ECONSTOR
Make Your Publications Visible.

A Service of
ZBW
Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Beerli, Andreas; Peri, Giovanni

**Working Paper**

# The labor market effects of opening the border: Evidence from Switzerland

KOF Working Papers, No. 431

**Provided in Cooperation with:**
KOF Swiss Economic Institute, ETH Zurich

*Suggested Citation:* Beerli, Andreas; Peri, Giovanni (2017) : The labor market effects of opening the border: Evidence from Switzerland, KOF Working Papers, No. 431, ETH Zurich, KOF Swiss Economic Institute, Zurich,
https://doi.org/10.3929/ethz-b-000169157

This Version is available at:
https://hdl.handle.net/10419/167648

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

ETH zürich Research Collection

Working Paper

# The Labor Market Effects of Opening the Border: Evidence from Switzerland

**Author(s):**
Beerli, Andreas; Peri, Giovanni

**Publication Date:**
2017

**Permanent Link:**
https://doi.org/10.3929/ethz-b-000169157 →

**Rights / License:**
In Copyright - Non-Commercial Use Permitted →

This page was generated automatically upon download from the ETH Zurich Research Collection. For more information please consult the Terms of use.

ETH Library

ETH zürich

KOF Swiss Economic Institute

# The Labor Market Effects of Opening the Border: Evidence from Switzerland

Andreas Beerli and Giovanni Peri

**KOF Working Papers,** No. 431, June 2017

KOF

**KOF**

ETH Zurich
KOF Swiss Economic Institute
LEE G 116
Leonhardstrasse 21
8092 Zurich, Switzerland

Phone +41 44 632 42 39
Fax +41 44 632 12 18
www.kof.ethz.ch
kof@kof.ethz.ch

# The Labor Market Effects of Opening the Border: Evidence from Switzerland*

Andreas Beerli (ETH Zürich) Giovanni Peri (UC Davis)

June 2017

**Abstract**

Between 1999 and 2004 Switzerland fully opened its border region (BR) to cross-border workers (CBW), who are foreign residents commuting to Switzerland for work. In this paper, we exploit the timing of implementation and the fact that CBW commute almost exclusively to municipalities close to the border to estimate the effect of this policy on foreign labor supply and on native labor market outcomes, using a difference-in-difference approach. We find that opening the border to CBW increased their employment within 10 minutes of commuting time from the border by 4 to 5 percentage points. The increased inflow was mainly constituted of highly-educated workers and it was associated with an increase of wages of highly-educated Swiss workers and no significant changes of wages of other workers. We also find weak evidence that employment and hours worked by less educated native workers increased. Native highly-educated workers became more likely to fill top managerial positions after the liberalization and they became more likely to stay in border regions. Occupation upgrading and complementarity with highly-educated natives, particularly strong in high-skilled manufacturing and knowledge-intensive services, contribute to explaining these effects of CBW on natives.

**JEL Codes:** F22, J24, J61.

**Key Words:** border region, free labor mobility, policy change, cross-border workers, labor markets.

*Andreas Beerli: KOF Swiss Economic Institute, ETH Zürich, Leonhardstrasse 21, 8092 Zürich, Switzerland, beerli@kof.ethz.ch; Giovanni Peri: Department of Economics, UC Davis, One Shields Avenue, Davis Ca 95616, USA, gperi@ucdavis.edu.

# 1 Introduction

Some European countries are reconsidering their commitment to the free mobility of workers within the European Union (EU). They fear that immigration from the rest of Europe could harm the labor market opportunities of their native workers. Following these type of fears, British citizens voted, on June 23rd 2016, to leave the EU (the so-called "Brexit"). Some policy makers have emphasized the costs of free mobility within Europe, arguing that it will produce fewer jobs and depressed wages for local workers. Free mobility of workers, however, also means more opportunities for businesses to hire a wider variety of skills. This may stimulate productivity and growth offsetting the consequences of pure labor market competition.

Rarely have economists been able to study the consequences of a policy that opened labor market access to foreign workers, permanently and completely. This is what we do in this paper. We consider the case of Switzerland, which - in steps between 1999 and 2007 - granted EU citizens free access to its labor markets. In particular, we will focus on the group of workers who were first granted free access. These are the cross-border workers (CBW), residents of the countries bordering Switzerland (Italy, Germany, Austria and France) and allowed to work in Switzerland, commuting there on a daily basis. Agreements regulating the flow of CBW date back to the first part of the 20th century, when Swiss employers could hire them if no Swiss resident was found to fill a job opening. Beginning in 1999, with the signing of the bilateral agreement for free labor mobility with the EU, the constraints on Swiss employers to hire CBW were progressively reduced and fully abolished in 2004. In 2007 all other EU immigrants were granted free labor market access to labor markets in Switzerland. Despite mounting discontent, free mobility of CBW in Switzerland has persisted to this day.[1]

The case of CBW in Switzerland is useful as a case-study of a policy that *permanently and completely* removed legal barriers to labor market access on foreign labor supply. There are three important advantages in studying this CBW liberalization. First, the liberalization process entailed two distinct phases. Starting with significant migration barriers (pre-1999), a partial liberalization (1999-2004), and a full liberalization (post 2004) phase followed. Second, as CBW commute to work from abroad, these policies affected the labor supply in regions very close to the border, while they did not affect similar regions farther away. These features allow us to analyze the local labor markets affected by CBW before and after the policy change in comparison with similar labor markets not affected by the policy because they were somewhat farther away from

[1] The Ticino region of Switzerland, for instance, has approved a measure in September 2016, to limit again the movement of CBW. See "The Parable of Ticino" in The Economist (2016), September 24th.

the border. Finally, the permanent nature and the policy-origin of this immigrant flow makes it more informative and relevant for the discussion of potential effects immigration policies than the analysis of idiosyncratic events such as temporary push-driven surges in immigrants.

CBW are a specific type of migrant workers. They work, but do not live and hence do not spend and consume in Switzerland. While this may limit the ability to generalize from this case, it also isolates the "labor supply" effect from the potential "consumption" effect of immigrants. Several effects, on local housing prices (e.g. Saiz, 2003) and on increased local demand for non-tradable consumption goods (e.g. Hong and McLaren, 2015), do not result from this inflow. This policy produces a pure labor supply shift in the labor markets near the border. Hence this episode should produce the strongest negative effect on demand for native workers and hence a lower bound on the wage and employment effect of immigrants.

The main findings of this paper are the following: First, the full liberalization of CBW in Switzerland (achieved in *Phase II* starting in 2004) produced an increase of cross-border workers equal to 4 to 5 percentage points of total employment in municipalities within 10 minutes of commuting time from the border. Municipalities within 10 to 20 minutes of commuting time experienced an increase of about 2 to 3 percentage points of the labor force, while municipalities between 20 and 30 minutes of commuting time from the border experienced less than a one percentage point change.[2] This increase began after the full liberalization of 2004 and continued until 2010, the last year of our analysis. We also document that the inflow was more concentrated among highly-educated workers, relative to the existing Swiss labor force.

Second, looking at the impact on wages and employment of native workers, we find that Swiss workers with tertiary education within 10 minutes from the border experienced a significant positive wage change following complete liberalization. Primary-educated workers experienced a less significant increase in employment and total hours worked, instead. The changes of wages and hours worked by secondary-educated workers in the 10-15 minute commuting area were not significant. As the change in CBW represented an inflow of highly-educated workers, the wage increase of highly-educated natives cannot be rationalized by a simple model of pure supply shift with homogeneous labor and no demand changes. However, we document that highly-educated native workers specialized in different occupations and responded by taking advantage of new opportunities in managerial positions, complementary to jobs of CBW. This mechanism can contribute to generate complementarities and efficiency-productivity gains that may explain the wage growth.

[2] At higher travel time from the border the growth of CBW employment share was even smaller than 1 percent after 2004.

To better identify winners and losers among native workers, and to understand the channels through which these wage and employment effects occurred, we analyze, in detail, the impact of opening the border on the flow of native workers into and out of employment, and into and out of the municipalities. We also track their transitions across occupations, jobs, sectors, and the heterogeneity of effects across sectors and types of firms. We find suggestive evidence of three interesting mechanisms. First, fewer highly-educated native workers from other regions of Switzerland moved into municipalities close to the border after the liberalization. However, also fewer highly-educated natives moved out of border municipalities. While CBW may have reduced immigration of natives from the rest of Switzerland, it also encouraged highly-educated workers to stay, consistent with the positive wage effect on this group. Second, native highly-educated workers were more likely to move to higher managerial positions after the opening of the border, and middle-educated workers upgraded their occupations to higher paid ones. Third, wages of natives increased the most in the high-tech manufacturing sector following the free mobility of CBW. Also highly-educated workers, in the knowledge-intensive sector and in large firms, experienced larger wage increases, and these are the same sectors that absorbed most of the CBW. There is also some evidence of an increase in employment (but not wages) of low-skill intensive services such as hospitality, restaurant, and food services. The employment growth of less-skilled natives is consistent with a simple complementarity effect of highly-skilled CBW who, by working in more cognitive and analytical-intensive occupations, may have increased demand for more manual type of jobs filled by the less skilled.

This paper is related to a few recent studies that exploit changes in policies on cross-border workers to learn about the consequences of an increase in foreign labor supply. A recent paper by Dustmann, Schönberg and Stuhler (2017) analyzes the opening of Germany's border to Czech cross-border workers in June 1991 and the subsequent large inflow to municipalities close to the border. Between 1991 and 1993, employment of Czech workers increased strongly in areas close to the border. The paper tracks the effect on employment and wages of natives. After 1993, the policy was de-facto withdrawn and a corresponding decrease in the number of Czech workers took place. The paper analyzes the short-run impact of such temporary shock in a difference-in-difference set-up. It finds a strong, negative effect on employment of natives and a more moderate, negative effect on wages. The negative effect on native employment is mainly due to a decrease of inflows of natives from non-employment and from employment in other regions of Germany. The authors use distance from the Czech-German border to identify the intensity of the supply shock and compare native outcomes in matched regions farther

from the border. Importantly, the episode they study was *temporary*, as the policy was only in place for two years, and cross-border workers were mainly *low- skilled*. It took place in a historically extraordinary period, when the economy of the Czech Republic was depressed and undergoing a major transition, right after the fall of the Communist regime. Hence, our results are particularly interesting and informative when compared to those in Dustmann, Schönberg and Stuhler (2017). Several features of the Swiss policy standing in contrast to the German one, e.g. its early announcement, its phased-in implementation and predictability, and the fact that immigrants were mostly high-skilled, plus the longer-run perspective of our analysis, may all contribute to explain the much more positive effects for native workers that we find relative to Dustmann, Schönberg and Stuhler (2017).

In another paper closely related to ours and written concurrently, Ruffner and Siegenthaler (2016) present complementary results on the impact of the same liberalization episode in Switzerland on firms. Using a similar difference-in-difference strategy as we do here, they show that the policy had a positive impact on the productivity and innovation activity of firms, as we will describe below in greater detail. The focus of our paper is to document the validity of the policy experiment, and to characterize the dynamics and the channels through which immigration affected wages and employment of natives. In particular we consider the internal migration dynamics and the sector- and skill-specific responses to the opening of the border. They provide, instead, the analysis of the impact on domestic firms' outcomes showing important evidence on the positive effect of the increase in CBW on firms' innovation, productivity and sales, and strong negative effects on off-shoring.[3]

Evaluating the impact of policy changes is a step forward in the literature on the labor market effects of immigrants. Most studies perform cross-sectional or panel regression analysis exploiting area variation of immigrants. Often, however, these studies lack a strong identification strategy, so the result can only be interpreted as partial correlations. Some of the most prominent papers in the literature are summarized in Blau and Kahn (2012), Lewis and Peri (2014), and Longhi, Nijkamp and Poot (2005). Only a few recent papers have analyzed specific immigration policy changes and their impact on economic outcomes apart from those cited above. Kerr and Lincoln (2010) and Peri, Shih and Sparber (2015*a*) have exploited the change in the H1-B visa cap (the high-skilled immigrant visas in the U.S.) to analyze effects on innovation and productivity in U.S. cities. Bohn, Lofstrom and Raphael (2014) analyzed the impact of Arizona's Worker Act

[3]Two policy reports (Henneberger and Ziegler, 2011; Losa, Bigotta and Gonzales, 2012) first explored the idea to study the effects of the free movement of persons policy by comparing wage and employment changes between regions close to the Swiss border and the interior region. In an unpublished paper, Bigotta (2013) analyses the effects of this policy on the unemployment duration of natives.

on undocumented immigrant labor market performance. For Europe, Glitz (2012) analyzed the effect of a policy allowing ethnic Germans in Eastern Europe to obtain German citizenship, which generated - in combination with the fall of the iron curtain - a sudden inflow of migrants. Also combining a sudden push-driven inflow of refugees and national policies of refugee dispersal, Foged and Peri (2016) estimate the impact on natives' wages, employment, and occupational transitions. They find substantial job upgrading among natives that granted them positive wage effects after the refugee inflow. A handful of additional papers tried to measure immigration policies and estimate the effect of policy changes on immigrant inflows in a multi-country gravity framework. Mayda (2010) and Ortega and Peri (2014) are two examples. In the Swiss context, Abberger et al. (2015) show that freer immigration for EU workers increased their net inflows by 10,000 to 15,000 individuals annually. Beerli and Indergand (2016) point out that the increase in the positive selection of newly-arriving immigrants was mostly driven by skill-biased demand-pull effects rather than immigration policies.

The rest of the paper is organized as follows. Section 2 describes the changes in policy concerning the access of cross-border workers to jobs in Swiss firms between 1999 and 2010. Section 3 describes the main data sources, the key trends relative to the supply of cross-border workers and resident immigrant workers, and shows summary statistics of demographics and labor market outcomes of citizens. Section 4 discusses the main empirical specifications and section 5 presents the estimates of the impact of border liberalization on the supply of CBW and total new immigrants in the border region. Section 6 analyzes the consequences on key labor market outcomes for natives such as wages, employment, and hours worked. Section 7 inquires into possible channels, dynamic transitions, and heterogeneous effects triggered by opening of the border to CBW. Section 8 concludes the paper.

## 2 Policy Framework and Timeline

The process of opening the Swiss labor market to European Union citizens started with signing of bilateral agreements between the EU and Switzerland on June 21, 1999 that included the Agreement of Free Movement of Persons (AFMP), i.e. the full bilateral access to each other's labor markets.[4] In an announcement by the federal administration in 1999, it became clear cross-border workers would be the first group to benefit from a phase-in of the liberalization reform

[4] As an integral part of the EU's 'acquis communautaire', the EU required free mobility of workers as a pre-requisite to grant access to the EU market to Swiss firms (Bundesrat, 1999). The package of bilateral agreements included also agreements on the reduction of technical barriers to trade, the liberalization of trade in agricultural goods and public procurement, transport and the participation of Switzerland in the EU's research framework program. See Online Appendix C for more details on the bilateral agreement.

(Bundesrat, 1999). Yet, the exact implementation of the liberalization remained uncertain since the bilateral agreements had to go through a ratification process in all EU member states and through a national referendum in Switzerland. This took place in May 2000 and the agreement was approved with 67.2% of favorable votes.

Due to long-established bilateral agreements with neighboring countries the group of *cross-border workers* (CBW) enjoyed a special status in the *border region* (BR).[5] Prior to 1999, firms were allowed to hire a CBW if no equally qualified resident worker could be found for a given job (the so-called "priority requirement").[6] Moreover, CBW could not work in the *non-border region* (NBR) of Switzerland. The remaining foreign workers who resided in Switzerland, that we call *resident immigrants (RI)*, were subject to yearly national quotas set by the federal government and to the "priority requirement". Once allowed, they could work anywhere in Switzerland. Figure 1 shows a map of Switzerland with the municipalities in the BR shaded in gray, while the NBR are represented in white. The separation of municipalities between BR and NBR does not overlap with the cantonal borders (indicated by black lines) or other cultural characteristics of the population (e.g. the major language areas). The boundaries of the BR remained unchanged with the introduction of the free movement policy.

Between 1994 and 1999, the status quo was as described above. This is what we call the *Pre-Liberalization Phase*: CBW had restricted access to the labor market in the BR, they had to commute daily, and could not work in the NBR. Then in *Phase I* of the liberalization, between June 1, 1999, and May 31, 2004, cantonal immigration offices in the border region gained more discretion in allowing firms to hire CBW.[7] In particular, the official introduction of the AFMP in 2002 was an important step toward opening the border region labor market to CBW. CBW were allowed to commute weekly (rather than daily), their permits were no longer bound to a particular job and they were valid for 5 years (rather than only one year), and applicants for a new CBW permit were not required to have resided in the adjacent border region of the neighboring country for the previous six months.

On June 1, 2004, *Phase II* of the reform was enacted and the labor market of BR municipalities became fully accessible to CBW who could be hired by local firms at no different condition

[5]These bilateral agreements were signed with Italy in 1928, with France in 1946, with Germany in 1970 and with Austria in 1973.

[6]Firms which wanted to hire a CBW had to provide the cantonal migration offices with details about the job requirement and the working conditions. They also had to demonstrate to have searched unsuccessfully for a suitable worker. In turn, the cantonal immigration offices checked whether there was no equally qualified resident worker registered as unemployed. This procedure imposed substantial costs for firms to hire CBW.

[7]Conversations with representatives from cantonal immigration offices revealed there was also a more relaxed handling of new CBW applications after 1999 and particularly after the national referendum on May 21 2000 as it was clear that eventually CBW would be the first to gain unrestricted access to the border region.

than a Swiss worker. CBW still had no access to work in the NBR. This phase marks the biggest jump in freedom of access to labor markets for cross-border workers.

Finally, on June 1, 2007, Border and Non-Border regions adopted full liberalization for CBW and for resident immigrants from the EU. Importantly, the progressively easier access of CBW to labor markets in the border region from 1999 to 2007 clearly generated a growing asymmetry between regions close to the border and other regions in accessing foreign labor supply. This was due to the fact that CBW - whose concentration were largest within the areas closest to the border - had progressively more access to Swiss jobs, while other EU immigrants to Switzerland had the same access to all labor markets in Switzerland, if they were admitted.

