that aimed at supporting refugees in finding employment faster. Using a difference-in-difference design around the introduction of the reform, they do not find any significant short-term results of increased support by the Public Employment Agency. While these three studies focus on refugees, they evaluate a different policy than the one we examine and they also do not use our methodology of a randomized controlled trial.

We believe that this paper makes two main contributions to the existing literature. First, we provide a thorough evaluation of a job matching service for refugees through a randomized controlled trial. Using a clean identification strategy is important in this context, since comparing refugees who voluntarily decide to access services of an NGO with other refugees would create a selection problem. We show that refugees do not know where to look for work and that this friction can be alleviated by a job matching service. This suggests that policies targeted at facilitating labour market entry may be effective. Second, we provide new data and descriptive statistics on newly arrived refugees and their short-term labour market and integration outcomes. This evidence covers the largest inflow of refugees into Germany since World War II. Furthermore Germany is one of the largest refugee receiving countries in the developed world. We thus study a large and very relevant case of refugee labour market integration. The feasibility of refugee labour

market integration is a large controversy in German and European politics and is likely to have severe consequences for politics (Dustmann et al., 2016b).

The paper is structured as follows. The subsequent Section provides background information about the legal framework for refugees to access the labour market in Germany. Section 3 explains the experimental set-up and Section 4 describes the collected data. Section 5 provides preliminary results of the follow-up and outlines the next steps. Section 6 outlines limitations of this study and Section 7 concludes and provides policy recommendations.

3.2 Institutional Framework

The word 'refugee' is commonly used to denote an individual that his left her country of origin and seeks shelter from persecution or war in a third country. The term is typically used in a broad sense, comprising different categories of refugee statuses with important implications for their labour market access. The following section will provide a short overview of the German asylum system and in particular the labour market access of refugees. The first differentiation one has to make is between an asylum seeker and a recognised refugee or someone with a temporary residence permit. In Germany, the asylum process typically takes between four months and two years and during the process different rules apply than afterwards.[9] During the asylum process, most refugees have general labour market access but are subject to several restrictions.

Since 2014, asylum seekers are allowed to start working three months after arrival in Germany. This is typically the time when they live in the initial reception centres in the state to which they were allocated by a certain distribution rule ("Königsteiner Schlüssel"). After three months, they are supposed to move into a new accommodation, so-called community accommodation, which are located in the same state but might be in a different municipality. After this move, asylum seekers register with their new municipality and receive a general work permit. Due to space constraints, many times refugees end up

[9]The duration of the asylum process strongly varies by nationality and date of arrival. For Syrian nationals, for example, it is on average much faster and takes less than six months.

staying in the initial reception centres for up to six months and may receive their work permit later. Asylum seekers from safe countries of origin are excluded from receiving general work permits. A second restriction is that asylum seekers need the approval of the Foreigners Office ("Ausländerbehörde") before any specific employment starts. This approval can be requested with a simple form and it takes on average two to three weeks to obtain. The Foreigners Office checks that an adequate wage is paid ("salary review") and that there is no EU citizen that could be hired instead ("priority review"). The third restriction is that work for temporary employment agencies and self-employment are not permitted for asylum seekers. For asylum seekers who have been in Germany for more than 15 months, the priority review and the prohibition to work for temporary employment agencies is dropped.[10] To summarize, working is possible for most asylum seekers after three months and after undergoing bureaucracy.

There are three possible outcomes for an asylum application: refugees either receive asylum status, a form of temporary protection or a rejection. Recognised refugees or asylum seekers with temporary protection have unlimited access to the labour market and are treated like German nationals in terms of employment laws.[11] Rejected asylum seekers lose their right to work and face deportation.

3.3 Experimental Set-up

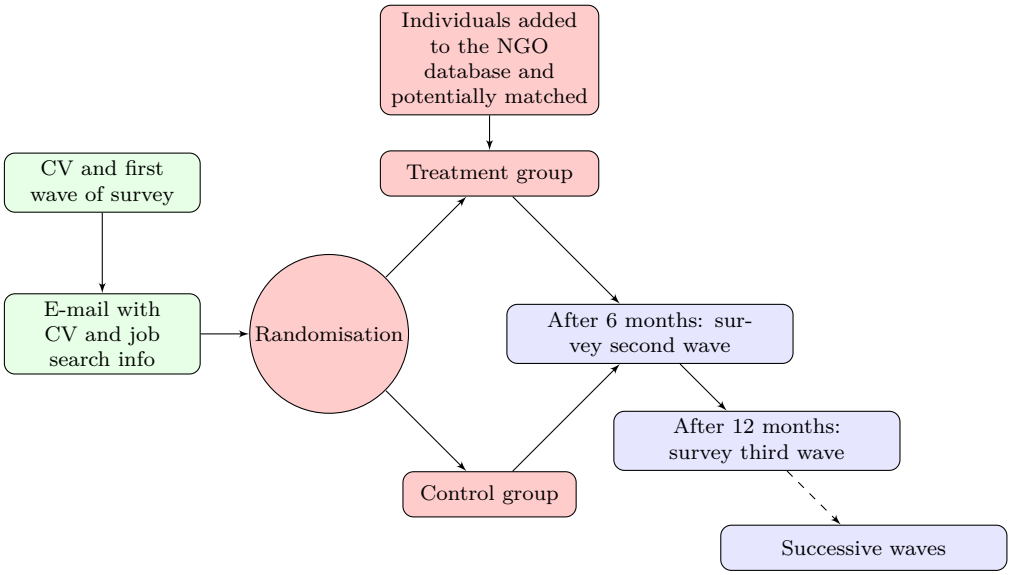
Our experimental set-up can be divided into three stages: the CV preparation stage (first stage), the treatment stage (second stage) and the follow-up stage (third stage). The difference between the treatment and the control group is made during the second stage; through randomisation 50 percent of participants receive the additional job-matching treatment. The first and second stage have started in May 2016 in Munich and are ongoing until May 2017. The follow-up stage begins six months after the CV preparation

[10]In the framework of the new Integration Law, some of these restrictions are no longer applied in certain municipalities. In Munich all restrictions are still in place.

[11]In 2016, 63 percent have received some form of protection and residency permit. For the non-European top 10 source countries, this percentage varies from 4 percent for Pakistan to 98 percent for Syrian nationals. Source: BAMF (2016).

stage and is conducted from November 2016 to November 2017.[12] Figure 3.1 provides a graphical overview of the timeline of the experiment. The first stage (CV preparation stage) is illustrated in green, the second stage (treatment stage) in red and the third stage (follow-up stage) in blue.

Figure 3.1: Timeline of the experiment



3.3.1 General Information About the Partner NGO

To conduct the experiment we collaborate with a Munich-based NGO that assists job-seeking refugees. The NGO was founded in 2015 and currently counts six employees and about 20 part-time volunteers. It is financed through donations, and in 2016 it had a budget of 50,000 Euros. The NGO conducts weekly CV preparation sessions in central Munich and advises job-seekers about basic legal and cultural specificities of the German labour market. In addition, it organises a number of support activities, including CV photo-shoots, e-mail set-up classes or social activities. The NGO has established a network of local partners including the Federal Employment Agency, the Chamber of Commerce, other initiatives for refugees, and social workers. Through its network, the NGO receives information about open vacancies and, when applicable, forwards CVs of suitable refugees to employers. During the time of the experiment, our research group

[12]The experimental design was approved by the Ethics commission of the Economics faculty of the University of Munich.

has participated in all regular CV preparation sessions of the NGO and has organized (on behalf of the NGO) a number of additional ones at different locations in and around Munich.

3.3.2 Participants

The participants of the experiment are job-seeking refugees who come to the CV preparation sessions of the NGO. In addition, three eligibility rules apply to ensure that the participants qualify to enter the German labour market. First, they have to possess a general work permit. Asylum-seekers usually obtain work permits three months after arrival in Germany. This excludes refugees from "safe origin countries" (Bosnia-Herzegovina, Macedonia, Serbia, Montenegro, Albania, Kosovo, Ghana, and Senegal). Consequently, the NGO cannot effectively support them in the job search and they are thus excluded from our analysis.[13] Second, refugees in our sample must be able to communicate in a language spoken by the members of the NGO or our research team. These languages include Arabic, Dari, English, Farsi, French, German, Italian, Kurdish and Russian and cover around 98 percent of the refugees that come to CV sessions.[14] Third, participants must be 18 years of age or older. The NGO does not include under-age refugees in its target group as it is probably better for them to attend an educational institution. Additionally, the age restriction is necessary for us to obtain the participation consent.[15] We are aware that these restrictions imply that our sample is not representative of the refugee population at large. We believe that this was to some extent unavoidable, given that we need participants to voluntarily take part in the session and be willing and quali-

[13] At the time of writing, there is an active debate whether Algeria, Morocco, and Tunisia should be declared as "safe origin countries" or not. There is no political consensus yet and we have not excluded these nationalities. However, the number of refugees from these countries in Munich has been very small and so far none of our participants are nationals of any of these countries.

[14] So far, we have met five candidates, whom we had to send away because they only spoke Urdu or Pashto. These were probably rather low educated refugees that would not have a good chance to integrate into the German labour market and who would need to focus on German classes first.

[15] To comply with the data protection laws of Bavaria, every participant needs to sign a data protection agreement (available in Appendix C.5). Refugees below the age of 18 cannot legally sign the data protection agreement.

fied to enter the German labour market. We also believe, however, that this is the natural population for evaluating a job matching programme.

3.3.3 Set-up of the Experiment

First Stage: CV Preparation

The first stage of the experiment consists of CV preparation sessions, which are jointly organized by the NGO and our research team. The regular sessions take place once a week in the centre of Munich. The participants can easily reach the location by public transportation. We have organized several additional sessions in a support centre for refugees (provided by Caritas) and in big refugee camps in Munich. The NGO advertises the sessions through social workers, Facebook, word of mouth, and partner organisations. The main incentives for the refugees to come to these sessions are receiving a CV in German (that they can then forward to employers or to the job centre), as well as acquiring information on their job-search process. The standard NGO's procedures apply for all sessions. The flyer for these sessions and some pictures can be found in Appendix C.1 and C.2.

During the CV preparation sessions, the interviewers (the volunteers of the NGO and our research team) conduct one-to-one interviews with job-seeking refugees to collect the information needed to prepare their CVs. After collecting the CV data, the interviewers ask questions from a baseline survey to determine the job-search behaviour, salary expectations, and job preferences of the participants. Additionally, the interviewers ask the participants about their family circumstances, their perceptions of integration, and their progress in studying German. The complete baseline survey can be found in Appendix C.2.

In general, it then takes the NGO around two weeks to process the collected information and to prepare the CV. The finished CV includes a participant's personal picture and copies of the work permit and certificates, if available. The NGO sends out the CV to all participants as a pdf attachment by e-mail around two weeks after their session. If participants do not have an e-mail address, the NGO sends it to them as pdf attachment

via the text messaging application "WhatsApp" and, if possible, to the responsible social worker. The pdf attachment is accompanied by an e-mail text, which outlines that "there is a chance that we match" the candidate with a possible employer, but "while we do our best to support" in the job search, "we cannot guarantee that we can find" a suitable employer, this is why we highly encouraged the candidates to keep searching for a job on their own. In addition to this text, advice is sent on how to search for work in Germany. The NGO recommends every participant to register with the federal employment agency and search on websites that publish vacancies such as *monster.de* and *stepstone.de*. The NGO also advises the refugees to continue to learn German as this would greatly improve their chances of finding a job. The complete e-mail text can be found in Appendix C.6.

Second Stage: Treatment

During the treatment stage, we randomly assign the participants to either the treatment or the control group. For the treatment group (50% of the participants), we add the CVs to the NGO's database of potential job candidates. During May-November 2016, through this process an additional 150 CVs have been added to the database, which initially comprised around 100 candidates. This database is searched for suitable candidates every time a vacancy arrives and up to five suitable CVs are sent directly to the firm. The vacancies are received through the network of the NGO, which includes a partnership with the Federal Employment Agency and the Chamber of Commerce. In addition to the available offers, the NGO employees look for other vacancies that would fit the participants in the database on websites and through their network. Once the NGO identifies a potential match, it informs the participant about the vacancy and sends the CV to the employer. It is important to note, that while this intervention reduces the matching frictions between employers and job-seekers, it does not affect the skill set of participants in any way. Both control and treated participants can take part in other activities organized by the NGO or, upon request, receive information support (for example, about the interview or the hiring process).

To determine which candidates are allocated to the treatment and the control group, we randomise for each session separately, thereby insuring that for each session we have the same number of participants in the treatment and in the control group. For every

session, participants are ranked by a random number generator and the upper 50 percent of participants are allocated to the treatment.[16] As the sessions take place at different locations and time and individuals in the same session are more likely to be similar, we believe that this procedure helps us in having people with similar characteristics in the treatment and in the control group. Therefore this provides a useful (albeit weak) stratification. People who attend the regular CV sessions are likely to differ from those who get interviewed directly in their camp, participants from different camps might have access to varying degrees of support services through local social workers, etc. Moreover, it is logistically impossible to reach and to interview all potential participants within a short time span. This means that a single randomisation of all candidates would not be feasible. We conduct this session-based individual randomization every two weeks, so that the NGO receives new CVs twice a month. We thereby guarantee a stable flow for the NGO and ensure that the treatment starts at about the same time after the first meeting with the participants.[17]. Table C.1 in the Appendix provides a balance table on personal and labour market characteristics to provide evidence that the randomisation has worked well and created two comparable groups.

Third Stage: Follow-Up

During the last stage, we contact all participants of the treatment and the control group after six months to ask them about their labour market status and to update our integration measures. Our research team contacts the candidates preferably by phone or alternatively by WhatsApp, Facebook messenger, E-mail or through an additional contact person, who was previously indicated. Refugees that found a job are asked about the details of their new work and how they obtained it. Refugees that have not found a job are asked about their job search behaviour and their challenges. All refugees are additionally asked the same questions about integration outcomes and perceptions and their progress in studying German and some additional questions. The follow-up questionnaire can be found in Appendix C.3.

[16]If the number of candidates is odd, the additional person is randomly allocated to the control or the treatment group.

[17]On average, every week we meet with 15 new job-seekers during the CV preparation sessions.

3.4 Descriptive Statistics of Baseline Characteristics

This section presents descriptive statistics of the personal characteristics of the participants, their job search behaviour, expectations and perceptions of integration. All this information was collected during the first stage, when questions related to the CV were asked and the baseline survey was administered. There is currently very little information available about the characteristics of recently arrived refugees in Germany. In particular, there is only one report by Brücker et al. (2016) on education levels, labour market history, expectations and integration of the recent refugee wave. Their report documents interview answers of 2,349 refugees in Germany. The results are largely in line with our descriptive statistics and there are no contradictory findings. However, one has to keep in mind that our study has low numbers of observations and possibly a selected sample (see Section 6.1), so it is difficult to extrapolate this information to the population of recent refugees in Germany.

3.4.1 Personal Characteristics

Table 3.1 shows gender, age, marital status, percentage of participants with at least one child, number of months spent in Germany, average years of education and work experience for the different countries or regions of origin. It also shows the percentage of refugees who have at least some university education and the percentage of refugees who have no formal schooling. Countries of origin with more than forty observations are listed separately (Afghanistan, Nigeria, Syria). Other African[18] and Asian[19] countries are grouped together.

Most of the participating refugees are young unmarried men without children. The majority arrived in 2015 and, on average, has been in Germany eight months at the time of our baseline survey. Figure 3.2 shows the distribution of educational attainments for the whole sample. Yet, there is substantial heterogeneity across countries. In line with the

[18]Other African country include: Congo, Eritrea, Mali, Sierra Leone, Somalia, Tanzania and Uganda.

[19]Other Asian countries include Iran, Iraq, Jordan, Pakistan, Palestine, Turkey and the United Arab Emirates.

Table 3.1: Descriptive Statistics by Country

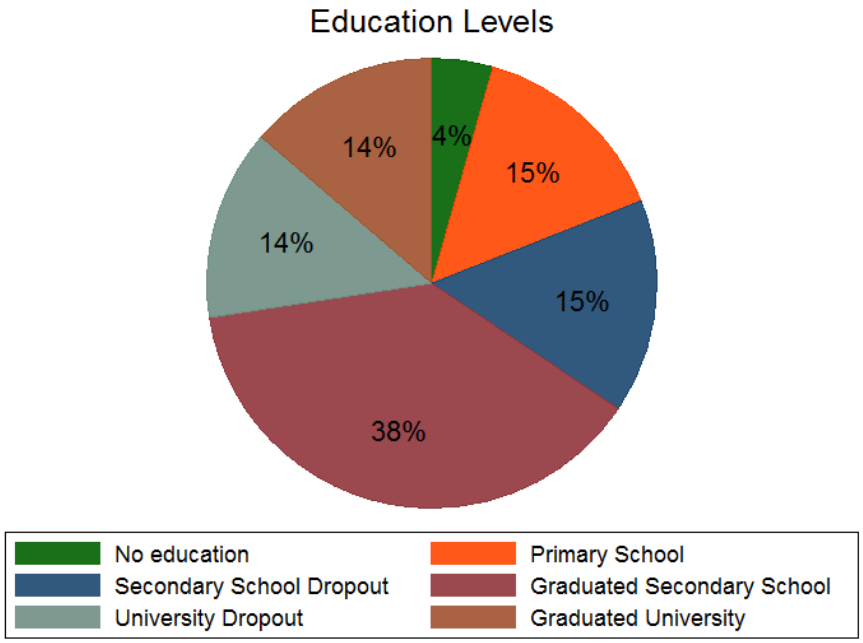
	Afghanistan	Nigeria	Syria	r_Africa	r_Asia	Total
Male	0.947	0.941	0.980	0.887	0.956	0.941
	(0.225)	(0.237)	(0.143)	(0.320)	(0.208)	(0.236)
Age	24.10	49.29	31.75	26.52	29.99	34.17
	(5.461)	(195.1)	(9.254)	(7.550)	(8.201)	(106.1)
Married	0.211	0.188	0.388	0.226	0.356	0.260
	(0.411)	(0.393)	(0.492)	(0.423)	(0.484)	(0.439)
At least one child	0.158	0.224	0.306	0.302	0.378	0.263
	(0.368)	(0.419)	(0.466)	(0.463)	(0.490)	(0.441)
Months since arrival	7.622	5.836	10.76	6.830	7.905	7.528
	(7.163)	(6.730)	(8.383)	(6.837)	(4.604)	(7.023)
Years of education	10.98	9.706	13.76	9.811	10.96	10.86
	(3.720)	(4.005)	(4.333)	(5.141)	(4.497)	(4.515)
Years of work exper.	5.211	6.694	9.224	5.943	9.156	7.076
	(5.287)	(5.073)	(8.260)	(6.109)	(6.742)	(6.358)
Attended university	0.281	0.0824	0.633	0.208	0.356	0.280
	(0.453)	(0.277)	(0.487)	(0.409)	(0.484)	(0.450)
No formal education	0.0351	0.0471	0	0.0943	0.0444	0.0450
	(0.186)	(0.213)	(0)	(0.295)	(0.208)	(0.208)
Observations	57	84	49	54	45	289

Notes: This table shows the gender, age, marital status, percentage with at least one child, number of months in Germany, average years of education and work experience, percentage of refugees who have at least some university education and the percentage of refugees who have no formal education. Countries of origin with more that 45 observations are listed separately (Afghanistan, Nigeria, Syria). Other African country include: Congo, Eritrea, Mali, Sierra Leone, Somalia, Tanzania and Uganda. Other Asian countries include Iran, Iraq, Jordan, Pakistan, Palestine, Turkey and the United Arab Emirates.

findings of Brücker et al. (2016), refugees from countries, which until recently had a well functioning educational system, for instance Syria, have relatively high levels of education. The average years of education for Syrian refugees is 13.8 years and everyone has finished primary school. Figure 3.3 shows the percentage of refugees that have started university and those that have graduated for different countries of origin. While 63 percent of Syrians have attended university, only 27 percent have graduated. This difference can be explained by a lot of young men, whose university education was interrupted by the war. Countries that had war for more than a decade, such as Afghanistan or Iraq, have much worse educational attainments.

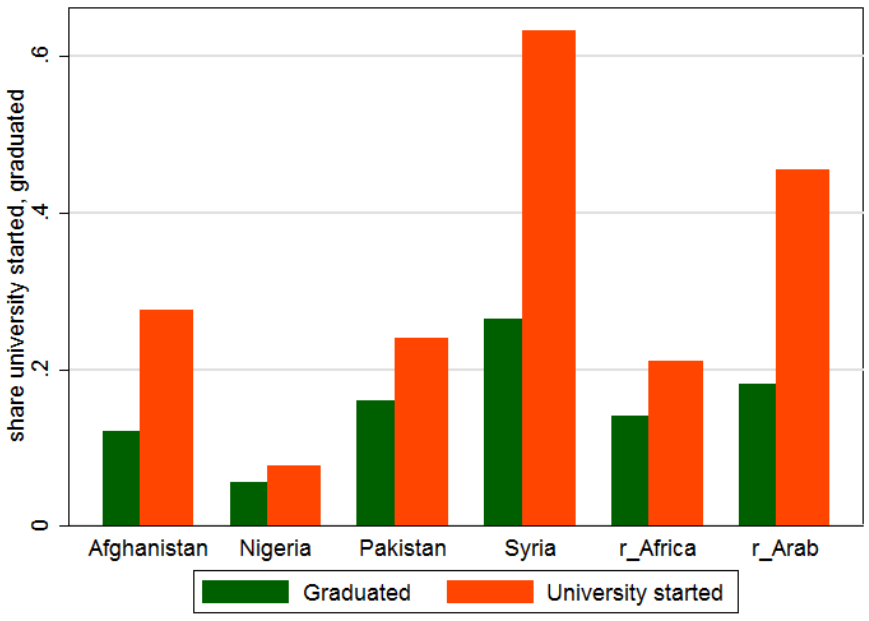
Participants from African countries are less likely to have attended university. In particular, Nigeria has a very low tertiary education rate of around eight percent. Furthermore, the percentage of participants with no formal education is highest for African countries. We attribute this to the high poverty rates and the ongoing conflicts in some of the countries such as Congo, Eritrea, Nigeria, Mali and Somalia.

Figure 3.2: Education attainment of the whole sample



Notes: This figure shows the education attainment of the whole sample.

Figure 3.3: University attainment by country of origin



Notes: This figure shows the percentage of individuals that have some university (orange) and that have graduated from university (green).

3.4.2 Job Search Behaviour and Expectations

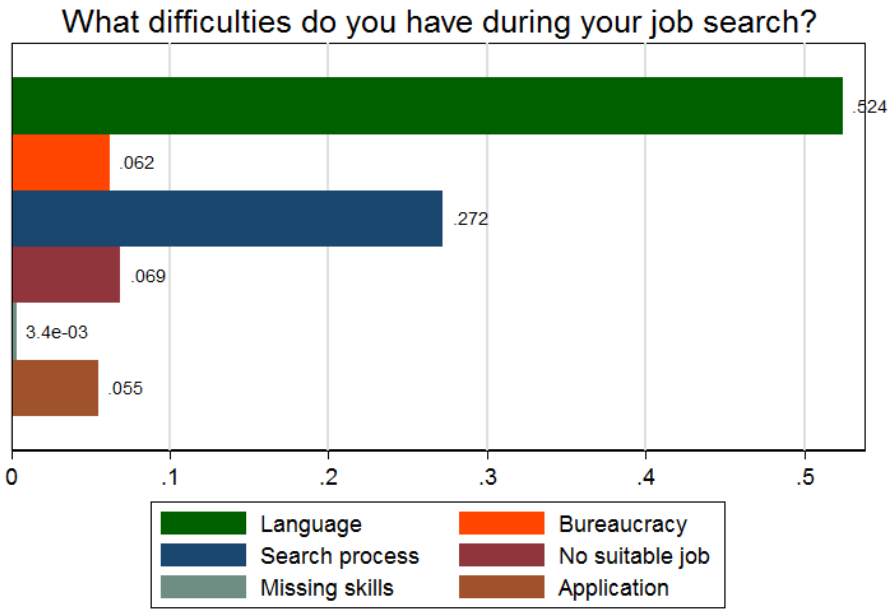
Moreover, we asked refugees about their job search behaviour and about their expectations of working in Germany. The descriptive statistics provide interesting insights about the challenges refugees face during the search and about their expectations of labour market integration.

Around half of the refugees had already actively looked for employment before attending the CV preparation session. Figure 3.5 and Table 3.2 shows that the most common way to search for work is to ask employers directly (23 percent), for instance by going to their shop or restaurant. Almost the same percentage is relying on friends (21 percent) or their social worker (18 percent). About a quarter of refugees have registered as looking for work at the Federal Employment Office and 17 percent are actively using the Federal Employment Agency to find work. Surprisingly, relatively few of the refugees surveyed (17 percent) are searching for work online. There is, however, a large heterogeneity across nationalities. While almost 50 percent of Syrians are using the Internet during their job search, less than 12 percent of refugees from Afghanistan or Nigeria are searching for work in the Internet. This is probably due to both the unavailability of computers for refugees and their limited information about online job searches and applications. Figure 3.4 shows what refugees perceive as their difficulties during the job search. More than a quarter (27 percent) of refugees indicated that they do not know where to search for a job. This is the second largest difficulty after the language barrier (52 percent).

Another challenge is the unavailability of school, university or vocational certificates. A majority (69 percent) of participants do not have the original certificate of their highest degree with them in Germany. This percentage is lower for participants that have attended university (29 percent) and graduated from university (33 percent). In all three cases, the unavailability of original documents will be an administrative challenge for the further academic or professional career of refugees.

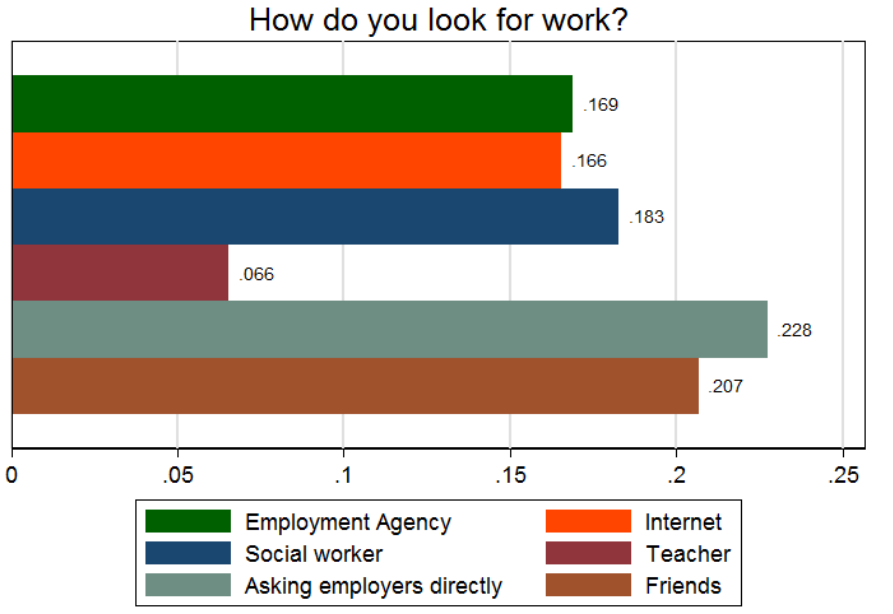
On average, refugees expect a monthly net wage of 1,330 Euros. A majority (65 percent) would be willing to work for less than the minimum wage. This again varies tremendously by country of origin. Refugees from Afghanistan have the highest expected net wage with

Figure 3.4: What difficulties refugees have during their job search



Notes: This figure shows the percentage of individuals that name these difficulties during their job search.

Figure 3.5: How refugees look for work



Notes: This figure shows the percentage of individuals that have used the named job search strategies during their job search.

1,775 Euros, whereas refugees from Nigeria expect only 1,177 Euros. Syrians expect a net wage of roughly 1372 Euros. It is interesting to note that the initial reaction of most refugees to this question is "I do not know". Due to language barriers, unfamiliarity with the system of online job search and applications and unfamiliarity with the German labour market in general, refugees seem to have difficulties to look for work without support.

Table 3.2: Search Behavious by Country

	Afghanistan	Nigeria	Syria	r_Africa	r_Asia	Total
Searches at Arbeitsagentur	0.158	0.176	0.224	0.130	0.156	0.169
	(0.368)	(0.383)	(0.422)	(0.339)	(0.367)	(0.375)
Searches in Internet	0.0702	0.106	0.490	0.111	0.111	0.166
	(0.258)	(0.310)	(0.505)	(0.317)	(0.318)	(0.372)
Searches with social worker	0.0877	0.212	0.224	0.167	0.222	0.183
	(0.285)	(0.411)	(0.422)	(0.376)	(0.420)	(0.387)
Searches by asking in shops directly	0.211	0.235	0.367	0.0185	0.333	0.228
	(0.411)	(0.427)	(0.487)	(0.136)	(0.477)	(0.420)
Searches with friends	0.228	0.153	0.429	0.130	0.133	0.207
	(0.423)	(0.362)	(0.500)	(0.339)	(0.344)	(0.406)
Difficulty: Language	0.579	0.482	0.633	0.352	0.622	0.524
	(0.498)	(0.503)	(0.487)	(0.482)	(0.490)	(0.500)
Difficulty: Don't know where to search	0.263	0.200	0.306	0.296	0.356	0.272
	(0.444)	(0.402)	(0.466)	(0.461)	(0.484)	(0.446)
Observations	57	85	49	54	45	290

Notes: This table shows job search behaviour and the difficulties during the job search. It indicates what percentage of participants are using the Federal Employment Office, the internet, the social workers or friends to look for work and what percentage asks directly in shops. It also shows, what fraction of participants indicates that language is a difficulty during the job search and what fraction of participants does not know where to search. Countries of origin with more that forty observations are listed separately (Afghanistan, Nigeria, Syria). Other African country include: Congo, Eritrea, Mali, Sierra Leone, Somalia, Tanzania and Uganda. Other Asian countries include Iran, Iraq, Jordan, Pakistan, Palestine, Turkey and the United Arab Emirates.

The descriptive statistics provide some preliminary evidence that both missing skills, mainly language skills, and frictions in the labour market hinder refugees labour market integration. The friction that 27 percent of refugees mention is that they "do not know where to search". This friction is alleviated for the treatment group as CVs are sent directly to suitable employers. The randomised controlled trial thus evaluates if such search and matching frictions can be alleviated for refugees through the services provided by the NGO.

3.4.3 Perceptions of Integration

Although the integration of refugees is a key policy objective, there is neither a unique definition of integration, nor a clear way of measuring it (Ager and Strang, 2008).[20] In practice, integration has different facets and this paper uses a number of different questions to proxy integration.[21] We first look at the answers for individual questions by nationality and then we form an index of these questions to have one integration measure. The questions we use to proxy integration are the following:

- Did you make new friends in Germany?
  - Multiple answer options: Yes, from Germany; Yes, from my country; Yes, from other countries; No.
- Do you already feel at home in Germany?
  - Answer scale from 0 to 4, 0 meaning not at all and 4 meaning completely.
- Have you ever been invited to the house of a German?
  - Answer options: Yes or No.
- What activities do you do outside of the community accommodation?
  - Multiple answer options: Study/German; sports; meeting friends; shopping; or other activities.
- Level of German as assessed by interviewer
  - Answer options: Absolute Beginner, A1, A2, B1, B2, C1.

Table 3.3 shows the percentage of refugees from a certain country answering yes to these questions. For the second question, we consider the answer to be yes, if the candidate answered 4 or 5. For the fourth question we consider the answer to be yes, if he does at

[20]The economic literature has sometimes used the earnings gap between natives and foreigners to measure integration. However, as earnings typically take more than a decade to assimilate for refugees and most of our participants are not working yet, this project focuses on other outcomes with a more short-term view and a stronger focus on the integration into the German society.

[21]The inspiration for some questions was taken from the European Social Survey and the Longitudinal Survey of Immigrants to Canada. The questions were then adapted to the specific context of refugees in Germany.

least two activities outside his community accommodation and for the last question we consider the level A2 or above (which corresponds to basic German knowledge).

Table 3.3: Integration by Country

	Afghanistan	Nigeria	Syria	r_Africa	r_Asia	Total
Integration Index	2.060	1.850	2.939	2.100	2.044	2.153
	(1.047)	(0.907)	(1.073)	(1.046)	(1.127)	(1.083)
Return intention	0.289	0.280	0.429	0.241	0.267	0.298
	(0.411)	(0.398)	(0.408)	(0.409)	(0.434)	(0.412)
friends_Germany	0.298	0.476	0.796	0.593	0.467	0.516
	(0.462)	(0.502)	(0.407)	(0.496)	(0.505)	(0.501)
Feel at home	3.439	3.583	2.898	3.222	3.200	3.311
	(0.866)	(0.795)	(1.159)	(1.058)	(0.991)	(0.982)
invited	0.263	0.226	0.633	0.352	0.422	0.356
	(0.444)	(0.421)	(0.487)	(0.482)	(0.499)	(0.480)
active	2.211	1.619	2.510	1.722	2.022	1.969
	(1.206)	(1.029)	(1.063)	(0.899)	(0.988)	(1.088)
German	0.368	0.107	0.429	0.167	0.111	0.225
	(0.487)	(0.311)	(0.500)	(0.376)	(0.318)	(0.418)
Observations	57	84	49	54	45	289

Notes: This table shows the integration index and the individual components by country. The integration index is described in details in subsection 3.4.3 of this paper. German friends indicates the percentage of people indicating that they have German friends. Feel at home is a subjective measure ranging from 1 to 5, 5 being the highest. Invited is an indicator measuring if the person has ever been invited to the house of a German. Active means that the person does at least two leisure activities and German means that the person has at least reached level A2. Additionally, return measures the desire to return to ones country if it was safe. Countries of origin with more that forty observations are listed separately (Afghanistan, Nigeria, Syria). Other African country include: Congo, Eritrea, Mali, Sierra Leone, Somalia, Tanzania and Uganda. Other Asian countries include Iran, Iraq, Jordan, Pakistan, Palestine, Turkey and the United Arab Emirates.

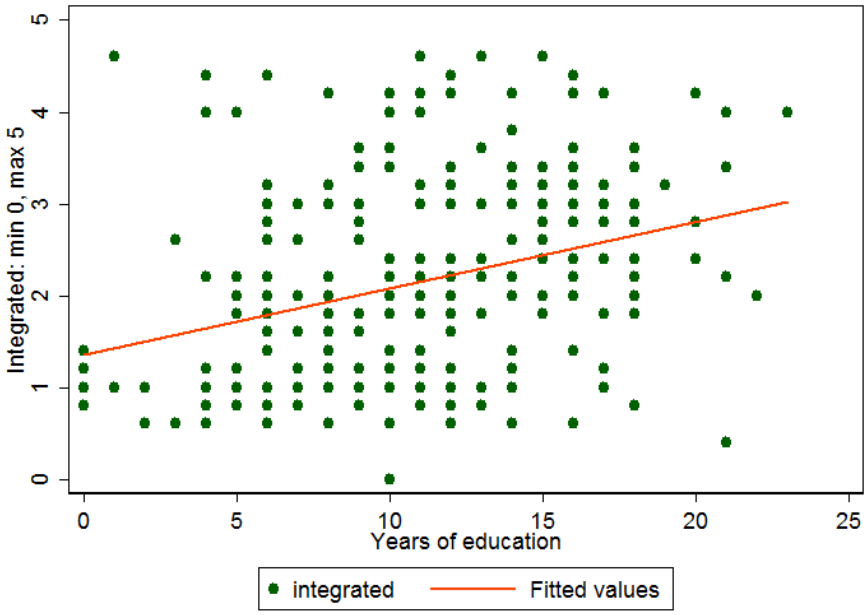
To take the analysis one step further, we build an integration index using these questions. The index covers the range from zero to five and takes the value of five if the person is fully integrated. A value of five is obtained, if one individual fulfils all five criteria:

- He has German friends (binary)
- He feels at home (on a scale from 0 to 4)
- He has been invited to the house of a German (binary)
- Number of activities he does outside the community housing (on a scale from 0 to 4)
- His level of German is at least A2 (binary)

If only one criterion is fulfilled, the individual obtains a value of 1 in the integration index, if two criteria are fulfilled the value 2, etc. The variable feel at home and number of activities is divided by 4, so that it ranges between 0 and 1. Of course, the aggregation of various questions to one index comes at a cost: the index depends on the questions and cut-offs one selects. As expected, the individual components are correlated as shown in Table C.2 in the Appendix. Yet, it is useful to have a comprehensive measure of integration covering various different aspects.

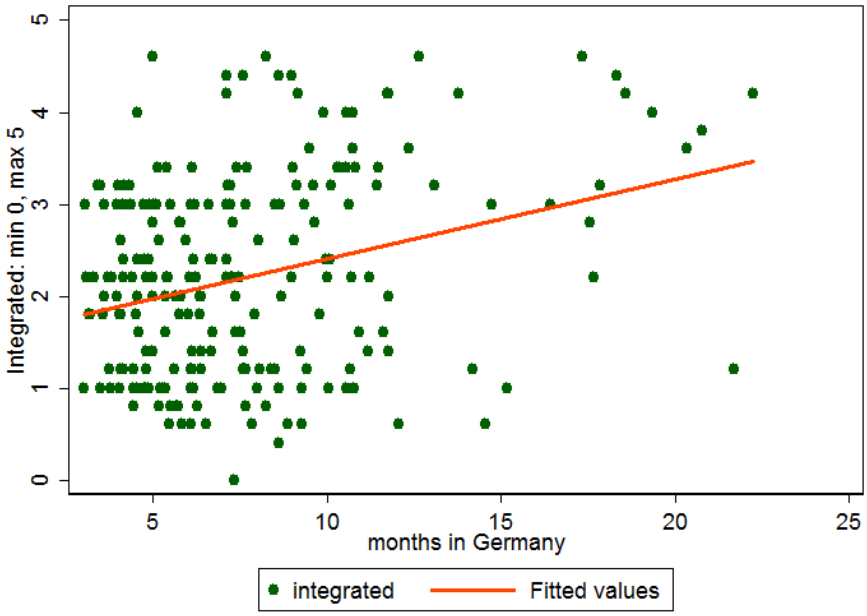
This index can be correlated with individual characteristics such as education, age, gender or total time spent in Germany. Figure 3.6 shows the correlation between the integration index and education. As expected, there is a clear positive relationship between education and integration. One interesting observation is that the variation seems to be coming from individuals with either minimal or considerable education, while integration outcomes are very heterogeneous for intermediate levels of education. Refugees also seem to need time for integration. It is reassuring to see that the more time a refugee spends in Germany, the more developed his integration is (Figure 3.7).

Figure 3.6: Correlation between Integration and Education



Notes: The Integration Index is measures as described in Section 3.3. One dot equals one participant.

Figure 3.7: Correlation between Integration and Time in Germany



Notes: The Integration Index is measures as described in Section 3.3. One dot equals one participant.

3.4.4 Multivariate Regressions Results for Integration

While the graphs show us a positive association between integration and education or duration of stay respectively, it is important to conduct regression analysis in order to control for observable factors. To determine the effect of different explanatory variables on integration we estimate the following empirical model:

$$Integ_i = \beta_0 + \beta_1 Educ_i + \beta_2 Months_i + \beta_3 Eng_i + \beta_4 Syr_i + \beta_5 Afg_i + \beta_6 Nig_i + \beta_7 X_i + \epsilon_i \quad (3.1)$$

where the index i denotes an individual. $Integ_i$ is the outcome of interest - the Integration Index or different measures of integration respectively. $Educ_i$ is the years of education, $Months_i$ denotes the months spent in Germany, Eng_i the level of English, and Syr_i, Afg_i and Nig_i are country dummies for the largest nationalities that occur in our sample. X_i includes additional controls, in particular if the individual is married and if he has children.

Table 3.4 shows the results of ordinary least squares regressions[22], where the integration index is regressed on the years of schooling. For each additional year of schooling, the integration index increases by about 0.06 points. This means that the integration index of a participant that has some university experience (e.g. 14 years of schooling) is 0.6 points higher than of someone who has just finished primary school. The amount of time spent in Germany also has a positive and significant effect on integration. This makes sense, as refugees are more likely to have improved their German language skills or have German friends. Furthermore, a good level of English is beneficial for integration. Keeping other observables constant, Syrian nationals seem to be better integrated than other participants. One explanation could be their considerably faster asylum process and their protection rate of 98 percent. This in turn allows them to participate in government support programmes and language courses much faster than participants from Afghanistan, Nigeria or other countries.

[22]The integration index is measured with two digits after the comma. It takes 60 different realisations, which is a justification to use OLS instead of Ordered Probit regressions. Ordered Probit regressions have been estimated for robustness and lead to exactly the same results in terms of magnitude and significance.

Table 3.4: Integration by personal characteristics

	(1) Integrated	(2) Integrated	(3) Integrated	(4) Integrated
Years of education	0.0708***	0.0799***	0.0592***	0.0626***
	(0.0138)	(0.0131)	(0.0136)	(0.0144)
Months since arrival		0.0533***	0.0459***	0.0475***
		(0.00872)	(0.00951)	(0.00902)
Good English			0.333***	0.306**
			(0.122)	(0.125)
Syria			0.609***	0.619***
			(0.188)	(0.184)
Afghanistan			0.0977	0.0118
			(0.180)	(0.182)
Nigeria			-0.158	-0.175
			(0.135)	(0.140)
Additional Controls				X
Observations	283	283	283	283
R2	0.0842	0.202	0.254	0.274

Notes: This table shows OLS regressions of the integration index on years of education, months since arrival, level of English and a Syria, Afghanistan and Nigeria dummy. Additional controls are age, age squared, being married and having at least one child. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

It is interesting to see how the manifold personal characteristics influence the five components of the integration index differently. Table 3.5 illustrates that higher education is positively associated with having German friends, doing activities outside one's home and speaking good German. The time spent in Germany appears to be most important for being invited to the house of a German, doing activities outside ones' home and speaking good German. A good level of English is positively associated only with the likelihood of having German friends.

Given the structure of the data, the possibility exists that different observations are not independent from each other. Candidates that arrived in Germany at the same time, have the same education level or come from the same country might be correlated. Table C.3 in the Appendix shows regression results equivalent to Table 3.4 column 4 (including all controls). It shows that all significance levels are robust to different ways of clustering (with the exception of the English language coefficient that becomes significant for country level clustering).

It is important to keep in mind that in this section of the paper, we do not make any causal statements. Results of these simple OLS regressions might be biased due to reverse causality or omitted variable biases. The causal part of the paper is provided only by the

Table 3.5: Different integration outcomes by personal characteristics

	(1) German friends	(2) Feel at home	(3) Invited	(4) Active	(5) Level of German
Years of education	0.0199***	-0.00734	0.0168***	0.0597***	0.0156***
	(0.00676)	(0.0152)	(0.00615)	(0.0153)	(0.00521)
Months since arrival	0.00746	-0.0118	0.0189***	0.0382***	0.0159***
	(0.00468)	(0.00764)	(0.00339)	(0.00978)	(0.00403)
Good English	0.123*	-0.0728	0.136**	0.0513	0.0399
	(0.0657)	(0.135)	(0.0568)	(0.135)	(0.0520)
Syria	0.203**	-0.314	0.189**	0.359*	0.213***
	(0.0855)	(0.208)	(0.0917)	(0.199)	(0.0809)
Afghanistan	-0.210**	0.168	-0.0574	0.270	0.187**
	(0.0860)	(0.174)	(0.0828)	(0.197)	(0.0757)
Nigeria	-0.0619	0.313**	-0.109*	-0.150	-0.0250
	(0.0747)	(0.141)	(0.0637)	(0.148)	(0.0534)
Controls	X	X	X	X	X
Observations	283	282	283	283	283
R2	0.168	0.0695	0.191	0.183	0.190

Notes: This table shows OLS regressions of different integration measures on years of education, months since arrival, level of English and a Syria, Afghanistan and Nigeria dummy. Additional controls are age, age squared, being married and having at least one child. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

results from the randomised controlled trial. We still think, however, that these regression results are of interest as they provide first insights for a new and under-researched topic.

3.4.5 Other Results

There are a number of other factors that are not directly linked to job search or integration but are nonetheless interesting to understand the labour market integration of refugees. These are the return intentions and the willingness to move within Germany or Europe, the experience of xenophobia and the reason for choosing Germany as the destination country.

A majority (62 percent) of refugees in the sample do not want to return to their country once it is safe. Less than one quarter (22 percent) want to return and 16 percent do not know. With 27 percent, the intention to return is highest amongst Syrian refugees. Almost all refugees (89 percent) would like to live in Munich at least for some years if they are given the possibility to stay and work in Munich. The majority (74 percent) would, however, be willing to move within Germany or Europe if they were offered a job there. This shows that from the point of view of the refugees, they hope to stay if given the opportunity.

When it comes to the behaviour of natives towards refugees, 75 percent of refugees report that they have never felt being treated with less courtesy or respect because they are refugees. Another 22 percent have felt this way sometimes and only three percent have had this experience often or all the time. This is the subjective feeling of the refugees and it might have ramifications on their integration and return intentions.

Germany has received many more asylum seekers than other European countries. There are a number of institutional, geographic and other reasons for this. If one asks the refugees directly why they chose Germany as opposed to Italy, France or the UK, the most common answer is safety (52 percent), followed by a good reputation (39 percent), job opportunities (24 percent) and asylum possibilities (24 percent). Nine percent chose Germany due to relatives residing in Germany.[23] In comparison with labour migrants, the majority of refugees have thus not chosen Germany due to job related reasons. This confirms our conjecture that refugees may be less prepared for employment in Germany.

[23]Respondents could chose up to three answers.

3.5 Results of First Follow-up (Pilot)

The following results come from a pilot follow-up survey that we conduct in October 2016. It is comprised of 56 refugees we initially met in March and April for the CV preparation stage.[24] We contact them by phone six months later to question them about their current labour market status.[25] If they found work, we ask them about the details of their work, how they found it and how satisfied they are with different aspects of their work. If they did not find work, we ask them about their search behaviour and experience. There is also the possibility that they are currently neither working nor looking for work and in this case we ask them about the reason for being out of the labour force. In addition, we ask about perceptions of integration, German language progress and in general about their life in Germany.[26] This pilot sample has not been randomised as we did not have the approval of the ethics commission in April and we were still experimenting with the baseline survey.[27] For this reason everyone of the pilot sample has received the treatment and has thus been added to the database of the NGO.

3.5.1 Labour Market Outcomes

Of the 56 follow-up surveys conducted, 20 participants have found work, 34 participants are currently not working but would like to work and two participants are not looking for work as they are in full-time German language classes. Among those 20 refugees who have found work, seven found the work through the NGO, six with the help of friends or relatives, three through a social worker and two with the help of their teacher. Only two refugees have found work by themselves, one through the internet and one by asking in a shop directly. This seems to suggest that matching frictions matter. At the same

[24]This Section provides some initial ideas about the kind of analysis that is feasible once we have collected the follow-up data for the real sample of around 500 refugees. At this stage it is difficult to draw significant conclusions due to the small sample size.

[25]We have no opportunity to independently verify the obtained information, except in a few cases in which the NGO is in contact with the employer. We assume that the obtained information is correct as the refugees have very little incentives to lie and can benefit from obtaining an updated CV.

[26]The complete follow-up survey can be found in the Appendix.

[27]It is not possible to systematically analyse the baseline survey for this pilot group as we were still adapting and improving the survey during the pilot in March and April.

time, it also highlights the importance of a randomised controlled trial for generating a credible counterfactual. It is interesting that none of the refugees found work through the Federal Employment Agency.

How the refugees have found their work seems to be correlated with the kind of work they found. While most refugees that have found their work without the NGO are now working in the cleaning industry (four candidates) or in a restaurant (four candidates), refugees that have found their work through the NGO have positions that mostly match their education and experience in: administration, agriculture, accounting, engineering, IT, child care and in a theatre. The treatment thus does not only determine the probability of a match but also the match quality.

Of those twenty working refugees, half found employment in a regular job, while 25 percent are doing an internship and a further 25 percent are doing part-time work. Three salaries are above the minimum wage and two contracts are longer than one year. With regards to work satisfaction, 77 percent of workers are happy with their colleagues and 61 percent are happy with their tasks at work. However, only 23 percent are happy with the salary. Half of the working refugees feel overqualified for the work and 68 percent are looking for better work.

Of the 34 refugees who are currently actively looking for work, 17 people had no contact to employers, ten had unsuccessful informal meetings or job interviews and three people had job offers, which they did not accept due to the low wage, being overqualified and missing documents respectively. Four people have worked but ended the work relationship. Two have quit due to a low salary, one contract ended and one person was dismissed.

3.5.2 Integration Outcomes

Table 3.6 shows the different components of the integration index by working status. We are using the same questions as in the baseline survey and the same explanations as outlined in Section 4.3. One can clearly see that working refugees score higher on the integration index. They are more likely to have German friends and more likely to have been invited to the house of a German. Moreover, they have a higher level of German and

are less likely to wish to return to their home country. They also do less leisure activities outside their house, probably due to time constraints and, surprisingly, refugees that work feel less at home.

Table 3.6: Integration by working status

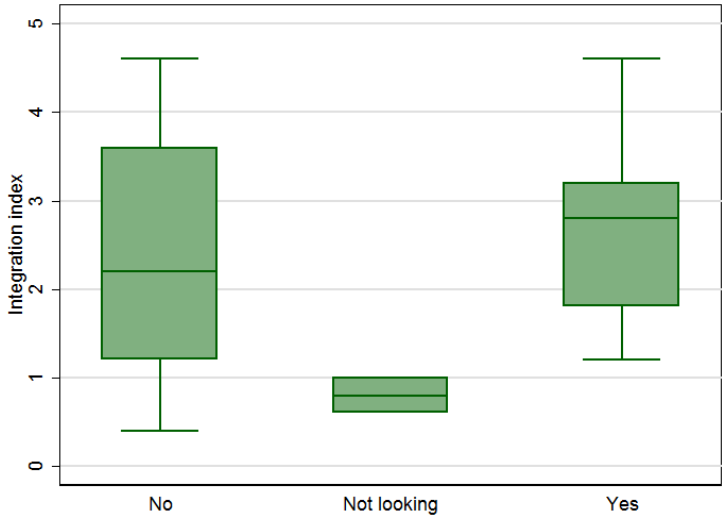
	No	Not looking	Yes	Total
Integration Index	2.682	1.075	3.050	2.737
	(1.293)	(0.318)	(0.978)	(1.221)
Germann friends	0.467	0	0.688	0.521
	(0.507)	(0)	(0.479)	(0.505)
Feel at home	4.367	3.500	4	4.208
	(0.718)	(0.707)	(1.095)	(0.874)
Invited	0.333	0	0.438	0.354
	(0.479)	(0)	(0.512)	(0.483)
Active	2.033	1.500	1.750	1.917
	(1.098)	(0.707)	(1.065)	(1.069)
German	0.500	0	0.688	0.542
	(0.509)	(0)	(0.479)	(0.504)
Return intention	0.233	0	0.188	0.208
	(0.430)	(0)	(0.403)	(0.410)
Observations	34	2	20	56

Notes: This table shows the integration index and the individual components by working status. The integration index is described in details in subsection 3.4.3. German friends indicates the percentage of people indicating that they have German friends. Feel at home is a subjective measure ranging from 1 to 5, 5 being the highest. Invited is an indicator measuring if the person has ever been invited to the house of a German. Active means that the person does at least two leisure activities and German means that the person has at least reached level A2. Additionally, return measures the desire to return to ones country if it was safe.

Two caveats apply. First, this Table does not capture a causal relationship between work status and integration, due to possible omitted variable bias and/or reverse causality. It is currently not possible to determine if the fact that one found work helps the integration process or if those refugees that are better integrated are the ones that find work. Given the design of the randomised controlled trial, we will be able to disentangle this and draw causal statements once we have the follow-up result of the randomised participants. Second, the very low number of observations of the pilot makes it impossible to obtain statistically significant differences. Comparing Table 3.6 with Table 3.3, one can see that refugees that are asked six months later have a higher integration index (2.74 compared with 2.42). This is in line with the regression result that indicate that time spent in Germany has a positive effect on integration outcomes.

Figure 3.8 illustrates that working refugees not only have a higher average integration index but also the variance is smaller.

Figure 3.8: Integration by Work Status



Notes: The Integration Index is measures as described in subsection 3.4.3. The box plot shows the mean, the 25/75 percentile and the minimum/maximum of the integration index for those not working, not looking and those who are working.