# 3 Data and Summary Statistics

## 3.1 Data Sources and Variable Definitions

Our main data source is the Swiss Earnings Structure Survey (SESS) which collected demographic and labor market information every two years from 1994 to 2010 and constitutes a representative repeated cross-section of workers in Switzerland.[8] The survey includes detailed information about workers, including their place of work (by zip code). We use this information to identify the municipality of work (the smaller units identified in Figure 1) for each worker.[9] As described in Section 2 and shown in the Figure, each municipality belongs either to the BR or the NBR. To compute the shortest travel time to the national border for each municipality, we identified municipalities with a road border crossing using data from Federal Customs Administration and used data on road travel time between any two municipalities from search.ch, a web search engine.[10]

Our data include individuals between 18 and 65 years old, working in the private sector with non-missing information for nationality, place of work, education, wages, hours worked, and other basic demographics. In the data we can identify workers based on their residency permit as *native workers* (with Swiss nationality), immigrant workers with a short-term residency permit (RI), and cross-border workers (CBW). Combined, we denote the last two groups as *new immigrants*.[11]

[8]The official title of this data set is "Bundesamt für Statistik, Schweizerische Lohnstrukturerhebung 1994-2010" (BFS, 2010). The survey reflects the labor market situation on October 31 of the corresponding year.

[9]We use an official crosswalk from the Federal Statistical Office (FSO). As the number of municipalities (and zip codes) changes over time due to mergers, we use the municipality definition in year 2000 as a time-invariant unit. Observations with outdated zip codes that could not be matched (less than 0.3%) were dropped. We thank Maurizio Bigotta for sharing the data of border region identifiers for each Swiss municipality. See Losa, Bigotta and Gonzales (2012) for a detailed description.

[10]We thank search.ch and Andreas Steinhauer for sharing the commuting data with us. Municipalities with a border crossing are assumed to have zero travel time to the national border.

[11]Technically, short-term resident immigrants hold either a L permit (4 to 12 months) or a B permit (1 to 6

The first outcome of the policy changes we analyze is the change in the number of cross-border workers and new immigrant workers (RI+CBW) as a share of total employment. When we consider outcomes relative to native workers in a municipality, we use the total number of hours worked and their hourly wage as measures of their labor supply and marginal productivity, respectively. The data set contains the gross monthly wage for each individual worker (in the month of October) in Swiss Francs. This measure includes social transfers, bonuses, and one-twelfth of additional yearly payments. We divide this measure by the number of hours worked in October and we use the consumer price index to deflate it into the *real hourly wage* of an individual worker at 2010 constant prices. We then express *hours worked* as a fraction of the number of hours worked by a full-time worker so that one unit is a full-time worker equivalent.

In our regressions, we aggregate data at the municipality level, constructing the total number of workers, total working hours, or the average log hourly wage.[12] In most of the analysis we separate outcomes by skill group. As education is a key determinant of skills, we use three groups, by level of schooling, as capturing the relevant differences. This is similar to the common partition between college- and non-college-educated used in large part of the wage inequality and immigration literature, but with one intermediate skill to refine our analysis and because in the Swiss education system people with secondary education tend to do more technical and specialized jobs than those with primary education only. We define workers with tertiary education as being *highly-educated*. Workers with less than a college education are then partitioned in two further groups. Those with secondary education, up to completion of it, are defined as *middle-educated* and workers with only completed primary education or less as *low-educated*.[13]

In section 7, we use two complementary data sets to analyze worker transitions and heterogeneous effects across subgroups. The first data set is the Swiss Labor Force Survey (SLFS), which we use with similar sample restrictions and definitions for skill groups and geography. This data set covers the whole population, including unemployed and individuals currently not in the labor force. Information on the place of work of individuals is available yearly since 1996. As individuals were interviewed repeatedly (up to five years), we can track individuals over consecutive years and analyze transitions.[14] We exploit this feature to construct a measure for

years), whereas cross-border workers hold a G permit. The foreign-born individuals with a permanent residence permit (C permit) can be considered as *earlier immigrants*. This is a group that we do not include in our analysis.

[12] When analyzing wage outcomes we trim our sample by excluding individuals with wages above the 99th percentile of real hourly wages in each year.

[13] As the education level has a considerable amount of missing information (roughly 15% on average), we checked the consistency of all results by classifying workers into wage terciles each year or using the the 23 available occupations in the data set to classify them into groups of high, middle and low-paying occupations. All results that we show are similar when we use these alternative skill classifications.

[14] We focus on individuals' transitions between two consecutive years as most individuals are only two consecutive years in the panel. Although this data set is much richer in scope as the SESS, its sample is much smaller at the

the up-/down-grading of an individual's occupation or for the flow (in or out) of a municipality of work to employment in other areas or to non-employment (see definitions in section 7). A second complementary data set is the Swiss Business Census (BC), available in 1995, 1998, 2001, 2005 and 2008. It covers the universe of public and private sector establishments in Switzerland and reports for each the total employment of natives and foreign workers. We use it to analyze the share of native workers across different industries.

### 3.2 Summary Statistics and Trends

The group of CBW went from about 7% to 9.5% of the employment in the Border region from 1998 to 2010. Moreover, as we show below, their presence became more concentrated in the municipalities closest to the border. How did the characteristics of CBW and the possible change of these characteristics during the period considered compare to the characteristics of native workers? The potential labor market impact of this increased inflow of workers depended on their skills and how they compare to those of natives. Table 1 shows the summary statistics for the population of CBW and native workers in the border regions of Switzerland. We report the characteristics of those two populations in 1998 and 2010 and their change. Three features are noteworthy. First, while in 1998 the composition of CBW was more concentrated among the less-educated relative to natives (with 33% among CBW with only primary education versus 13% of natives), the change in composition of CBW during the period considered was strongly towards highly-educated. In 2010, the percentage of college-educated among CBW was comparable to that of natives (28% to 26%), and the net change during the period considered was quite college-intensive for CBW relative to natives (see the columns labeled "change" in Table 1). The growth of CBW in the 1999-2007 period represented a skill-intensive increase in labor supply. Second, CBW were less likely to be in high management positions and more likely to be in non-management positions, relative to natives. This is consistent with the interpretation that CBW were highly-educated and had technical skills but may lack the cultural skills to be at the top management levels of Swiss companies. They specialized instead in Information Technology, R&D, and other professional functions. Third, their inflow between 1998 and 2010 was mainly in the intermediate and high tercile of the wage distribution, confirming their high level of skills. The sector composition of CBW and native workers shows that the largest increase for the first group was in IT/R&D/Business and real estate, while, for the group of natives, the share of workers in health occupations grew the most.

level of our geographical units which is why we use it only as a complementary data source. However, all our baseline findings based on the SESS are qualitatively similar when we use the SLFS instead.

It is also useful to compare the economic and demographic characteristics across the four regions that received different intensity of the "treatment" (availability of CBW), with the more distant regions from the border (above 30 minutes of commute) being the "control" group as it hosted a negligible number of those workers. Table 2 shows summary statistics for municipalities in the border region in the distance bins at $0-10, 10-20, 20-30$, and more than 30 minutes travel time from the Swiss border. The last column shows the characteristics of municipalities in the entire non-border region that we add to the control group in some specifications. Looking at education, age, and gender composition as of 1998, the last year before the policy changes, one does not identify any specific or systematic differences. The bin closest to the border has a larger Italian and French speaking population, relative to the more distant bins, which is due to the historical composition of Swiss Cantons. Also, the region close to the border has a larger share of workers in large cities. However, the second closest region does not have a large urban population and the sector composition of employment does not exhibit a clear pattern. In our empirical analysis we control for fixed effects at the municipality levels, region-trends, and sector-composition driven effects. However, there does not seem to be a systematic correlation of the considered economic variables with the distance from the border, which provides further reassurance to the validity of our identifying assumption. As we will detail below, we also test the pre-1999 trend in immigrants and cross-border workers across distance bins to make sure that those were not significantly different.

# 4 Identification and Empirical Specifications

Our identification strategy is based on the timing of the labor market liberalization for CBW and on the difference that the policy change produced in areas near the border relative to areas further away. Figure 2 shows the essence of the identifying variation that we use in our analysis. In the top two panels of that figure, denoted as Panel A, we show CBW as share of total employment in municipalities grouped based on their commuting time from the national border crossing. The graph shows the values aggregating 5-minute bins from 0 to 85 minutes of travel time from the border, with 0 representing a municipality with a border crossing. Each of the two top panels has four lines, representing the CBW share in different years. We show the connected values for the years 1994 and 1998, which are both before any policy change, for year 2004 which is at the end of *Phase I* and at the very beginning of *Phase II* of the implementation of the free movement agreements, and then in year 2010, which is six years after

full liberalization.[15] The left panel represents municipalities in the border region going up all the way to the national border. The panel on the right represents municipalities in the non-border region and, hence, it does not include municipalities less than 35 minutes from the border.[16] It is clear from these two pictures that CBW are a significant share of employment only in border regions and, within them, only in municipalities that are very close to the border. Even before the policy reform, CBW constituted 10-20% of employment, but only in municipalities within 15 minutes of commuting time from the border. The gradient of their employment share is very steep so that past 30 minutes of commuting time from the border their presence was essentially zero.

What is most important for our identification, however, are the two lower panels of Figure 2. They show the net change of the number of CBW as share of employment in 1998 for the period 1994-1998 (pre-liberalization), for the period 1998-2004 (during *Phase I* of liberalization), and for the period 2004-2010 (during *Phase II* of liberalization). Importantly, the 1994-1998 change is very small and even negative for municipalities near the border, the change in the period 1999-2004 is positive for municipalities between 0 and 20 minutes from the border and much smaller elsewhere, and the change between 2004 and 2010 is large and positive for municipalities up to 20 minutes from the border, non-negligible but much smaller for municipalities between 20 and 30 minutes of commute time, and close to zero for municipalities above 30 minutes (and exactly zero above 40 minutes). Hence most of the change associated to liberalization of CBW took place between 0 and 20 minutes from the border, with some effects up to 30 minutes. The non-border region (on the right in Panel B of Figure 2) shows essentially no changes during *Phase I* or *Phase II* because the distance from the border implies that CBW did not work there even after liberalization. In some robustness checks below we include municipalities in the non-border region. This contributes to our analysis only by increasing the size of the control group, i.e. those municipalities with more than 30 minutes from the border that received essentially no treatment. We also check that the large inflow of CBW in municipalities near the border between 2004 and 2010 was not offset by a corresponding decrease of resident immigrants but that it resulted in a total increase of foreign-born in those regions. This is shown in the Online Appendix. In Panel B of Figure A1, we can see that, for the border regions, the change in new immigrants as a share of employment mirrors the changes of CBW being negative and rather

[15] In fact, the full free mobility of CBW was implemented on June 1, 2004, and the data points in the SESS represent the situation of the labor market in October 31 of a particular year. Thus, the data point in 2004 can be regarded as the first year of *Phase II*.

[16] For the sake of illustration, bins with a very low level of total employment are omitted from this figure, i.e. bins in the border region more than 80 minutes from the border and bins in the non-border between 13 and 35 and above 85 minutes from the border. In the analysis below, the sample includes all municipalities as indicated.

flat in the 1994-1998 period, positive and decreasing with distance in the 1999-2003 period and larger and with a steeper decline away from the border in the 2004-2010 period. For the non-border region, whose foreign-born are almost only resident immigrants, we see more noise and non-zero changes in each period without a clear pattern in terms of travel time from the border.

### 4.1 Basic Treatment-Control Specification

We first test formally whether the full opening of the border after 2004, corresponding to *Phase II* in our policy characterization, had a significant effect on several outcomes in municipalities very close to the border, relative to municipalities farther than 30 minutes from the border, where essentially no CBW were employed. To this end, we define a dummy $FREE_t$ which equals zero prior to 2004, and it is one beginning in 2004, when workers could be freely hired in border region. Then we interact this variable with indicator dummies that differentiate municipalities according to their distance from the border so that $I(D_i \leq dist_m < D_j)$ is equal to 1 if municipality $m$ is between $D_i$ and $D_j$ minutes of commuting time from the border and 0 otherwise. This strategy produces a treatment-control type of framework as the distance of a municipality from the border determines the intensity of the received "treatment" represented by CBW. Considering municipality $m$ in year $t$ as unit of observation and calling $y_{m,t}$ an outcome in this municipality, the empirical specification we estimate is as follows:

$$\begin{aligned} y_{m,t} &= \alpha_m + \alpha_t + \beta_0 FREE_t + \beta_{d1}\left[FREE_t \times I(dist_m \leq D_1)\right] + \\ &\quad \beta_{d2}\left[FREE_t \times I(D_1 < dist_m \leq D_2)\right] + \\ &\quad + \beta_{d3}\left[FREE_t \times I(D_2 < dist_m \leq 30)\right] + \gamma Controls_{m,t} + \epsilon_{m,t} \end{aligned} \tag{1}$$

The term $\alpha_m$ represents municipal-level fixed effects. The term $\alpha_t$ capture year fixed effects. We usually partition the distances within 30 minutes from the border into three groups: $[0-10)$, $[10-20)$, and $[20-30)$ so that we can estimate a potentially decreasing effect of the "treatment" on municipalities progressively farther from the border. The municipalities at 30-plus minutes constitute the control group. In the basic specification we limit our analysis to municipalities in the border region. For the specifications including the whole country, municipalities in the non-border region are also included and they are in the control group.[17] The term $Controls_{m,t}$ captures economic controls that may affect labor demand in the municipality. We usually include

[17] When we include the non-border region (NBR) in the sample, the definition of the dummy is $FREE_{m,t}$ and, for the municipalities in NBR, it equals one only from 2007 as that is the year of full liberalization of mobility for CBW in non- border region.

municipality fixed effects, and region-by-year effects, which capture region-specific economic trends. The main labor demand control included is a variable that captures the sector-driven growth in local employment.[18] The basic idea for this variable is that industry-specific demand shocks at the national level affected municipalities differentially due to their initial industry specialization. In other words, if employment in a given industry increased (decreased) nationally, municipalities in which that industry represented a significant share of employment must have experienced a positive (negative) relative change in the demand for workers relative to those where that industry was scarcely present. We define the sector-driven employment growth for group $G$ in a commuting zone $cz$ in year $t$ as:

$$\widetilde{EMP}^{G}_{cz,t} = \sum_{i \in \{1,50\}} \left( EMP^{G}_{i,cz,1994} \times \frac{EMP^{G}_{-cz,i,t}}{EMP^{G}_{-cz,i,1994}} \right) \tag{2}$$

where $EMP^{G}_{i,cz,1994}$ is the employment level of group $G$ (which could be, alternately, all workers or specific education group of workers) in commuting zone $cz$ and (2-digit) industry $i$ in the earliest available year, 1994. $\frac{EMP^{G}_{-cz,i,t}}{EMP^{G}_{-cz,i,1994}}$ is the group employment growth factor between 1994 and year $t$ for the industry nationally, excluding the commuting zone of interest.[19] Following the literature, we sometimes call this imputed demand-shifter the "Bartik index" for employment growth, following Bartik (1991). The term $\epsilon_{m,t}$ is an idiosyncratic error with zero mean and the key assumption is that it is uncorrelated with the interaction of policy and the distance dummies. The main coefficient of interest in regression (1) is $\beta_{d1}$ which captures the impact of the free movement policy where it should be at its strongest. The value of $\beta_{d2}$ and $\beta_{d3}$ are also interesting as they capture how the effects fades when moving away from the border.

## 4.2 Year-by-Year Analysis

While the full opening to CBW was implemented in 2004 with *Phase II*, the signing of the AFMP in 1999 triggered progressive loosening of immigration restrictions even before full liberalization. As described in section 2 above, some measures reducing the barriers to CBW mobility were enacted beginning with *Phase I*, between 1999 and 2004. We analyze the dynamics of the reform

[18] This control was initially proposed by Bartik (1991) and Blanchard and Katz (1992) and has found wide application in the literature, e.g. Autor and Duggan (2003); Peri, Shih and Sparber (2015*b*). We include this control as the liberalization of trade with the EU after 2002 (see Online Appendix C) and differential technological growth may have affected local growth trends. The Bartik control allows absorbing such sector-driven demand trends that could affect regions differently due to their pre-existing industrial structure.

[19] Here, group $G$ is total employment, later - e.g. in section 6 - we will use education group specific Bartik measures. To avoid spurious correlation, we exclude each commuting zone's own industry employment in the calculation of the growth factor. Note that we can only construct meaningful Bartik controls on the commuting zone level, as the sample size is too small at the municipality level. Each municipality belongs to one of 106 commuting zones which are often used to represent local labor markets (e.g. Favre, Lalive and Zweimüller (2013)). We dropped the industry 'Recycling' which was not available in all years.

in a regression environment by using interactions of the distance indicator dummies with each year, including both the pre- and post-reform year, and omitting (and hence standardizing for) the year 1998 which is the last year before *Phase I* of the reform. This is implemented by estimating the following specification:

$$\begin{aligned} y_{m,t} &= \alpha_m + \alpha_t + \sum_{t=1994}^{2010} \gamma_{d1,t} I(year = t) \times [I(dist_m \leq D_1))] \\ &+ \sum_{t=1994}^{2010} \gamma_{d2,t} * I(year = t) \times [I(D_1 < dist_m \leq D_2))] \\ &+ \sum_{t=1994}^{2010} \gamma_{d3,t} * I(year = t) \times [I(D_2 < dist_m \leq 30))] + \gamma Controls_{m,t} + \epsilon_{m,t} \end{aligned} \tag{3}$$

The variable $I(year = t)$ is an indicator dummy equal to one in year $t$ and zero in every other year, while the other variables are as defined in equation (1). We include year dummies, $\alpha_t$ and area dummies, $\alpha_m$. Since we omit the interaction term for year 1998 in the summation, the other coefficients will represent the difference relative to the 1998 effect. The estimates of the coefficients $\gamma_{d1,t}$ for each year between 1994 and 2010 are the parameters of interest. When considering this specification, we have a testable assumption regarding the validity of our identification strategy. The estimated impact of the policy should be zero prior to the date it was announced. Hence, we should find $\gamma_{d1t} = 0$ for $t < 1998$. If the policy had any impact on any outcome, $y_{mt}$, we should find a positive effect after the signing of the agreement after 1999, in the region closest to the border. The estimates for the $1999 - 2004$ years provide evidence of an effect during *Phase I*, while the estimates of the post-2004 coefficients test wether there was an effect during *Phase II* of the reform. Hence, some of the coefficients $\gamma_{d1,t}$ for $t \geq 1999$ should be larger than zero. The time profile of the estimates $\gamma_{d2,t}$ and $\gamma_{d3,t}$ would identify the impact, if there is any, in each year in the second and third distance bin relative to the municipalities over 30 commuting minutes which should have not been affected.

# 5 Effects on CBW and New Immigrants

## 5.1 Impact of Each Policy Phase on CBW Supply

Table 3 shows the estimates for the coefficients of interest ($\beta_{d1}$,$\beta_{d2}$, and $\beta_{d3}$) from equation (1). The values of these coefficients provide the estimate of the effect of free mobility on the supply of CBW. The specification in column (1) includes year and municipality fixed effects and the Bartik index of employment as controls. It includes only border-region municipalities in the analysis.

Column (2) adds a set of seven region-specific trends (NUTS II definition of region). Column (3) performs the estimates including also municipalities in the non-border region. Then, the columns (4) to (6) replicate the same sequence of regressions as in columns (1)-(3), but they use only two distance bins, i.e. dividing municipalities with 0-30 minutes commuting time from the border into a group with [0-15) minutes and a group with [15-30) minutes, respectively. The standard errors of the estimates are clustered at the commuting zone level (which is a group of municipalities in the same labor market). The upper part of Table 3, Panel A, uses the number of cross-border workers in municipality $m$ and year $t$ divided by the total employment in the municipality in 1998, $\frac{CBW_{m,t}}{Emp_{m,1998}}$, as the dependent variable ($y_{m,t}$ in equation 1). This allows us to interpret the change of CBW as percentage points of employment. We keep the denominator fixed as of year 1998 to avoid introducing spurious effects due to changes in native employment during this period. The lower part of the table, Panel B, uses as dependent variable the sum of CBW and new resident immigrants in municipality $m$ and year $t$, which represents total new immigrants, standardized by the same denominator (total employment in 1998), $\frac{CBW_{m,t}+RI_{m,t}}{Emp_{m,1998}}$. The results in Panel B allow us to check whether the growth in total new immigrants in municipalities near the border corresponds to the growth of CBW, which would be the case if the coefficients in Panel A and B are similar. A large differential response of resident immigrants may suggest, on the one hand, the presence of other unobserved factors or, on the other hand, an offsetting impact (crowding-out or -in) on those immigrants and should be accounted for when analyzing the labor market impacts of the change in CBW supply.

Let us first focus on the estimates of the coefficients for the $FREE_{m,t}$ dummy interacted with the bin closest to the border for CBW: $0-10$ minutes in specification (1)-(3) or $0-15$ minutes in specification (4)-(6). In all specifications the effect on this group is significantly positive and its value is between 3.5 and 5 percentage points of employment (namely between 0.034 and 0.047). Thus, the share of CBW increased on average by about 4 percentage points between 2004 and 2010 in the municipalities closest to the border. The second bin, at a distance of $10-20$ minutes, shows a positive, and also significant, effect around 3 percentage points. The $15-30$ minute bin instead shows a change around 0.5 to 1 percentage points (specifications (4)-(6)) and the coefficient for the 20-30 minutes bin is never larger than 1.2 percent and sometimes not significant. The estimates using the total share of new immigrants, in Panel B, are somewhat larger than those in Panel A. They are between 4 and 6 percent of employment for the closest bin and between 2 and 4 percent for the intermediate bins (10-20 and 20-30 or 15-20). These estimates are not significantly different from those of Panel A and confirm the largest part of

the effect is due to the response of CBW in the bin closest to the border (comparing the two coefficients the first is about 80% of the second). These initial findings suggest two observations. First, the estimates show a clear but limited effect of full liberalization on the increase in supply of CBW. An increase of 4 to 5 percentage points in the municipalities close to the border, accruing over the course of several years, is not a massive change in supply. Second, the monotonically decreasing gradient of the effect, moving away from the border, reaching essentially a value of zero for the municipalities in the 20-30 minute bin, confirms that taking the municipalities farther than 30 minutes from the border as the control group is a reasonable choice. In assessing the impact of a change in the supply of immigrants on native labor markets' outcomes, it is very promising to show the policy considered had a clear and limited geographical effect. This feature allows us to compare similar and close municipalities; some of which were affected in a substantial way by the increase in immigrant labor supply after liberalization while others were not.

### 5.2 Year-by-Year Estimates

Next, we present the estimates of the year-by-year dynamics of these effects. Rather than showing the point estimates of the coefficients $\gamma_{d1,t}, \gamma_{d2,t}$ and $\gamma_{d3,t}$ (for $t$ = 1994, ..., 2010) estimated from equation (3) we represent them in a graph. Figure 3 shows the estimated values for the coefficients $\gamma_{d1,t}$ relative to the $0-10$ minute bin as diamonds connected by a solid black line.[20] As we have biannual data, we report the estimates for the even years 1994-2010, omitting 1998 (which is standardized to zero). We show the 95% confidence interval as vertical line with "ticks" around the diamonds. The triangles connected by a dark gray line represent the coefficients $\gamma_{d2,t}$ for the $10-20$ minute bin and the squares connected by the light gray line represent the $\gamma_{d3,t}$ coefficients for the $20-30$ minute bin. Panel A, on the left of Figure 3, reports the estimates using CBW as a share of employment in 1998 as the dependent variable. Panel B shows estimates obtained using all new immigrants (CBW+RI) as a share of employment in 1998. For reference we include in the Figure a vertical line in 1999 marking the beginning of *Phase I* of the free mobility agreement and another one in 2004 marking the beginning of *Phase II* that introduced full mobility of CBW. Four features of the figures stand out. First, in the pre-1999 years, none of the estimates for any of the travel time bins is significantly different from zero at the 95% confidence interval. The estimates for the $0-10$ bin show some fluctuations from 1994 to 1998 but none significantly different from zero. The estimates for the other two bins are

[20] We estimate equation (3) only for municipalities in the border region, including as controls a full set of municipality and year fixed effects, NUTS II-specific trends and the Bartik index of employment.

very close to zero. This is consistent with the fact that before the reform of 1999, there was no differential growth in the share of CBW in the municipalities near the border relative to others. Second, the coefficients of the 20-30 minute bin for the CBW supply are small throughout the period 1994-2010, implying very small changes for CBW in this distance group even in *Phase II*. Thus, the trend for *CBW* in this bin is not very different from that of the control group (more than 30 minutes) which received no CBW. Third, there is a weak upward trend in the 1999-2004 years, with an estimated increase in the CBW share of the population between 2 and 3 percent.[21] Hence, the coefficients on the $0-10$ minute bin shows some mild increase already during *Phase I*. The fourth and most important fact is that after 2004 the coefficient on the $0-10$ minutes bin grew consistently becoming significantly different from zero with positive and significant point estimates in 2006, 2008 and 2010, when the free mobility policy was in place. The point estimate in 2010 is about 0.07, implying that CBW workers increased by 7 percentage point of initial employment between 1999 and 2010. Similarly, the coefficient for the $10-20$ minute bin (triangles connected by the gray dashed line) shows significant growth and an upward trend since 2004, reaching a value of 0.06 in 2010. The estimates for total new immigrants in Panel B, show similar patterns. The one difference is that the coefficients on the $20-30$ minute bin show some positive and more significant effects in *Phase II* potentially revealing inflows of resident immigrants to this region especially after liberalization of resident immigrants in 2007.

Let us also emphasize a feature of the results reported in Figure 3 that is quite important. While the supply of CBW in municipalities at $0-10$ minutes from the border clearly took off with the implementation of *Phase II*, it is also clear that there was no immediate "jump" produced by an open border policy, but rather a trend from 2004 to 2010. Possibly, the opening of the border made firms recognize opportunities to hire new workers and it encouraged them to create job openings, slowly affecting their employment. This emphasizes the importance of analyzing the "total" rather than "partial" effects of immigration over time, accounting for several margins of adjustment. The dynamics of capital investment, the transition of natives across occupations, and firms' growth occurred *at the same time* as the CBW inflow took place in anticipation and response to that. Hence, the comparison of outcomes with the changes in CBW across years produces a picture of simultaneous adjustments and total effects in response to a cumulated increase of immigrants. What is new in this paper is that we can analyze the "first stage" of

[21] When compared to 1998, the point estimates of 2002 and 2004 for the 0-10 bin seem to reveal a positive deviation. However, if one compares them with an average pre-1999 (1994, 1996 and 1998) there is really no deviation.

the effect of an immigration policy on immigration flows before analyzing the consequence of immigrants on natives. Our study, and the work of Ruffner and Siegenthaler (2016), are the only cases we know that track the effects of a permanent immigration policy change in a developed country. Our focus is on the analysis of its consequences both on immigrants and on labor market outcomes and on the internal migration and inter-sectoral dynamics of workers. The paper by Dustmann, Schönberg and Stuhler (2017) instead considers a temporary change of cross-border workers in Germany (reversed after two years) leading to inflow of mainly unskilled workers in a period (1991-1993) of deep crisis in Eastern European institutions and markets. In contrast, our analysis focuses on the consequences of *permanently* eliminating barriers to immigrant workers in a period of otherwise normal economic growth in sending and receiving economies.

### 5.3 Matched Municipalities Estimation

In this section we apply a tighter strategy to identify the coefficients of equation 1 using matched pairs of "treated" and "control" municipalities. Specifically, we match to each municipality in the $0 - 10$ minute time range from the border, another municipality at more than 30 minute time, but still within the border region (hence not too far but untreated) and we choose one that is as close as possible to the treated municipality according to one of six criteria. Pooling two pre-shock waves to gain precision (1996-1998), we minimize either (1) the total employment difference between municipalities, (2) the employment-share difference using 13 industries (and minimizing the sum of squared differences in the share of employment in each industry), (3) industry-employment differences (also using 13 industries), or (4) difference in average wage levels. Alternatively we minimize (5) the difference in employment-growth 1994-1998 or (6) the difference in average wage-growth 1994-1998. By doing so, we select one control for each treated municipality, ensuring maximum similarity in their pre-1998 size, or industrial structure, or employment/wage growth. The requirement that the control is at least 30 minutes from the treated municipality ensures that local spillovers of Swiss commuters do not affect the control municipality. We then include only the group of matched municipalities in a regression like equation 1 and we additionally include as many matched-pair dummies as there are municipalities in the 0-10 interval, and their interaction with $FREE_t$. In this case the coefficient on the interaction between $FREE_t$ and the dummy $I(dist_m < 10)$ is estimated based only on the difference between the treated municipality and its matched control, allowing for any common unobservable factor in the two matched areas before and after the border opening. Alternatively, we estimate

the year-by-year regression, as in (3) including the matched-pair dummies and their interaction with the $FREE_t$ dummy as additional controls.

Table 4 shows the estimates of the coefficients of interest using the six different matching criteria (in columns 1 to 6). Panel A's dependent variable is the CBW as a share of employment, while Panel B includes all new immigrants as a share of employment. The estimated effect of the border opening on CBW is very significant and similar to the effect shown in Table 3. Its value is around 4 to 5 percent of employment and, similarly, the change in all immigrants after the opening of the border is between 4 and 5 percent of employment. Even absorbing all unobservable factors in the matched pair dummies, the difference between treated and control municipalities post-2004 is statistically significant, precisely estimated and close in magnitude to our previous estimates. Figure 4 reports the estimates of the coefficients $\gamma_{d1,t}$ of a year-by-year specification like equation (3) using the six alternative matching criteria. It shows very similar patterns as Figure 3 both for CBW (Panel A) and for all new immigrants (Panel B).

These results indicate that, considering two municipalities as similar as possible on several dimensions, prior to 1998, and allowing for any common unobserved trend over time, the municipalities in the 0-10 minute time bin experienced a significant increase in CBW after 2004 relative to the ones at 30+ minutes. These results also confirm the progressive nature of the increase over time between 2004 and 2010 and the overall size of it, roughly in the order of 4 to 5 percent of employment between 2004 and 2010.

# 6 Effects on Native Labor Market Outcomes

## 6.1 Effects on Native Wages

The results of the previous section establish that the policy of free labor market access for CBW increased their supply by about $4-5$ percentage points of employment in municipalities within $0-10$ minutes distance from the border by 2010. It also increased their supply by about 3 percentage points in municipalities at $10-20$ minutes from the border. Beyond that commuting time, the effects on CBW supply are 1 percent or smaller. The aggregate statistics also imply a net increase in the supply of tertiary-educated CBW relatively to secondary- and primary-educated. Hence, this was a relatively skill-intensive increase in supply of workers available to employers concentrated in municipalities near the border. Did this result in depressing the wages of highly-skilled natives? Were the wages of other groups of workers affected through complementarity? Or did firms respond by creating jobs for highly-educated? And did native

workers respond by moving from close to the border to other areas?

To answer these questions, we analyze the effect of the liberalization policy on wages, employment, and hours worked by natives. In so doing, we first estimate a regression in the form of equation (1) with municipalities as units and the average logarithm of native hourly wages as the dependent variable.[22] We show the main estimated coefficients in Table 5. To keep the table more compact we report the estimates for the coefficients of the two 10-minute bins closest to the border in columns (1) and (2) as they are those with the economically and statistically significant change in CBW supply. We also show the coefficient on the 0-15 bin in columns (3) and (4). If one thinks of the change in supply of CBW as the dependent variable and of the *post-2004* dummy for the liberalization policy, interacted with distance bins, as the instrument, then Table 5 shows the results of a reduced-form IV regression. The coefficient estimates represent the intention-to-treat effect (ITT). The point estimates of the impact on native wages can then be used to derive the elasticity of their response to the change in the supply of CBW, estimated in Table 3, dividing the first coefficient by the second. The columns of Table 5 include only the specifications with province-specific trends, columns (1) and (3), and those including also the non-border regions municipalities, columns (2) and (4).[23] In Panel A of the table, we show the estimated coefficients when the dependent variable is the average log hourly wage of all native workers in a municipality. We then consider potential effects by education group. Panel B considers average log hourly wage of highly-educated natives in the municipality as outcome. Panel C does the same for middle-educated native workers and Panel D for less-educated native workers.[24] The point estimates show the "total" effect of immigrants on the wage of each group (or on average). The coefficient captures the impact on native wages both from competition of CBW with similar skills and from complementarity from CBW with different skills.[25]

[22]Table A1 in the Online Appendix shows the estimates using log of monthly wages as dependent variable. Monthly wages are originally collected in the SESS. The results are similar to those obtained using log hourly wages.

[23]Note that we construct a separate Bartik measure for wage outcomes:

$$\widetilde{w_{cz,t}} = \sum_{i \in \{1,50\}} s_{i,cz,1990} \left( w^G_{i,cz,1994} \times \frac{w^G_{-cz,i,t}}{w^G_{-cz,i,1994}} \right)$$

where $w^G_{i,cz,1994}$ is the initial log hourly wage payed in (2-digit) industry $i$ for education group $G$ in commuting zone $cz$ in the first available wave in 1994 and $\frac{w^G_{-cz,i,t}}{w^G_{-cz,i,1994}}$ measures industry wage growth for that group on the national level (excluding commuting zone $cz$). Wage growth is aggregated using each industry's employment share in 1990 $s_{cz,i,1990}$ taken from the national Census.

[24]The random sampling of the SESS implies that some municipalities have missing information for the dependent variable of some education groups. This explains the difference in the number of observations across education groups (panels) of a particular specification in the Tables 5 and also in Table 6. We found similar results when dropping municipalities below the 20 percentile of aggregate employment each year or dropping municipalities that had missing information in aggregate employment in any year. These results are shown for log hourly wages and total hours as dependent variables in the Online Appendix Tables A2 and A3, respectively.

[25]See Ottaviano and Peri (2012) for a more formal argument about the estimation of a total effect of immigrants

Inspecting the estimates, the first consideration is that the effect on the overall average wages, in the $0-10$ and $10-20$ minute bins are very small and never significant. The point estimate for the bin closest to the border in column (2) is -0.019 (-1.9%) but the standard error is 0.024 so that the significance is well below any standard level. Since we found that the post-2004 liberalization increased the share of CBW by about 4 to 5 percent of the employment (Table 3) the negative point estimate for the wage effect is compatible with an elasticity of short-run demand around -0.3, which is argued by Borjas (2003) to be a reasonable short-run demand elasticity. However, a zero effect cannot be rejected at any level of confidence and positive effects cannot be discarded either. The fact that a simple "change in supply for fixed demand" explanation does not work well in this case is even clearer when we look at the impact by education group. As described, labor market opening produced a larger inflow of highly educated CBW relative to middle- and less-educated workers. Hence, the simple "partial effects" model would imply a negative wage effect on highly-educated natives and positive effects on the other education groups (i.e. low- or middle-educated or both). To the contrary, the most significant effects, which are robust across specifications column (1)-(4) panel B of Table 5, are represented by the *positive* estimates on the wages of highly educated, in the order of $+$ 3.4% in the $0-10$ minute bin and around 3.0% in the $10-20$ minute bin. These effects decline with travel time from the border and (as we will also see in Figure 5 below) arise only after *2004*. Hence these changes in wages of highly-educated natives are consistent with a causal effect of the increase in CBW. The point estimates of the effects on wages of middle-educated are instead mostly negative and never significant at the 5% level for the 0-10 minute bin. The point estimates on low-educated wages are negative and also not significant in columns (2) and (4).

Figure 5, Panels A-D, show the year-bin coefficient estimates for the $(0-10]$, $(10-20]$, and $(20-30]$ minute bins (and the 95% confidence interval for the 0-10 minute bin) obtained from specification (3) with the logarithm of native wages as the dependent variable in Panel A, the log wage of highly-educated natives in Panel B and the same wage measure for middle- and low-educated natives in Panels C and D, respectively.[26] There is substantial variability and imprecision (leading to large standard errors) in the estimates before 2004, but none of the estimated yearly coefficients are significant at standard confidence levels. The change in log wages is largest and most significant for highly-educated natives after 2004, in municipalities within 20 minutes from the border. Panel A shows positive estimated values (of about 4-5%

aggregating all the direct competition and indirect complementarity effects from different skill groups.