3.5.3 Next Steps

This project is ongoing and expected to last at least until the end of 2017. The CV preparation and baseline surveys are planned to run from May 2016 until May 2017 and we aim at 500 participants in total. The follow-up survey is conducted six months after the respective CV preparation session and is thus running from November 2016 until November 2017. While this paper is being written, we have just started the first follow-up surveys. This follow up survey is being conducted on the phone by our multilingual research team; in the same way as outlined for the trial survey. It is possible to conduct further waves of the follow up survey to track refugees for a longer period of time and also investigate medium and long term labour market and integration outcomes.[28]

The analysis of the data can be divided into two parts. First, we investigate labour market outcomes and, in particular, we test the hypothesis whether participants in the treatment group have better labour market outcomes in the short term than the control group. Evidence of positive effects would suggest that matching frictions between German employers and job-seeking refugees exist. The employment of refugees thus does not only depend on the skills they possess, but also on their possibility to be considered

[28]The actual implementation of additional follow up surveys will depend on attrition and funding.

by employers who are trying to fill a vacancy. Overcoming these frictions may then facilitate labour market integration of refugees in Germany. The main outcome variables will be employment status, duration and wages. Once the main effect is established, it is important to understand what drives the result. The treatment may modify the outcomes of participants by 1) creating awareness of job opportunities, 2) reducing search time, 3) enhancing match quality or 4) serving as a referral to the employer. Identifying the channel(s) is relevant for policy-making. Therefore, we additionally investigate a number of supplementary variables. These include: the number of applications sent, search strategies, time until the first interview, number of job interviews, job match quality and job satisfaction.

Second, we are interested in integration outcomes. We aim to test, whether earlier (and/or better) employment leads to enhanced integration outcomes in the short term. The treatment status can hereby serve as an instrumental variable for employment. The key outcome variables will be the components of the integration index. Additionally, we can study their housing conditions and report stress, happiness and optimism levels. Detailed statistical model specifications can be found in the pre-analysis plan in the Appendix and has been uploaded on the American Economic Association's registry for randomized controlled trials.

3.6 Limitations

3.6.1 Selection

The refugees that are taking part in our experiment are not representative of all refugees living in Germany for several reasons: our eligibility criteria, their motivation to come to our sessions and a focus on refugees residing in Munich. This selection has implications for external validity. An expansion of the programme or a different setting might lead to different results. However, it does not impact the internal validity of the experiment as we randomize over equally selected participants.

First, our sample is selected due to our eligibility criteria, we only work with refugees that have a work permit. This excludes all refugees from safe countries of origin. We argue that this is the relevant group to study for labour market integration. Refugees from safe countries of origin are legally excluded from the labour market and thus cannot benefit from job matching support. We had to reject around three percent of candidates due to this restriction (all coming from Senegal). For legal reasons, we also have to focus on refugees aged 18 or above.[29] This is the relevant target group as refugees below the age of 18 are typically recommended to attend an educational institution and only refugees aged 18 or above are encouraged to integrate into the labour market. We had to send away around two percent of candidates due to this restriction. Our last eligibility criterion excluded participants that did not speak any of the languages our team speaks. This has excluded around four percent of participants.

The second reason why our sample is selected is that the refugees who came to us are likely to be different from those who did not, and these differences are likely to matter for most of the outcomes that we are interested in. One obvious difference is motivation. It takes extra effort to come to our CV preparation sessions and we expect our candidates to be positively selected on motivation. These highly motivated refugees are likely to be also highly motivated to learn German, search more intensively for a job and to go to other support institutions. Other reasons for a selected sample might be educational background, extroversion, foreign language ability or psychological well-being. Furthermore, in our way of reaching candidates, we are focusing on refugees living in communal accommodation. By targeting this group, we exclude those that have the means to support themselves or who have already a network of family or friends. We thus focus on the ones asking for support, which is a very policy relevant group of refugees.

We can make a rough estimation of the percentage of all refugees in Munich that take part in our experiment. There have been around 12,000 refugees in Munich at the end of 2015. If we restrict this to men of working age, then we have a pool of potential candidates of 6,000. Further subtracting refugees without a work permit and from safe

[29] In 2015, 31 percent of arriving refugees in Germany were below 18 years old.

countries of origin restricts the pool to around 5,000.[30] We thus have a participation rate of around seven percent of relevant and eligible candidates in Munich.[31]

3.6.2 Attrition

We are aware that sample attrition could be high when working with this population. We concentrate our efforts on obtaining contact details that do not change over time. Besides obtaining their e-mail address and phone number, we also ask if we can contact them via WhatsApp or Facebook. One advantage in this respect is that we provide everybody with some support (CV in German). The treatment group is rather easy to follow up with. As the NGO offers additional support activities, the control group also had an incentive to stay in touch with us. Sample attrition may thus be lower than for a simple survey, where the individuals have no gain in remaining in the sample.

3.6.3 Non-Compliance

There are two form of non-compliance we need to be aware of. The first case happens if participants who have been allocated to the control group receive the treatment. This case can be excluded as the experiment design does not make it possible for the control group to be added to the database. Refugees are not aware of the internal organisation of the NGO and can not push for their CV to be included. The second case happens if the participants of the treatment group do not receive the treatment. This could happen if the NGO matches treated participants but they do not attend job interviews or accept the position. This happens, for instance, if refugees attend full time German classes or if they get an asylum rejection. Due to our follow up interview, we can identify these cases in the data (It has been the case for two candidates in the pilot follow up). This will bias our estimates towards zero.

[30]There are around 4,000 asylum seekers registered with the Munich branch of the Federal Employment Agency.

[31]Numbers are taken from the Munich municipality. Estimations are only rough approximations.

3.6.4 Spillovers

Spillovers could occur if a candidate from the treatment group finds work and then recommends his friend, who is in the control group, to his employer. If this person then gets hired, he has received spillovers from the treatment group. The best we can do in this situation is to observe the spillover.[32] These spillovers are interesting in themselves and can be analysed further. As spillovers trigger a positive effect for the control group, this would bias our effect towards zero.

3.6.5 Displacement Effects

One worry in labour market experiments is that participants of the treatment group obtain jobs that might have been filled by the control group in the absence of the experiment. If there is a limited number of jobs and both control and treatment group are competing for these jobs, then this is a valid concern. Crepon et al. (2013) find that displacement effects are particularly strong in labour markets with high unemployment. We think that displacement effects are of limited importance in the context of our experiment for two reasons. First Munich has a very low unemployment rate and the 150 people in our treatment group seem small given the large number of vacancies in Munich. Second, most companies indicated that they would be willing to hire additional people if they have the required German and technical skills. So the amount of vacancies does not seem to be the limiting factor. However, if one thinks about expanding the programme in terms of size or in location, then one would need to take general equilibrium effects into consideration.

3.6.6 Ethical Concerns

Doing experiments with a vulnerable group of people is a sensitive issue and we needed to ensure that we do not harm anyone participating in our experiment. It was critical to

[32] We ask the name of the company in the follow up survey and we also ask how the person has found the work.

make sure that people in the control group are not put in an unfair position and we did not deprive them from finding a job. We ensured this in two ways. First, we collected many more CVs than the NGO could match to the available vacancies. The NGO is newly established, has less than 10 full-time staff and thus limited capacity. We made sure that at any time they had more suitable CVs than open positions. Thus, they were already working at full capacity with the treatment group. Second, the participants in the control group will be added to the database one year later. Through this phased-in design we ensured that everyone receives the treatment in the end, timing being the only difference. Furthermore, we provided both the control and the treatment groups with a CV in German and valuable information on the job search in Munich and we made sure to communicate to the control group in a way that they did not expect a guaranteed job from the NGO. We also guaranteed compliance with the recommendations from the Ethics commission of the Faculty of Economics at the University of Munich.

To ensure that we follow data protection requirements of the Bavarian government and the university, we had a consent declaration of every participant that specified that we were allowed to use their data for research purposes (see appendix B). This form is in accordance with Bavarian Data Protection Law. We treated the data in a pseudonymised way and made sure that no confidential data is distributed to third persons. In particular, we saved the personal identification in a separate place and only merged it for follow-up purposes.

3.7 Conclusions and Policy Implications

To conclude, this paper has provided new insights into the labour market integration of recently arrived refugees in Germany. Apart from missing language skills, job search and matching frictions seem to be a major concern, as refugees do not know where to search and only rarely use the internet in their job search. The most successful strategies to find a job were matching services provided by an NGO and a network of friends and relatives. As the majority of job-seeking refugees, however, have not found a job after six month, there seems to be scope for more support. We currently conduct the

described randomized controlled trial to provide a more causal analysis and evaluation of the usefulness of matching services.

More educated refugees and refugees who have stayed in Germany for a longer time are better integrated into the society. Additionally, refugees who work are better integrated on average. The results from the experiment will show if there is a causal relationship between finding work and integration outcomes.

Beside the better support that is needed to promote the labour market integration of refugees, there are several labour market regulations that need to be removed to guarantee a free and efficient labour market entry for refugees. These labour market regulations include the residency requirement, the priority rule, the prohibition of temporary employment agencies and the prohibition of self employment during the asylum process. In the framework of the new German Integration Law ("Integrationsgesetz"), the residency requirement was made stricter and the priority rule and the prohibition of temporary employment agencies were lifted in most German cities but kept in most Bavarian cities including Munich due to political reasons.[33]

First, most refugees are randomly allocated to a certain municipality and are required to live there during and also after the asylum process as long as they are receiving social benefits. Many times refugees also are reallocated to different municipalities during their asylum process. This residency requirement reduces the possibility of finding employment as the search radius is restricted. While it is theoretically possible to make a transfer request once a refugee has found work in another municipality, practically speaking this is extremely very difficult due to a long lasting process and severe bureaucratic hurdles. Godoy (2016) and Aslund and Rooth (2007) show that refugees in Sweden and Norway, who have randomly been allocated to areas with bad labour market outcomes for immigrants, experience persistent reductions in wages and employment. Dustmann et al. (2016a) shows that the acceptance of refugees by the local population is higher in urban areas.

[33]The priority rule and the prohibition to work for temporary employment agencies are still in place in: Bavaria (only: Aschaffenburg, Bayreuth-Hof, Bamberg-Coburg, Fuerth, Nuremberg, Schweinfurt, Weiden, Augsburg, Munich, Passau, Traunstein), in Northrhine Westphalia (only: Bochum, Dortmund, Duisburg, Essen, Gelsenkirchen, Oberhausen, Recklinghausen) and in the entire Mecklenburg-Hither Pomerania.

Second, the priority rule is making it difficult for firms to hire asylum seekers. The priority rule regulates that a firm can hire asylum seekers only if they cannot find a suitable German, EU, EEA citizen or recognized refugee to fill the position. This priority review is conducted by the foreigners office before the hiring process and typically takes several weeks. This creates a burden for the firm as it increases hiring time, effort and uncertainty. A German-wide removal of the priority review would make it easier for firms to hire asylum seekers and thus increase their success on the labour market.

Third, asylum seekers are allowed to work for temporary employment agencies only 15 months after arrival in Germany. This is preventing refugees from utilising an important stepping stone into the labour market. Jahn and Rosholm (2013) and Jahn and Rosholm (2014) find that temporary employment agencies facilitate immigrants labour market entry as it reduces information asymmetries, allows a firm to screen a worker at little cost and provides the refugee with contacts, on-the-job language training and country specific human capital. The studies further confirm that immigrants benefit in the long term from their temporary employment experience as they earn higher wages and have a higher employment probability in regular employment. Temporary employment agencies thus have the potential to ease refugees labour market integration and remaining restrictions should be lifted.

Fourth, an additional restriction asylum applicants face is the prohibition of self employment. Once an asylum request is accepted, this prohibition is lifted but significant entry barriers such as regulations, permits and financial constraints remain. This limits the potential labour market integration of refugees as, according to our baseline survey, 49 percent have experience being self employed before arriving in Germany. A majority (72 percent) of our surveyed refugees could imagine being self employed in Germany but have not tried this step so far. Caliendo and Kuenn (2011) for example show that start-up subsidies in Germany had long-lasting positive effects on wages and employment, especially for low educated unemployed. Thus there is the possibility of improving refugees labour market integration by reducing barriers to self employment. Further research is necessary to evaluate what policies are most effective to stimulate successful self employment of refugees.

Chapter 4

Household Behaviour in Times of Political Change: Evidence from Egypt*

4.1 Introduction

"Enough is enough! We want change. Enough of this man ruling all these years. We don't want inherited rule. This is a state, not a kingdom."
From the Guardian 1/25/2011, quote of an Egyptian student in Tahrir Square, Cairo.

On 11 February 2011 long lasting protests and demonstrations in Egypt led to President Mubarak stepping down after 30 years in power. This paper exploits this major political change in Egypt to analyse how households respond to and cope with a politically unstable environment. Social unrest and instability is not uncommon in many countries and analysing how these sporadic yet recurrent events affect households is critical in understanding development.

*This chapter is based on joint work with Almedina Music.

To study the effects of the outbreak of the Egyptian Revolution we rely on two datasets. We combine the representative Egypt Household Income, Expenditure and Consumption Survey with survey rounds in 2009, 2011 and 2013 with the *Wiki Thawra* dataset, a unique statistical record of all individuals arrested, injured or killed during political protests throughout the country. This unique dataset allows us to measure not only exposure to violence but also exposure to varying intensities of the revolution. Our key assumption is that, while everyone is aware of the casualties and violence occurring during demonstrations and protests through various media channels, individuals are more sensitive to casualties in their area of residence because of the increased perception that they themselves or relatives and friends could be affected. Using a difference-in-difference estimator and comparing affected and less affected households, we study several dimensions along which households may respond to the political change and unstable environment: 1) household income and expenditure; 2) education related investment choices by child's education level and gender; 3) health expenditure; and 4) household savings. We also analyse heterogeneous effects along income levels and location (rural/urban) of the household.

Our findings show that the political change and unstable environment had sizeable effects on household behaviour in Egypt, even after controlling for a set of socio-economic variables. While we do not identify strong effects on overall income and expenditures, we observe that households increase education spending as a percentage of total expenditure indicating an increased preference for education after the political change. Specifically, households increase overall education expenditures by 11 percent and this increase seems to be driven by households with sons enrolled at the higher education level. Education expenditures for daughters remain unaffected indicating a gender bias and a strong preference for the education of sons. We do not observe expenditure effects on children at primary school level and only weak results for the secondary education level. Furthermore, households living in close proximity of violent events decrease their health expenditures by 23 percent, and this result is mainly driven by households with a high income level. Affected households also save a larger share of their income after the outbreak of the revolution. This result is particularly driven by high-income households. We test the validity of our findings by conducting a range of robustness checks (excluding

Cairo, constructing different measures of political instability) and placebo tests to which our estimates remain robust.

We further explore some channels that could explain our results. We interpret the increase in savings and decrease in health expenditure as precautionary behaviour due to an uncertain environment. To explain the increase in education expenditure we look into two additional data sources: election outcome data of the 2012 presidential election and the Arab Democracy Barometer Survey. We find that the increase in education expenditures is particularly prominent in areas where households were in favour of a regime change. We argue that after the fall of Mubarak those households had a positive outlook towards the future, with better labour market prospects, and therefore invested more in their sons' education.

Our research is related to several strands of the literature. Cross-country analyses at the macro-level have shown that political instability and civil unrest are barriers to economic development in terms of growth, investment and saving rates (Alesina and Perotti, 1996; Alesina et al., 1996; Barro, 1991; Yiannis P. Venieris, 1986).[1] There is also a growing literature on the micro-level effects of violence on non-income variables in the context of developing countries generally identifying negative effects on variables of interest. For example, Akresh et al. (2011) and Leon (2012) show negative effects on educational attainment in post-conflict Rwanda and Peru respectively. Shemyakina (2011) looks at the 1992-1998 conflict in Tajikistan and finds that exposure to violence leads to a lower likelihood of being enrolled in school, especially for girls. There is also research showing negative effects on health outcomes e.g. in Burundi (Bundervoet et al., 2009), Cote d'Ivoire (Minoiu and Shemyakina, 2012) and Colombia (Camacho, 2008). Thirdly, this paper is also related to the literature investigating whether violence changes the perception of risk and economic decisions. Aaberge et al. (2014) find that, in line with a precautionary savings model, households save more following a political shock in the context of China.

[1]Existing research shows that episodes of social unrest and their associated market disruptions, even if short-lived, may have long-term consequences, especially in low-income countries where individuals lack savings, insurance, and other formal means of coping with shocks. (See for example Frankenberg et al. (2003) on household responses to the Asian Financial Crisis in Indonesia, McKenzie (2003) on Mexican Peso Crisis, and Stillman and Thomas (2008) on the 1996-1998 economic crisis in Russia)

Callen et al. (2014) investigate the relationship between violence and economic risk preferences in Afghanistan and identify a preference for certainty with more exposure to violence. Large adverse shocks can thus alter savings and investments decisions, and potentially have long-run consequences - even if the shocks themselves are temporary. Dupas and Robinson (2012) study the economic and social consequences of a post-election crisis in Kenya and find that in addition to lost income, workers engaged in riskier health behaviour. On the other hand, Voors et al. (2012) examine the impact of exposure to conflict on social, risk and time preferences and find that individuals exposed to violence display more altruistic behaviour towards their neighbours, are more risk-seeking, and have higher discount rates.

Our contribution to the literature is threefold. First, and most importantly, we analyse a major and unanticipated intense political crisis which has had significant effects in many countries in the Middle East, including Egypt, a country that has not been extensively researched by the literature. While previous literature has shown that civil war has devastating effects on affected communities, our contribution is to show that violence and unrest, a milder and more common form of conflict, can also have important significant effects on the behaviour of households. Our unique dataset allows us to analyse the effects of violence and political change on a geographically disaggregated level with detailed information on the intensity of the events. Second, we add to the literature on the response of households to shocks by exploring the relation between violence and political change, education and health expenditure as well as savings. We offer an innovative and new interpretation of a surprising result - the increase in education expenditure of affected households - although this result needs to be observed with caution due to a small sample size. Third, this paper contributes to the large literature on risk-coping and decision making after large and traumatising aggregate shocks. We contribute to this literature by showing the effects of violent demonstrations and protests on savings behaviour in the context of post-revolution Egypt.

The paper is organised in the following way: Section 2 provides an overview of the outbreak of the Egyptian Revolution and the economic and political context in Egypt. Section 3 describes our data and presents descriptive statistics and Section 4 describes

the empirical identification strategy. Section 5 discusses results and Section 6 provides a heterogeneity analysis. Section 7 shows robustness checks and Section 8 discusses our channels. The final Section concludes.

4.2 Egypt and the 25 January Revolution

4.2.1 Context: The 25 January Revolution

On 17 December 2010, a 26-year old Tunisian man set himself on fire after abusive police confiscated his unlicensed vegetable cart, his only source of income. This desperate act of protest inspired a movement that swept the country and ignited calls for reform throughout the region. On 25 January 2011, Egyptians from a range of socio-economic and religious backgrounds came together by the thousands to launch a massive pro-democratic movement throughout the country and demanded the overthrow of President Hosni Mubarak. The sparks behind the outbreak were various political and legal issues, including police brutality, lack of free elections and freedom of speech, corruption and economic issues such as high unemployment and low wages[2]. Eighteen days of mass protests forced Hosni Mubarak to resign in February 2011, after three decades in power.

Following Mubarak's resignation, the Supreme Council of the Armed Forces (SCAF) assumed presidential powers. Parliamentary elections in 2012 saw an overwhelming victory for the Muslim Brotherhood's Freedom and Justice Party. In June 2012, Mohammed Morsi (Muslim Brotherhood party) was elected president with 52 percent of votes. Public opposition to Morsi began to build in November 2012, when he issued a decree granting himself far-reaching powers, and were fuelled by the passage of what some considered an Islamist-leaning draft constitution. Morsi was deposed by the military in June 2013 after thousands of protesters took to the streets and he was replaced by an interim government. Security forces then launched a crackdown on the Muslim Brotherhood, killing almost 1,000 people at two pro-Morsi sit-ins in Cairo and Giza. In December 2013, a

[2]See archives of numerous newspaper articles including in Al Jazeera, The Economist, France 24, Reuters etc.

constituent assembly finished drafting a new constitution to replace the 2012 charter. Since then, Egypt has been polarised between supporters of the interim government and the military on one side, and supporters of the Muslim Brotherhood and those who fear the authorities have become too repressive on the other side. We have summarised the key dates of the Egyptian Revolution below:

- **25 January 2011:** Outbreak of the Egyptian Revolution forcing President Mobarak to resign.
- **18 June 2012:** First elections held since President Hosni Mobarak stepped down. The Muslim Brotherhood Party represented by Mohammed Morsi wins the election.
- **3 July 2013:** Mohammed Morsi is desposed by the military and replaced by an interim government.
- **8 June 2014:** Abdel Fattah El-Sisi (previously head of the Egyptian Armed Forces) is sworn into office as President.
- **Since:** Occasional demonstrations and protests.

Figure 4.1: Death occurrence per month

4.2.2 Context: Egypt

With over 83 million inhabitants, Egypt is the largest country in the Middle East and North Africa. From the mid-2000s to 2011, the Egyptian economy has been growing at a strong pace. Since 2011, the macroeconomic picture has deteriorated due to unresolved political tensions. The GDP growth rate in Egypt averaged 3.69 percent from 1992 until 2014, reaching an all time high of 7.30 percent in the first quarter of 2008 and a record low of -4.30 percent in the first quarter of 2011. In terms of the Human Development Index (HDI) of Egypt, reported by the United Nations to measure the progress of a country, Egypt scored 0.682 points in 2013, leaving it in 104th place in the table of 178 countries

published. Egypt is divided into 27 governorates and each governorate has a capital. The governorates are further divided into regions or districts.

Egypt is going through a demographic phase marked by a significant portion of young people in the population that is projected to increase in the next decade. With past high rates of population growth, the current age structure is heavily weighted towards the young: one-third of the population is under the age of 14, and another third is between the ages of 15 and 29. While this age structure can be advantageous to a country, the pressure to provide employment opportunities is enormous. This paper focuses on changes in education and health expenditure as well as savings following the outbreak of the Egyptian Revolution in January 2011. It is useful to start by briefly providing basic information concerning the education and health system in Egypt.

The adult literacy rate of 67 percent does not reflect the historically high primary school enrolment and completion rates, calling into question the efficacy of primary education. The school system consists of six years of primary school education (age 6-12), three years of preparatory school (age 13-15) and three years of either general or vocational secondary school (age 16-18). Compulsory schooling ends after the 9th grade. Those students who graduate from the general secondary school can enter university (roughly 30 percent per cohort). Upper secondary education and higher education are heavily oriented towards academic university degrees, instead of towards the skills demanded in the labour market. At all levels of the education system, parents can chose whether they wish to send their children to the public education institutions or to higher quality but also more expensive private institutions. According to the Ministry of Education, the share of public expenditures on education is about 12.5 percent, close to that of the Organisation for Economic Cooperation and Development (OECD) countries, which calls for efficiency improving.

Egypt manages a complex social security system, including employment services, social insurance (health, pension, and unemployment) and social assistance (food and fuel subsidies and cash transfers). The system faces significant challenges, in particular high youth unemployment, a large informal sector, and costly untargeted subsidies, which are a large burden on the budget. In Egypt, the health care system provides health care services

through three channels. These channels are: the public sector, the private sector and the civil society. While the government provides basic and emergency care through public hospitals, many times Egyptians need to pay for better or special treatment. Health care costs can cause financial hardship directly via health care payments, and indirectly due to lost income resulting from the inability to work. Some households may use savings, borrowing or selling assets to cope with health shocks. Other households with limited resources may have no option but to cut their spending on necessary goods to cover their health expenses. According to the World Health Organisation (WHO) database, the share of the government in total health spending declined from 41.7 percent in 2010 to 37 percent in 2011 putting more burden on households. So-called out-of-pocket payments account for about 60 percent of total health spending.

4.3 Data and Descriptive Statistics

Findings of this paper rely on two main data sources: the Egypt Household Income, Expenditure and Consumption Survey (HIECS) collected by the Central Agency for Public Mobilisation and Statistics (CAPMAS) and "Wiki Thawra"[3] an independent statistical database of the Egyptian Revolution, collected by the Egyptian Center for Economic and Social Rights.

4.3.1 The Household Survey

The Household Income, Expenditure and Consumption Survey (HIECS) is administered by the CAPMAS and made available by the Economic Research Forum[4]. The survey was conducted every five years until 2009 and is now implemented every two years. In this study, we use three rounds of the HIECS: 2008-2009, 2010-2011 and 2012-2013 (in short 2009, 2011, and 2013). Survey samples are nationally representative and stratified by governorate, and urban and rural substrata. The original full samples of the 2009 survey

[3]http://wikithawra.wordpress.com/

[4]www.erf.org.eg

included 48,000 households, but starting from 2011 the survey includes a smaller sample of 16,000 households. The households are selected via a multi-stage random process from a master sample constructed from the 2006 population census. The survey period of each HIECS extends over a 12 months period, starting from July and ending in June of the following year. Households were observed for two continuous weeks to collect information on food expenditure.

The HIECS is one of the largest household surveys and has been used extensively for the study of poverty and living standards in Egypt. The survey includes information on various aspects of a household's income, expenditure and consumption. The CAPMAS provides researchers with access to only 50 percent of observations of the HIECS. Also, the household questionnaire contains much more detailed questions on all sorts of expenditures but not all responses have been published by the institutions. The quality of the Egyptian household survey data has been assessed by the World Bank (2014), a study that carried out a number of quality tests on the data related to income and expenditure. The study did not find relevant problems related to measurement, data input and item non-response.

4.3.2 Revolution Intensity

The Egyptian Center for Economic and Social Rights' project "Wiki Thawra" aims to provide neutral documentation of Egypt's revolution. *Thawra* is Arabic and means "revolution". Wiki Thawra aggregates a large quantity of material, including videos, news clips, official and human rights reports, and lists those killed, injured and detained since 25 January 2011. With a comprehensive and detailed inventory of those killed during protests, Wiki Thawra tracks recent events from the outbreak of the January 25 Revolution to the ouster of former President Mohamed Morsi in 2013. According to Wiki Thawra 1983 individuals have been killed in protests and demonstration from 25 January 2011 to 30 June 2013 throughout the country. The database contains information on each victim including the day of death, event, exact place of death as well as personal information such as age, profession, address etc. Reputable NGO's such as Amnesty International, Human Rights Watch and others are relying on the data of Wiki Thawra.

We have combined the two datasets at the governorate level (see Table 4.1). The *Wiki Thawra* database would allow a more disaggregated analysis as we can observe the address of each individual included in the database. The household questionnaire does include information at district level, but this data is neither publicly available nor available upon request. Table 4.1 provides the population number by region and shows the fraction of death occurrences by population, sorted by death occurrences as a fraction of the population size in each region. The significance of a given number of deaths in a domestic disturbance or a civil war clearly depends to some extent on the size of the population. Thus, the number of deaths are measured in per capita, not in absolute, terms. As expected, Cairo witnessed the highest number of death occurrences in total numbers. However, some small regions (North Sinai, Port Said, South Sinai, Suez) appear to be more strongly affected when the population size is taken into account. We can see that only the Red Sea region has not experienced any death occurrences.