[26] As previously, we estimate equation (3) only for municipalities in the border region and always include a full set of municipality and year fixed effects, region-specific trends and an education-specific Bartik measure for wages.

relative to the 1998 value). The timing of the effect is also consistent with the increase in CBW shown in Figure 3. The other two groups (middle- and less-educated) have smaller changes, with the low-educated experiencing first a decline between 2000 and 2004 and a more mixed path between 2004 and 2010.[27] Yet, these estimates are noisy and not significant in most cases. In the aggregate (Panel A), average wages do not exhibit any significant deviation during the whole post-2004 period.

### 6.2 Effects on Natives' Employment and Hours Worked

A second important aspect of labor market effects is the impact on native labor supply. We measure this variable as the logarithm of total number of native workers or, alternatively, as the logarithm of total hours worked by natives. The first measure captures only the extensive margin of labor supply, while the second combines the extensive and intensive margin. Table 6 shows the coefficients of interest when using, as the dependent variable, the logarithm of total number of native workers (columns 1-2) or the logarithm of the total hours worked by natives (columns 3-4). As usual, Panel A shows the effects when including all native workers in the construction of the dependent variable. Panel B analyzes the effects when considering only highly-educated natives, Panel C is limited to middle-educated natives and Panel D includes low-educated only. We only show the estimates for the two 10-minute bins closest to the border and we include only border regions municipalities in columns (1) and (3), or all of them in columns (2) and (4). Figure 6 plots the coefficients estimates (from regressions as specified in equation (3)) for each time bin ($0-10$, $10-20$ and $20-30$ minutes) with total hours worked by natives as the dependent variable in Panel A. Panel B shows the estimates including only highly-educated natives to construct the dependent variable and Panel C and D look at hours worked by middle- and less-educated, respectively.[28] The estimates in Table 6 (and Figure 6) are somewhat noisy as the standard errors can be as large as 5-6 percent and exceed 15 percent for the small group of less-educated. They, however, never show evidence of a "crowding out" effect on native employment or native hours worked (negative and significant coefficients). The point estimates for the employment effects are mostly not significant and usually positive. The aggregate estimates for both distance bins are non-significant and positive for employment and

[27] We find qualitatively similar results when we use two alternative definitions of workers' skills and when we use two distance bins (0-15 and 15-30 minutes) only. Figure A2 shows the year effects for 15-minute distance partitions (Panel I) and for wage tercile and occupation based partitions (Panel II and III). In all cases the effect on the average wage is non-significant in post 2004 years, the effect on highly skilled wage is positive and usually significant for the region closest to the border in the post 2004 years, and the effect on low skilled wages is negative and usually not significant post 2004.

[28] The regressions with year-specific coefficients includes year and municipality fixed effects, region-specific trends and education group specific Bartik index for log total hours as specified in equation (2).

hours worked (see also Figure 6, panel A). Moreover, for individual education groups, we see some positive and close to significant coefficients on the highly-educated working hours (and less so on employment). For less-educated, there seems to be a positive but not significant (noisy) effect near the border for employment and hours worked. This increase in employment and hours of less-educated natives can suggest an increase in the demand for their services resulting from the complementarity with the skilled CBW. This demand could have triggered a rather elastic labor supply response of less-skilled workers without affecting their wages much. The estimates, however, are not significant at standard confidence levels.

Taken together, the estimated wage and employment coefficients are consistent with a positive complementary effect of CBW on native workers, especially highly skilled ones. The channels of this complementarity can be several. We suggest three of them here that have been recently proposed in relation to immigrants. First, a larger supply of CBW pushes firms to expand and create new jobs (as in a search model à la Chassamboulli and Palivos (2014)) with some of those jobs filled by natives. Second, firms' return to investing in equipment capital that complement the skills of CBW increases and investment enhances productivity of native workers too (as in Lafortune, Tessada and Lewis (2015) or in Peri (2012)). Finally, local human capital externalities, of the type analyzed in Moretti (2004a,b; 2010) could increase productivity through learning and technological adoption. Increased productivity and job creation are also consistent with the firm-level evidence presented by Ruffner and Siegenthaler (2016) and reviewed in Section 7.6 below.

The identified effects do not suggest crowding out, or pure competition from CBW. In particular, the positive and significant effect on the wages of highly-educated and the null to positive overall effects on their employment are at odds with pure competition effects. In order to understand better the channels of response of native workers and firms that allow such a null/positive impact on native workers, we analyze in greater detail some specific transitions of native workers into and out of employment, and between jobs or regions.

# 7 Native Workers' Transitions and Heterogeneous Effects

## 7.1 In-Out of Employment and In-out of Municipalities

As municipalities are small open economies, part of the effect of a larger supply of CBW may spread to other municipalities. In particular local workers may move to other municipalities or fewer workers from other Swiss municipality may move in. Alternatively native workers may

be pushed out of employment if crowding-out prevails or into employment if complementarity stimulates job creation. Past research (e.g. Card and DiNardo, 2000; Peri and Sparber, 2011*a*) has not found significant outflows of natives in response to immigration. However recent papers (e.g. Dustmann, Schönberg and Stuhler, 2017) have suggested that inflows of natives from other areas may be reduced following immigration. In this section we also investigate whether the CBW inflow affected the distribution of natives across occupations and sectors and which demographic groups of natives were affected more in their job market outcomes. The estimates of such adjustment margins and of heterogeneous response will provide indirect evidence on the channels of complementarity on high-skilled wages.

We decompose the change in local employment of natives into "inflows" and "outflows" and analyze how the onset of CBW's free mobility affected those flows. In Table 7, the dependent variable for each column (1 to 6) is a different flow (in or out of employment of municipality $m$), and the regression specification is similar to equation (1) that includes fixed effects, region-specific trends, and the Bartik control. Column (7) then shows the estimates using net flows (Inflow-Outflows) as the dependent variable. To construct the dependent variable the inflows into employment of municipality $m$ between year $t-1$ and $t$ and the outflows from employment of municipality $m$ between year $t$ and $t+1$ are standardized by the employment in that municipality in year $t$. Those rates, $\frac{In_{m,t-1/t}}{Emp_{m,t}}$ and $\frac{Out_{m,t/t+1}}{Emp_{m,t}}$, are the dependent variables of column (1) and (4) of Table 7, respectively. Then, we decompose the inflows ($In_{m,t-1/t}$) into inflows from other municipalities (column 2) and inflows from non-employment (column 3). Similarly, the outflows of employment ($Out_{m,t/t+1}$) are split into outflows to another municipality (column 5) and outflows to non-employment (column 6). To construct these variables, we use the Swiss Labor Force Survey (SLFS) as a complementary data set. Most individuals in the SLFS were interviewed for two consecutive years, and we can calculate the flow variables at the municipal level using the employment status and the place of work for each individual in the previous or the next year, respectively.[29] Panel A of Table 7 shows the effect including all native workers in the municipalities, Panel B including highly-educated ones, Panel C for middle-educated, and Panel D for less-educated workers. For compactness, the table shows only the interaction of the post-liberalization dummy with the two bins closest to the border, i.e. $(0-10]$ and $(10-20]$ minutes, for all workers and the interaction with the closest bin to the border for the individual

[29]Due to a structural break in this data from year 2010 onward, we only use the years 1996 to 2009 (on a yearly basis) when computing flow variables between two consecutive years (e.g. in table 7 or table 9). In contrast, when we exploit the cross-section information, we also include the year 2010 (e.g in table 8). We only use the SLFS to analyze additional mechanisms and worker transitions as the data set is much smaller than the SESS, which we use for our main analysis. Nevertheless, we replicated all our main results using the SLFS and all results were qualitatively similar. See Appendix B for more details on the exact calculation of the flow variables.

education groups (Panels B-D).[30]

Panel A shows that we do not find very significant impacts on any margin after liberalization. The columns capturing total inflows (1), outflows (4), and the total net flows (7) show insignificant and small effects in Panel A. The only marginally significant coefficients reveal a slight decrease in the workers' inflows from other municipalities and an increase in inflows from non-employment to employment. Native workers seem to be more likely to find jobs in municipalities most affected by CBW, and potential native competitors from other municipalities seem less likely to move in after the free mobility policy was enacted. Focusing on highly-educated native workers, we find an overall zero effect on net-flows in column (7), (broadly consistent with the insignificant employment effects for this group in Table 6). Yet, we observe two interesting patterns. First, we estimate a significant decrease of the inflows, driven by fewer workers moving in from other municipalities. This effect is relatively strong and significant and it is consistent with a reduction of the inflows from other municipalities equal to 5 percent of the employment in the high-skilled group. At the same time, we estimate a 3 percent, but not statistically significant, reduction in the outflow of local native workers to other municipalities in the free mobility period (column 5). These two effects (reduced inflow and outflow) almost offset each other so that the net flows show a small non significant change. They suggest an interesting pattern that aligns well with some results in Dustmann, Schönberg and Stuhler (2017) and may contribute to explain the positive effect on wages of highly-educated. Highly-educated natives from the rest of Switzerland may have been discouraged to seek employment in municipalities near the border as more CBW were hired. The incumbents, however, were more likely to remain, possibly because of the better career perspectives that we will discuss below. If incumbents were more likely to stay and newcomers less likely to arrive, a composition effect could also contribute to increasing the wages, as the incumbents had longer experience spans, specific human capital, and possibly higher wages. This effect is consistent with an increase in wages of highly-educated natives. This result is also broadly consistent with other recent findings that emphasize that the response in internal mobility may attenuate effects on incumbents in the local labor markets (Dustmann, Schönberg and Stuhler, 2017; Cadena and Kovak, 2016; Monras, 2015). In our context, the reduced native mobility (less inflow and less outflow) may contribute to the wage gains and to the zero/positive impact on employment that we observe for highly-educated workers.

The other groups do not seem to experience significant changes in any of the flows. Let us also note here that the flows of Swiss workers from the border region to outside Switzerland

[30]Coefficients on the other bins are not significant in any specifications.

(as commuters or migrants in the reverse direction from the one considered in the paper) is negligible, as the wage differential between Switzerland and municipalities in other countries near the border is large (up to 30%).[31]

### 7.2 Moving to Upper Management

A second, potentially important response of natives to the inflow of CBW, prevalently employed in Technical/Scientific and Engineering type of jobs, was to move towards managerial jobs (see a similar phenomenon in Peri and Sparber (2011*b*) and Peri, Shih and Sparber (2015*b*)). Positions in the top organizational tiers of Swiss companies are likely to require knowledge of local culture and norms, and possibly a local network of contacts. Those are easier to have for a native than for a foreign individual.[32] The demand for these managerial jobs grows as firms become larger and more productive, and hiring STEM workers is a way to grow. Hence, we analyze whether natives, especially highly-educated ones, became more likely to be employed as high-level managers after the introduction of free mobility of CBW. To do this, we define high-management positions using a question in the SLFS that defines whether a worker is in the executive committee ("Direktion/Geschäftsleitung") of the firm. We define these positions as "top tier of management".

Table 8 uses as the dependent variable the share of native workers who are in the top tier of management (in columns 1 and 2) and then the log number employed and the log hours worked by natives in those top managerial positions (columns 3 and 4). We show the coefficients on the interaction between the treatment period "$FREE_{m,t}$" and the two distance bins closer to the border, $(0-10]$ and $(10-20]$, and we partition the results in panels reporting the estimates for all workers (Panel A), for highly-educated workers (Panel B), middle-educated workers (Panel C), and for less-educated workers (Panel D), respectively. Consistent with the previous hypothesis, we find that in the aggregate and, in particular, for highly-educated, there was a significant increase in the share of natives in the top tier of management. Employment and hours worked in those jobs also increased.[33] This effect was particularly large and significant for the highly-educated in the municipalities at $0-10$ minutes from the border. For middle-educated we also

[31] In fact, aggregate statistics collected by the Federal Statistical Office suggest that the absolute number of Swiss cross-border workers commuting for work abroad increased since 2002 but still constitutes a negligible share of total employment (Swiss Federal Statistical Office, 2015).

[32] This might be particularly important, as most CBW speak the local language of their work-place as shown in the Online Appendix Table A5. In this case, language might not be a significant source of comparative advantage and there might be less specialization along communication versus non-communication tasks as pointed out in the previous literature.

[33] The latter two effects confirm that the change in share of managers must be driven by the entry of individuals into management positions rather than the exit of non-managers in highly exposed areas. In unreported results, we found no effect on the employment and hours of non-managers.

estimate a weak positive effect on the share of top-tier management, but this occurs in the $(10-20]$ minute bin and not in the $(0-10]$. The effect on middle-educated is not significant for workers and hours (column 3 and 4). We infer that for this group the response is not as clear as for highly-educated. These estimates are consistent with the idea that, due to complementarity and productivity growth, native workers were more likely to become top-tier managers in firms that hired CBW as technical and scientific professionals. By moving to those jobs, natives' wages increased, and this accounts for a portion of the increase in the wage found for this group in Table 5.[34] Natives with intermediate levels of education show smaller and not very significant effects on the probability of being in high managerial positions and at low level of education the effect on natives is negative (but not very robust). This group is not likely to be in high-management positions: only 8% of less-educated are in top management while 33% of highly-educated are (as shown in the last row in each panel). Hence a reasonable margin of adjustment for highly-educated Swiss workers was to transition towards managerial positions as highly-educated CBW took technical, math-intensive, and engineering type of jobs.

### 7.3 Occupation Upgrading

Moving to the top tier of management is not the only way to adjust one's job in response to CBW complementarity, especially for non-highly-educated workers. Native workers may change occupations, upgrade their job, and in general adjust their specialization. For instance, a larger supply of technical, scientific, and IT workers may increase the demand for other supporting jobs in human resources, administration, supervisory roles, business services, or sales. Thus, we analyze whether we can identify an occupational "upgrading" in response to CBW using the panel dimension of the SLFS. This type of transition using longitudinal data has been analyzed in Cattaneo, Fiorio and Peri (2015) for countries in the European Union and in Foged and Peri (2016) for Denmark. Those papers found that native workers upgrade their occupations in response to immigration, by moving towards more complex and less manual type of jobs. Hence we classify workers into four broad occupation groups based on the wage rank of their ISCO occupation (main category).[35] Then we associate a +1 to a worker who moves from a

[34] Using SLFS data, highly educated individuals working in the top management tier earn roughly 30% more than other highly educated workers (as shown in the last row in Panel B of table 8). Thus, a rough back of the envelope calculation yields that a 6.2 percentage point increase in the share of individuals in theose positions increases the average wage of all highly educated by roughly 2 percentage points (0.30*0.06). Hence, the wage change associated with moving into the top management might explain roughly 2 of the 3 percent wage increase we found in table 5 for this group of native workers.

[35] The occupation partition is as follows. Managers or professionals (ISCO main groups 1 and 2) is the occupation group with the highest wage rank. Technicians (ISCO 3) are an upper intermediate group. Clerks, craft and machine operators (ISCO 4, 7 and 8) constitute a lower intermediate group whereas service workers and elementary occupation (ISCO 5 and 9) are the lowest ranked group. We drop agricultural workers (ISCO main category 6)

lower-ranked to a higher-ranked occupation group between $t$ and $t+1$ and a $-1$ to a worker who moves from a higher- to a lower-ranked occupation and a zero in all other cases. Averaging this variable across all individuals in a municipality, we obtain the "net"-upgrading rate of workers in it. Table 9 shows the impact of the $FREE_{m,t}$ dummy interacted with the two travel-time bins on this variable, first in aggregate (Panel A), and then, separately, for each education group (Panels B-D). In partial support of this hypothesis we obtain a positive and marginally significant effect only for the middle-educated group (+0.020), which implies an increase of the frequency of occupation upgrading by 2 percent (or a decrease in the frequency of downgrading by 2 percent, or any combination of the two that adds up to +2 percent) for that group. Such an effect is concentrated in the $0-10$ minute bin. The estimated effects on the other groups are very small.

### 7.4 Sector-Specific Wage and Hours Effects on Natives

An important dimension of the heterogeneity of impact of CBW on Swiss workers is the potential difference across broad sectors. The fact that CBW were heavily employed as IT professionals, engineers, and scientists may imply a more direct impact on productivity growth in the sectors that use these workers extensively, i.e. in the high-tech manufacturing sector. Also some of the more knowledge-intensive services (finance, business services, human resource management) can be complementary to high-tech production and benefit more from the inflow. If native workers are, at least in the short term, not perfectly mobile across sectors (as we corroborate below), e.g. due to search and matching frictions (Rogerson and Shimer, 2011) or industry- or firm-specific human capital (Neal, 1995), the inflow of CBW may have affected wages differentially across sectors.

Table 10 shows the coefficients on the relevant interaction (between $FREE_{m,t}$ and the $0-10$ distance bin) when the dependent variable is the log of native wages for workers in different sectors. In column (1) the sector is manufacturing, then split into high-tech and low-tech manufacturing (Columns 2 and 3 respectively).[36] In column (4), the sector is services, then divided between knowledge-intensive services (in column 5) and not-knowledge intensive services in column (6).[37] In columns (7)-(9) we partition workers based on the size of the establishment

from this analysis.

[36] We follow the Eurostat classification of industries and define high (and medium-high)-technology manufacturers as industries with NACE Rev 1.1 code 24, 29, 30, 31, 32, 33, 34 and 35 excluding 351. Broadly speaking, this includes producers of pharmaceuticals, IT, air/space-craft and other high-tech machinery and electronics. Low-technology manufacturers are the remaining manufacturing industries, e.g. producers of textile, raw-material, food, repair industries etc

[37] Knowledge-intensive services are NACE Rev 1.1 industries 61, 62, 64, 65-67, 70-74, 80, 85, 92, e.g. financial intermediation, education, research and development etc. Not-Knowledge intensive services are the remaining

they work in (large, medium, or small).[38] Larger firms may have stronger potential to benefit from the complementarity of CBW as their productivity is higher and they employ a larger varieties of skills.

The first row of Table 10, called Panel A, shows the post-liberalization change in CBW as the share of employment into the specific sectors at 0-10 minutes from the border. Then in Panel B we show the post-liberalization change in average log wages for all native workers, Panel C shows the change for highly-educated native workers and Panels D and E show the effect for middle- and less-educated ones, respectively. In each column/panel, we estimate a specification as equation (1) including year and area fixed effects, Bartik controls, and regional trends. We only report the coefficient on the interaction between "$FREE$" and the $[0-10)$ distance bin.