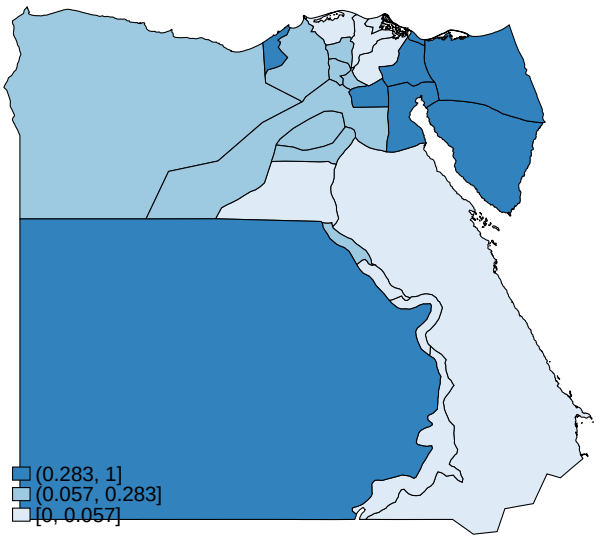
Table 4.1: Death occurrence by governorate between January 2011 and June 2013

Region	Population	Number of deaths	Per 10,000 inhabitants
North Sinai	395,000	118	2.9873
Port Said	628,000	144	2.2929
South Sinai	159,000	20	1.2578
Suez	576,000	61	1.0590
Cairo	8,762,000	650	0.7418
New Valley	208,000	15	0.7211
Alexandria	4,509,000	150	0.3326
Ismailia	1,077,000	32	0.2971
Matrouh	389,000	11	0.2827
Giza	6,979,000	183	0.2622
Faiyum	2,882,000	65	0.2255
Asyut	3,888,000	81	0.2083
Qalyubia	4,754,000	90	0.1893
Beni Suef	2,597,000	28	0.1078
Beheira	5,327,000	52	0.0976
Gharbia	4,439,000	38	0.0856
Monufia	3,657,000	25	0.0683
Minia	4,701,000	27	0.0574
Damietta	1,240,000	7	0.0564
Qena	2,801,000	14	0.0499
Dakahlia	5,559,000	26	0.0467
Asuan	1,323,000	6	0.0453
Al Sharqia	6,010,000	27	0.0449
Sohag	4,211,000	17	0.0403
Luxor	1,064,000	3	0.0281
Kafr El Sheikh	2,940,000	8	0.0272
Red Sea	321,000	0	0
Total	81,396,000	1983	0.2436

Notes: Source: Population numbers from CAPMAS (as of January 2012) and number of deaths from Wiki Thawra for the period 25.January 2011 to 30.June 2013. Column 4 shows the relative number of deaths, dividing column 3 by column 2 and multiplying by 10,000.

Figure 4.2 displays the geographical distribution of death occurrences between January 2011 and June 2013. Based on the Wiki Thawra database, we created three revolution intensity levels: weak, medium and strong. A weak intensity group witnessed less than 10 deaths in their region and contains one third of all observations. The strong (medium) intensity group witnessed more than 160 death occurrences (between 11 and 159) and contains one third of all observations. We have conducted robustness checks by creating several other intensity measures (by number of regions, relative number of deaths etc.) to verify whether we receive different results but the results were consistent with any type of intensity measure. The reason for this is that regions typically change their position in the ranking only slightly if we use alternative measures and thus they stay in the same category of weak, medium or strong treatment. To summarise, strongly affected regions have witnessed a relatively high number of death occurrences. These regions are marked in dark blue in Figure 4.2.

Figure 4.2: Egypt revolution intensity at governorate level



Notes: Deaths per 10.000 inhabitants.

4.3.3 Measuring Political Instability

Social and political instability is hard to define and to measure in a way which can be used for econometric work. Political instability can be viewed in two ways. The first

one emphasises executive instability. The second one is based upon indicators of social unrest and political violence.

The first approach defines political instability as the 'propensity to observe government changes'. These changes can be 'constitutional', i.e. take place within the law, or 'unconstitutional', i.e. they can be coups d'etat. The basic idea is that a high propensity to executive changes is associated with political uncertainty. Alesina and Perotti (1996) investigate the relationship between political instability and per capita GDP growth and find that in countries with a high propensity of government collapse, growth is significantly lower. Yiannis P. Venieris (1986) identify an inverse relationship between political instability and the savings rate. In their paper, political instability introduces a new element of uncertainty in the decision-making calculus of the economic actor since it is usually perceived as a precursor of conceivable changes in the governmental regime, which, in turn, may affect one's future level of accumulated wealth and income.

The second approach to measuring political instability is constructing an index which summarises various variables capturing phenomena of social unrest. Our paper is in line with the second approach, although it is not the first one aiming to measure political instability by focusing on the number of deaths occurring during demonstrations. Notably, Barro (1991) uses indicators such as number of assassinations, the occurrence of violent revolutions and military coups in a cross-country analysis to study their effects on average growth levels on a large sample of countries. Alesina and Perotti (1996) study the effects of income distribution on investment, by focusing on political instability as the channel which links these two variables. Their paper relies on an index constructed by using information on the number of politically motivated assassinations; the number of people killed during mass violences as a fraction of total population; the number of successful coups etc. An important reference on this point is Hibbs (1973), who uses the method of principal components to construct such an index. Gupta (1990), Özler and Tabellini (1991) and Benhabib and Spiegel (1992) have used several indices of socio-political instability as an explanatory variable in various regressions in which the dependent variable is growth, savings or investment.

4.3.4 Descriptive Statistics

This Section aims at providing some basic descriptive statistics. Table 4.2 contains summary statistics of the Egypt Household Income, Expenditure and Consumption Survey across all three time periods we are observing (2009, 2011 and 2013). We look at several variables such as household total expenditure, total disposable income, some household characteristics, and focus on expenses on education by educational level, health expenses as well as savings. In the Household Income, Expenditure and Consumption Survey all expenditure variables are recorded as yearly amounts. The data is deflated using specific inflation rates that differ by rural and urban region and by expenditure category (specific education and health inflation rates). 2009 and 2011 (column 1 and 2) show outcomes for households before the revolution started and 2013 (third column) presents outcomes for households after the revolution had started. We observe that between 2009 and 2011 total expenditure and all education related expenditures have increased. Between 2011 and 2013, however, these expenditures have decreased. Medical expenses increase continually over the years, whereas savings decrease between the first two rounds and increase again between 2011 and 2013. The number of earners per household as well as the household size (number of persons) decreased over the three survey years. There are over 7000 households observed in each survey year.

It is worth mentioning that the variable *expenditure on education* includes expenses for all education levels and does not cover expenditure on educational materials such as books, catering and transport services. Education expenses by education level (primary, secondary and tertiary) also include costs of private tutoring and tutoring groups. Expenses on health include medical products, appliances and equipment, outpatient services, and hospital services. Payments for health insurances are excluded. Savings are calculated by deducing total expenditure from total disposable income.

The revolution started on 25 January 2011. However, we consider the two survey years 2009 and 2011 as the pre-revolution phase, and only 2013 as post-revolution. This is mainly because the relevant variables on household expenditure and income are provided on an annual basis and we consider the few months after 25 January 2011 as too short to identify any effect of the revolution. Therefore, the survey year 2010/2011 is considered

as pre-revolution in our analysis. We have conducted a robustness check by running the same estimations without the year 2010/2011 and we receive consistent results.

Table 4.2: Descriptive statistics by year

	2009	2011	2013	Total
Total expenditures	18025.4	19042.4	18707.3	18586.0
	(14328.0)	(14294.1)	(11752.8)	(13538.9)
Total disposable income	21838.9	21533.3	21712.4	21695.9
	(24750.0)	(17738.7)	(15398.5)	(19779.3)
Net wages	13791.8	14273.9	15288.9	14430.2
	(11321.1)	(11059.9)	(10698.2)	(11055.0)
Number of earners	1.781	1.735	1.646	1.722
	(0.955)	(0.933)	(0.868)	(0.922)
Expenses on education	1087.3	1266.3	1145.8	1163.7
	(3473.8)	(3942.2)	(2486.8)	(3355.9)
Expenses on primary education	475.2	562.7	509.9	514.3
	(2048.5)	(1379.9)	(990.1)	(1559.2)
Expenses on secondary education	910.1	1027.1	968.9	967.3
	(2298.4)	(2607.7)	(1670.5)	(2221.7)
Expenses on tertiary education	1296.4	1887.0	1453.9	1518.2
	(3080.8)	(5960.0)	(3870.4)	(4342.6)
Education exp. as % of total expenditure	0.0409	0.0438	0.0432	0.0426
	(0.0516)	(0.0535)	(0.0529)	(0.0526)
Expenses on health	999.2	1702.1	1911.1	1529.4
	(3098.4)	(2872.5)	(2828.0)	(2963.7)
Eavings	3813.5	2490.9	3005.1	3109.9
	(17945.3)	(10245.1)	(8150.0)	(12918.5)
Observations	7913	7719	7528	23160

Notes: This table shows the mean and the standard deviation in brackets. Data is deflated, using 2010 as the basis year. The price index is based on information provided by CAPMAS. These figures are annual numbers for the Egyptian financial year, i.e. 2009 means July 2008-June 2009. Source: CAPMAS and ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

Table 4.3 provides basic descriptive statistics for the different governorates by revolution intensity (weak, medium and strong) in 2013. There are considerable differences among households living in these three regions. Total expenditure, income and wages are much higher in the strongly affected regions. Overall education expenditure in strongly affected regions is double the expenditure in weakly affected regions (three times as high for primary education). When it comes to health expenditures, however, there are only small differences. Savings are slightly lower in strongly affected areas. Overall, we observe 7528 households in 2013 with a slightly higher number in weakly affected areas.

Table 4.3: Descriptive Statistics by revolution intensity (in 2013)

	Weak	Medium	Strong	Total
Total expenditures	17422.1	17745.1	21043.0	18707.3
	(9330.6)	(10085.5)	(14872.2)	(11752.8)
Total disposable income	20455.9	20954.4	23825.7	21712.4
	(12565.5)	(14785.0)	(18344.3)	(15398.5)
Net wages	14792.4	14067.5	16852.4	15288.9
	(9509.0)	(9641.7)	(12379.4)	(10698.2)
Number of earners	1.610	1.729	1.610	1.646
	(0.851)	(0.925)	(0.827)	(0.868)
Expenses on education	806.5	676.7	2004.1	1145.8
	(1604.2)	(1393.9)	(3672.5)	(2486.8)
Expenses on primary education	311.4	295.9	978.7	509.9
	(463.8)	(515.1)	(1533.9)	(990.1)
Expenses on secondary education	707.0	594.1	1648.6	968.9
	(897.3)	(1113.7)	(2451.6)	(1670.5)
Expenses on tertiary education	1024.0	1077.6	2103.1	1453.9
	(2949.5)	(2232.3)	(5163.6)	(3870.4)
Education exp. as % of total expenditure	0.0341	0.0282	0.0686	0.0432
	(0.0424)	(0.0363)	(0.0667)	(0.0529)
Expenses on health	1928.1	1737.8	2054.5	1911.1
	(2575.0)	(2313.7)	(3460.6)	(2828.0)
Savings	3033.8	3209.3	2782.7	3005.1
	(7024.1)	(8830.4)	(8646.3)	(8150.0)
Observations	2763	2298	2467	7528

Notes: This table shows the mean and the standard deviation in brackets. Data is deflated, using 2010 as the basis year. The price index is based on information provided by CAPMAS. These figures are annual numbers for the Egyptian financial year, i.e. 2009 means July 2008-June 2009. Weak (Strong) means the 33 percent least (most) affected regions (measured in number of deaths). Source: CAPMAS and ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.4 Empirical Identification Strategy

In this paper, we provide evidence on how households respond to political instability and political change using the outset of the Egyptian Revolution on 25 January 2011 as a quasi-natural experiment. This involves answering the counterfactual question: what would have been the household's behaviour in terms of expenditure, income and consumption in the absence of the Egyptian Revolution? Obviously, it is impossible to observe the same household in these two scenarios at the same time and therefore, we rely on the construction of a counterfactual to assess the impact of an increased politically unstable environment. Although the Egyptian Revolution affected the entire country, it is possible to differentiate the intensity of the revolution by region.

One key assumption behind our approach is that individuals living closer to violent demonstrations and casualties are more sensitive, because of the higher perception that they themselves or relatives may be affected. While everyone is aware of the violent events through various media channels, households residing in higher risk areas are more likely to feel insecure and at risk.

We measure political instability by the number of deaths per region that occurred during political demonstrations. Violences and deaths are to a large extent unpredictable events. To account explicitly for the possibility that households in the affected regions had different time-invariant characteristics, the identification strategy is based on the comparison of household expenditure, income and consumption before and after the outbreak of the Egyptian Revolution in weakly, medium and strongly affected regions. This approach could be interpreted as a continuous difference-in-difference analysis (Meyer, 1995).

Suppose that there are two groups indexed by treatment status $D = 0, 1$ where $D = 0$ indicates households living in a region where very few or no violences took place, i.e. the control group, and $D = 1$ indicates households living in a region that was affected by violences, i.e. the treatment group. We take into account that the intensity of the revolution varies by region, therefore the treatment variable has different intensities measured by the number of death occurrences (medium and strong) across regions. Assume that we observe households in two time periods, $t = 0, 1$ where $t = 0$ indicates a time

period before treatment i.e. before the revolution started, in our dataset this would be the years 2008/9 and 2010/11 and $t = 1$ indicates a time period after treatment i.e. after the revolution started, in our dataset this would be the year 2012/13. The outcome is modeled by the following equation:

$$y_{h,t} = \alpha + \beta D_{m/s} + \gamma t + \delta(D_{m/s} * t) + \lambda X_{h,t} + \epsilon_{h,t} \tag{4.1}$$

where h and t are household and time indices. X consists of a number of additional controls, such as household size, education of the household head and rural area. The coefficients given by $\alpha, \beta, \gamma, \delta$ are all unknown parameters and ϵ is a random, unobserved "error" term which contains all determinants of y_h that the model omits. The coefficients in the equation have the following interpretation:

α = constant
β = treatment group specific effect (to account for average permanent differences between treatment and control group)
γ = time trend common to control and treatment groups
δ = treatment effect for coefficient of interest

The purpose of the analysis is to find a good estimate of δ through a difference-in-difference approach. The difference-in-difference estimator is defined as the difference in average outcome in the treatment group before and after treatment *minus* the difference in average outcome in the control group before and after treatment:

$$\delta_{DD} = [E(treated_{after}) - E(treated_{before})] \text{ - } [E(control_{after}) - E(control_{after})]$$

The method of estimation is least squares and clustered standard errors at the governorate level are calculated throughout. For the main specification above to yield causal estimates of the treatment effects, we rely on two assumptions: 1. Exogenous revolution pattern; 2. Common trend assumption. We complement this with a placebo test.

4.4.1 Balancing Test

Table 4.4 provides a balancing test for 2009 including the mean and standard deviation for each variable of interest as well as the t-test for the difference of means. We have split the governorates by revolution intensity i.e. low, medium and strong. Low means that this group was weakly or not affected by the revolution in terms of number of death occurrences. This is our control group. The other two groups were affected by an increasing intensity level. A balancing test allows us to understand if the affected areas (by intensity level) had different baseline characteristics in 2009 (pre-revolution). We can see that the difference between the control group (i.e. low) is not significantly different from the medium affected group (column 5). This means that the baseline characteristics of these two groups are very similar i.e. they are comparable. The difference between the strongly affected group and the other two, however, is significant, which means that the baseline characteristics of these comparison groups are quite different and they cannot be compared easily. The only variable where the difference is insignificant across groups is the variable for savings suggesting that savings behaviour is similar across all three groups. In the difference-in-difference analysis it is not problematic to have different baseline characteristics, as long as the trends are the same. We will analyse this in the next subsection.

Table 4.4: Balance table, 2009

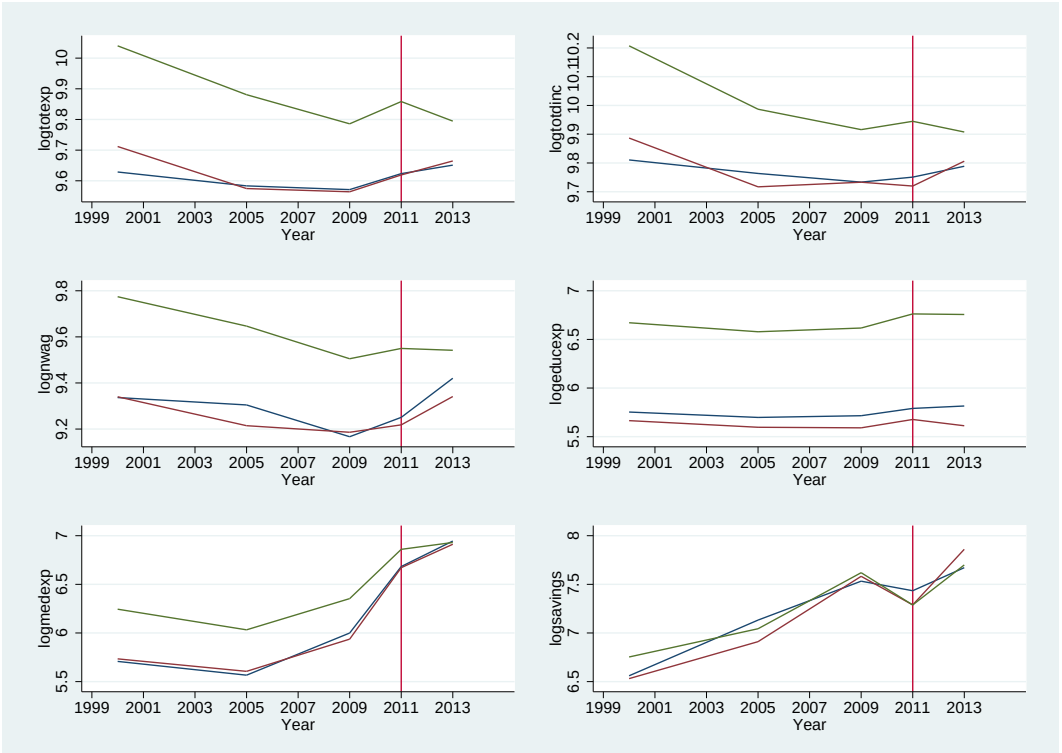
	(1) Total	(2) Low	(3) Medium	(4) Strong	(5) t-test M-L	(6) t-test S-L	(7) t-test S-M
Total expenditure	18586.03	16889.62	16933.25	21816.32	43.63	4926.69***	4883.06***
	(13538.93)	(9738.98)	(9958.22)	(18266.89)	(-0.27)	(-19.57)	(-21.70)
Total disposable income	21695.94	20067.15	20222.56	24671.45	155.41	4604.30***	4448.89***
	(19779.30)	(15235.51)	(20846.51)	(21461.21)	(-0.51)	(-14.54)	(-13.57)
Net wage	14430.22	13009.92	12861.02	17016.68	-148.90	4006.77***	4155.66***
	(11054.99)	(9158.60)	(9302.30)	(13218.76)	(0.78)	(-16.44)	(-19.24)
Rural residence	0.46	0.28	0.27	0.80	-0.01	0.52***	0.53***
	(0.50)	(0.45)	(0.45)	(0.40)	(0.92)	(-73.54)	(-80.07)
Number of earners	1.72	1.73	1.76	1.68	0.03	-0.05***	-0.08***
	(0.92)	(0.92)	(0.95)	(0.89)	(-2.22)	(3.24)	(5.79)
Household size	4.48	4.52	4.71	4.20	0.18***	-0.33***	-0.51***
	(2.05)	(2.10)	(2.16)	(1.83)	(-5.21)	(9.93)	(16.28)
Education expenditure	1163.70	736.39	703.95	2061.52	-32.44	1325.13***	1357.56***
	(3355.87)	(1709.78)	(1648.02)	(5203.87)	(0.90)	(-14.81)	(-17.71)
Primary education exp	514.28	289.98	284.18	1005.64	-5.80	715.65***	721.45***
	(1559.24)	(540.09)	(477.17)	(2603.36)	(0.46)	(-14.03)	(-16.61)
Secondary education exp	967.29	598.39	605.37	1745.67	6.98	1147.28***	1140.31***
	(2221.73)	(793.22)	(963.47)	(3587.36)	(-0.27)	(-14.38)	(-16.39)
Tertiary education exp	1518.23	1100.08	1067.30	2185.44	-32.78	1085.36***	1118.14***
	(4342.56)	(3426.19)	(3319.39)	(5445.69)	(0.18)	(-4.35)	(-4.90)
Education of total exp	0.04	0.03	0.03	0.07	-0.00	0.03***	0.03***
	(0.05)	(0.04)	(0.04)	(0.07)	(1.62)	(-26.46)	(-31.91)
Health expenditure	1529.43	1445.71	1383.96	1760.48	-61.75	314.77***	376.52***
	(2963.70)	(2511.24)	(3121.14)	(3109.19)	(1.30)	(-6.54)	(-7.76)
Savings	3109.91	3177.52	3289.30	2855.13	111.78	-322.39	-434.17
	(12918.51)	(10632.10)	(16687.22)	(9339.62)	(-0.47)	(1.94)	(2.04)

Notes: This table shows differences in the control group (low) and the two treatment intensities (medium and strong) for 2009. All figures are deflated, using 2010 as the basis. For column (1) to (4), it shows means and standard errors in parenthesis: * p<0.10, ** p<0.05, *** p<0.01. Column 5-7 respectively show the mean difference between medium treatment intensity and the control group, strong treatment intensity and the control group and medium and strong treatment intensity (t-statistic in parenthesis). Source: CAPMAS and ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.4.2 Common Trends Assumption

The difference-in-difference estimation strategy requires that the counterfactual *trend* behaviour of treatment and control group is the same. Treatment, which is in our case being exposed to a medium or high level revolution intensity, induces a deviation from this common trend. Although the treatment and control regions can differ, this difference is meant to be captured by the respective region fixed effect. The common trends assumption can be investigated by using data on multiple periods. We obtained data of the Egypt Household, Expenditure and Consumption Survey for the 2000 and 2005. This enables us to investigate the common trends assumption for the variables of interest. For most variables, the graphs in Figure 4.3 and 4.4 provide strong visual evidence that follow a common underlying trend, and a treatment effect that induces a deviation from this trend. Figure 4.3 shows trends for total expenditure, total disposable income, net wage, education expenditure, medical expenditure and savings (all in logarithms).

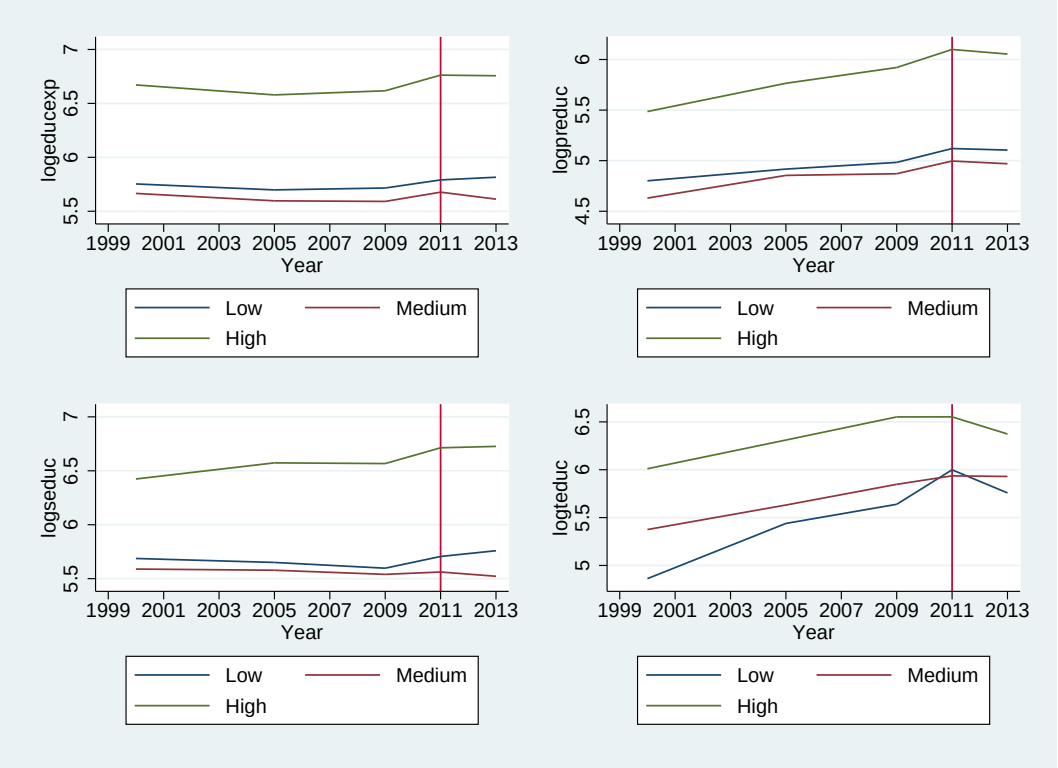
Figure 4.3: Trends for outcome variables



Notes: Blue indicates weak, red medium and green strong treatment. The red line marks the onset of the revolution. Data is deflated. Source: CAPMAS and ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

Figure 4.4 shows trends for expenditure on education (all education levels) and well as education expenditure by education level (primary, secondary and tertiary level, all in logarithms).

Figure 4.4: Trends for education expenditure variables



Notes: Blue indicates weak, red medium and green strong treatment. The red line marks the onset of the revolution. Data is deflated. Source: CAPMAS and ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.4.3 Placebo Analysis

An important validity instrument of the assumptions in our research context is a placebo test. The placebo test verifies whether treated and control regions have experienced different behaviour also during previous time periods, in the absence of the violent protests and demonstrations. Table 4.5 provides a placebo test for the main outcome variables using the year 2007 as the placebo year. The results of the placebo test confirms our original assumption of the parallel trend in variables of interest across governorates that were to a varying degree affected by the revolution. As we do not find any significant

effects we can conclude that the results we identify are driven by the casualties during violent demonstrations and protests.