The first row shows the differential increase of CBW across sectors, after liberalization. The post-liberalization period was characterized by a much larger inflow of CBW in high-tech manufacturing (+5.8 percent) and knowledge intensive services (+5.1 percent) than in other sectors. There is also some evidence that large firms experienced a somewhat larger increase in CBW (although the coefficients of Panel A are not significantly different between large and small firms). These heterogeneous inflows are consistent with the idea that CBW were mainly employed in high-tech, knowledge-intensive, highly-productive firms. Hence those sectors are also where we expect the strongest complementarity effect on native workers.

When looking at sector-specific wage effects on native workers combining all education groups, the only significant coefficient is the one on wages in high-tech manufacturing for workers in the $0-10$ minute bin and, to a smaller extent, the one on knowledge-intensive sectors (not significant but close to 10% significance). As hypothesized above, this may be due to the higher productivity brought by CBW and possibly by better management from native workers in high-tech companies. The particularly strong effect in high-tech manufacturing is consistent with the results in Ruffner and Siegenthaler (2016) showing that CBW increased the innovation potential of firms: the effects they found were particularly strong in high-tech firms with significant R&D spending. Interestingly, the positive wage effects in this sector seem mainly concentrated among middle- and less-educated native workers who are very likely to be complementary to the technical skills of CBW. When we break the estimates further down by education groups, we find a positive wage effect in the order 5.7 percentage points at $0-10$ minutes from the border for highly-educated in knowledge-intensive services. To the contrary, less-educated

service industries, e.g. wholesale and retail trade, hotels and restaurant, transport etc. Agriculture, mining and construction is omitted from this table as these sectors are very small and the effects were never significant.

[38] We define establishment with more than 250 workers as large establishments, those with 50 to 249 workers as medium sized establishments and those below 50 as small establishments.

workers in services may have experience a wage loss around 3 percentage points near the border. The breakdown into different firm size reveals only small differences. The positive wage effects for highly-educated is somewhat larger in large and medium-sized firms, but not significantly larger than in small ones. This is consistent with the evidence of a positive effect of CBW on productivity and innovation in firms with more than 100 full-time equivalents reported by Ruffner and Siegenthaler (2016). There seem to be negative effects for less-educated wages in large- and medium-size firm in the order of -4% but the results are not very significant. Overall, the differentiation across firm size does not reveal a strong pattern.

Table 11 Panels A-D, shows a set of industry-specific coefficients, similar to those shown in Table 10, on log of hours worked by natives. An effect of the increased productivity at the sector level may be larger demand for work of natives. While the patterns are not too strong, there is some evidence for a positive effect on the employment of less-skilled natives in services that are not knowledge-intensive and especially in small firms. This is suggestive of positive job-multiplier effects (as described by Moretti (2010)) on local, low-skill services and support companies (e.g. hotel, food, hospitality industries). The positive effect on employment and zero effect on the wages of low-educated natives in this sector is consistent with a very elastic labor supply for these jobs that require only very generic skills.

Panel E of Table 11 shows the coefficients when the dependent variable is the share of the sector in native employment.[39] These are estimated using data from the Swiss Business Census (BC), a different database, and include also, differently from the rest of the paper, public-sector workers. These coefficients would identify an impact on the allocation of native workers across sectors. The coefficients are mostly not significant, suggesting only small transitions of native workers across these sectors. CBW did not trigger reallocation of native workers across sectors (consistent with the findings of Card and Lewis (2007) for the US), while they did produce some occupational and managerial upgrading *within* sectors (as shown above in tables 8 and 9). However, one significant effect shown in Table 11 is the tendency of native workers to move towards public sector jobs, in response to CBW. There is a significant shift of about 1.6% of native employment moving from the private to the public sector after liberalization. This transition could be an additional channel, through which natives protected their wages from immigrant competition. We do not know of any other study that analyze this margin specifically.

[39]Note that sector shares sum up to one (i) across manufacturing and services (omitting the results for the construction sector for compactness), or (ii) across establishment size groups, (iii) or across firms with private (omitted) and public legal form. Consequently, the coefficients in Table 11 (Panel E) sum up to zero inside these firm category groups.

### 7.5 Effects on Different Demographic Groups

Tables 12 and 13 decompose the coefficients in the wage and hours worked regression across demographic groups, separating male and female workers (columns 2 and 3), old (more than 38 years) and young workers (columns 4 and 5), and workers with high (more than 6 years) and low tenure at the current job (column 6 and 7). The small aggregate wage effect, shown in Table 12, Panel A, are not very different across subgroups. Among the highly educated, there is not a clear pattern of differential wage response between these groups as most coefficients are significantly positive in the order of 3 percent (Table 12, Panel B). The other groups (Table 12, panels C and D) do not show significant effects. More interesting are the post-liberalization changes in hours worked by different groups. Supporting the hypothesis that CBW stimulated demand for highly-educated natives in managerial positions, Table 14 shows that males, older workers, and those with longer tenure are the groups experiencing a larger and more significant increase in hours worked. This is the group more likely to assume managerial positions in the Swiss economy. Higher demand for highly-educated males and highly-experienced natives is consistent with the upgrading story at the top of the managerial ladder. This heterogeneous impact on hours worked can also contribute to explain the positive overall wage impact on highly-educated native workers as older men with long tenure is the group that earns higher wages among highly educated and the liberalization induced them to supply more labor. As for less educated, there is some evidence that the supply of hours by young workers with low tenure had a larger increase relative to that of older workers with longer tenure (but the coefficients are not statistically different from each other). The complementarity here seems in increasing demand for low-skilled local services (in not-knowledge intensive sectors such as hospitality, food services, personal services) that hire younger and newer worker without increasing wages (in fact such change in composition is compatible with lower wages of less-skilled).

In sum, the most plausible explanation of the results presented in these tables is that at the high end of the skill spectrum complementarity between CBW, who specialize in technical and scientific skills, and top management/administration drove wages and demand of older, highly-skilled, and mainly male workers up. This is the strongest and more consistent effect found throughout the paper. The CBW inflow and native upgrade may have also stimulated local economies and the demand for local non-knowledge intensive services that hired young low-skilled workers. This effect is less robust and not always significant, hence we consider this as suggestive and an avenue to analyze further in future research.

### 7.6 Comparison of Results with Recent Studies

Before concluding, we compare more systematically our results with those of two recent papers related to this one. The first is Ruffner and Siegenthaler (2016), developed at the same time as this one and focused on the same episode of liberalization of cross-border workers. Ruffner and Siegenthaler (2016) use firm-level data and focus on firm outcomes: labor productivity, sales, innovation, and off-shoring after CBW liberalization. They provide results that are complementary to those presented in this paper. First, they show that firms close to the border experienced an increase in aggregate employment and an expansion in sales and a mild increase in productivity post liberalization. The authors also document that firms expressing worries about shortages of highly-skilled workers in the pre-liberalization period (via a survey) experienced larger increase in sales and in value-added per workers following the liberalization. This confirms that the expansion of CBW supply may have facilitated growth, investment, and productivity gains. Second, firms that benefited most with respect to productivity and growth were those in the high-tech sector, larger firms, and those previously dependent on cross-border workers. This result is consistent with the stronger positive wage effects we find on high-tech manufacturing workers in the aggregate and in large firms (Table 10). Third, Ruffner and Siegenthaler (2016) find that firms also experienced larger innovation rates, larger employment shares in R&D, more entry of new establishments, and less off-shoring (import of intermediates) as a consequence of CBW liberalization.

Our paper, on the other hand, goes much more in depth into the analysis of the labor market dynamics triggered by the opening of the border. First, it shows that CBW did not crowd out other immigrants, but increased total foreign-born employment, especially of highly-skilled. Second we show that they triggered dynamics through which highly-educated local workers were more likely to become top managers and stay in the municipality, while inward mobility of Swiss workers decreased. Third our analysis suggests that, possibly because of a positive local job multiplier (as in Moretti (2010)) from CBW, the employment and hours worked by less-skilled workers in non-knowledge intensive sectors increased with no significant effects on their wages. These effects are not as robust but point at the presence of inter-sector complementarity. What both studies suggest is the fact that the absorption of new CBW after 2004 took place via job creation and increased productivity, innovation, and total employment. Our analysis also unveils a more detailed account of who gained and who lost from the opening of the border among Swiss workers. Older, highly-educated, male workers with longer tenure were the main beneficiaries, as they took managerial jobs in response to CBW inflow. Importantly, these positive effects

may be connected to the fact that the new CBW were highly skilled, that the growth in their supply was expected, and, thus, that firms could prepare their adjustment as they had a long experience hiring these type of workers. In other words, this was not an unexpected event, but an expected and well-prepared one. As such, it resembles important, recent policy changes in immigration laws, whose implementation takes some time and are usually announced well in advance. Hence, in evaluating the impact of immigration policy changes and the consequences of the ensuing inflow of immigrants, this episode may be particularly useful.[40]

A second paper with important similarity to ours, especially for the type of policy considered, is Dustmann, Schönberg and Stuhler (2017). The authors analyze the effect of a temporary agreement allowing the free access of cross-border workers from the Czech Republic to Germany between 1991 and 1993. This agreement followed the fall of Communism in Eastern Europe, and increased the presence of Czech workers in the bordering German regions. Similarly to the Swiss case, the effect on labor supply was highly concentrated near the border because of the commuting requirement. Yet, Dustmann, Schönberg and Stuhler (2017) find that this inflow was associated with a large decline in the employment of old unskilled Germans and a larger decline in wages of younger workers. The authors explain these differences with different degrees of rigidity of wages and elasticity of supply of different age groups. Our findings are particularly interesting in light of these results. However, it must be born in mind that there are three main differences between the German set-up and the Swiss case. First, the Czech inflow was mainly composed of less-educated workers hired in relatively manual-intensive occupations. Second, it was unexpected and not planned years in advance. Third, it was *temporary*, and perceived as such, and it was reversed in 1993. Each of these features may have reduced the response margin of native workers and firms, limiting the ability to absorb the new workers and hence these differences may contribute to explain the different labor market effects on natives: negative in the case of Dustmann, Schönberg and Stuhler (2017), and positive in our case. Dustmann, Schönberg and Stuhler (2017) also discuss the main channels of adjustment of native employment, which seems to be a reduction of other natives moving to those regions. This seems plausible because the region near the border with the Czech Republic, due to the turmoil created by the end of Communism, may have experienced more economic uncertainty and less growth than other regions around 1991-1992. The Swiss experiment, instead, took place around

[40]It is somewhat harder to reconcile our results with the initial policy report by Losa, Bigotta and Gonzales (2012) that looked at the employment and wage effects of removing barriers on CBW. That paper applied a simple difference in difference approach between border and non-border regions and it focused on the short run effects (2 years after the policy). Such an approach can incur significant noise and measurement error as we documented that the changes in CBW took a few years since 2004 and that only the municipalities closest to the border (rather than the whole border region) experienced a significant increase in their supply.

2004, a period in which the countries near the border were not experiencing significant economic transitions. Hence it may be a cleaner case to isolate the effect of a *permanent immigration reform* on local labor markets, avoiding other economic spillover effects from across the border. Also the high skills of immigrants and the different horizon of the policy may be crucial to explain our positive results on native wages.

# 8 Conclusion

In this paper, we use the liberalization of labor market access for cross-border workers implemented in Switzerland between 1999 and 2007, to analyze the impact of this policy on the labor supply of foreign workers and on native labor market outcomes in a difference-in-difference approach. We exploit the fact that the supply response of cross-border workers was strongly affected by the commuting time from the national border since these workers had to reside abroad and commute to work in Switzerland. After showing that the introduction of free labor market access for these workers in 2004 produced a progressive and significant increase in their employment in municipalities within $0 - 20$ minutes of travel time from the border, but no effect beyond 30 minutes from the border, we analyze their impact on labor market outcomes of natives. We find that, in the aggregate, natives in municipalities within the $0 - 20$ minute range from the border did not experience any differential change in average log wage, log employment, or log hours after the liberalization relative to natives in similar municipalities farther away from the border. This insignificant post-liberalization change in average, masks, however, a positive and significant change of wages of highly-educated natives. This effect is the strongest and most robust found in the paper. We also find a positive but less robust and only marginally significant positive change on hours worked by less-educated natives in the region near the border after liberalization. To better understand these results, we analyze several margins of adjustment and heterogeneous effects for native workers that may explain the positive wage change for highly-educated natives, which is not consistent with a increase in supply in the canonical labor market model.

We provide suggestive evidence on three interesting mechanisms that seem to be at work in response to new immigrants. First, we find a reduction in mobility among highly educated natives consistent with an average wage increase for them (through increased tenure). Second, highly educated natives, probably mostly older and more senior workers, became more likely to take top management positions. Also middle-educated natives were more likely to upgrade their occupations. Third, native wages increased most in the high-tech manufacturing sector

and skilled services, where the employment of skilled CBW increased the most and whose productivity was boosted by their presence. In addition, we present suggestive evidence that a weakly positive employment effect on less educated natives was produced by a complementary (or job-multiplier) effect which allowed low-skilled services (e.g. as hotels and restaurants) to expand.

Overall, this suggests that the CBW produced positive effects on local highly-educated workers, possibly through both a complementarity and a productivity channel, by pushing some of them to managerial and high-pay occupations and by allowing firms in knowledge-intensive sectors to become more productive. The variety of responses to immigration makes clear that a simple static, partial-effects model of fixed demand and change in supply does not work well in explaining the effect of immigration in this case. Rather, different types of complementarity, gains from specialization, and productivity effects are at work when firms and workers adapt. Most importantly, this paper is one of the very first to directly analyze the labor market consequences of a *permanent* and *complete* labor market liberalization policy for some foreign workers in local labor markets.

## References


Abberger, Klaus, Yngve Abrahamsen, Thomas Bolli, Andreas Dibiasi, Peter Egger, Andres Frick, Michael Graff, Florian Hälg, David Iselin, Samad Sarferaz, Jörg Schläpfer, Michael Siegenthaler, Banu Simmons-Süer, Jan-Egbert Sturm and Filip Tarlea. 2015. "Der Bilaterale Weg - Eine ökonomische Bestandsaufnahme." *KOF Studien* 2015(58).

Autor, David H and Mark G Duggan. 2003. "The Rise in the Disability Rolls and the Decline in Unemployment." *The Quarterly Journal of Economics* 118(1):157–205.

Bartik, Timothy J. 1991. "Who Benefits from State and Local Economic Development Policies?" *Books from Upjohn Press* .

Beerli, Andreas and Ronald Indergand. 2016. "Which Factors Drive the Skill-Mix of Migrants in the Long-Run?" Mimeo.

BFS. 2010. "Bundesamat für Statistik, Schweizerische Lohnstrukturerhebung 1994 - 2010.".

Bigotta, Maurizio. 2013. Priority to Local Workers and its Consequences on Unemployment Duration. Technical report LIVES Working Papers.

Blanchard, Olivier Jean and Lawrence F Katz. 1992. "Regional Evolutions." *Brookings Papers on Economic Activity* 1992(1):1–75.

Blau, Francine D and Lawrence M Kahn. 2012. Immigration and the Distribution of Incomes. Technical report National Bureau of Economic Research, Working Paper No. 18515.

Bohn, Sarah, Magnus Lofstrom and Steven Raphael. 2014. "Did the 2007 Legal Arizona Workers Act reduce the state's unauthorized immigrant population?" *Review of Economics and Statistics* 96(2):258–269.

Borjas, George J. 2003. "The Labor Demand Curve Is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market." *The Quarterly Journal of Economics* 118(4):1335–1374.

Bundesrat. 1999. "Botschaft zur Genehmigung der sektoriellen Abkommen zwischen der Schweiz und der EG vom 23. Juni 1999." `https://www.admin.ch/opc/de/federal-gazette/1999/6128.pdf`.

Cadena, Brian C and Brian K Kovak. 2016. "Immigrants Equilibrate Local Labor Markets: Evidence from the Great Recession." *American Economic Journal: Applied Economics* 8(1):257–90.

Card, David and Ethan G Lewis. 2007. The diffusion of Mexican immigrants during the 1990s: Explanations and Impacts. In *Mexican immigration to the United States*. University of Chicago Press pp. 193–228.

Card, David and John DiNardo. 2000. "Do Immigrant Inflows Lead to Native Outflows?" *American Economic Review* 90(2):360–367.

Cattaneo, Cristina, Carlo V Fiorio and Giovanni Peri. 2015. "What Happens to the Careers of European Workers When Immigrants ''Take Their Jobs''?" *Journal of Human Resources* 50(3):655–693.

Chassamboulli, Andri and Theodore Palivos. 2014. "A Search-Equilibrium Approach to the Effects of Immigration on Labor Market Outcomes." *International Economic Review* 55(1):111–129.

Dustmann, Christian, Uta Schönberg and Jan Stuhler. 2017. "Labor Supply Shocks, Native Wages, and the Adjustment of Local Employment." *The Quarterly Journal of Economics* 132(1):435–483.

Economist. 2016. "The parable of Ticino. The harsh lessons from Switzerland for Brexiteers." http://www.economist.com/news/europe/21707550-harsh-lessons-switzerland-brexiteers-parable-ticino.

Favre, Sandro, Rafael Lalive and Josef Zweimüller. 2013. Verdrängungseffekte des Freizügigkeitsabkommens Schweiz-EU auf dem Schweizer Arbeitsmarkt. Technical report Schlussbericht zuhanden von Staatssekretariat für Wirtschaft SECO.

Foged, Mette and Giovanni Peri. 2016. "Immigrants' Effect on Native Workers: New Analysis on Longitudinal Data." *American Economic Journal: Applied Economics* 8(2):1–34.

Glitz, Albrecht. 2012. "The Labor Market Impact of Immigration: A Quasi-Experiment Exploiting Immigrant Location Rules in Germany." *Journal of Labor Economics* 30(1):175–213.