Table 4.5: Placebo table, using 2007 as the revolution year

	(1) Wages	(2) Tertiary education exp.	(3) Health expenditures	(4) Savings
Strong*2009	-0.0117	0.0477	-0.154	0.199
	(0.0252)	(0.189)	(0.110)	(0.130)
Medium*2009	0.0259	0.00831	0.0331	0.0591
	(0.0227)	(0.207)	(0.118)	(0.138)
Strong Revolution	-0.149***	-0.477***	0.165***	-0.646***
	(0.00860)	(0.0383)	(0.0313)	(0.0414)
Medium Revolution	-0.108***	-0.363***	0.0172	-0.377***
	(0.00956)	(0.0530)	(0.0293)	(0.0376)
after_placebo	0.205***	0.527***	0.627***	-0.726***
	(0.0194)	(0.153)	(0.102)	(0.130)
logtotdinc	0.675***	0.852***	0.828***	1.899***
	(0.0147)	(0.0437)	(0.0211)	(0.0850)
Observations	51232	8344	74197	63350
r2	0.574	0.282	0.366	0.354

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Variables are measured in logarithms. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling for urban, education of household head, household composition. The source is CAPMAS and ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.5 Estimation Results

In this paper we address the question whether and to which extent a politically unstable environment affects household's economic behaviour in terms of expenditure and savings. This Section presents the estimation results on 1) overall income and expenditure; 2) education expenditures (by education level and child); 3) health expenditures and 4) savings. We show heterogeneous effects throughout the Section where applicable (by income level and gender).

4.5.1 Average Effects on Income and Expenditures

Table 4.6 presents the results of our estimation with total expenditure, total expenditure per capita, total disposable income and net wage and salaries as dependent variables. These variables are not the primary focus of our analysis and the results are mainly presented to provide a complete picture of the revolution effects. The coefficients of interest

are the interaction terms *Strong*2013* and *Medium*2013*. They illustrate households after the revolution in medium or strongly affected areas. We can see that the revolution had a sizeable and significant effect on almost all variables. Total expenditure decreased by 3.0 percent in strongly affected areas. The revolution had the strongest effects on net wage with a 12.1 percent decrease in strongly affected areas and a 3.8 percent decrease in medium affected areas.

Table 4.6: The effects of the revolution on expenditure, income and wages

	(1) expenditures	(2) log(exp.)	(3) log (exp. p.c.)	(4) log(income)	(5) wages
Strong*2013	-934.9**	-0.0296**	-0.0166	-0.0235	-0.121***
	(382.7)	(0.0129)	(0.0156)	(0.0419)	(0.0307)
Medium*2013	-743.5*	-0.00927	-0.0148	0.0980***	-0.0377
	(406.2)	(0.0134)	(0.0157)	(0.0318)	(0.0289)
Strong Revolution	5370.5***	0.110***	0.0861***	0.0496**	-0.191***
	(165.4)	(0.00651)	(0.00886)	(0.0209)	(0.0103)
Medium Revolution	2212.9***	0.0351***	-0.00230	0.00977	-0.116***
	(218.9)	(0.00519)	(0.00652)	(0.0127)	(0.0104)
2013	285.5	0.0293**	0.0291**	0.0383	0.136***
	(299.2)	(0.0113)	(0.0126)	(0.0278)	(0.0241)
income	17844.6***	0.767***	0.705***		0.703***
	(2371.7)	(0.0244)	(0.0311)		(0.0158)
Observations	23159	23159	23159	23159	15121
r2	0.583	0.853	0.780	0.389	0.445

Notes: This table shows the mean and standard errors (clustered at the governorate level) in parenthesis: * p=0.10, ** p=0.05, *** p=0.01. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year. Controls: governorate, rural, household size, education of household head. Column (1) shows total expenditures, column (2) total expenditures in logs, column (3) shows total per capita expenditures in logs and column (4) total disposable income in logs. Column (5) shows a standardised measure of wages. Data source: CAPMAS/ERF, HIECS.

4.5.2 Effects on Education Expenditure

Analysing revolution effects on education expenditure is one of our main purposes for this paper. Particularly in post-conflict contexts and in otherwise fragile states, education plays a significant stabilising role. Education is the one public service that touches the lives of most individuals and the quality of education is quickly apparent to most people. Educational outcomes are fundamental in determining what opportunities are available to an individual after leaving school. If, because of a politically unstable environment, households invest less in their children's education this would be another "cost" of the Egyptian Revolution because of negative long-terms effects. Education is normally paid by the parents who expect their children to benefit in the future (provided that

expectations of returns to education are large enough) but at the same time opportunity cost need to be taken into account. Theoretically, parental decision can go into two directions: First, education is a consumption good and parents are altruistic. In case of liquidity constraints, a redistributive policy is needed. Second, education is an investment and because parents are considered selfish there is an underinvestment in education. In this case, subsidising educational expenditure is needed.

With political instability, education expenditure can develop in both directions: Households may chose to invest more in education because there is a possibility that returns to education might increase with the prospective change of the political system. At the same time, household may chose to disinvest in education because political instability makes it unlikely that returns to education will be sufficiently high. Also, with household budget constraints, households may prefer family members to work in order to smooth consumption. The empirical literature on the effects of idiosyncratic shocks shows that in richer countries, like the United States, child health and education outcomes are counter-cyclical: they improve during recessions. In poorer countries, mostly in Africa and low-income Asia, the outcomes are pro-cyclical: infant mortality rises and school enrollment and nutrition fall during recessions. In middle-income countries, the picture is more nuanced: health outcomes are generally pro-cyclical and education outcomes counter-cyclical.

Tables 4.7- 4.9 show our estimation results for all education related outcome variables. Table 4.7 shows the effects of political instability (by revolution intensity) for overall education expenditure by income level. Table 4.8 presents education expenditure by child and by education level. Table 4.9 shows education expenditure by gender. Existing literature argues that parental education positively influences children's schooling by improving children's ability through home education and also through the better management of children's health conditions (Strauss and Thomas, 1995). We therefore control for the education of the household head, the region and the household size throughout the analysis.

4.5.2.1 Total education expenditure

Table 4.7 provides the result of the difference-in-difference estimation of the revolution effect on households' total education expenditure. We observe that being exposed to a strong revolution intensity, leads households to spend on average 10 percent more on education. Households living in medium affected areas do not seem to significantly change their behaviour. We analyse what type of household drives this result by looking at different income levels. It seems that medium income households spend relatively more on education when being exposed to a highly unstable environment. This might be due to the fact that the top income tertile already spends a lot on education, whereas the bottom tertile cannot afford to spend more. It is thus the middle class that significantly increases education expenses.

Table 4.7: Education expenditure by income level

	expenses on education	logeducexp	top33%	medium33%	bottom33%
Strong*2012	26.17	0.109***	-0.0292	0.238***	0.0754
	(179.6)	(0.0377)	(0.0837)	(0.0741)	(0.192)
Medium*2012	-189.5	-0.0216	-0.148	0.136**	-0.0803
	(123.5)	(0.0479)	(0.0961)	(0.0606)	(0.0833)
Strong Revolution	1799.5***	0.865***	0.940***	0.535***	-0.346***
	(72.73)	(0.0280)	(0.0376)	(0.0258)	(0.0571)
Medium Revolution	371.9	0.436***	0.571***	0.162***	-0.762***
	(260.2)	(0.0448)	(0.0538)	(0.0175)	(0.0398)
2013	-83.64	-0.0176	0.132***	-0.160***	0.00529
	(85.21)	(0.0262)	(0.0400)	(0.0456)	(0.0712)
Controls	X	X	X	X	X
Observations	13231	13231	5510	4792	2929
r2	0.198	0.401	0.338	0.223	0.282

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling for urban, education of household head, household size, number of children under 14. The source is CAPMAS/ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.5.2.2 Education expenditure by child

Table 4.8 shows our estimation results on education expenditure by child and by education level. Children enter school at the age of 6 or 7 and attend primary school up to the age of 15 (column 1 and 2). Post-compulsory education (upper-secondary education level) covers teenagers between 15-17 years of age (column 3 and 4), and finally students attend tertiary education at the age of 18 or above (column 5 and 6). After adding

a set of relevant controls (column 2, 4 and 6), being exposed to a politically unstable environment does not seem to have an effect on education spending by child at primary school level, regardless of the revolution intensity. The strongest effects are observed at tertiary education level: households increase their education expenditures by 30.7 percent per student enrolled in tertiary education. The effects for medium affected households are somewhat weaker although this coefficient is not significant after including the control variables.

Table 4.8: Education expenditure by child, by education level

	primary	primary	secondary	secondary	tertiary	tertiary
Strong*2013	-0.151**	-0.0753	0.0247	0.213	0.366**	0.307*
	(0.0588)	(0.0556)	(0.140)	(0.142)	(0.175)	(0.178)
Medium*2013	-0.0250	-0.0432	-0.0249	0.0222	0.362**	0.288
	(0.0471)	(0.0461)	(0.124)	(0.126)	(0.182)	(0.181)
Strong Revolution	0.855***	0.694***	0.686	0.733**	-0.748***	-0.889**
	(0.223)	(0.233)	(0.531)	(0.346)	(0.204)	(0.397)
Medium Revolution	0.174	0.155	-0.229	0.119	-1.167***	-1.042**
	(0.233)	(0.248)	(0.573)	(0.410)	(0.292)	(0.464)
2013	0.216***	0.0765**	0.130	-0.134	-0.0245	-0.132
	(0.0364)	(0.0361)	(0.0939)	(0.0969)	(0.130)	(0.133)
Controls		X		X		X
Observations	18460	16538	5193	4458	3259	2651
r2	0.129	0.276	0.140	0.247	0.0509	0.220

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling in column 2, 4 and 6 for total disposable income, urban, education of household head, household size, number of children under 14. The source is CAPMAS/ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.5.2.3 Expenditure by gender

Table 4.9 shows our estimation results on the effects of the revolution on education expenditure by gender (by gender and by education level). We observe no significant results at primary and secondary education level. At tertiary education level, however, we observe that households spend 60 percent more on their male children (i.e. students) and insignificantly more on their female children at tertiary education level. This result shows that households seem to have a preference for their sons attending university in a politically unstable environment. Parents might expect the returns to higher education to increase with the prospect of a change of government and therefore invest more in their sons. Another interpretation could be that the labour market deteriorated following the

outbreak of the revolution which meant that young men could not find any employment. Due to the lack of job offers, households therefore prefer to send their sons to university. The result for female students is not as high since young women were much less likely to work before the outbreak of the revolution and therefore the change is not as strong. The coefficient for female tertiary level students, however, is not significant and therefore does not allow to draw meaningful conclusions.

Table 4.9: Education expenditure by gender

	primary_f	primary_m	secondary_f	secondary_m	tertiary_f	tertiary_m
Strong*2013	0.0549	-0.0656	0.145	0.173	0.119	0.601**
	(0.104)	(0.0968)	(0.180)	(0.180)	(0.266)	(0.268)
Medium*2013	-0.0101	0.0235	-0.259	0.171	0.219	0.149
	(0.0868)	(0.0851)	(0.167)	(0.160)	(0.270)	(0.269)
Strong Revolution	0.569	0.645	1.479***	1.759***	0.542***	-0.474*
	(0.360)	(0.457)	(0.545)	(0.675)	(0.173)	(0.259)
Medium Revolution	0.0972	0.507	1.095*	0.958	1.302***	-0.216
	(0.378)	(0.492)	(0.607)	(0.731)	(0.349)	(0.510)
2013	-0.0616	0.0846	-0.0695	-0.240*	-0.0474	-0.231
	(0.0676)	(0.0651)	(0.125)	(0.123)	(0.185)	(0.204)
Controls	X	X	X	X	X	X
Observations	8009	8529	2181	2277	1183	1468
r2	0.228	0.206	0.280	0.287	0.242	0.188

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling for region, disposable income, education of household head, household size, number of children under 14. The source is CAPMAS/ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.5.3 Health Expenditure

Table 4.10 provides results of the difference-in-difference estimation of the revolution effect on households' total medical expenditure. Health expenditures decreased significantly in strongly affected areas as well as for the top 33 percent income levels. In strongly affected areas, top income-level households spend 32.8 percent less on health, whereas bottom income-level household decrase health expenditure by 10.1 percent. It is somewhat surprising that top income-level households decreased their health expenses by a higher percentage than bottom income-level households. This could potentially be explained by the fact that wealthier households spend more on their health to begin with. In related papers, findings show that relatively poor households have to decrease health spending to cope with budget constraints (Frankenberg et al., 2003). As described

above, expenses on health, cover medical products, appliances and equipment, outpatient services, and hospital services. Payments for health insurances, however, are excluded. In Egypt, health insurances cover approximately 57 percent of all households, although coverage is particularly low in rural areas and the majority of low-income households does not have a health insurance.

Table 4.10: The effects of the revolution on health expenditures

	(1) health exp.	(2) log(health exp.)	(3) log(health exp.)	(4) top33%	(5) bottom33%
Strong*2013	-214.7	-0.230*	-0.204*	-0.328***	-0.101
	(177.2)	(0.132)	(0.116)	(0.101)	(0.154)
Medium*2013	8.266	0.118	0.0388	-0.102	0.131
	(196.4)	(0.0973)	(0.0935)	(0.0845)	(0.131)
Strong Revolution	1320.8***	0.824***	0.694***	1.499***	0.815***
	(57.58)	(0.0415)	(0.0372)	(0.0314)	(0.0836)
Medium Revolution	1310.7***	0.816***	0.584***	1.268***	0.497***
	(54.57)	(0.0299)	(0.0298)	(0.0397)	(0.0789)
2013	667.0***	0.567***	0.546***	0.631***	0.448***
	(139.9)	(0.0832)	(0.0793)	(0.0631)	(0.118)
income			0.857***	0.707***	0.936***
			(0.0418)	(0.106)	(0.0527)
Controls	X	X	X	X	X
Observations	22953	22953	22952	7637	7636
r2	0.0300	0.103	0.208	0.123	0.144

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling for urban, education of household head, household composition. The source is CAPMAS/ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.5.4 Savings Results

Table 4.11 provides results of the difference-in-difference estimation of the revolution effect on households' savings. Savings are calculated by deducting expenditure from total disposable income. Households save more following the revolution, particularly in strongly affected areas. Households in strongly (medium) affected areas save 25.5 percent (25.9 percent) more. This result is mainly driven by high income-level households, although the coefficient for low-income households is positive but not significant.

Table 4.11: The effects of the revolution on savings

	(1) savings	(2) log (savings)	(3) top33%	(4) medium33%	(5) bottom33%
Strong*2012	711.4	0.255***	0.283***	0.275***	0.214*
	(423.8)	(0.0711)	(0.101)	(0.0795)	(0.120)
Medium*2012	-436.9	0.259***	0.261**	0.316***	0.128
	(487.4)	(0.0861)	(0.104)	(0.0809)	(0.138)
Strong Revolution	-2058.3***	-0.365***	-1.029***	-0.717***	0.222***
	(391.3)	(0.0348)	(0.0470)	(0.0404)	(0.0466)
Medium Revolution	-3123.1***	-0.373***	-0.378***	-0.490***	0.432***
	(149.8)	(0.0270)	(0.0426)	(0.0517)	(0.0483)
2013	-920.9***	-0.312***	-0.296***	-0.438***	-0.237**
	(322.1)	(0.0687)	(0.0893)	(0.0586)	(0.104)
logtotdinc	11176.7***	1.915***	1.675***	2.416***	1.721***
	(1590.5)	(0.110)	(0.109)	(0.192)	(0.0850)
Controls	X	X	X	X	X
Observations	23159	18922	6875	6485	5562
r2	0.157	0.361	0.253	0.133	0.121

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling for urban, education of household head, household composition. The source is CAPMAS/ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.6 Heterogeneity

Our data allows us to disentangle the heterogeneity of estimated effects by household characteristics. In Table 4.12, we estimate our empirical model on education expenditure, health expenditure and savings by the gender of the household head. In Table 4.13, we compare younger with older household heads.

Table 4.12: Expenditure by gender of household head

	(1) educexp_m	(2) educexp_f	(3) medexp_m	(4) medexp_f	(5) savings_m	(6) savings_f
Strong*2013	0.115**	0.0219	-0.177	-0.331**	0.279***	0.205*
	(0.0426)	(0.135)	(0.115)	(0.150)	(0.0736)	(0.106)
Medium*2013	-0.0181	0.0317	0.0611	-0.0552	0.277***	0.290**
	(0.0506)	(0.113)	(0.0930)	(0.127)	(0.0953)	(0.112)
strong_revolution3	0.860***	0.178**	0.743***	-0.0784	-0.850***	-0.292***
	(0.0341)	(0.0810)	(0.0394)	(0.0606)	(0.0356)	(0.0469)
medium_revolution3	0.123***	-0.763***	0.631***	-0.300***	-0.423***	-0.277***
	(0.0209)	(0.0477)	(0.0326)	(0.0551)	(0.0324)	(0.0772)
2013	-0.0203	0.0157	0.524***	0.636***	-0.339***	-0.202**
	(0.0324)	(0.0762)	(0.0794)	(0.106)	(0.0711)	(0.0914)
Controls	X	X	X	X	X	X
Observations	11665	1566	19006	3946	15858	3064
r2	0.400	0.431	0.202	0.249	0.362	0.353

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling for urban, education of household head, household size, number of children under 14. The source is CAPMAS/ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

In Table 4.12 we can observe that in strongly affected governorates households headed by a man spend significantly more on education even after controlling for income. As seen in previous sections, all affected households reduce their spending on health. Households headed by a woman, however, reduce their expenditure relatively more than households headed by a man. Households headed by a man also tend to save more than households headed by a woman, although the difference is weaker than for other outcome variables.

In Table 4.13 we look into expenditures and savings in affected households by age of the household head and we find that households with an older household head spend significantly more on education. Households with an older head reduce their health expenditures by a larger share which could be explained by a initially larger amount spent on health before the outbreak of the revolution. Households with a younger head tend to save more compared to households with an older head. A potential explanation could be that households with an older head already have a larger stock of savings and households with a younger head do not.

Table 4.13: Expenditure by age of household head

	(1)	(2)	(3)	(4)	(5)	(6)
	educexp_o	educexp_y	medexp_o	medexp_y	savings_o	savings_y
Strong*2013	0.165***	0.0284	-0.225	-0.192*	0.219**	0.305***
	(0.0468)	(0.0676)	(0.143)	(0.107)	(0.0850)	(0.0867)
Medium*2013	-0.0495	0.0117	0.0555	0.0255	0.238**	0.311***
	(0.0708)	(0.0665)	(0.0968)	(0.0991)	(0.0881)	(0.0961)
strong_revolution3	1.136***	0.800***	1.106***	1.501***	-0.927***	-0.448***
	(0.0320)	(0.0462)	(0.0527)	(0.0352)	(0.0363)	(0.0375)
medium_revolution3	0.606***	-0.0292	1.062***	1.355***	-0.959***	-0.395***
	(0.0465)	(0.0442)	(0.0442)	(0.0284)	(0.0470)	(0.0282)
2013	-0.00106	-0.0382	0.560***	0.518***	-0.291***	-0.338***
	(0.0338)	(0.0380)	(0.0770)	(0.0892)	(0.0667)	(0.0804)
Controls	X	X	X	X	X	X
Observations	7545	5686	11766	11186	9446	9476
r2	0.421	0.387	0.205	0.208	0.303	0.398

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling for income, urban, education of household head, household size, number of children under 14. The source is CAPMAS/ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.7 Robustness Checks

To verify the robustness of our results, a number of different alternative specifications have been used. First, we have dropped all observations, which were collected during the 2010/2011 survey as they might already include some form of effects of the revolution. The survey data was collected from July 2010 to June 2011, which means that almost half of all interviews were collected after 25 January 2011. However, as the questionnaire asks for yearly (July 2010 to June 2011) income and expenditure, this should have only minor effects. Table D.2 in the Appendix shows the effects of the revolution on the main outcomes but excluding the 2010/2011 observations and only comparing the 2008/2009 with the 2012/2013 observations. Most directions and significance levels remain the same, the results are just slightly less significant or weaker due to the loss of one third of observations. All other regression output tables have been checked using the same procedure and provide consistent results.

One might also be worried about the capital Cairo driving the results. Table D.1 in the Appendix shows the results excluding Cairo. While the sample becomes smaller, all coefficients remain robust and only the coefficient of health expenditures loses significance (but remains positive). All other coefficient estimates remain robust or become slightly weaker if one excludes Cairo.

Another way to check the robustness of our results is to use a different measure for the revolution intensity. One option is to look at data on injured and arrested individuals by region instead of death occurrences. This does not lead to different results because the number of deaths, arrests and injured is highly correlated and the regions categorisation into low, medium and strong intensity (i.e. treatment) stays the same. Another option is to divide the governorates into low, medium and strong treatment using another method to split the sample. In the main part of the paper, we divided the governorates so that we have an equal number of observation per treatment group. Another way would be to use specific cut-offs for death occurrences, for instance, defining low treatment as governorates with a death occurrence from 0-10, medium treatment as governorates

ranging from 11-100 and strong treatment as governorates above 101. Robust results are obtained for all regression tables.

Lastly, one can look at the relative death occurrence by region, measuring death occurrence per capita instead of in absolute numbers. This leads to very little changes because of two reasons. First, the relative and the absolute number of deaths occurrence are highly correlated. There are no regions, which are ranked high in absolute death occurrence and low in relative death occurrence or vice versa. Second, the governorates that change their position in the ranking, are typically very small states, that have an intermediate death occurrence in absolute terms but a high death occurrence in relative terms due to their small population size. However, those governorates only contribute relatively little to the regression because of their low number of observations and thus barely change the result.

4.8 Channels

We analyse two channels that could explain our results of increased education expenditure as well as decreasing health expenditure and higher savings. First, we argue that the decreased health expenditure and increased savings can be explained by precautionary savings behaviour for households that are particularly affected by the political change and unstable environment. Second, we argue that the increased education expenditures can be explained by some level of optimism by households after the fall of the dictator.

4.8.1 Precautionary Behaviour

In the theoretical literature, political instability enters economic models as a constraint that alters some critical element in the decision-making process of individuals. Theoretical models of buffer-stock saving predict that household consumption would drop when faced with an uncertainty shock. Political instability can therefore cause economic decisions, such as investment, production or labour supply to differ from the optima under no uncertainty. In the economics of psychology literature, the distortive effects of negative

emotions on human behaviour can help in explaining people's "irrational" response to an unstable environment (Tversky and Kahneman, 1973, 1974). Our findings are thus in line with the precautionary savings behaviour model.

4.8.2 Optimism

"We thought people didn't care and just threw their garbage on the street, but now we see that they just thought it was hopeless - why bother when it's so dirty? Why not be corrupt when everything is corrupted? But now things have changed, and it's a different mood overtaking. Even I can't stop smiling myself."
From the New Yorker 2/28/11, quote of an Egyptian student in the context of people cleaning up Tahrir square.

We find that affected households invest more in their sons' higher education. Parents may be more or less willing to invest in their son's education relative to their daughter depending on multiple factors. In the literature, there are several channels that may explain our results. First, parents may treat their sons as an investment for the future, especially if they consider that labour market prospects are likely to improve in the future. Labour market participation of women is very low in Egypt and therefore parents may have preferred investing in their sons' higher education expecting labour market prospects to be higher. The second channel could be related to safety as young women may be perceived as more vulnerable to attacks and abuses on their way to school and university and therefore may have to stay at home for their protection. We find some evidence for the first channel.

We argue that the increased spending in particularly affected areas can be explained by a positive outlook towards the future: households were expecting or hoping for a change in Egypt with better labour market prospects for their children and therefore invested more in their education. We analyse data from the Arab Democracy Barometer as well as election results data of the 2012 election to provide some evidence for this channel.

The period after the presidential election in June 2012 was a period of optimism in Egypt. The Arab Democracy Barometer survey[5] seeks to measure and track over time citizen attitudes, values, and behaviour patterns relating to pluralism, freedom, tolerance and equal opportunity; social and inter-personal trust; social, religious and political identities; conceptions of governance and an understanding of democracy; and civic engagement and political participation. In Egypt, data collection took place in the first week of April 2013 and 1200 individuals were interviewed. Results show that despite the negative perception of the economy and general awareness of the looming economic crisis, respondents were generally optimistic about the future. Overall, 82 percent expected the economy to improve within the next 3 years. Only 11 percent expected it to remain the same, while 7 percent expected it to worsen. At the same time, the confidence in public institutions increased.

We also analyse election results of the 2012 election at governorate level. We assume that in governorates where a large share of households voted for the opposition, households in those areas were particularly enthusiastic about the political change. According to our interpretation, therefore, education expenditure should increase especially in those governorates because of a more positive outlook towards the future. We analyse governorates where the Muslim Brotherhood party won the votes by at least 75 percent and higher, which is the case in two governorates (Matruh and Fayoum). We then implement our difference-in-difference estimator to detect the difference in education expenditures for governorates with a high vote share for Morsi (treatment) and compare it with governorates with a lower vote share (control). As can be seen in Table 4.14 we can indeed identify a significant increase in education expenditure in those governorates, which supports our preferred interpretation of households with a particularly positive outlook towards the future investing more in the education of their children. To the best of our knowledge, this is the first paper that provides suggestive evidence on the relationship between political affiliation, regime change and household investment behaviour.

[5]The third wave of the Arab Democracy Barometer was implemented from 2012-2014 in 12 countries: Algeria, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Palestine, Saudi Arabia, Sudan, Tunisia, and Yemen.

Table 4.14: Education expenditure in pro-Muslim Brotherhood governorates

	(1) expenses on education	(2) log education expenses	(3) education expenses of total expenses
Mursi_75_2013	254.6*	0.0844**	0.0838*
	(99.18)	(0.0253)	(0.0361)
Mursi_75	-1527.1***	-1.078***	-1.066***
	(105.4)	(0.0495)	(0.0243)
After	6.878	0.0687**	-0.0135
	(81.95)	(0.0236)	(0.0246)
Controls	X	X	X
Observations	13232	13232	13231
r2	0.103	0.324	0.236

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling for urban, education of household head, household size, number of children under 14. The source is CAPMAS/ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

4.9 Conclusions

Egypt's economy has been strongly affected by the political events since 2011 as evidenced by soaring debt, significant unemployment increases and inflation. While those consequences are well known and studied, there are other, less evident but equally important, changes at the individual and household level that might have long-term consequences. We analyse their effects at household level and show that political change and higher levels of instability significantly affects household behaviour in many ways, affecting their savings as well as health and education investments. Our results suggest that political instability and political change can affect long-term outcomes for households.

We find that households experience a loss in income and have lower expenditures. Despite this result, households spend more on the the education of their children, especially on their sons enrolled in tertiary education. We can also observe that households spend less on their health and increase their savings. To explain the findings we show two mechanisms: precautionary behaviour and optimism. The channels leading to the results depend on the political affiliation of the household. To our knowledge, this is the first paper providing some indication in this direction.