Henneberger, Fred and Alexandre Ziegler. 2011. Evaluation der Wirksamkeit der ankierenden Massnahmen zur Personenfreizu gigkeit: Teil 2: Empirische U berpru fung des Auftretens von Lohndruck aufgrund des Immigrationsdrucks aus den EU17/EFTA-Mitgliedstaaten. Technical report Diskussionspapiere des Forschungsinstituts für Arbeit und Arbeitsrecht an der Universität St. Gallen No. 125.

Hong, Gihoon and John McLaren. 2015. Are Immigrants a Shot in the Arm for the Local Economy? Technical report National Bureau of Economic Research, Working Paper 21123.

Kerr, William R and William F Lincoln. 2010. "The Supply Side of Innovation: H-1B Visa Reforms and US Ethnic Invention." *Journal of Labor Economics* 28(3):473–508.

Lafortune, Jeanne, José Tessada and Ethan Lewis. 2015. People and Machines: A Look at the Evolving Relationship Between Capital and Skill In Manufacturing 1860-1930 Using Immigration Shocks. Technical report National Bureau of Economic Research, Working Paper 21435.

Lewis, Ethan and Giovanni Peri. 2014. Immigration and the Economy of Cities and Regions. Technical report National Bureau of Economic Research, Working Paper 20428.

Longhi, Simonetta, Peter Nijkamp and Jacques Poot. 2005. "A Meta-Analytic Assessment of the Effect of Immigration on Wages." *Journal of Economic Surveys* 19(3):451–477.

Losa, Fabio B., Maurizio Bigotta and Oscar Gonzales. 2012. La Libre Circulation: Joies ou Douleurs? Technical report Analisi dell'Ufficio di statistica del Cantone Ticino.

Mayda, Anna Maria. 2010. "International Migration: A Panel Data Analysis of the Determinants of Bilateral Flows." *Journal of Population Economics* 23(4):1249–1274.

Monras, Joan. 2015. Immigration and Wage Dynamics: Evidence from the Mexican Peso Crisis. Technical report IZA DP No. 8924.

Moretti, Enrico. 2010. "Local Multipliers." *The American Economic Review, Papers and Proceedings* 100(2):1–7.

Neal, Derek. 1995. "Industry-Specific Human Capital: Evidence from Displaced Workers." *Journal of labor Economics* 13(4):653–677.

Ortega, Francesc and Giovanni Peri. 2014. "Openness and Income: The Roles of Trade and Migration." *Journal of International Economics* 92(2):231–251.

Ottaviano, Gianmarco IP and Giovanni Peri. 2012. "Rethinking the Effect of Immigration on Wages." *Journal of the European Economic Association* 10(1):152–197.

Peri, Giovanni. 2012. "The Effect of Immigration on Productivity: Evidence from US States." *Review of Economics and Statistics* 94(1):348–358.

Peri, Giovanni and Chad Sparber. 2011*a*. "Assessing Inherent Model Bias: An Application to Native Displacement in Response to Immigration." *Journal of Urban Economics* 69(1):82–91.

Peri, Giovanni and Chad Sparber. 2011*b*. "Highly Educated Immigrants and Native Occupational Choice." *Industrial Relations: a journal of economy and society* 50(3):385–411.

Peri, Giovanni, Kevin Shih and Chad Sparber. 2015*a*. Foreign and Native Skilled Workers: What Can We Learn from H-1B Lotteries? Technical Report Working Paper No. 21175 National Bureau of Economic Research.

Peri, Giovanni, Kevin Shih and Chad Sparber. 2015*b*. "STEM workers, H-1B visas, and productivity in US cities." *Journal of Labor Economics* 33(S1 Part 2):S225–S255.

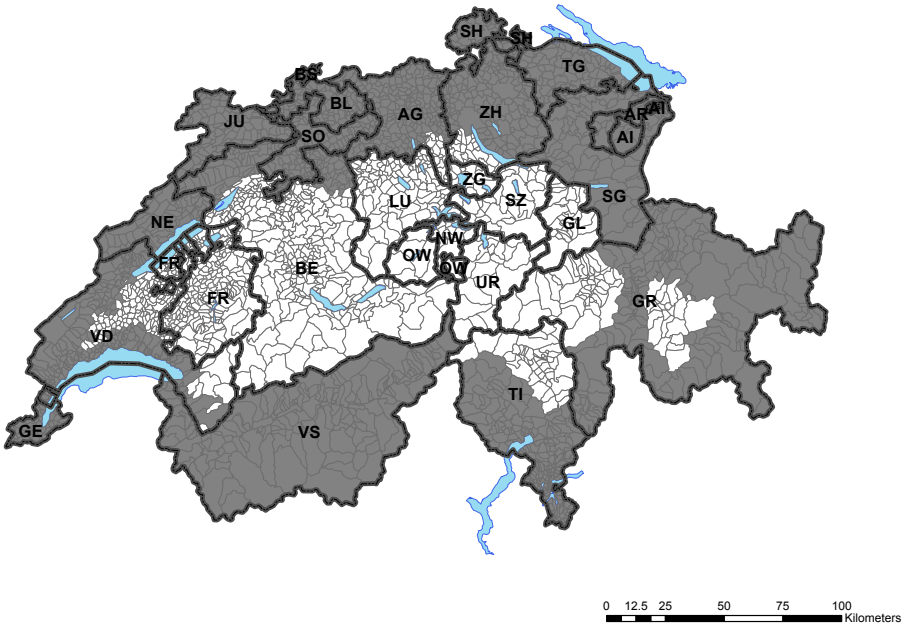
Rogerson, Richard and Robert Shimer. 2011. Search in Macroeconomic Models of the Labor Market. In *Handbook of Labor Economics*, ed. David Card and Orley Ashenfelter. Vol. 4A Elsevier pp. 619–700.

Ruffner, Jan and Michael Siegenthaler. 2016. "From Labor to Cash Flow? The Impact of Abolishing All Immigration Restrictions for EU Workers on Swiss Firms." Mimeo.

Saiz, Albert. 2003. "Room in the Kitchen for the Melting Pot: Immigration and Rental Prices." *Review of Economics and Statistics* 85(3):502–521.

Swiss Federal Statistical Office. 2015. "Grenzgänger/innen nach Wohn- und Arbeitsort (innerhalb oder ausserhalb der Schweiz), nach Nationalität. Durchschnitte über 3 Jahre." `https://www.bfs.admin.ch/bfs/de/home/statistiken/arbeit-erwerb/erhebungen/ggs.assetdetail.315072.html`.

Figure 1: Municipalities in the border region (gray) and in the non-border region (white)




*Notes*: Municipalities in the border region are indicated in gray and those in the non-border region in white. The black lines and letters denote cantonal borders and abbreviations, respectively. Note that border regions do not overlap completely with cantonal borders.

Table 1: Characteristics of natives and cross-border workers in the border region, 1998 and 2010

| | Natives | | | Cross-border workers | | |
|---|---|---|---|---|---|---|
| | 1998 | 2010 | Change | 1998 | 2010 | Change |
| *Demographic characteristics* | | | | | | |
| Share highly educated | 0.200 | 0.262 | 0.062 | 0.153 | 0.279 | 0.126 |
| Share middle educated | 0.667 | 0.631 | -0.036 | 0.513 | 0.490 | -0.023 |
| Share low educated | 0.134 | 0.107 | -0.027 | 0.334 | 0.232 | -0.102 |
| Mean age | 39.700 | 41.200 | 1.500 | 39.700 | 40.500 | 0.800 |
| Share male | 0.598 | 0.544 | -0.054 | 0.693 | 0.660 | -0.033 |
| Mean tenure | 9.300 | 8.200 | -1.100 | 9.400 | 7.200 | -2.200 |
| Mean log hourly real wage | 3.566 | 3.600 | 0.034 | 3.455 | 3.536 | 0.081 |
| Mean full time equivalent | 0.882 | 0.832 | -0.050 | 0.956 | 0.936 | -0.020 |
| Total number of FTE | 902,461 | 1,046,246 | 143,785 | 99,316 | 163,946 | 64,630 |
| Total number of workers | 1,023,236 | 1,256,986 | 233,750 | 103,863 | 175,206 | 71,343 |
| Sample observations | 181,380 | 596,258 | 414,878 | 19,898 | 86,178 | 66,280 |
| *Share in management positions* | | | | | | |
| Share high position | 0.066 | 0.075 | 0.009 | 0.019 | 0.028 | 0.009 |
| Share middle position | 0.088 | 0.084 | -0.004 | 0.052 | 0.063 | 0.011 |
| Share low position | 0.238 | 0.205 | -0.033 | 0.189 | 0.215 | 0.026 |
| Share no position | 0.608 | 0.636 | 0.028 | 0.739 | 0.694 | -0.045 |
| *Share in occupation groups (by wage tercile 1998)* | | | | | | |
| Share high tercile | 0.252 | 0.269 | 0.017 | 0.166 | 0.235 | 0.069 |
| Share middle terticle | 0.369 | 0.360 | -0.009 | 0.209 | 0.252 | 0.043 |
| Share low tercile | 0.379 | 0.371 | -0.008 | 0.624 | 0.513 | -0.111 |
| *Industry shares* | | | | | | |
| Agriculture/Fishing/Mining | 0.004 | 0.006 | 0.002 | 0.005 | 0.006 | 0.001 |
| Manufacturing | 0.265 | 0.205 | -0.060 | 0.461 | 0.380 | -0.081 |
| Utilities | 0.007 | 0.008 | 0.001 | 0.001 | 0.003 | 0.002 |
| Construction | 0.068 | 0.069 | 0.001 | 0.127 | 0.108 | -0.019 |
| Wholesale/Retail/Repair | 0.203 | 0.210 | 0.007 | 0.144 | 0.153 | 0.009 |
| Hotels/Restaurants | 0.037 | 0.044 | 0.007 | 0.055 | 0.051 | -0.004 |
| Transport/Communication/Storage | 0.062 | 0.048 | -0.014 | 0.064 | 0.054 | -0.010 |
| Financial Intermediation | 0.107 | 0.087 | -0.020 | 0.021 | 0.024 | 0.003 |
| Real Estate/R&D/IT/Business activities | 0.113 | 0.141 | 0.028 | 0.056 | 0.122 | 0.066 |
| Education | 0.022 | 0.023 | 0.001 | 0.007 | 0.014 | 0.007 |
| Health | 0.083 | 0.118 | 0.035 | 0.042 | 0.061 | 0.019 |
| Personal Services | 0.029 | 0.041 | 0.012 | 0.016 | 0.024 | 0.008 |

*Notes:* Occupations are categorized into high, middle, and low-paying occupations according to their average wage in 1998. SESS data.

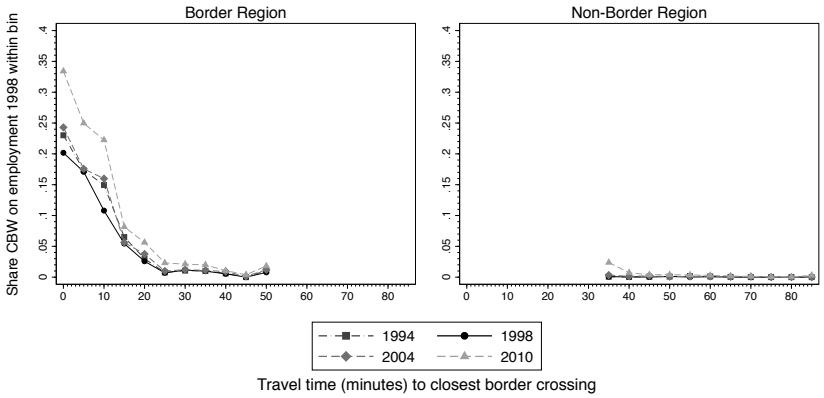
Table 2: Characteristics of workers depending on travel time of workplace from the border, border region 1998

| | Border Region | | | | Non-Border- |
|---|---|---|---|---|---|
| *Travel time to border crossing (minutes)* | 0 − 10min | 10 − 20min | 20 − 30min | >30min | Region |
| *Demographic characteristics* | | | | | |
| Share highly educated | 0.189 | 0.131 | 0.208 | 0.157 | 0.150 |
| Share middle educated | 0.543 | 0.601 | 0.605 | 0.600 | 0.616 |
| Share low educated | 0.268 | 0.269 | 0.187 | 0.242 | 0.234 |
| Mean age | 39.6 | 39.5 | 39.2 | 39.4 | 38.7 |
| Share male | 0.603 | 0.650 | 0.604 | 0.631 | 0.608 |
| Mean tenure | 9.3 | 9.1 | 8.6 | 9.2 | 9.1 |
| Mean log hourly real wage | 3.505 | 3.459 | 3.582 | 3.484 | 3.454 |
| Mean full time equivalent | 0.906 | 0.896 | 0.887 | 0.893 | 0.873 |
| Total number of FTE | 388,705 | 160,005 | 370,269 | 391,707 | 434,277 |
| Total number of workers | 428,989 | 178,480 | 417,237 | 438,717 | 497,470 |
| Sample observations | 74,891 | 27,932 | 75,857 | 70,475 | 83,106 |
| *Geographic characteristics* | | | | | |
| Share German speaking | 0.436 | 0.752 | 0.837 | 0.736 | 0.898 |
| Share French speaking | 0.396 | 0.183 | 0.160 | 0.263 | 0.090 |
| Share Italian/Romansh speaking | 0.168 | 0.065 | 0.003 | 0.000 | 0.011 |
| Mean travel time (min) to border | 4.408 | 14.869 | 26.717 | 39.549 | 61.173 |
| Mean travel distance (km) to border | 2.777 | 12.972 | 26.670 | 42.637 | 71.172 |
| Share workers in cities with population $\geq 100'000$ | 0.332 | 0.000 | 0.431 | 0.091 | 0.148 |
| Number of municipalities | 321 | 178 | 194 | 424 | 534 |
| *Industry shares* | | | | | |
| Agriculture/Fishing/Mining | 0.007 | 0.004 | 0.003 | 0.003 | 0.003 |
| Manufacturing | 0.312 | 0.323 | 0.211 | 0.337 | 0.259 |
| Utilities | 0.004 | 0.012 | 0.003 | 0.007 | 0.005 |
| Construction | 0.093 | 0.108 | 0.071 | 0.096 | 0.123 |
| Wholesale/Retail/Repair | 0.158 | 0.221 | 0.177 | 0.204 | 0.224 |
| Hotels/Restaurants | 0.052 | 0.055 | 0.058 | 0.056 | 0.081 |
| Transport/Communication/Storage | 0.056 | 0.052 | 0.058 | 0.054 | 0.056 |
| Financial Intermediation | 0.085 | 0.049 | 0.153 | 0.041 | 0.058 |
| Real Estate/R&D/IT/Business activities | 0.109 | 0.072 | 0.122 | 0.088 | 0.078 |
| Education | 0.018 | 0.020 | 0.021 | 0.019 | 0.014 |
| Health | 0.078 | 0.057 | 0.086 | 0.075 | 0.072 |
| Personal Services | 0.029 | 0.026 | 0.038 | 0.021 | 0.027 |

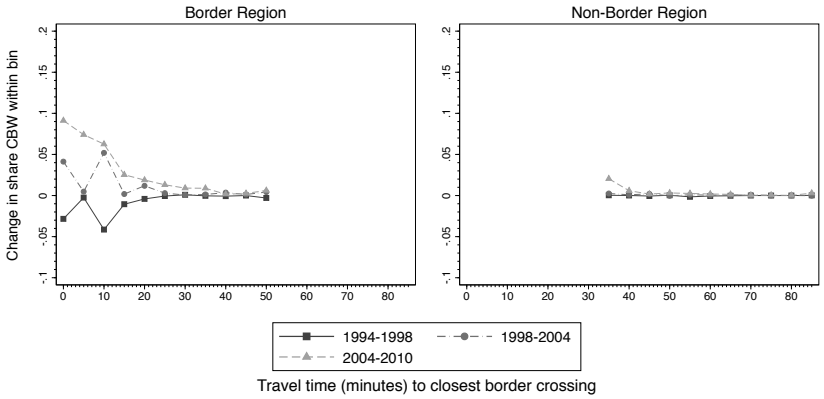
*Notes:* Municipalities in the border region are categorized into four bins according to their travel time in minutes to the next border crossing. SESS data 1998.

Figure 2: Employment share of cross-border workers in distance bins

A. Share of cross-border workers on total employment 1998




B. Change in share of cross-border workers on total employment 1998




*Notes:* The figure plots the share of cross-border workers on total employment in 1998 in Panel A and the change between those shares in Panel B, separately for the border region and the non-border region. Municipalities are grouped into bins of 5 minutes according to their travel time by car to the next border crossing. Bins with a small number of total workers are omitted, i.e. those with travel time above 50 minutes in the border region and those between 13 and 35 minutes and above 85 minutes in the non-border region. SESS data.