Our results suggest that social unrest can be an important channel through which political instability can affect long-term outcomes for households. Those consequences of political instability may be difficult to quantify, or even to recognise, and they have not yet been sufficiently integrated in a policy discussion on the consequences of the Egyptian

revolution. Such a change in economic behaviour, however, requires policy responses that hedge the risks for individuals through targeted policies such as loans, insurances or risk pooling in order to keep the 'cost' of social unrest at a minimum. However, as research in emerging economies is scarce, this is often overlooked. With our research we aim to contribute to a better understanding of these mechanisms.

Appendices

Appendix A

Appendix to Chapter 1

A.1 Additional Tables and Graphs

Figure A.1: Example of Legislation Dummies

iso316612	nace2	year	DEU	ESP	GBR	FRA
PL	10	2004	0	0	.6666667	0
RO	10	2004	0	0	0	0
PL	43	2004	0	0	.6666667	0
RO	43	2004	0	0	0	0
PL	10	2009	0	1	1	1
RO	10	2009	0	1	1	0
PL	43	2009	0	1	1	1
RO	43	2009	0	1	0	0
PL	10	2012	1	1	1	1
RO	10	2012	0	0	1	0
PL	43	2012	1	1	1	1
RO	43	2012	0	0	0	0

Notes: The figure shows a print-screen from Stata to illustrate the construction of the Free Movement variable. 0 denotes that a given market is closed, 1 denotes that it is open for labour migrants from the new member states. If a country did not open from the beginning of a calendar year (for example, Great Britain opened in May 2004), the legislation dummy is weighted accordingly.

Table A.1: Summary of Variables

	(1) Full	(2) Main_sample	(3) Incumbent	(4) Foreign	(5) Hightech	(6) Innovator
Firm-level data:						
number of employees	40.5	65.5	80.0	195	87.1	238
	[305]	[296]	[344]	[554]	[367]	[727]
sales, 000 EUR	3,908	5,554	6,686	26,972	9,954	34,662
	[162,210]	[61,742]	[70,814]	[172,423]	[109,758]	[267,709]
assets, 000 EUR	3,251	4,854	5,735	21,440	7,629	28,953
	[60,287]	[61,480]	[65,025]	[145,629]	[90,648]	[226,421]
firm age	9.16	10.7	13.6	10.8	10.8	14.6
	[8.03]	[7.78]	[7.71]	[8.66]	[7.78]	[9.63]
labour productivity ($\frac{Y}{L}$)	3.47	3.67	3.69	4.28	3.85	4.22
	[1.35]	[1.10]	[1.09]	[1.16]	[1.07]	[0.90]
labour productivity ($\frac{Y}{WL}$)	2.08	1.97	1.94	1.91	1.71	1.80
	[1.08]	[0.89]	[0.85]	[0.92]	[0.89]	[0.71]
TFP index	-0.012	-0.046	-0.050	-0.059	-0.10	-0.15
	[0.89]	[0.67]	[0.68]	[0.63]	[0.63]	[0.55]
Industry-level data, 2 digits:						
FM	0.083	0.13	0.13	0.14	0.19	0.15
	[0.11]	[0.14]	[0.14]	[0.14]	[0.18]	[0.15]
human capital constraints	0.090	0.092	0.10	0.088	0.096	0.12
	[0.11]	[0.11]	[0.12]	[0.11]	[0.12]	[0.13]
financial constraints	0.25	0.18	0.17	0.15	0.13	0.12
	[0.17]	[0.14]	[0.14]	[0.13]	[0.12]	[0.12]
number of employees	11.6	15.4	16.6	22.2	21.7	22.3
	[20.9]	[25.0]	[25.9]	[38.7]	[38.8]	[34.8]
sales, 000 EUR	948	1,033	1,136	2,076	1,911	2,468
	[5,403]	[7,006]	[8,135]	[7,331]	[5,174]	[11,083]
labour productivity ($\frac{Y}{L}$)	4.03	3.79	3.78	4.03	4.05	4.23
	[0.84]	[0.70]	[0.73]	[0.71]	[0.67]	[0.56]
labour productivity ($\frac{Y}{WL}$)	2.21	1.91	1.92	1.91	1.78	1.91
	[0.62]	[0.40]	[0.40]	[0.46]	[0.50]	[0.41]
Observations	3.25e+06	532760	334693	55979	116540	19143
No. of firms	555072	108256	58245	10628	26224	2758

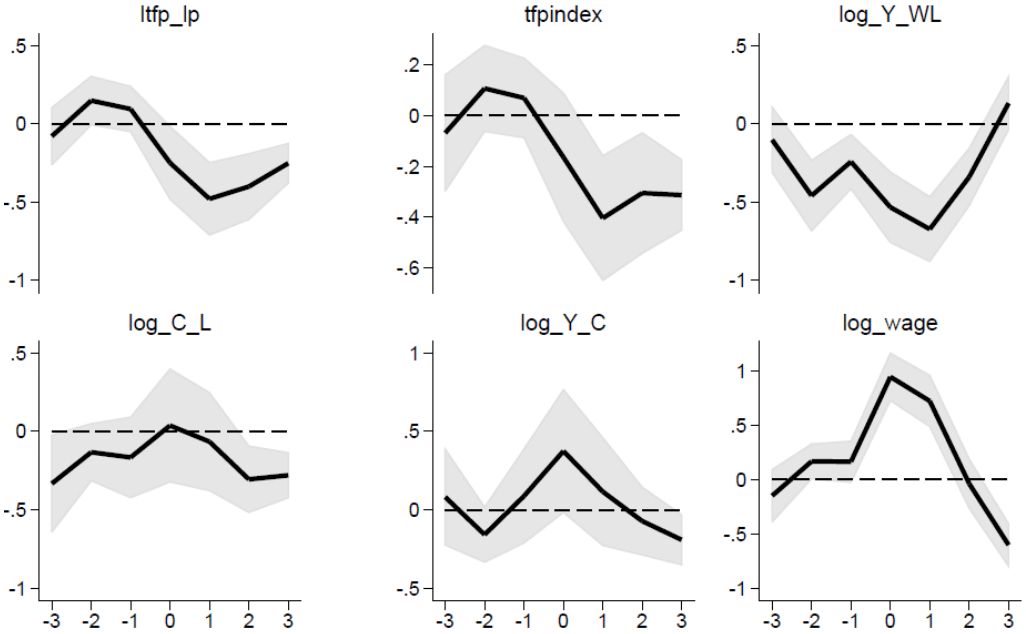
Notes: The table reports means and standard deviations (in brackets) of variables used in the regressions. 'Full' denotes the sample of all available observations. Further sub-samples do not include observations with missing variables. 'Main sample' is a sub-sample of firms used in the main regression. 'Incumbent' is a sub-sample of firms that existed prior to 2002. 'Innovator' denotes a sub-sample of firms with patents. 'High-tech' denotes a sub-sample of firms operating in high-tech industries according to the Statistical classification of economic activities in the European Community (NACE) at 2-digit level. 'Foreign' denotes a sub-sample of firms with foreign capital.
Productivity measures are reported in natural logarithms.
Constraints are measured as the shares of firms in a given industry-country-year reporting to be constrained.
FM is our preferred instrument: the sum of legislation dummies, weighted by proximity measures to a given old EU member-country.
Sources: Amadeus, EU Commission Business Survey, Eurostat Structural Business Statistics

Table A.2: First Stage Regression. Effect of Free Movement on Skill Shortages

	(1) FM, dist	(2) FM*skill sh., dist	(3) FM, migr	(4) FM*skill sh., migr
FM_{ict}	0.0522*	0.125***	0.0767***	0.112***
	(0.0298)	(0.0461)	(0.0144)	(0.0376)
$L.log\_investment_{ict}$	0.00644	0.00650	0.00400	0.00604
	(0.00451)	(0.00455)	(0.00447)	(0.00446)
$Log\_total\_sales_{it}$	0.0105	0.00993	0.0109	0.00912
	(0.00929)	(0.00914)	(0.00916)	(0.00885)
$Mean\ skill\ sh._{it}$	0.200**	0.165*	0.206**	0.148*
	(0.0905)	(0.0875)	(0.0891)	(0.0879)
$L.log\_FDI_{ct}$	0.00145***	0.00148***	0.00134***	0.00148***
	(0.000484)	(0.000483)	(0.000480)	(0.000482)
$D.log\_GDP_{ct}$	0.368***	0.372***	0.387***	0.377***
	(0.0807)	(0.0794)	(0.0812)	(0.0802)
Observations	2,069	2,069	2,069	2,069
Number of pp	428	428	428	428
R^2	0.349	0.352	0.357	0.355
Dummies	ci y	ci y	ci y	ci y
Clusters	428	428	428	428
Fstat	3.081	7.332	28.40	8.859
pval	0.0799	0.00704	1.60e-07	0.00308

Notes: The table presents reduced-form estimates of free movement on skill shortages. All specifications are estimated with industry·country fixed effects and time dummies. Dependent variable: % of firms reporting skill shortages. FM denotes the Free Movement variable. In specifications 1 and 2, we use distance-weighted FM dummies, in 3 and 4 - weights with migration stocks. In specifications 2 and 4, FM dummies are in addition interacted with skill shortages in destination industries. Standard errors (in parentheses) are clustered on the country-industry level.
*** p<0.01, ** p<0.05, * p<0.1

Figure A.2: Dynamic effects (lagging and forwarding the instrument)



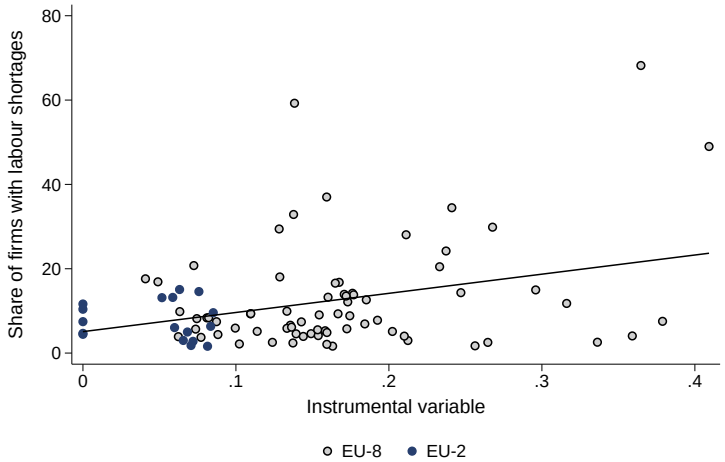
Notes: This graph shows the coefficients of the L&P TFP measure, the TFP index, wage-adjusted labour productivity, the capital labour ration, capital productivity and personnel costs when the instrument is lagged, simultaneous or forwarded by up to three years. The 0 value on the x-axis indicates the year of the labour market opening and the values 1,2,3 are the years following the opening, while the values -3,-2 and -1 are the years preceding the sector openings.

Table A.3: First Stage Regression (Robustness). Effect of Free Movement on Financial Shortages

	(1) FM, dist	(2) FM*skill sh., dist	(3) FM, migr	(4) FM*skill sh., migr
FM_{ict}	0.0791	-0.0414	-0.00399	-0.0800**
	(0.0535)	(0.0553)	(0.0274)	(0.0364)
$L.log\_investment_{ict}$	0.00126	0.00115	0.00131	0.00141
	(0.00638)	(0.00643)	(0.00654)	(0.00637)
$Log\_total\_sales_{it}$	0.00508	0.00522	0.00502	0.00601
	(0.0114)	(0.0115)	(0.0115)	(0.0113)
$Mean\ skill\ sh._{it}$	-0.0551	-0.0342	-0.0476	-0.00650
	(0.0970)	(0.0999)	(0.0967)	(0.102)
$L.log\_FDI_{ct}$	-0.000566	-0.000595	-0.000579	-0.000608
	(0.000508)	(0.000506)	(0.000512)	(0.000507)
$D.log\_GDP_{ct}$	-0.381***	-0.393***	-0.391***	-0.400***
	(0.0747)	(0.0730)	(0.0769)	(0.0734)
Observations	2,070	2,070	2,070	2,070
Number of pp	428	428	428	428
R^2	0.075	0.074	0.073	0.076
Dummies	ci y	ci y	ci y	ci y
Clusters	428	428	428	428
Fstat	2.184	0.561	0.0213	4.832
pval	0.140	0.454	0.884	0.0285

Notes: The table presents reduced-form estimates of free movement on skill shortages. All specifications are estimated with industry·country fixed effects and time dummies. Dependent variable: % of firms reporting skill shortages. FM denotes the Free Movement variable. In specifications 1 and 2, we use distance-weighted FM dummies, in 3 and 4 - weights with migration stocks. In specifications 2 and 4, FM dummies are in addition interacted with skill shortages in destination industries. Standard errors (in parentheses) are clustered on the country-industry level.
*** p<0.01, ** p<0.05, * p<0.1

Figure A.3: First stage illustration



Notes: Skill shortages and FM (instrumental) variable are aggregated on a country-level proportionally to the number of firms in each industry. Source: EU Commission Business Survey, own calculations.

A.2 Proof of the Comparative Statics and the Simulation of the Model

In this sub-section, we first present the proof of the comparative statics results using a general production function and then provide a numerical solution to the model using a Cobb-Douglas production function.

A.2.0.1 Comparative Statics

We assume a general production function with three variable inputs: skilled and unskilled labour (L_s, L_u) and training t. Capital is fixed in the short-term. The firm faces the output price P, wages w_s and w_u, and job separation rate of skilled labour δ_s. V_s denotes the number of posted vacancies, c_s denotes the cost of a skilled vacancy, and $c_t = 1$ denotes the costs per hour of training t. For simplicity search and training costs for unskilled labour are set to zero. The firm solves the following maximization problem:

$$\Pi = Pf(t, L_s, L_u) - L_s w_s - c_s V_s - tV_s - L_u w_u$$

s.t.

$$\frac{V_s}{L_s} = \delta_s.$$

$f(t, L_s, L_u)$ is increasing and strictly concave in t, L_s, L_u. We denote the first-order partial derivatives of f by f_i where $i = t, L_s, L_u$. $f_i > 0$. f_{ij} are the second-order derivatives. $f_{ii} < 0$. We assume that the cross-derivatives $f_{ij}, i \neq j$ are positive.

Firms maximise profits, by choosing the number of workers and the initial amount of training (which then affects the level of firm-specific knowledge t). The first order conditions give the implicit solution of the model.

FOC1: $\dfrac{\partial \Pi}{\partial L_s} = Pf_s - w_s - \delta_s c_s - \delta_s t = 0$

FOC2: $\dfrac{\partial \Pi}{\partial L_u} = Pf_u - w_u = 0$

FOC3: $\dfrac{\partial \Pi}{\partial \delta_s} = Pf_t - \delta_s L_s = 0$

We apply the implicit function theorem to determine the signs of $\dfrac{\partial L_s^*}{\partial \delta_s}$ - the effect of δ_s on the firm's demand for skilled labour and $\dfrac{\partial t^*}{\partial \delta_s}$ - the effect on the initial training and consequently the firm's TFP. We assume that the above system of equations has the unique internal solution L_s^*, L_u^*, t^*, which maximises the profit function.

$$\frac{\partial L_s^*}{\partial \delta_s} = \frac{|\tilde{D_{s\delta_s}}|}{|D|}$$

where $|D|$ is the determinant of the Hessian matrix:

$$D = \begin{bmatrix} Pf_{ss} & Pf_{su} & Pf_{st} - \delta_s \\ Pf_{su} & Pf_{uu} & Pf_{ut} \\ Pf_{st} - \delta_s & Pf_{ut} & Pf_{tt} \end{bmatrix}$$

To fulfil the second-order conditions, D has to be negative-definite, therefore, $|D| < 0$. $\tilde{D_{s\delta_s}}|$ is the determinant of the following matrix:

$$\tilde{D_{s\delta_s}}| = \begin{bmatrix} c_s + t & Pf_{su} & Pf_{st} - \delta_s \\ 0 & Pf_{uu} & Pf_{ut} \\ L_s & Pf_{ut} & Pf_{tt} \end{bmatrix}$$

The sign of $\dfrac{\partial L_s^*}{\partial \delta_s}$ depends on the term $(P^2 f_{uu} f_{tt} - P^2 f_{ut}^2)(c_s + t) + P^2 L_s f_{ut} f_{su} - P L_s f_{uu}(Pf_{st} - \delta_s)$. Under the assumption that the above profit maximization problem has a solution, this term will be positive.[1] Since $|D| < 0$, $\dfrac{\partial L_s^*}{\partial \delta_s} < 0$.

[1] $(P^2 f_{uu} f_{tt} - P^2 f_{ut}^2)(c_s + t) > 0$, $P^2 L_s f_{ut} f_{su} > 0$. $P L_s f_{uu}(Pf_{st} - \delta_s) > 0$, but should be smaller than the sum of the two first summands, otherwise the stationary point will be a saddle point.

Similarly, the sign of $\frac{\partial t^*}{\partial \delta_s}$ depends on the term $(P^2 f_{uu} f_{ss} - P^2 f_{su}^2)(L_s) + P^2(c_s + t) f_{ut} f_{su} - P(c_s + t) f_{uu}(P f_{st} - \delta_s)$, which is also positive. Therefore, $\frac{\partial t^*}{\partial \delta_s} < 0$.

A.2.0.2 Simulation

We further illustrate the effect of a increasing job separation rate δ_s on the firm's factor demand and TFP. For this exercise, we assume a Cobb-Douglas production function and simulate the model in Matlab.

$$\Pi = P t^{\gamma} L_s^{\alpha} L_u^{\beta} - L_s w_s - c_s V_s - t V_s - L_u w_u$$

s.t.

$$\frac{V_s}{L_s} = \delta_s.$$

The first-order conditions define the implicit solution of the problem.

FOC1: $\frac{\partial \Pi}{\partial L_s} = \alpha P t^{\gamma} L_s^{\alpha - 1} L_u^{\beta} - w_s - \delta_s c_s - \delta_s t = 0$

FOC2: $\frac{\partial \Pi}{\partial L_u} = \beta P t^{\gamma} L_s^{\alpha} L_u^{\beta - 1} - w_u = 0$

FOC3: $\frac{\partial \Pi}{\partial \delta_s} = \gamma P t^{\gamma - 1} L_s^{\alpha} L_u^{\beta} - \delta_s L_s = 0$

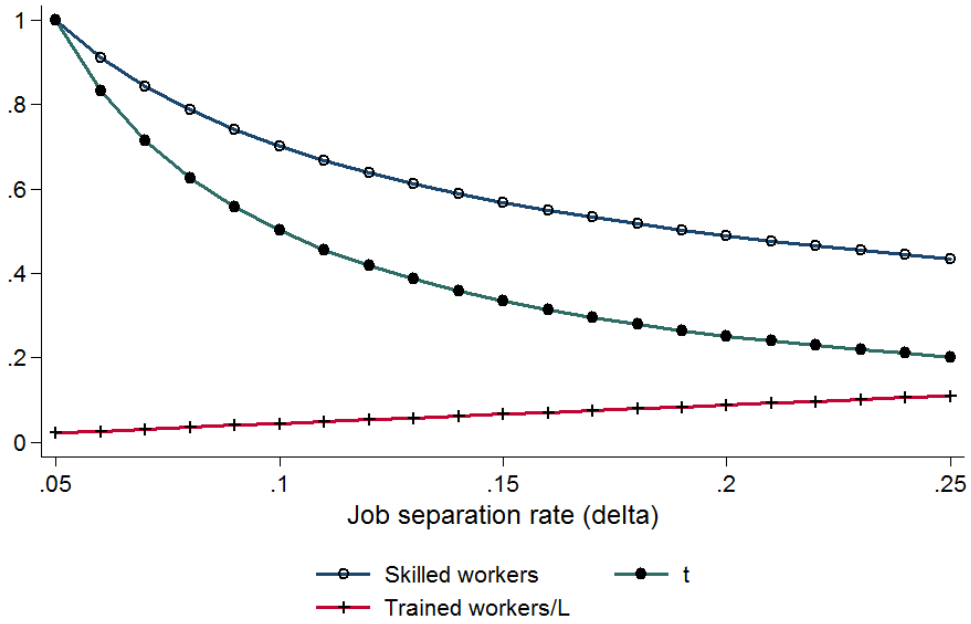
Again, we assume that the solution to the above maximization problem exists: $\gamma + \alpha + \beta < 1$ and the second-order conditions are satisfied.

To simulate the model, we used the following parameter values: $\gamma = 0.1$, $\alpha = 0.5$, $\beta = 0.3$, $w_s = 1$, $w_u = 0.6$, $c_s = 0.05$.

Figure A.4 presents the simulation results. We investigate the effect of δ_s on the firm's demand for skilled workers L_s, on the firm-specific knowledge t, and on the share of trained workers $\frac{\delta_s L_s}{L}$. The graph illustrates that if δ_s increases, the firm's demand for the skilled labour decreases and so does the amount of training t that the firm decides to

provide for the new hires. The latter eventually lowers the firm-specific knowledge and hence TFP. The share of trained workers to the total workforce, however, increases since more workers have to be trained.

Figure A.4: The Effect of the Job Separation Rate δ_s, Simulation Results



Note: This graph shows the simulation results of our theoretical framework for different values of delta (the job separation rate). "Skilled workers" - the amount of optimal skilled labour, "t" - the amount of of the optimal training (the firm-specific knowledge). Both "Skilled workers" and "t" are normalised to their optimal values at $\delta_s = 0.05$. "Trained workers/L" - the share of trained workers to the firm's total workforce.

A.3 TFP Index Calculation

We calculate the TFP index, following Gorodnichenko and Schnitzer (2013), according to the formula below:

$$TFP_{fict} = \hat{y}_{fict} - s_{ic}^{L}\hat{l}_{fict} - s_{ic}^{K}\hat{k}_{fict} - s_{ic}^{M}\hat{m}_{fict} \tag{A.1}$$

where $\hat{y}_{fict}, \hat{l}_{fict}, \hat{k}_{fict}, \hat{m}_{fict}$ are log deviations of a firm's output, labour, capital, and materials from industry's averages. The latter are calculated on a four-digit industry level (for each country), by taking geometric means across all firm-year observations.

By using deviations instead of levels, we exclude time-invariant country-industry fixed effects and make the index more comparable across different industries and countries.

$s_{ic}^{L}, s_{ic}^{M}, s_{ic}^{K}$ are cost shares of labour, materials, and capital, which are computed for each firm-year and then also aggregated on a four-digit industry level for each country.

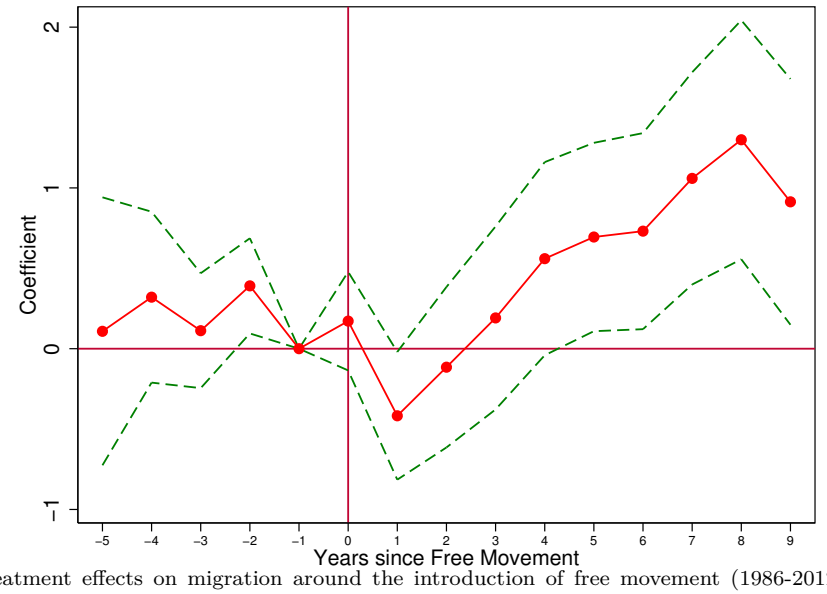
As a proxy of output we use firms' sales, labour (wages and salaries), capital (fixed assets), and material (material costs). We should note that the obtained TFP index contains not only firms' unobserved technology and management ability, but also firms' market power, and differences in their workforce composition.

Appendix B

Appendix to Chapter 2

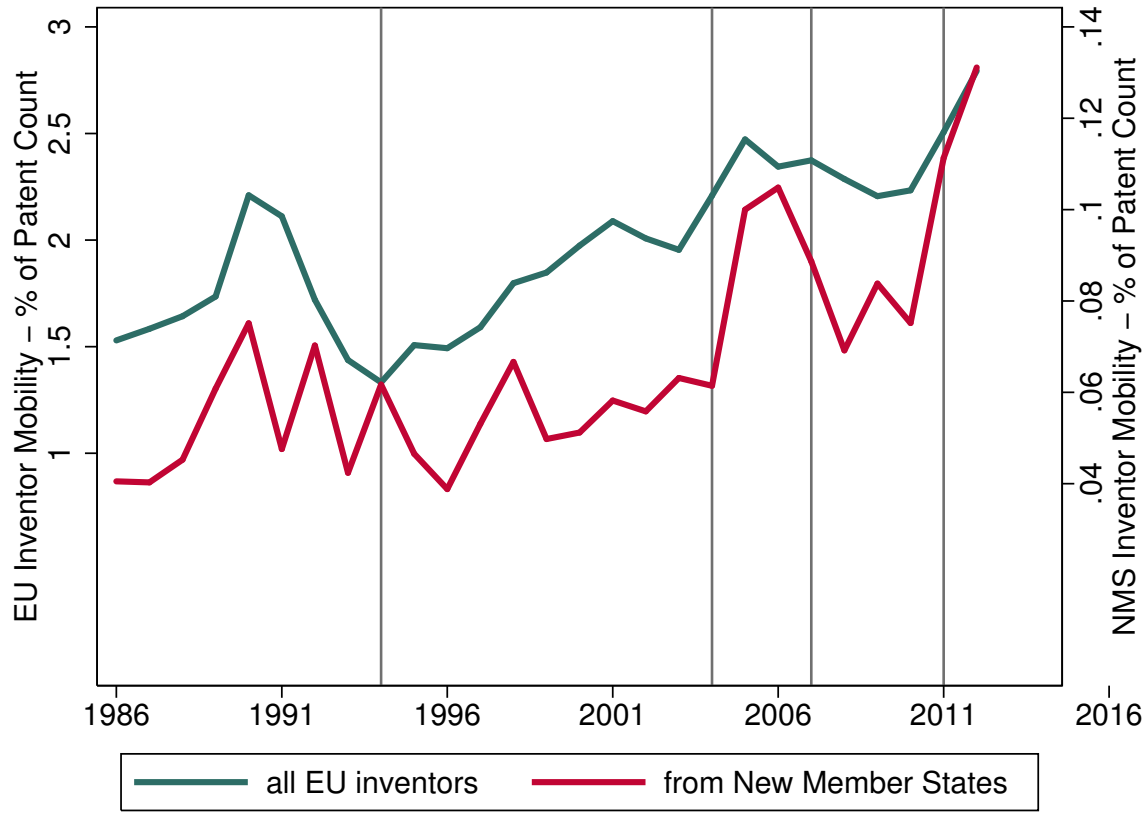
B.1 Additional Tables and Graphs

Figure B.1: Migration Flows, Annual Treatment Effects of Free Labour Mobility



Notes: Annual treatment effects on migration around the introduction of free movement (1986-2012). The regression includes destination-year and country-pair-industry fixed effects. Standard errors are clustered at the country-pair-industry level.
Source: PATSTAT, European Commission, own calculations.

Figure B.2: Inventor Mobility in Europe



Notes: The graph shows the number of mobile inventors normalised to the total number of patent applications. We count as mobile inventor and inventor who changes his country of residence compared to the previous patent application. Thus migrants can be identified only if they have at least one patent application in each country.
Source: PATSTAT.

Table B.1: Overview of the Gradual Opening of the EU15+4 Labour Markets

Country	NMS8 (2004 entry)	NMS2 (2007 entry)	Sectoral Exceptions
Austria	2011	2014	NMS8 (2007-2010), NMS2 (2007-2013): Construction, Manufacturing of Electronics and Metals, Food and beverage services (restaurant business), other sectors with labour shortages
Belgium	2009	2014	-
Denmark	2009	2009	-
Finland	2006	2007	-
France	2008	2014	NMS8 (2005-2007), NMS2 (2007-2013): Agriculture, Construction, Accommodation and food services (tourism and catering), other sectors with labour shortages
Germany	2011	2014	NMS8 (2004-2010), NMS2 (2007-2013): sectors with labour shortages
Greece	2006	2009	-
Iceland	2006	2012	-
Ireland	2004	2012	-
Italy	2006	2012	NMS8 (2004-2005): sectors with labour shortages; NMS2 (2007-2011): Agriculture, Construction, Engineering, Accommodation and food services (tourism and catering), Domestic work and care services, other sectors with labour shortages; Occupations: Managerial and professional occupations
Lichtenstein	2011	2016	-
Luxembourg	2008	2014	NMS2 (2007 - 2013): Agriculture, Viticulture, Accommodation and food services (tourism and catering)
Netherlands	2007	2014	NMS8 (2004-2006), NMS2 (2007-2013): International transport, Inland shipping, Health, Slaugther-house/meet-packaging, other sectors with labour shortages
Norway	2009	2012	NMS8 (2004-2008), NMS2 (2007-2011): sectors with labour shortages
Portugal	2006	2009	-
Spain	2006	2009	Reintroduction of restrictions for Romanians: 11/08/2011 - 31/12/2013
Sweden	2004	2007	-
Switzerland	2011	2014	-
United Kingdom	2004	2014	NMS2 (2007-2013): Agriculture, Food manufacturing

Notes: Column 2 shows the year of the labour market opening of the respective country for the NMS10 countries, column 3 shows the year of the labour market opening of the respective country for the NMS2 countries. Column 4 shows, which sectors were exempt from restrictions.
Source: European Commission.

Table B.2: Migration and Free Labour Mobility: First Stage

	(1) EU19 and NMS all migrants	(2) NMS all migrants	(3) NMS 2004 only all migrants	(4) EU19 and NMS patent potential
L3.FM	2.352***	5.039**	19.37*	-0.563
	(0.754)	(2.320)	(10.48)	(0.645)
L4.FM	1.860***	3.271*	4.298	1.156**
	(0.630)	(1.704)	(4.065)	(0.506)
L5.FM	-0.136	-0.0996	9.662	0.350
	(0.375)	(0.418)	(19.23)	(0.292)
in EU	0.447**	-4.541*		0.261
	(0.204)	(2.526)		(0.180)
L2.Trade flow	-1.077		-74.12	-2.072**
	(1.089)		(76.99)	(0.953)
L2.FDI inflow	1.14e-05	0.000161***	0.000185***	1.45e-05**
	(2.40e-05)	(4.31e-05)	(4.76e-05)	(6.90e-06)
Observations	383	186	163	383
R-squared	0.597	0.683	0.701	0.363
Region industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
F	10.20	48.57	660.0	10.11
Clusters	53	30	23	53

Notes: The regressions in this table estimate the first stage corresponding to table 2.1 in column 1 and 4: The dependent variable is the (second lag of the natural logarithm) of emigration in a region and outflow of migrants with patenting potential, respectively. The instruments are the free movement variables for the three previous years. The regressions include controls for EU membership, trade flows and FDI inflows. The first pair of columns includes all EU and EFTA countries, the third and fourth column limit the sample to new member states and the last two columns include only the 2004 accessions. All specifications include year and region-industry fixed effects. Robust standard errors are clustered at the region-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

Table B.3: Patent Applications and Free Labour Mobility (Reduced Form)

	(1) EU19 and NMS Patents	(2) EU19 and NMS cit. weighted	(3) NMS Patents	(4) NMS cit. weighted	(5) NMS 2004 only Patents	(6) NMS 2004 only cit. weighted
L3.FM	1.075*	1.309*	-0.276	-0.0181	1.758	2.047
	(0.576)	(0.717)	(2.315)	(2.193)	(3.247)	(4.016)
L4.FM	1.786***	2.206***	-0.606	-0.216	-4.447	-4.335
	(0.276)	(0.386)	(0.863)	(0.805)	(3.655)	(3.624)
L5.FM	-0.177	0.0565	-0.395	-0.264	3.418	4.612
	(0.392)	(0.526)	(0.545)	(0.710)	(3.751)	(3.579)
in EU	0.167	0.278**				
	(0.107)	(0.121)				
L2.Trade flow	-1.399**	-1.456*				
	(0.662)	(0.863)				
L2.FDI inflow	3.10e-05**	4.29e-05***	1.45e-05	4.15e-05	2.49e-05	5.34e-05
	(1.26e-05)	(1.28e-05)	(2.70e-05)	(2.75e-05)	(3.15e-05)	(3.20e-05)
Observations	496	496	209	209	184	184
R-squared	0.442	0.742	0.267	0.177	0.257	0.162
Region industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	56	56	32	32	24	24

Notes: The dependent variables in the regressions shown in this table are the number of patent applications (columns 1,3 and 5) and citation-weighted patent applications (columns 2,4 and 6). More precisely, the dependent variable is the natural logarithm of 1 plus these counts. The same transformation is applied to the trade flow regressor and for FDI inflows, the percentage change from the previous year is used as regressor. The first pair of columns includes all EU and EFTA countries, columns 3 and 4 include all countries which joined the EU in 2004 and later and the last two columns only includes those which joined in 2004. All specifications include year and region-industry fixed effects. Standard errors are clustered at the region-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

Table B.4: Patent Applications and Migration in NMS10, OLS and 2SLS

	(1) OLS Patents	(2) OLS cit. weighted	(3) OLS Patents	(4) 2SLS Patents	(5) 2SLS cit. weighted	(6) 2SLS Patents
L2.Migrants	0.0924**	0.0730*		0.115	0.212	
	(0.0350)	(0.0375)		(0.156)	(0.249)	
L2.Migr.pat.potential			0.203*			0.101
			(0.112)			(0.0950)
L2.Trade flow				0.482	-0.650	0.758***
				(0.518)	(0.820)	(0.251)
L2.FDI inflow	-1.41e-05	-5.82e-06	-3.23e-07	-1.80e-05	-3.03e-05	9.41e-07
	(1.87e-05)	(1.80e-05)	(1.72e-05)	(3.34e-05)	(4.83e-05)	(1.68e-05)
Observations	163	163	163	163	163	163
Region industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	23	23	23	23	23	23
F				16.81	26.31	65.74

Notes: The regressions in this table estimate the relationship between the migration flow out of a country and innovation in that country. The first three columns are estimated with OLS and the last three column use a 2SLS estimation with our instrument based on free movement legislation. The dependent variables are the number of patent applications in an industry and origin region in a year or, in columns 2 and 5, the citation-weighted patent applications (i.e. patent applications + forward citations to these patents). Patent application numbers and citation-weighted counts, number of migrants and trade flows are taken in natural logarithms. The sample includes only the 10 countries which joined the EU in 2004. All specifications include year and region-industry fixed effects. Robust standard errors are clustered at the region-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

Table B.5: Patent Applications and Migration, USPTO Patents Only, OLS and 2SLS

	(1) OLS Patents	(2) OLS cit. weighted	(3) OLS Patents	(4) 2SLS Patents	(5) 2SLS cit. weighted	(6) 2SLS Patents
L2.Migrants	0.0270	-0.0894		0.346**	0.503**	
	(0.0535)	(0.0694)		(0.171)	(0.232)	
L2.Migr.pat.potential			0.000889			0.702
			(0.0606)			(0.429)
in EU	0.0258	0.402	0.0182	0.115	0.567	-0.0508
	(0.204)	(0.305)	(0.206)	(0.238)	(0.374)	(0.222)
L2.Trade flow	1.623**	2.409**	1.740**	0.252	-0.144	2.493***
	(0.687)	(1.002)	(0.654)	(0.901)	(1.246)	(0.842)
L2.FDI inflow	1.24e-05	3.06e-05**	1.28e-05	7.25e-06	2.11e-05***	1.13e-06
	(1.02e-05)	(1.41e-05)	(9.91e-06)	(1.43e-05)	(8.16e-06)	(1.16e-05)
Observations	383	383	383	383	383	383
Region industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	53	53	53	53	53	53
F				32.56	273.0	26.87

Notes: The regressions in this table estimate the relationship between the migration flow out of a country and innovation in that country, counting only patents that were filed with the USPTO. The first three columns are estimated with OLS and the last three column use a 2SLS estimation with our instrument based on free movement legislation. The dependent variables are the number of patent applications in an industry and origin region in a year or, in columns 2 and 5, the citation-weighted patent applications (i.e. patent applications + forward citations to these patents). Patent application numbers and citation-weighted counts, number of migrants and trade flows are taken in natural logarithms. The sample includes all EU members and countries in the European Free Trade Association. All specifications include year and region-industry fixed effects. Robust standard errors are clustered at the region-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

Table B.6: Convergence in Patenting Levels ($Patents_{dest}/Patents_{origin}$) and Migration, NMS only, OLS and 2SLS

	(1) OLS $log(\frac{P_{diy}}{P_{oiy}})$ Patents	(2) OLS $log(\frac{P_{diy}}{P_{oiy}})$ cit. weighted	(3) OLS $log(\frac{P_{diy}}{P_{oiy}})$ Patents	(4) 2SLS $log(\frac{P_{diy}}{P_{oiy}})$ Patents	(5) 2SLS $log(\frac{P_{diy}}{P_{oiy}})$ cit. weighted	(6) 2SLS $log(\frac{P_{diy}}{P_{oiy}})$ Patents
L2.Migrants	0.0289	0.0349		-0.254*	-0.259*	
	(0.0229)	(0.0285)		(0.141)	(0.151)	
L2.Migr.pat.potential			0.118			-1.809
			(0.0747)			(2.810)
Patents, origin	-1.080***	-1.052***	-1.081***	-1.083***	-1.055***	-1.065***
	(0.109)	(0.120)	(0.109)	(0.110)	(0.122)	(0.119)
Patents, dest	1.078***	1.128***	1.080***	1.071***	1.120***	1.044***
	(0.0713)	(0.0910)	(0.0717)	(0.0765)	(0.0962)	(0.0890)
Within EU	0.0435	-0.0278	0.0431	0.0572	-0.0136	0.0724
	(0.0529)	(0.0584)	(0.0533)	(0.0555)	(0.0612)	(0.0693)
GDP_d/GDP_o	-0.444	-0.0942	-0.446	-0.480	-0.132	-0.471
	(0.359)	(0.413)	(0.360)	(0.372)	(0.430)	(0.365)
L3.Trade flow	-0.0394	0.0516	-0.0355	0.00323	0.0959	-0.0277
	(0.0623)	(0.0792)	(0.0616)	(0.0662)	(0.0842)	(0.0633)
L3.FDI flow	0.00139	0.00150	0.00108	0.000924	0.00101	0.00544
	(0.00662)	(0.00662)	(0.00663)	(0.00750)	(0.00741)	(0.0112)
Observations	2,763	2,763	2,763	2,681	2,681	2,681
R-squared	0.499	0.565	0.499	0.458	0.535	0.406
Origin-dest-industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	559	559	559	477	477	477
F				90.89	137.0	81.10

Notes: The dependent variable is the natural logarithm of $Patents_{dest}/Patents_{origin}$. Number of patents (in origin and destination countries), number of migrants, FDI, and trade flows are in natural logarithms. The sample includes country-industry pairs, where origins are NMS and destinations - EU19 countries. All specifications include year and origin-destination-industry fixed effects. Robust standard errors are clustered at the origin-destination-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

Table B.7: Convergence in Patenting Levels ($Patents_{dest}/Patents_{origin}$) and Free Labour Mobility (Reduced Form)

	(1) EU19 and NMS Patents	(2) EU19 and NMS cit. weighted	(3) NMS only Patents	(4) NMS only cit. weighted	(5) EU19 and NMS (all) Patents	(6) NMS only (all) Patents
L3.FM	-0.0135	0.00186	-0.0150	-0.00166	0.0179	-0.0131
	(0.0368)	(0.0434)	(0.0412)	(0.0496)	(0.0122)	(0.0130)
L4.FM	-0.0631	-0.0573	-0.0534	-0.0554	-0.0403***	-0.0337**
	(0.0440)	(0.0469)	(0.0505)	(0.0554)	(0.0133)	(0.0146)
L5.FM	-0.0256	-0.0393	-0.0267	-0.0283	-0.0166	-0.00647
	(0.0419)	(0.0449)	(0.0495)	(0.0534)	(0.0127)	(0.0137)
Patents, origin	-1.242***	-1.407***	-1.094***	-1.067***	-0.640***	-0.618***
	(0.0797)	(0.0873)	(0.111)	(0.122)	(0.0113)	(0.0114)
Patents, dest	1.051***	1.090***	1.062***	1.112***	0.800***	0.813***
	(0.0725)	(0.0921)	(0.0729)	(0.0929)	(0.0216)	(0.0218)
Within EU	-0.00662	-0.100*	0.0241	-0.0442	-0.0781***	-0.0527***
	(0.0494)	(0.0549)	(0.0553)	(0.0620)	(0.0141)	(0.0149)
GDP_d/GDP_o	0.00771	0.555	-0.251	0.0737	0.183***	0.175***
	(0.331)	(0.391)	(0.384)	(0.451)	(0.0393)	(0.0402)
L3.Trade flow	-0.0450	0.00903	-0.0127	0.0766	-0.0499***	-0.0341***
	(0.0629)	(0.0810)	(0.0629)	(0.0807)	(0.00866)	(0.00878)
L3.FDI flow	0.00170	0.000342	0.00259	0.00241	-0.0140***	-0.0112***
	(0.00656)	(0.00665)	(0.00651)	(0.00659)	(0.00416)	(0.00418)
Observations	2,946	2,946	2,763	2,763	71,496	66,504
R-squared	0.487	0.552	0.500	0.565	0.217	0.225
Origin-dest-ind FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	582	582	559	559	5688	5304

Notes: The dependent variable is the natural logarithm of $Patents_{dest}/Patents_{origin}$. Number of patents (in origin and destination countries), number of migrants, FDI, and trade flows are in natural logarithms. All specifications include year and origin-destination-industry fixed effects. Robust standard errors are clustered at the origin-destination-industry level. Specifications 1-4 show the reduced form regressions for the sample used in the OLS/2SLS estimations (i.e. the sub-sample for which migration data are available), specifications 5-6 show estimates for the full sample of country-industry pairs in 2000-2012.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

Table B.8: Citations to Destination Industries, NMS only, OLS and 2SLS

	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
L2.Migrants	0.00255	0.00895		0.427*	0.436*	
	(0.0281)	(0.0282)		(0.222)	(0.224)	
L2.Migr.pat.potential			0.124			5.695
			(0.133)			(5.457)
Patents, origin		0.124***	0.124***		0.146***	0.158**
		(0.0332)	(0.0331)		(0.0369)	(0.0622)
L3.Patents, dest		0.0118	0.0121		0.0183	0.0317
		(0.0224)	(0.0224)		(0.0248)	(0.0332)
Within EU		-0.00869	-0.00991		-0.0280	-0.0827
		(0.0608)	(0.0609)		(0.0637)	(0.0991)
L3.Trade flow		-0.0575	-0.0566		-0.122	-0.0791
		(0.0722)	(0.0724)		(0.0837)	(0.0895)
L3.FDI flow		0.00342	0.00306		0.00393	-0.0129
		(0.0122)	(0.0122)		(0.0127)	(0.0268)
Observations	2,763	2,763	2,763	2,681	2,681	2,681
R-squared	0.083	0.087	0.088			
Origin-dest-industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	559	559	559	477	477	477
F				11.64	8.404	6.418

Notes: The dependent variable is the number of citations from a region and industry to another country in a year. Citation counts, number of migrants, total number of patent application in origin and destination industries, FDI and trade flows are taken in natural logarithms. The sample is limited to new EU member states. All specifications include year and origin-destination-industry level. Robust standard errors are clustered at the origin-destination-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

Table B.9: Citations to Destination Industries and Free Labour Mobility (Reduced Form)

	(1) EU19 and NMS	(2) NMS only	(3) EU19 and NMS (all)	(4) NMS only (all)
L3.FM	0.00662	0.0785	0.0400**	0.0670**
	(0.0349)	(0.0516)	(0.0163)	(0.0306)
L4.FM	0.0734	0.0856	0.0431**	0.0903**
	(0.0451)	(0.0603)	(0.0182)	(0.0392)
L5.FM	0.0480	0.0753	0.0255	0.0406
	(0.0470)	(0.0559)	(0.0169)	(0.0337)
Patents, origin	0.138***	0.134***	0.0591***	0.0974***
	(0.0238)	(0.0308)	(0.00785)	(0.0119)
L3.Patents, dest	0.0478***	0.000519	0.0258***	-0.0130*
	(0.0137)	(0.0192)	(0.00541)	(0.00687)
Within EU	0.0154	0.163***	0.00274	0.180***
	(0.0361)	(0.0553)	(0.0144)	(0.0247)
L3.Trade flow	-0.152***	-0.0732	-0.0627***	0.0372**
	(0.0352)	(0.0596)	(0.00955)	(0.0144)
L3.FDI flow	-0.000418	0.0114	0.0257***	0.0235***
	(0.00520)	(0.0113)	(0.00357)	(0.00639)
Observations	7,279	3,498	29,604	11,851
R-squared	0.174	0.133	0.099	0.110
Origin-dest-industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Clusters	1322	592	2304	912

Notes: The dependent variable is the number of citations from a region and industry to another country in a year. Citation counts, number of migrants, total number of patent application in origin and destination industries, FDI and trade flows are taken in natural logarithms. All specifications include year and origin-destination-industry level. Robust standard errors are clustered at the origin-destination-industry level. Columns 1 and 2 show the reduced form regressions for the sample used in the OLS/2SLS estimations (i.e. the sub-sample for which migration data are available), columns 3 and 4 show estimates for the full sample of country-industry pairs in 2000-2012.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

Table B.10: Citations to Destination Industries, USPTO Patents Only, OLS and 2SLS

	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
L2.Migrants	0.0476**	0.0313*		0.679***	0.288	
	(0.0188)	(0.0178)		(0.197)	(0.184)	
L2.Migr.pat.potential			0.0512			0.745
			(0.0485)			(1.703)
Patents, origin		0.193***	0.194***		0.186***	0.195***
		(0.0221)	(0.0221)		(0.0227)	(0.0227)
L3.Patents, dest		0.0545***	0.0542***		0.0542***	0.0491**
		(0.0147)	(0.0147)		(0.0150)	(0.0195)
Within EU		0.00444	0.00724		-0.00468	0.0300
		(0.0332)	(0.0332)		(0.0343)	(0.0667)
L3.Trade flow		0.0797*	0.0858**		0.0294	0.0853**
		(0.0416)	(0.0417)		(0.0552)	(0.0418)
L3.FDI flow		-0.00960*	-0.0102*		-0.00738	-0.0152
		(0.00526)	(0.00527)		(0.00568)	(0.0134)
Observations	7,299	7,287	7,287	7,136	7,124	7,124
R-squared	0.132	0.150	0.149			
Origin-dest-industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	1322	1320	1320	1159	1157	1157
F				44.41	35.32	34.64

Notes: The dependent variable is the number of citations from a region and industry to another country in a year. Citation counts, number of migrants, total number of patent application in origin and destination industries, FDI and trade flows are taken in natural logarithms. The sample is limited to citations among US patents. All specifications include year and origin-destination-industry level. Robust standard errors are clustered at the origin-destination-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Sources: Patstat, Eurostat, CEPII

Table B.11: Only Citations Added by the Applicant

	(1) OLS	(2) OLS	(3) OLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
L2.Migrants	0.0234	0.0258		0.489***	0.336*	
	(0.0176)	(0.0172)		(0.170)	(0.192)	
L2.Migr.pat.potential			0.0759**			1.239
			(0.0342)			(1.915)
Patents, origin		0.149***	0.150***		0.139***	0.150***
		(0.0220)	(0.0220)		(0.0231)	(0.0233)
L3.Patents, dest		0.0253	0.0247		0.0249	0.0162
		(0.0161)	(0.0161)		(0.0165)	(0.0221)
Within EU		-0.0992***	-0.0958***		-0.110***	-0.0574
		(0.0335)	(0.0334)		(0.0354)	(0.0712)
L3.Trade flow		-0.0194	-0.0143		-0.0805	-0.0153
		(0.0369)	(0.0369)		(0.0542)	(0.0373)
L3.FDI flow		0.00811	0.00735		0.0108*	-0.000953
		(0.00506)	(0.00508)		(0.00554)	(0.0154)
Observations	7,299	7,287	7,287	7,136	7,124	7,124
R-squared	0.070	0.080	0.080			
Origin-dest-industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Clusters	1322	1320	1320	1159	1157	1157
F				22.90	20.46	18.95

Notes: The dependent variable is the number of citations from a region and industry to another country in a year. Citation counts, number of migrants, total number of patent application in origin and destination industries, FDI and trade flows are taken in natural logarithms. The sample is limited to citations which have been added by the applicant according to PATSTAT. Robust standard errors are clustered at the origin-destination-industry level.
*** p<0.01, ** p<0.05, * p<0.1
Source: Eurostat and PATSTAT.

Appendix C

Appendix to Chapter 3

C.1 Additional Tables and Graphs

Table C.1: Balance table

	(1) Treatment = 0	(2) Treatment = 1	(3) Diff. T-C
Age	27.25	40.98	13.73
	[7.520]	[149.5]	(12.43)
Married	0.223	0.275	0.05
	[0.418]	[0.448]	(0.05)
At least one child	0.250	0.255	0.00
	[0.434]	[0.437]	(0.05)
Months since arrival	7.281	7.566	0.28
	[6.994]	[6.982]	(0.81)
Years of education	10.99	10.67	-0.32
	[4.465]	[4.545]	(0.52)
Years of work exper.	6.571	7.349	0.78
	[6.419]	[6.157]	(0.73)
Attended university	0.264	0.281	0.02
	[0.442]	[0.451]	(0.05)
No formal education	0.0473	0.0392	-0.01
	[0.213]	[0.195]	(0.02)
Started searching	0.568	0.510	-0.06
	[0.497]	[0.502]	(0.06)
Contact to employer	0.297	0.269	-0.03
	[0.458]	[0.445]	(0.05)
Previous offers	0.269	0.145	-0.12***
	[0.445]	[0.353]	(0.05)
Look in Internet	0.152	0.179	0.03
	[0.360]	[0.385]	(0.04)
Language difficulties	0.593	0.455	-0.14**
	[0.493]	[0.500]	(0.06)
Search difficulties	0.262	0.283	0.02
	[0.441]	[0.452]	(0.05)
German	0.209	0.222	0.01
	[0.408]	[0.417]	(0.05)
Attends class	0.669	0.703	0.03
	[0.472]	[0.458]	(0.05)
Integration Index	2.153	2.138	-0.02
	[1.108]	[1.073]	(0.13)
Return intention	0.272	0.321	0.05
	[0.408]	[0.415]	(0.05)
Observations	140	143	289

Notes: This table shows average values for the treatment and the control group and their differences for all relevant variables in column 3. Standard errors are reported in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C.2: Cross-correlations

Variables	Integrated	German friends	Feel at home	Invited	Active	Level of German
Integration Index	1.000					
German friends	0.722	1.000				
	(0.000)					
Feel at home	0.043	-0.137	1.000			
	(0.465)	(0.020)				
Invited	0.752	0.405	-0.030	1.000		
	(0.000)	(0.000)	(0.611)			
Active	0.522	0.287	-0.140	0.249	1.000	
	(0.000)	(0.000)	(0.017)	(0.000)		
Level of German	0.572	0.126	-0.087	0.206	0.268	1.000
	(0.000)	(0.032)	(0.142)	(0.000)	(0.000)	

Notes: This table shows the cross-correlation of the components of the integration index and with the integration index itself. The integration index is described in details in part 3.3 of this paper. German friends indicates the percentage of people indicating that they have German friends. Feel at home is a subjective measure ranging from 1 to 5, 5 being the highest. Invited is an indicator measuring if the person has ever been invited to the house of a German. Active means that the person does at least two leisure activities and German means that the person has at least reached level A2.