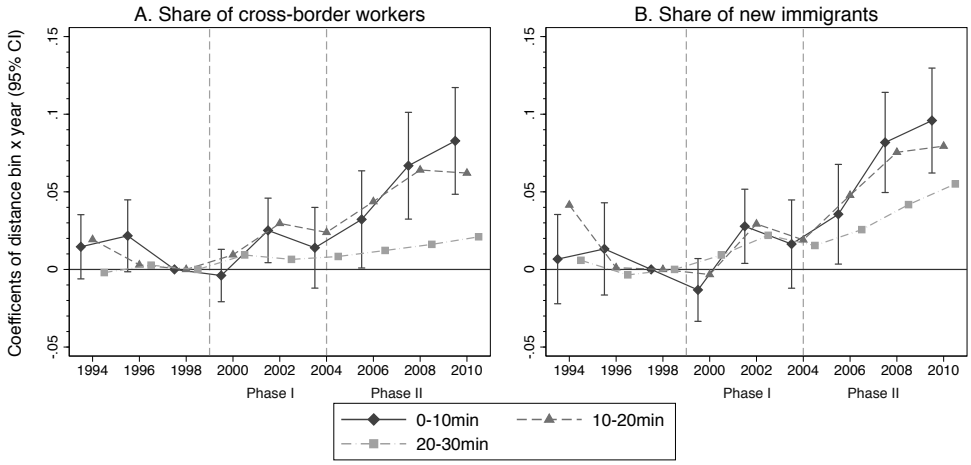
Table 3: Effect of free movement policy on share of immigrants on total employment

Dependent variable: Share of cross-border workers (Panel A) and new immigrants (Panel B) on total employment 1998

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | | A. Share of cross-border workers | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.047 | 0.036 | 0.034 | | | |
| | (0.016)*** | (0.012)*** | (0.012)*** | | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.031 | 0.035 | 0.033 | | | |
| | (0.014)** | (0.013)*** | (0.012)*** | | | |
| $FREE_{m,t} \cdot I(20 < dist_m \leq 30)$ | 0.003 | 0.012 | 0.010 | | | |
| | (0.002) | (0.004)*** | (0.004)*** | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | | 0.047 | 0.038 | 0.037 |
| | | | | (0.014)*** | (0.011)*** | (0.011)*** |
| $FREE_{m,t} \cdot I(15 < dist_m \leq 30)$ | | | | 0.005 | 0.014 | 0.011 |
| | | | | (0.003)* | (0.004)*** | (0.004)*** |
| R-squared | 0.544 | 0.545 | 0.553 | 0.544 | 0.545 | 0.553 |
| Observations | 10053 | 10053 | 14859 | 10053 | 10053 | 14859 |
| | | | B. Share of new immigrants workers | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.058 | 0.049 | 0.045 | | | |
| | (0.019)*** | (0.011)*** | (0.011)*** | | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.029 | 0.041 | 0.036 | | | |
| | (0.018) | (0.017)** | (0.016)** | | | |
| $FREE_{m,t} \cdot I(20 < dist_m \leq 30)$ | 0.023 | 0.027 | 0.023 | | | |
| | (0.007)*** | (0.007)*** | (0.007)*** | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | | 0.057 | 0.049 | 0.045 |
| | | | | (0.018)*** | (0.011)*** | (0.011)*** |
| $FREE_{m,t} \cdot I(15 < dist_m \leq 30)$ | | | | 0.021 | 0.028 | 0.023 |
| | | | | (0.007)*** | (0.007)*** | (0.006)*** |
| R-squared | 0.515 | 0.517 | 0.508 | 0.515 | 0.517 | 0.508 |
| Observations | 10053 | 10053 | 14859 | 10053 | 10053 | 14859 |
| Including NBR Sample | | | √ | | | √ |
| Year/Area fixed effects | √ | √ | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ | √ | √ |
| Nuts II trend | | √ | √ | | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total workforce in 1998 in a cell. SESS data.

Figure 3: Event analysis of effect of free movement policy on share of immigrants on total employment




*Notes:* The figure plots the coefficients and the 95% confidence interval for the 0-10min distance bin of a regression based on equation (3) with the share of cross-border workers on total employment in 1998 as dependent variable. Regressions are weighted using the total workforce in 1998 in a cell and include Nuts II trends and the Bartik measure. Standard errors are clustered on the CZ level. The sample includes only municipalities in the border region. SESS data.

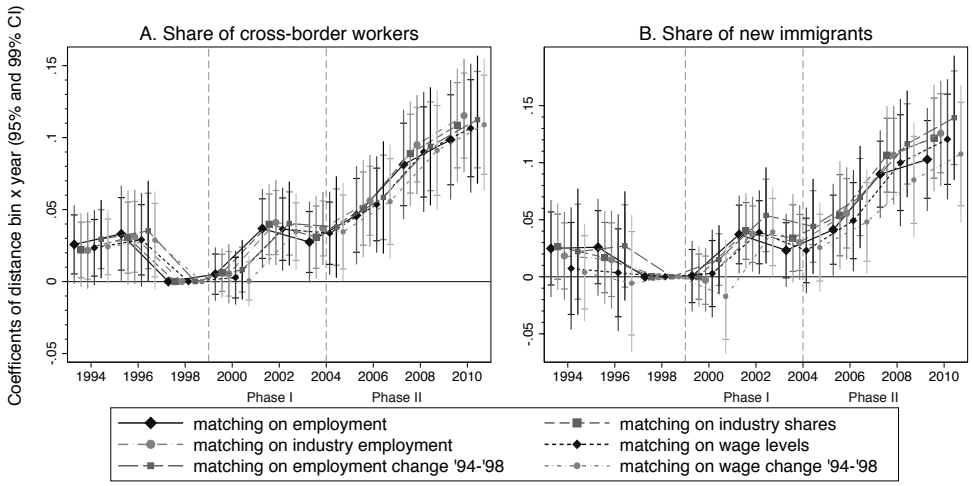
Table 4: Effect of the free movement policy on share of cross-border workers and new immigrants in matched municipalities in the border region

Dependent variable: Share of cross-border workers (Panel A) and new immigrants (Panel B) on total employment 1998

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | | A. Share of cross-border workers | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.036 | 0.037 | 0.048 | 0.045 | 0.043 | 0.050 |
| | (0.011)*** | (0.009)*** | (0.010)*** | (0.013)*** | (0.013)*** | (0.014)*** |
| R-squared | 0.640 | 0.631 | 0.642 | 0.629 | 0.649 | 0.625 |
| | | | B. Share of new immigrants workers | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.038 | 0.043 | 0.053 | 0.051 | 0.051 | 0.051 |
| | (0.013)*** | (0.011)*** | (0.012)*** | (0.016)*** | (0.017)*** | (0.017)*** |
| R-squared | 0.611 | 0.608 | 0.638 | 0.632 | 0.640 | 0.652 |
| Observations | 3528 | 3528 | 3528 | 3528 | 3528 | 3528 |
| Matching on | Employment | Industry shares | Industry employment | Wage level | Employment change | Wage change |
| Year & Area fixed effects | √ | √ | √ | √ | √ | √ |
| Bartik & Nuts II trends | √ | √ | √ | √ | √ | √ |
| $FREE_{m,t}\times$ Pair fixed effects | √ | √ | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004. ($dist_m \leq 10$) indicates that a municipality is located less or equal than 10 travel minutes from the next border crossing. Regressions are weighted using the total number of natives in a cell in 1998. The sample includes 196 municipalities 0-10min bin in the border region matched with one municipality in the border region 30 minutes or more from the border. Matching is based on minimizing the following variable: column (1), the squared difference in employment 1996-1998; column (2), the sum of squared differences in 13 industry shares 1996-1998; column (3), the sum of squared differences in employment levels in 13 industries 1996-1998; column (4), the squared difference in wage levels 1996-1998; column (5), the squared difference in employment growth 1994-1998; column (6), the squared difference in wage growth 1994-1998. SESS data.

Figure 4: Event analysis of effect of free movement policy on share of immigrants on total employment in matched municipalities in the border region




*Notes:* The figure plots the coefficients and the 95% (tick) and 99% confidence interval (vertical line continuing after tick) of a regression based on equation (3) with the share of cross-border workers on total employment in 1998 as dependent variable. Vertical lines indicate the beginning of *Phase I* in 1999 and *Phase II* in 2004. The sample includes 196 municipalities 0-10min bin in the border region matched with one municipality in the border region 30 minutes or more from the border. Matching is based on minimizing the following variable: Large diamonds and straight line, the squared difference in employment 1996-1998; Large squares and dashed line, the sum of squared differences in 13 industry shares 1996-1998; Large circles and dash/dotted line, the sum of squared differences in employment levels in 13 industries 1996-1998; Small diamonds and short dashed line, the squared difference in wage levels 1996-1998; small squares and long-dashed line, the squared difference in employment growth 1994-1998; small circles and short dash/dotted line, the squared difference in wage growth 1994-1998. Regressions are weighted using the total workforce in 1998 in a cell and include Nuts II trends, the Bartik measure and an interaction of an indicator for each matched pair with $FREE_{m,t}$ dummy. Standard errors are clustered at the CZ level. SESS data.

Table 5: Effect of free movement policy on wage levels of natives

Dependent variable: Average log hourly wages of natives by education group

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| **A. All education groups** | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.020 | -0.019 | | |
| | (0.024) | (0.024) | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.004 | 0.006 | | |
| | (0.008) | (0.008) | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | -0.013 | -0.012 |
| | | | (0.019) | (0.019) |
| R-squared | 0.774 | 0.768 | 0.774 | 0.767 |
| Observations | 11727 | 17616 | 11727 | 17616 |
| **B. Highly educated** | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.033 | 0.034 | | |
| | (0.011)*** | (0.010)*** | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.029 | 0.030 | | |
| | (0.010)*** | (0.009)*** | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | 0.033 | 0.035 |
| | | | (0.010)*** | (0.009)*** |
| R-squared | 0.637 | 0.619 | 0.637 | 0.619 |
| Observations | 8778 | 13005 | 8778 | 13005 |
| **C. Middle educated** | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.025 | -0.025 | | |
| | (0.022) | (0.022) | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.002 | -0.001 | | |
| | (0.008) | (0.008) | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | -0.018 | -0.018 |
| | | | (0.018) | (0.018) |
| R-squared | 0.689 | 0.687 | 0.689 | 0.686 |
| Observations | 11282 | 16942 | 11282 | 16942 |
| **D. Low educated** | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.031 | -0.026 | | |
| | (0.015)** | (0.016) | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.019 | -0.014 | | |
| | (0.015) | (0.016) | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | -0.027 | -0.022 |
| | | | (0.014)* | (0.014) |
| R-squared | 0.543 | 0.515 | 0.543 | 0.515 |
| Observations | 9398 | 13914 | 9398 | 13914 |
| Including NBR Sample | | √ | | √ |
| Year/Area fixed effects | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ |

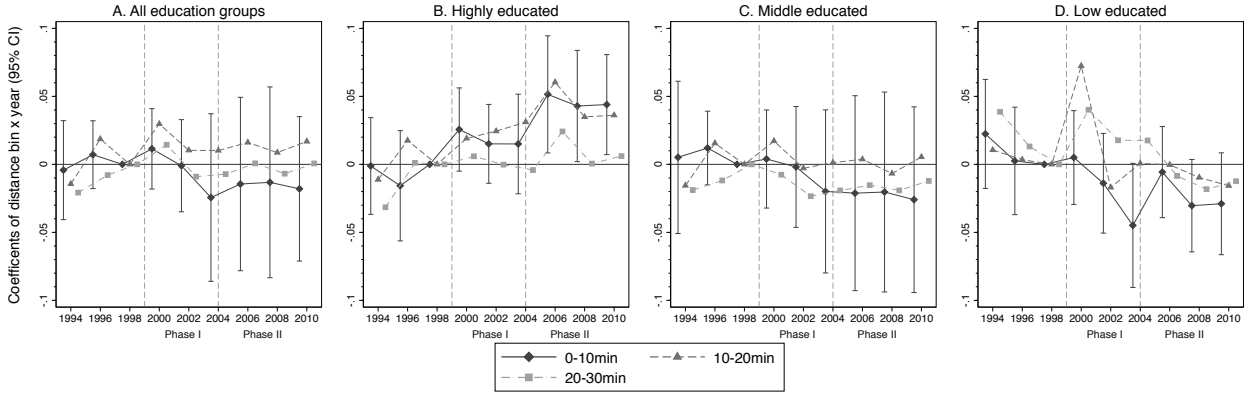
*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. SESS data.

Table 6: Effect of free movement policy on employment and hours worked by natives

| Dependent variable | Log total workers | | Log total hours | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| A. All education groups | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.045 | 0.042 | 0.035 | 0.030 |
| | (0.064) | (0.062) | (0.054) | (0.053) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.031 | -0.033 | -0.035 | -0.038 |
| | (0.050) | (0.051) | (0.045) | (0.046) |
| R-squared | 0.976 | 0.973 | 0.975 | 0.972 |
| Observations | 11734 | 17626 | 11734 | 17626 |
| B. Highly educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.042 | 0.041 | 0.057 | 0.053 |
| | (0.039) | (0.034) | (0.036) | (0.031)* |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.024 | 0.023 | 0.031 | 0.027 |
| | (0.078) | (0.075) | (0.078) | (0.075) |
| R-squared | 0.976 | 0.973 | 0.975 | 0.972 |
| Observations | 8810 | 13046 | 8810 | 13046 |
| C. Middle educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.000 | -0.003 | -0.008 | -0.013 |
| | (0.058) | (0.056) | (0.050) | (0.049) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.047 | -0.047 | -0.052 | -0.054 |
| | (0.046) | (0.046) | (0.042) | (0.042) |
| R-squared | 0.973 | 0.970 | 0.972 | 0.969 |
| Observations | 11287 | 16949 | 11287 | 16949 |
| D. Low educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.263 | 0.252 | 0.235 | 0.226 |
| | (0.168) | (0.164) | (0.158) | (0.155) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.028 | 0.018 | -0.001 | -0.009 |
| | (0.076) | (0.075) | (0.068) | (0.068) |
| R-squared | 0.927 | 0.918 | 0.923 | 0.914 |
| Observations | 9398 | 13914 | 9398 | 13914 |
| Including NBR Sample | | √ | | √ |
| Year/Area fixed effects | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ |

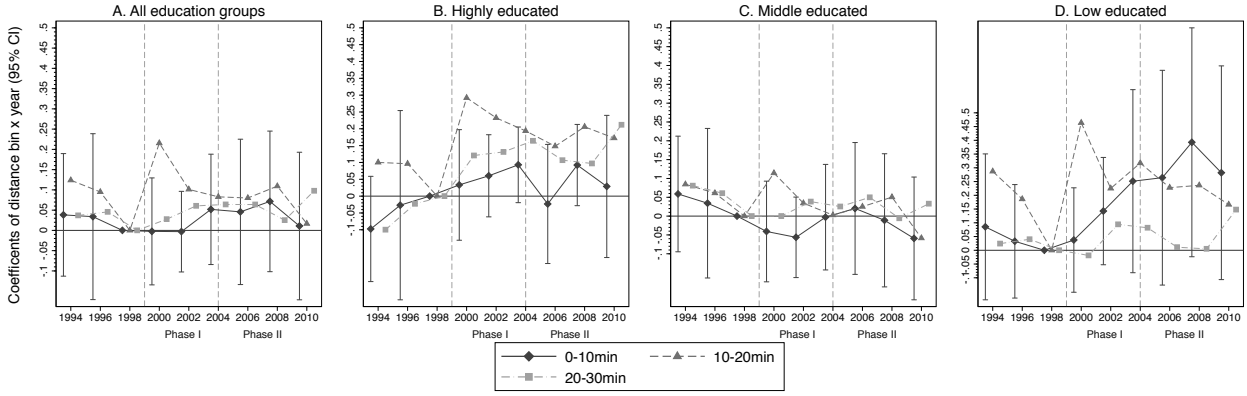
*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. SESS data.

Figure 5: Event analysis of effect of free movement policy on wage levels of natives




*Notes:* The figure plots the coefficients (and the 95% confidence interval for the 0-10min distance bin) of a regression based on equation (3) with the average log hourly wage of an education group of native workers as dependent variable. Regressions are weighted using the number of native in a cell and include Nuts II trends and the education specific Bartik measure. Standard errors are clustered on the CZ level. The sample includes only municipalities in the border region. SESS data.

Figure 6: Event analysis of effect of free movement policy on hours worked by natives




*Notes:* The figure plots the coefficients (and the 95% confidence interval for the 0-10min distance bin) of a regression based on equation (3) with the log total hours worked of an education group of native workers as dependent variable. Regressions are weighted using the number of native in a cell and include Nuts II trends and the education specific Bartik measure. Standard errors are clustered on the CZ level. The sample includes only municipalities in the border region. SESS data.

Table 7: Effect of free movement policy on inflow and outflow of local employment by natives

| | | Inflow components | | | Outflow components | | |
|---|---|---|---|---|---|---|---|
| Dependent variable | $IN^{total}/E$ | $IN^{-m\to m}/E$ | $IN^{NE\to m}/E$ | $OUT^{total}/E$ | $OUT^{m\to -m}/E$ | $OUT^{m\to NE}/E$ | $NET/E$ |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | A. All education groups | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.007 | -0.018 | 0.011 | 0.004 | -0.006 | 0.010 | -0.010 |
| | (0.008) | (0.008)** | (0.006)* | (0.015) | (0.015) | (0.009) | (0.016) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.004 | -0.003 | 0.007 | -0.009 | 0.002 | -0.011 | 0.008 |
| | (0.013) | (0.014) | (0.007) | (0.015) | (0.015) | (0.012) | (0.016) |
| R-squared | 0.208 | 0.214 | 0.176 | 0.208 | 0.212 | 0.203 | 0.110 |
| Observations | 7824 | 7824 | 7824 | 6273 | 6273 | 6273 | 5796 |
| | | | B. Highly educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.052 | -0.049 | -0.003 | -0.024 | -0.030 | 0.006 | -0.026 |
| | (0.020)*** | (0.018)*** | (0.010) | (0.025) | (0.021) | (0.011) | (0.030) |
| R-squared | 0.225 | 0.236 | 0.274 | 0.256 | 0.263 | 0.249 | 0.149 |
| Observations | 3399 | 3399 | 3399 | 2514 | 2514 | 2514 | 2253 |
| | | | C. Middle educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.020 | -0.000 | 0.020 | 0.020 | 0.007 | 0.012 | -0.001 |
| | (0.010)** | (0.009) | (0.008)** | (0.019) | (0.016) | (0.011) | (0.022) |
| R-squared | 0.215 | 0.219 | 0.188 | 0.213 | 0.226 | 0.204 | 0.113 |
| Observations | 6493 | 6493 | 6493 | 5101 | 5101 | 5101 | 4658 |
| | | | D. Low educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.017 | 0.002 | -0.019 | 0.018 | -0.011 | 0.028 | -0.027 |
| | (0.050) | (0.028) | (0.040) | (0.063) | (0.050) | (0.044) | (0.040) |
| R-squared | 0.322 | 0.321 | 0.315 | 0.301 | 0.263 | 0.343 | 0.161 |
| Observations | 2068 | 2068 | 2068 | 1415 | 1415 | 1415 | 1190 |
| Year/Area fixed effects | √ | √ | √ | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. $IN^{\psi}/E$ is the inflow rate of natives either from other regions ($\psi = -m \to m$), from non-employment ($\psi = NE \to m$) or combined ($\psi = total$). $OUT^{\psi}/E$ is the outflow rate of natives either to other regions ($\psi = m \to -m$), to non-employment ($\psi = m \to NE$) or combined ($\psi = total$). $NET/E$ is the sum of total inflows minus outflows, i.e. $\left[IN^{total}/E\right] - \left[OUT^{total}/E\right]$. See Section 7.1 and Online Appendix B for more details. SLFS data 1996-2009.