Table C.3: Different clustering

	(1) Integrated	(2) Integrated	(3) Integrated	(4) Integrated	(5) Integrated
Years of education	0.0626***	0.0626***	0.0626***	0.0626***	0.0626***
	(0.0142)	(0.0144)	(0.0176)	(0.0112)	(0.00920)
Months since arrival	0.0475***	0.0475***	0.0475***	0.0475***	0.0475***
	(0.00857)	(0.00902)	(0.00892)	(0.00640)	(0.00961)
Good English	0.306**	0.306**	0.306**	0.306**	0.306**
	(0.128)	(0.125)	(0.117)	(0.104)	(0.122)
Syria	0.619***	0.619***	0.619***	0.619*	0.619***
	(0.183)	(0.184)	(0.197)	(0.245)	(0.107)
Afghanistan	0.0118	0.0118	0.0118	0.0118	0.0118
	(0.174)	(0.182)	(0.189)	(0.194)	(0.102)
Nigeria	-0.175	-0.175	-0.175	-0.175	-0.175*
	(0.146)	(0.140)	(0.131)	(0.107)	(0.0923)
Cluster	None	Robust	Arrival Date	Education	Country
Observations	283	283	283	283	283
R2	0.274	0.274	0.274	0.274	0.274

Notes: This table shows different ways of clustering for OLS regressions of the integration index on years of education, months since arrival, level of English and a Syria, Afghanistan and Nigeria dummy. Additional controls are age, age squared, being married and having at least one child. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C.2 Baseline Survey

Questionnaire for refugees looking for work

Applicant's ID: _____

Volunteer name: _____

Date: _____

Job search

1. **When did you arrive in Germany ?** _____

2. **When did you start to look for a job in Germany?**

After arrival ☐ After getting the work permit ☐ Not yet ☐

3. **How do you look for work?** (up to 3 answers)

Arbeitsagentur ☐ Internet ☐ Social worker ☐ Teacher ☐ Asking employers/shops directly ☐ Friends/relatives ☐ Other _____

4. **Have you registered at the Arbeitsagentur as looking for a job?** Yes ☐ No ☐

4.1. When? _____

4.2. How many times were you there? _____

5. **How many hours per week do you spend searching for a job?** 0 ☐ $1-4$ ☐ $5-8$ ☐ $9-12$ ☐ >12 ☐

6. **What difficulties do you have during your job search?** (up to 3 answers)

Language ☐ Many rules ☐ Don't know where to search ☐ No suitable job ☐ Missing skills ☐ Job application ☐ Other _____

7. **Have you been in contact with a German employer?** Yes ☐ No ☐

If yes, how?

Informal meeting ☐ Job interview ☐ Job offer ☐ Work ☐ Other _____

8. **Have you already received one or more offers?** (up to 3 answers) Yes ☐ No ☐

8.1. From whom?

Arbeitsagentur ☐ Employer directly ☐ From the camp/housing ☐ Other _____ Friends/relatives ☐

8.2. For what kind of work?

Full-time work ☐ Part-time work ☐ Internship ☐ Other _____

9. **Did you accept the offer?** Yes ☐ No ☐

If not, why?

Low wage ☐ Does not match your skills: too easy ☐ too hard ☐

Not full-time ☐ Too far ☐ Other _____

10. **If you already had an internship/job in Germany, what were the reasons to leave it?**

Contract is over ☐ Small wage ☐ Didn't like it ☐ Moving location ☐ Other _____

Job expectations and interests

1. **In which jobs would you like to work?** (up to 3 answers)

IT/Software Developer ☐ Engineer ☐ Construction worker ☐ Cleaning services worker ☐ Security ☐ Bar/restaurant ☐ Manufacturing ☐ Administrative work ☐ Personal care ☐ Car mechanic ☐ Sales person ☐ Other _____

2. **Are there any jobs you would never do?** (up to 3 answers)

IT/Software Developer ☐ Engineer ☐ Construction worker ☐ Cleaning services worker ☐ Security ☐ Bar/restaurant ☐ Manufacturing ☐ Administrative work ☐ Personal care ☐ Car mechanic ☐ Sales person ☐ Other _____

3. **What is the minimum monthly wage for you to accept a full time job offer?** _____

4. **The minimum monthly wage in Germany is about netto 1000 Euro per month. If it were dropped to 700 Euro, would you work for this wage?**

Yes ☐ No ☐

5. **Do you wish to get education or continue your education?**

University ☐ School ☐ Berufsausbildung (job training) ☐ No ☐

6. **Do you have experience being self-employed before arrival to Germany?** Yes ☐ No ☐

7. **Do you think you will be self-employed in Germany?** Yes ☐ No ☐

Integration

1. **Do you have family in Germany?**	Yes ☐ No ☐
2. **Are you married?**	Yes ☐ No ☐
3. **Is your husband/wife here in Germany?**	Yes ☐ No ☐
3.1. Is he/she working in your home country?	Yes ☐ No ☐
3.2. Is he/she looking for a job in Germany?	Yes ☐ No ☐
4. **Can we contact him/her regarding job assistance?**	Yes, at: _____ No ☐
5. **In your family, who do you think should look for a job here in Germany in the future?**	
You only ☐ Your partner only ☐ You and your partner ☐	
6. **Do you have children?**	Yes ☐ No ☐
7.1 How many?	_____
7.2 In Germany?	Yes ☐ No ☐
7.3 How old are they?	_____ years
8. **Are you planning for your wife and/or children to join you in Germany?**	Yes ☐ No ☐
9. **What is the highest education of your father?**	
No school ☐ Primary School ☐ Secondary School ☐ University ☐	
10. **Do you want to stay in Munich?**	Yes, forever ☐
	Yes, a few years ☐ No ☐
	Don't know ☐
10.1. Would you move for work?	Yes, within Germany ☐
	Yes, within Europe ☐ No ☐
	Don't know ☐
10.2. Do you want to return to your country once it is safe?	Yes ☐ No ☐
	Don't know ☐
11. **What was the main reason for choosing Germany as your destination as opposed to Italy, France or the UK?** (up to 3 answers)	
Relatives/friends ☐ Jobs ☐ Safety ☐ Good reputation ☐	
Asylum possibilities ☐ Other _____	
12. **Did you make new friends in Germany?**	Yes ☐ No ☐
12.1. **Where are these people from?**	
Your country	Yes ☐ No ☐
Germany	Yes ☐ No ☐
Other country	Yes ☐ No ☐

13. **You already feel at home in Germany**

1 (Not at all) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (Completely) ☐

14. **Have you ever been invited to the house of a German?** Yes ☐ No ☐

15. **What activities do you do outside of the GU?**

Study/German ☐ Sport ☐ Shopping ☐ Meeting with people ☐ None ☐ Other _____

16. **Since coming to Germany, have you ever felt treated with less courtesy or respect because you are a refugee?**

Never ☐ Sometimes ☐ Often ☐ All the time ☐

Organisational details

1. **For how long have you learned German (in months)?** _____
2. **Are you currently in a class?** Yes ☐ No ☐

2.1. If yes, where? Language school ☐ Courses by volunteers ☐ _____
Other

3. **At what day and time is your class?** _____
4. **How many hours per week do you learn German on your own?** _____
5. **Do you have the certificate of your highest degree?** Yes, original ☐ Yes, copy ☐ No ☐
6. **Do you have a bank account set-up?** Yes ☐ No ☐
7. **How did you hear about this session?**

Internet ☐ Flyer ☐ Social worker ☐ Friends ☐
Teacher ☐ Other _____

8. **We would like to stay in touch and see how we can best support you in your job search. How can we best reach you?**

Phone _____ What's app _____
E-Mail _____ Facebook _____
Phone number/E-mail address of friend or family member _____

C.3 Follow-up Survey

Follow-up questionnaire for refugees looking for work

Applicant's Name: _____

Applicant's ID: _____

Volunteer name: _____

Gender: _____

Date: _____

Job search

1. **Are you currently working?** Yes ☐ No ☐ Not looking ☐

Job search - not found

If no, continue here

2. **Would you like to work?** Yes ☐ No ☐

3. **How do you look for work?** (up to 3 answers)

Arbeitsagentur (employment office/job center) ☐ Internet ☐ Social worker ☐ Teacher ☐ Asking employers/shops directly ☐ Friends/relatives ☐ Other _____

4. **Have you registered at the Arbeitsagentur (employment office/job center) as looking for work?** Yes ☐ No ☐

4.1. When? _____

4.2. How many times were you there? _____

5. **How many hours per week do you spend searching for work?** 0 ☐ 1 – 4 ☐ 5 – 8 ☐ 9 – 12 ☐ > 12 ☐

6. **What difficulties do you have during your job search?** (up to 3 answers)

Language ☐ Many rules ☐ Don't know where to search ☐ No suitable job ☐ Missing skills ☐ Job application ☐ Other _____

7.1 **Have you been in contact with a German employer?** Yes ☐ No ☐

If yes, how?

Informal meeting ☐ Job interview ☐ Job offer ☐ Work ☐ Other _____

7.2 **How many times did you send or give your CV to an employer?** 0 ☐ 1 – 4 ☐ 5 – 8 ☐ 9 – 12 ☐ > 12 ☐

8. **Have you already received one or more offers?** (up to 3 answers) Yes ☐ No ☐

8.1. From whom?

Arbeitsagentur ☐ Employer directly ☐ From the camp/housing ☐ Friends/relatives ☐ Other _____

8.2. For what kind of work?

Full-time work ☐ Part-time work ☐ Internship ☐ Ausbildung/job training ☐ Other _____

9. **Did you accept the offer?** Yes ☐ No ☐

If not, why?

Low wage ☐ Does not match your skills: too easy ☐ too hard ☐

Not full-time ☐ Too far ☐ Other _____

Job search - found

If yes, continue here

1. **How did you find your work?** (up to 3 answers)

Arbeitsagentur ☐ Internet ☐ Social worker ☐ Teacher/School ☐ Asking employers/shops directly ☐ SIR ☐ Friends/relatives ☐ Previous employer ☐ Other _____

2. **When did you start working?** _____

3.1 **What is the name of the company?** _____

3.2 **What is your position in the company?**

4. **In which sector is the work?**

IT/Software Developer ☐ Engineer ☐ Construction worker ☐ Cleaning services worker ☐ Security ☐ Bar/restaurant ☐ Manufacturing ☐ Administrative work ☐ Personal care ☐ Car mechanic ☐ Sales person ☐ Other _____

5. **What type of work is it?**

Normal job ☐ Mini-job (part-time, 1 E job)☐ Internship ☐ Ausbildung ☐ Other _____

6. **What is the net salary? (What you receive every months on your bank account)** _____

7. **What is the gross salary? (Before tax and other deductions)** _____

8. **For how long is the contract? (in months)** _____

9. **How many hours do you work per week? (Full time is 40)** _____

10. **Is the job too easy for you?** Yes ☐ No ☐

11. **Which languages do you speak at work?**
German ☐ English ☐ Arabic ☐ Other ☐

12. **Are you the only refugee in your work place?**
Yes, the only one ☐ No, one more ☐ No, several ☐ Don't know ☐

13. **How happy are you with your colleagues?**
1 (Not at all) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (Completely) ☐

14. **How happy are you with the salary?**
1 (Not at all) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (Completely) ☐

15. **How happy are you with the tasks at work?**
1 (Not at all) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (Completely) ☐

16. **How long does it take you to arrive at work (in minutes)?** _____

17. **Are you looking for better work?** Yes ☐ No ☐

18. **Why did the work end?**
I quit ☐ fired ☐ contract ended ☐ legal issues ☐ other ☐

Not looking

If not looking, continue here

1. **Why are you not looking for work?** (up to 3 answers)
Studying German ☐ In School ☐ At university ☐ Taking care of family ☐ Medical reasons ☐ net salary not high enough ☐ Enough money ☐ Uncertainty about asylum process ☐ no work permit ☐
Other _____

Yes ☐ No ☐

2. **Will you look for work in the future?**

2.1. If yes, when (date) _____

Integration

1. **Did someone from your family join you in Germany in the last six months?** Yes ☐ No ☐

2. **Do you want to stay in Munich?** Yes, forever ☐
Yes, a few years ☐ No ☐
Don't know ☐

2.1. Would you move for work? Yes, within Germany ☐
Yes, within Europe ☐ No ☐
Don't know ☐

2.2. Do you want to return to your country once it is safe? Yes ☐ No ☐
Don't know ☐

Yes ☐ No ☐

3. **Did you make new friends in Germany?**

3.1. **Where are these people from?**

Your country Yes ☐ No ☐

Germany Yes ☐ No ☐

Other country Yes ☐ No ☐

4. **Did the refugees you are in contact with find work**

Yes, many ☐ A few ☐ One ☐ No one ☐

5. **Do you feel at home in Germany**

1 (Not at all) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (Completely) ☐

6.1 **How is your life now compared to 6 months ago?**

Better ☐ Worse ☐ Same ☐

6.2 **How will your life be in six months?**

Better ☐ Worse ☐ Same ☐

7. **Have you ever been invited to the house of a German?**

Yes ☐ No ☐

8. **Do you still live at *address from CV*?**

Yes ☐ No ☐

8.1 **If no, where do you live now?**

apartment alone or with own family ☐ apartment with flatmates ☐

another GU/camp ☐

8.2 **What is your new address?**

9. **What activities do you do outside of your house?**

Study/German ☐ Sport ☐ Shopping ☐ Meeting with people ☐ None Other _____ ☐

10. **Since coming to Germany, have you ever felt treated with less courtesy or respect because you are a refugee?**

Never ☐ Sometimes ☐ Often ☐ All the time ☐

Organisational details

1. **For how long have you learned German (in months)?** _____

2. **In Deutsch: Bist du gerade im Kurs?** Yes ☐ No ☐

2.1. Welches Niveau? (A1, A2, B1, B2, C1) _____

2.2. Wann und wieviel? _____

_____

2.1. Interviewer estimate (A1, A2, B1, B2, C1)

3. **How many hours per week do you learn German on your own?** _____

Yes ☐ No ☐

4. **Did you already get your asylum decision?**

4.1. If yes, what is the outcome?

accepted for 3 years ☐ accepted for 1 year ☐ rejected but can stay ☐ rejected and have to leave ☐

4.2. When? _____

5. **How much do you agree or disagree with the following statements?**

5.1. **I am happy that I came to Germany.**

1 (Not at all) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (Completely) ☐

5.2. **I will (still) be working in the next 6 months.**

1 (Not at all) ☐ 2 ☐ 3 ☐ 4 ☐ 5 (Completely) ☐

5.3. **Compared to what you expected, ist your life better, worse or as expected?**

Worse ☐ equal ☐ better ☐

5.4. **What did you know about the life of a refugee in Germany before you came?**

Worse information ☐ exact information ☐ better information ☐

5.5. **I need to focus on studying German before finding a job.**

Yes ☐ No ☐

5.6. **I had wrong information about Germany before I came.**

Yes ☐ No ☐

5.7. **What is the most important thing the German government could do to improve your situation?**

Facilitate family reunification ☐ Faster asylum decision ☐ Job finding support ☐ Better German courses ☐ Better housing ☐ free movement ☐ Other _____

C.4 Excerpt of the Pre-analysis Plan

Analysis

The analysis is divided into two parts, one focusing on labour market outcomes and one on further integration and self-reported satisfaction outcomes. Below, we focus on each of the parts separately, emphasizing the effects where our treatment could have an impact. As very effectively discussed in Olken (2015)[1] that is intrinsic in projects like ours.

Labour Market Outcomes

The hypothesis we would like to test here is simply whether participants in the treatment group have better labour market outcomes in the short (6 months) and medium (12-24 months) term compared to those in the control group. Evidence of positive effects would suggest that matching frictions between German employers and job-seeking refugees exist, and that the employment of refugees does not only depend on the skills they possess, but also on their possibility to be considered by employers who are trying to fill a vacancy. Overcoming these frictions may then facilitate labour market integration of refugees in Germany.

We consider two sets of variables. First, we look at a series of standard labour market outcomes, which can provide experimental evidence of a treatment effect. Second, we investigate a series of ancillary variables, which are useful to provide some (non-experimental) way of learning about the relative importance of different underlying mechanisms.

Main variables:

- Employed (at the point of the follow-up survey)
- Duration of employment (in months from the randomization day to the day of the follow-up survey)
- Wage (monthly (gross and net) wage at the point of the follow-up survey or in the last employment)

We define "employment" broadly as being in a paid job, internship, or vocational training. We might also consider each of the outcomes separately.

Once the main effect is established, it is important to understand what drives the result. The treatment may modify the outcomes of the participants by 1) creating awareness of the job opportunity, 2) reducing the search time, 3) enhancing the quality of the match or 4) serving as a referral to the employer.

[1] Olken (2015), Promises and Perils of Pre-Analysis Plans, *Journal of Economic Perspectives*, Volume 29, Number 3, Pages 61-80.

Identifying the channel(s) is relevant for policy-making. We would also like to check for alternative mechanisms, i.e. whether the treatment (rather than or together with removing matching friction) modified the skills of participants, their knowledge of the local labour market, or job-search behaviour. This might happen through job interviews, for instance.

Supplementary variables

- Time until the first interview/trial/employment offer
- Number of job interviews for the first job (invited, happened)
- Number of job trials for the first job (invited, happened)
- Number of applications for the first job
- Where searched for vacancies (indicator variable as in the baseline survey)
- Job/skill match (an indicator variable: overqualified/ok/underqualified, based on observables, can measure for jobs they apply to and for the job they actually get)
- Self reported job satisfaction, self reported match quality
- Reservation wage (at the point of the follow-up)
- Difficulty in the job search (indicator variable as in the baseline survey)
- (Ask employers to see if they consider our treatment as a referral, if refugees contacted them directly)

Integration Outcomes

The hypothesis we would like to test is whether earlier (better) employment leads to better integration outcomes in the short- and medium-term. The treatment will serve as an instrumental variable for employment.

Main variables (measures of integration):

- Intention to stay (dummy variable)
- Knowledge of German language (indicator variable)
- Local acquaintances (dummy)
- Activities: study, sport, shopping, meeting with friends (total number)
- Feel at home (indicator on Likert scale)
- Integration index: $\geq A2German + German\ friends + Invited + Activities + Feel\ home$

- Any other investment in human capital (as driving license)?
- Housing conditions
- Stress, happiness and optimism levels

These outcomes directly correspond to questions in the follow-up survey. Because many of these questions are included in the initial (pre-treatment) survey as well, these variable can be analysed both in levels and in changes.[2]

Network Effects

Two measures of network: 1) proxy - address (camp) and nationality, 2) directly ask in the follow-up survey, if their friends participated in the NGO's CV sessions and if, yes, ask for the names.

Possible outcomes: spillovers within the network, sharing information about vacancies and referrals. This would allow us to evaluate the extent to which results depend on whether contacts/friends of the focal individual have been treated as well. In addition, this also allows us to evaluate the extent to which knowledge of a friend being treated has any effect.

Inclusion Rules

All observations, for which we have CV information, pre- and post-treatment survey, will be included in the analysis. Participants who are not eligible for the experiment (see eligibility rules in section 3.3.2) will be excluded from the analysis.

Statistical Model Specifications

We will start by comparing the means between the treatment and the control group as the treatment should be orthogonal to the covariates.

We will complement the analysis with OLS regressions with treatment as the main independent variable. Although these may be too demanding given our sample size, we will include some specifications in which we add location and time fixed effects to our regressions: as the entry into the experiment spans over several months and locations, we expect significant differences between the locations over time, which

[2]Clearly, because of the randomisation the two results should be identical, but adding pre-treatment levels as controls might lead to more precise estimates, which could be important given our limited sample size.

will lower precision of the unconditional estimates. The coefficient of the treatment variable will, hence, measure the "intention-to-treat" effect within a given location for a given time.

For medium-term labour market outcomes and integration results, we will estimate both "intention-to-treat" effects and LATE using the treatment variable as an instrument for (earlier) employment.

We then will perform heterogeneity analysis and robustness checks with covariates (education, years of work experience, region of origin), for which the balance tests indicates significant differences.

There might be an opportunity to merge our data with some data from the lab, where some of our Arab speaking candidates have participated in an experiment. We could potentially get measures of risk taking and time preferences. However it is not yet clear if enough people will be part of both studies so that a meaningful analysis is feasible.

We intend to cluster observations at the location and time level. We have conducted CV preparation sessions around five different locations: EWH, Kammerspiele, Gruenwald, Caritas, Bayernkaserne.

Balance Tables

We will present balance Tables for the following variables: Country of origin (largest countries of origin), months in Germany, family in Germany, years of education, years of work experience, date of job search start, previous contact with employer, received job offer previously, uses Internet in job search, has language difficulties in job search process, does not know where to search, level of German, currently in German class, integration index, return intention. These all correspond to questions in the pre-treatment survey.

Heterogeneity

For both labour market and integration outcomes, there are several interesting dimensions of heterogeneity, which we intend to analyse. First, by nationality or by nationality group.[3] We might be able to analyse the countries with many refugees (Syria, Afghanistan and Nigeria) seperately, while the rest of the countries can be grouped as other Arab countries, other Asian countries, other Subsaharan African Countries.

Another dimension of heterogeneity will be the level of education. Here, we can group people according to the highest school level completed (no school, primary completed and some secondary, secondary completed and some university, university completed).

[3]Given our sample size, it is unlikely that we will be able to get meaningful results if we analyse each individual country of origin separately.

Other interesting dimensions of heterogeneity will be age group, single refugees versus refugees that came with their family, asulym opportunities, and duration of stay in Germany.

C.5 Consent Form

Consent form: University of Munich

Researchers at the University of Munich (Giesing Yvonne, Nadzeya Laurentsyeva) and the Ifo Institute (Michele Battisti) are planning a research project to study the integration of job-searching refugees in the German labour market. The purpose is to find out how refugees can be integrated into the labor market, which characteristics are especially important and how this impacts further integration.

The datasets that contain information about your CV and questions about integration in Germany are analysed in Munich in a pseudonymous form and information that allows personal reference will be stored separately for data security reasons. Only employees of the research team of the University of Munich and the Ifo Institute will have access to the data. The data will be saved on local files on computers of the LMU and the Ifo.

Your personal data is used only for this research project. It will not be passed to third parties for other purposes. As soon as the research purpose permits, the information that creates a personal reference will be anonymised or destroyed for data security reasons. The data is processed pseudononymously, so that no identification of individuals is possible. Anonymised and aggregated results will be published.

Your consent is voluntary. By withholding your consent you incur no disadvantages. You can revoke your consent for the future at any time and request deletion or destruction of your data.

I have received the information about the research project. I agree with the intended use of my data and currently have no further questions. For questions I can write to yvonne.giesing@econ.lmu.de

_____

Date, Place, Signature

C.6 E-Mail

Dear *NAME*,

Kindly find your German CV attached to this email.
There is a chance that we match you with a possible employer from our database. If we find an employer that is looking for someone with your qualifications, we will send your CV and they will contact you directly. While we do our best to support you in the job search, we cannot guarantee that we can find you a suitable employer, this is why we highly encourage you to keep searching for a job on your own. Here are some job-search tips for you:

- Register at the Agentur für Arbeit
  The Agentur für Arbeit helps job-seekers by providing advice and finding job vacancies.
- To register, you need to go there in person, once you have your work permit, and fill a form. Do not forget to take your ID (Ausweiss) and certificates if available!
- To get the address of the Agentur für Arbeit in your area, visit this link https://www.muenchen.de/rathaus/dienstleistungsfinder.html, search for "Arbeitsvermittlung" and then give in your address.
- Please, visit their website for further information: www.arbeitsagentur.de
- Use job-search websites Many people in Germany find jobs online, so you can additionally look for jobs using websites like:
  - http://www.monster.de
  - http://www.stepstone.de
  - http://www.jobpilot.de
  - http://www.jobboerse.de
- Continue to learn German, as this will greatly improve your chances of finding a job

If you find an employer through your own search and need support in preparing for the interview or in understanding the contract, please, contact us at this email address (*e-mail address*) and we would be happy to assist you.

In order to be able to contact you regarding possible job vacancies and other activities, it is extremely important for us to have your updated contact details (e-mail, phone, and whatsapp number). Please, let us know as soon as you change any of your contact details.

Please also like our Facebook Page to stay updated about new events:
Link to Facebook page

If your friends are also looking for a job, please recommend them to meet us every Thursday 3-5pm at *address*.

We wish you good luck and best regards,

Your *NGO* Team

C.7 Flyer

Figure C.1: Flyer to advertise CV preparation sessions

C.8 Pictures of the CV Preparation Sessions

Figure C.2: Pictures taken during CV preparation sessions in Munich

Appendix D

Appendix to Chapter 4

D.1 Additional Tables

Table D.1: The effects of the revolution without Cairo

	(1) lognwag	(2) logteduc	(3) logmedexp	(4) logsavings
Strong*2012	-0.100***	0.168**	-0.109	0.248***
	(0.0271)	(0.0768)	(0.115)	(0.0761)
Medium*2012	-0.0380	0.147	0.0414	0.250***
	(0.0287)	(0.103)	(0.0937)	(0.0865)
Strong Revolution	0.105***	1.465***	0.868***	-0.964***
	(0.0106)	(0.0272)	(0.0303)	(0.0280)
Medium Revolution	0.240***	1.811***	0.587***	0.0266
	(0.0132)	(0.0369)	(0.0297)	(0.0338)
2013	0.135***	-0.141**	0.546***	-0.318***
	(0.0240)	(0.0681)	(0.0793)	(0.0702)
Observations	13222	1905	20286	16686
r2	0.425	0.205	0.210	0.376

Notes: This table shows the mean and the standard deviation in brackets, all standard errors are clustered at the governorate level. Data is deflated and 2010 is the basis year. These figures are annual numbers for the financial Egyptian year, i.e. 2009 means July 2008-June 2009. Controlling for urban, education of household head, household size, number of children under 14. The source is CAPMAS/ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

Table D.2: The effects of the revolution without the 2010/2011 survey round

	(1) lognwag	(2) logteduc	(3) logmedexp	(4) logsavings
Strong*2012	-0.148***	-0.0882	-0.264*	0.146
	(0.0364)	(0.137)	(0.151)	(0.104)
Medium*2012	-0.0472	0.168	0.134	0.186
	(0.0306)	(0.143)	(0.144)	(0.111)
Strong Revolution	-0.00381	-0.337***	0.575***	-0.668***
	(0.0167)	(0.0362)	(0.0720)	(0.0510)
Medium Revolution	0.0571***	-0.233***	0.323***	-0.798***
	(0.0157)	(0.0741)	(0.0601)	(0.0593)
2013	0.173***	-0.0510	0.843***	-0.494***
	(0.0228)	(0.105)	(0.107)	(0.0926)
logtotdinc	0.695***	0.832***	0.789***	1.901***
	(0.0172)	(0.0790)	(0.0444)	(0.108)
Observations	10095	1585	15325	12863
r2	0.449	0.234	0.265	0.394

Notes: This table shows differences in the control group (low) and the two treatment intensities (medium and strong) for 2009. All figures are deflated, using 2010 as the basis. For column (1) to (4), it shows means and standard errors in parenthesis: * p<0.10, ** p<0.05, *** p<0.01. Column 5-7 respectively show the mean difference between medium treatment intensity and the control group, strong treatment intensity and the control group and medium and strong treatment intensity (t-statistic in parenthesis). Source: CAPMAS and ERF, Egyptian Household, Income and Expenditure Survey (HIECS).

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