Table 8: Effect of the free movement policy on share and number of natives in top tier management

| Dependent variable | Share board members | | Log (board members) | |
|---|---|---|---|---|
| | | | # Workers | # Hours |
| | (1) | (2) | (3) | (4) |
| A. All education groups | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.016 | 0.017 | 0.057 | 0.054 |
| | (0.010) | (0.010)* | (0.045) | (0.047) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.030 | 0.028 | 0.172 | 0.178 |
| | (0.011)*** | (0.010)*** | (0.075)** | (0.085)** |
| R-squared | 0.308 | 0.290 | 0.953 | 0.944 |
| Observations | 10836 | 16177 | 5035 | 5035 |
| Mean Dep. Var. | 0.196 | 0.196 | | |
| B. Highly educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.062 | 0.062 | 0.179 | 0.151 |
| | (0.026)** | (0.024)** | (0.063)*** | (0.066)** |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.033 | 0.032 | 0.118 | 0.133 |
| | (0.027) | (0.026) | (0.101) | (0.105) |
| R-squared | 0.394 | 0.379 | 0.948 | 0.943 |
| Observations | 5041 | 7289 | 2705 | 2705 |
| Mean Dep. Var. | 0.326 | 0.326 | | |
| C. Middle educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.002 | -0.001 | -0.099 | -0.095 |
| | (0.011) | (0.011) | (0.069) | (0.080) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.030 | 0.026 | 0.112 | 0.081 |
| | (0.012)** | (0.011)** | (0.089) | (0.105) |
| R-squared | 0.310 | 0.287 | 0.924 | 0.907 |
| Observations | 9189 | 13764 | 3427 | 3427 |
| Mean Dep. Var. | 0.157 | 0.157 | | |
| D. Low educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.034 | -0.029 | -0.037 | -0.133 |
| | (0.020)* | (0.019) | (0.127) | (0.173) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.035 | 0.040 | -0.470 | -0.198 |
| | (0.030) | (0.030) | (0.192)** | (0.269) |
| R-squared | 0.309 | 0.305 | 0.694 | 0.654 |
| Observations | 3374 | 5057 | 389 | 389 |
| Mean Dep. Var. | 0.080 | 0.080 | | |
| Including NBR Sample | | √ | | |
| Year/Area fixed effects | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. SLFS data 1996-2010.

Table 9: Effect of the free movement policy on up- and downgrading of ISCO main occupations by natives

Dependent variable: Upgrading ISCO occupations by education group

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| A. All education groups | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.012 | 0.012 | | |
| | (0.008) | (0.008) | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.003 | 0.003 | | |
| | (0.009) | (0.009) | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | 0.010 | 0.010 |
| | | | (0.009) | (0.008) |
| R-squared | 0.147 | 0.141 | 0.147 | 0.140 |
| Observations | 5637 | 8424 | 5637 | 8424 |
| B. Highly educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.007 | -0.008 | | |
| | (0.017) | (0.015) | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | -0.006 | -0.007 |
| | | | (0.017) | (0.015) |
| R-squared | 0.223 | 0.206 | 0.224 | 0.206 |
| Observations | 2226 | 3202 | 2226 | 3202 |
| C. Middle educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.019 | 0.020 | | |
| | (0.012) | (0.011)* | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | 0.017 | 0.018 |
| | | | (0.012) | (0.011) |
| R-squared | 0.160 | 0.157 | 0.160 | 0.157 |
| Observations | 4556 | 6816 | 4556 | 6816 |
| D. Low educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.007 | 0.002 | | |
| | (0.034) | (0.030) | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | -0.006 | -0.011 |
| | | | (0.035) | (0.031) |
| R-squared | 0.243 | 0.241 | 0.244 | 0.242 |
| Observations | 1180 | 1793 | 1180 | 1793 |
| Including NBR Sample | | √ | | √ |
| Year/Area fixed effects | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. The dependent variable is an average of an upgrading/downgrading-indicator among natives in a municipality-education-year cell. See text in section 7.3. SLFS data 1996-2009.

Table 10: Effect of the free movement policy on wage levels of natives in sector

Dependent variable: CBW share (Panel A) and average log hourly wages of natives by education group (Panel B-E)

| Category of employment | Manufacturing | | | Services | | | Establishment size | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | High-tech | Low-tech | Total | Knowl.-intensive | Not-Knowl. intensive | Large | Medium | Small |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **A. Share of CBW on emloyment in 1998** | | | | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.029 | 0.058 | -0.012 | 0.038 | 0.051 | 0.019 | 0.045 | 0.041 | 0.034 |
| | (0.020) | (0.028)** | (0.016) | (0.011)*** | (0.005)*** | (0.020) | (0.023)* | (0.008)*** | (0.013)** |
| R-squared | 0.418 | 0.326 | 0.678 | 0.478 | 0.475 | 0.479 | 0.396 | 0.600 | 0.493 |
| Observations | 4995 | 2898 | 3762 | 8919 | 5355 | 7974 | 6876 | 5580 | 5607 |
| **B. All education groups** | | | | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.029 | 0.042 | 0.008 | -0.024 | 0.020 | -0.028 | -0.059 | -0.003 | 0.009 |
| | (0.008)*** | (0.013)*** | (0.010) | (0.026) | (0.014) | (0.024) | (0.050) | (0.012) | (0.008) |
| R-squared | 0.783 | 0.818 | 0.658 | 0.777 | 0.757 | 0.669 | 0.793 | 0.691 | 0.629 |
| Observations | 7969 | 5360 | 6720 | 10608 | 8326 | 9131 | 6502 | 7151 | 9662 |
| **C. Highly educated** | | | | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.005 | 0.010 | -0.017 | 0.047 | 0.057 | 0.019 | 0.034 | 0.030 | 0.020 |
| | (0.014) | (0.014) | (0.026) | (0.010)*** | (0.012)*** | (0.021) | (0.020)* | (0.017)* | (0.010)* |
| R-squared | 0.586 | 0.631 | 0.495 | 0.639 | 0.643 | 0.596 | 0.726 | 0.553 | 0.521 |
| Observations | 5660 | 3795 | 4383 | 7260 | 5899 | 4938 | 3605 | 4997 | 6989 |
| **D. Middle educated** | | | | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.021 | 0.032 | 0.005 | -0.027 | 0.009 | -0.028 | -0.064 | -0.004 | 0.002 |
| | (0.008)** | (0.012)** | (0.012) | (0.023) | (0.016) | (0.020) | (0.042) | (0.014) | (0.009) |
| R-squared | 0.720 | 0.767 | 0.605 | 0.706 | 0.696 | 0.622 | 0.735 | 0.604 | 0.538 |
| Observations | 7522 | 5036 | 6304 | 10043 | 7752 | 8514 | 5916 | 6679 | 9289 |
| **E. Low educated** | | | | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.024 | 0.033 | 0.011 | -0.033 | -0.030 | -0.015 | -0.050 | -0.039 | -0.010 |
| | (0.013)* | (0.020)* | (0.012) | (0.012)*** | (0.015)** | (0.010) | (0.028)* | (0.021)* | (0.012) |
| R-squared | 0.676 | 0.790 | 0.579 | 0.557 | 0.630 | 0.528 | 0.657 | 0.512 | 0.426 |
| Observations | 5713 | 3385 | 4608 | 7834 | 4625 | 6573 | 4991 | 5065 | 6730 |
| Year/Area fixed effects | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ | √ | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. Columns (1)-(6) split group employment into mutually exclusive and exhaustive industries (omitting agriculture, mining and construction). High-tech manufacturing is NACE Rev 1.1 industries 24, 29, 30, 31, 32, 33, 34 and 35 excluding 35.1. Low-tech manufacturers are the remainder manufacturing categories. Knowledge-intensive services are NACE Rev 1.1 industries 61, 62, 64, 65-67, 70-74, 80, 85, 92. Columns (7)-(9) split group employment according to the size of the establishment. Large establishments have more than 250 FTEs, medium sized establishments have 50-250 FTEs and small establishments have 5-50 FTE. SESS data.

Table 11: Effect of the free movement policy on hours worked by natives and share of natives employed in sector

Dependent variable: Log total hours worked by education group (Panel A-D) and share of employment (Panel E) by natives in category

| Category of employment | Manufacturing | | | Services | | | Establishment size | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total | High-tech | Low-tech | Total | Knowl.-intensive | Not-Knowl. intensive | Large | Medium | Small | Public Sector |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| | | | | A. Hours worked by all education groups | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.0343 | 0.0354 | -0.0317 | 0.106 | -0.0192 | 0.282 | 0.0823 | 0.0499 | 0.0494 | |
| | (-0.51) | (0.40) | (-0.43) | (1.35) | (-0.47) | (1.62) | (0.77) | (0.95) | (1.13) | |
| R-squared | 0.904 | 0.896 | 0.863 | 0.977 | 0.975 | 0.949 | 0.966 | 0.943 | 0.943 | |
| Observations | 7976 | 5365 | 6726 | 10618 | 8337 | 9132 | 6507 | 7161 | 9666 | |
| | | | | B. Hours worked by highly educated | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.182 | 0.291 | 0.070 | 0.055 | 0.064 | 0.113 | 0.017 | 0.146 | 0.175 | |
| | (0.077)** | (0.099)*** | (0.097) | (0.049) | (0.058) | (0.090) | (0.074) | (0.077)* | (0.062)*** | |
| R-squared | 0.911 | 0.904 | 0.856 | 0.976 | 0.975 | 0.931 | 0.963 | 0.946 | 0.950 | |
| Observations | 5686 | 3810 | 4409 | 7289 | 5931 | 4956 | 3615 | 5028 | 7010 | |
| | | | | C. Hours worked by middle educated | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.079 | -0.010 | -0.056 | 0.072 | -0.074 | 0.267 | 0.049 | -0.001 | 0.019 | |
| | (0.073) | (0.102) | (0.075) | (0.079) | (0.046) | (0.170) | (0.106) | (0.055) | (0.042) | |
| R-squared | 0.896 | 0.888 | 0.860 | 0.973 | 0.971 | 0.946 | 0.964 | 0.941 | 0.933 | |
| Observations | 7528 | 5038 | 6309 | 10047 | 7758 | 8515 | 5918 | 6683 | 9293 | |
| | | | | D. Hours worked by low educated | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.051 | -0.027 | -0.065 | 0.385 | 0.030 | 0.576 | 0.301 | 0.110 | 0.127 | |
| | (0.082) | (0.088) | (0.098) | (0.216)* | (0.070) | (0.308)* | (0.242) | (0.072) | (0.057)** | |
| R-squared | 0.834 | 0.841 | 0.786 | 0.926 | 0.920 | 0.899 | 0.924 | 0.845 | 0.832 | |
| Observations | 5714 | 3385 | 4610 | 7834 | 4625 | 6573 | 4991 | 5065 | 6730 | |
| | | | | E. Sector shares (CE data) | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.004 | 0.003 | 0.001 | -0.005 | -0.001 | -0.004 | 0.002 | -0.005 | 0.003 | 0.016 |
| | (0.004) | (0.005) | (0.003) | (0.004) | (0.006) | (0.005) | (0.010) | (0.008) | (0.007) | (0.004)*** |
| R-squared | 0.958 | 0.942 | 0.925 | 0.964 | 0.961 | 0.905 | 0.898 | 0.771 | 0.918 | 0.924 |
| Observations | 7953 | 7953 | 7953 | 7953 | 7953 | 7953 | 7522 | 7522 | 7522 | 7959 |
| Year/Area fixed effects | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. Columns (1)-(6) split employment into mutually exclusive and exhaustive industries (omitting agriculture, mining and construction). High-tech manufacturing is NACE Rev 1.1 industries 24, 29, 30, 31, 32, 33, 34 and 35 excluding 35.1. Low-tech manufacturers are the remainder manufacturing categories. Knowledge-intensive services are NACE Rev 1.1 industries 61, 62, 64, 65-67, 70-74, 80, 85, 92. Columns (7)-(9) split employment according to the size of the establishment. Large establishments have more than 250 FTEs, medium sized establishments have 50-250 FTEs and small establishments have 5-50 FTE. in Column (10), Public sector affiliation is based on the legal form of the establishment (estimates for private sector omitted). SESS data and BC data.

Table 12: Effect of free movement policy on wage levels of natives, by demographic group

Dependent variable: Average log hourly wages of natives by demographic and education group

| *Demographic Group* | All | Gender | | Age | | Tenure | |
|---|---|---|---|---|---|---|---|
| | | male | female | old | young | high | low |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | A. All education groups | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.020 | -0.005 | -0.029 | -0.024 | -0.013 | -0.035 | -0.009 |
| | (0.024) | (0.016) | (0.023) | (0.028) | (0.018) | (0.033) | (0.015) |
| R-squared | 0.774 | 0.783 | 0.776 | 0.756 | 0.730 | 0.760 | 0.748 |
| Observations | 11727 | 10946 | 10750 | 11190 | 10838 | 10757 | 11058 |
| | | | B. Highly educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.033 | 0.025 | 0.033 | 0.029 | 0.035 | 0.021 | 0.035 |
| | (0.011)*** | (0.011)** | (0.012)*** | (0.011)*** | (0.011)*** | (0.011)* | (0.011)*** |
| R-squared | 0.637 | 0.625 | 0.605 | 0.600 | 0.622 | 0.607 | 0.624 |
| Observations | 8778 | 8399 | 6053 | 7993 | 7340 | 7667 | 7594 |
| | | | C. Middle educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.025 | -0.013 | -0.030 | -0.029 | -0.016 | -0.039 | -0.010 |
| | (0.022) | (0.016) | (0.022) | (0.025) | (0.017) | (0.029) | (0.015) |
| R-squared | 0.689 | 0.702 | 0.685 | 0.668 | 0.637 | 0.683 | 0.654 |
| Observations | 11282 | 10412 | 10208 | 10529 | 10332 | 10162 | 10524 |
| | | | D. Low educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.031 | -0.042 | -0.026 | -0.039 | -0.014 | -0.043 | -0.028 |
| | (0.015)** | (0.013)*** | (0.017) | (0.020)* | (0.012) | (0.029) | (0.016)* |
| R-squared | 0.543 | 0.502 | 0.598 | 0.549 | 0.505 | 0.598 | 0.489 |
| Observations | 9398 | 7430 | 8343 | 8829 | 7359 | 7912 | 8224 |
| Year/Area fixed effects | √ | √ | √ | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. Column (1) repeats the regression in column (2) of table 5. For age and tenure groups, workers are split by the median values (38 and 6, respectively) in 1998. SESS data.

Table 13: Effect of free movement policy on hours worked by natives, by demographic group

Dependent variable: Log hours worked by natives by demographic and education group

| *Demographic Group* | All | Gender | | Age | | Tenure | |
|---|---|---|---|---|---|---|---|
| | | male | female | old | young | high | low |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | A. All education groups | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.035 | -0.001 | 0.095 | 0.017 | 0.058 | 0.048 | 0.041 |
| | (0.054) | (0.037) | (0.086) | (0.056) | (0.058) | (0.066) | (0.051) |
| R-squared | 0.975 | 0.970 | 0.973 | 0.972 | 0.972 | 0.968 | 0.974 |
| Observations | 11734 | 10956 | 10755 | 11200 | 10839 | 10764 | 11064 |
| | | | B. Highly educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.057 | 0.087 | -0.038 | 0.082 | 0.060 | 0.105 | 0.062 |
| | (0.036) | (0.036)** | (0.058) | (0.044)* | (0.051) | (0.046)** | (0.052) |
| R-squared | 0.975 | 0.972 | 0.966 | 0.973 | 0.969 | 0.965 | 0.973 |
| Observations | 8810 | 8436 | 6068 | 8048 | 7348 | 7722 | 7613 |
| | | | C. Middle educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.008 | -0.056 | 0.065 | -0.041 | 0.026 | -0.000 | 0.005 |
| | (0.050) | (0.036) | (0.078) | (0.046) | (0.064) | (0.060) | (0.050) |
| R-squared | 0.972 | 0.961 | 0.973 | 0.969 | 0.968 | 0.965 | 0.969 |
| Observations | 11287 | 10419 | 10209 | 10537 | 10333 | 10169 | 10526 |
| | | | D. Low educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.235 | 0.151 | 0.301 | 0.225 | 0.276 | 0.266 | 0.239 |
| | (0.158) | (0.127) | (0.187) | (0.175) | (0.137)** | (0.194) | (0.129)* |
| R-squared | 0.923 | 0.887 | 0.918 | 0.910 | 0.912 | 0.911 | 0.905 |
| Observations | 9398 | 7430 | 8343 | 8830 | 7360 | 7913 | 8224 |
| Year/Area fixed effects | √ | √ | √ | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. Column (1) repeats the regression in column (5) of table 6. For age and tenure groups, workers are split by the median values (38 and 6, respectively) in 1998. SESS data.

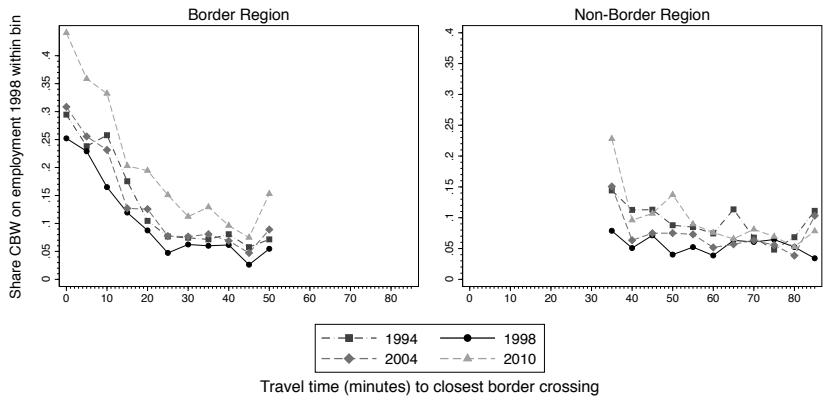
# Appendix to "The Labor Market Effects of Opening the Border: New Evidence from Switzerland" *

Andreas Beerli (ETH Zurich) Giovanni Peri (UC Davis)

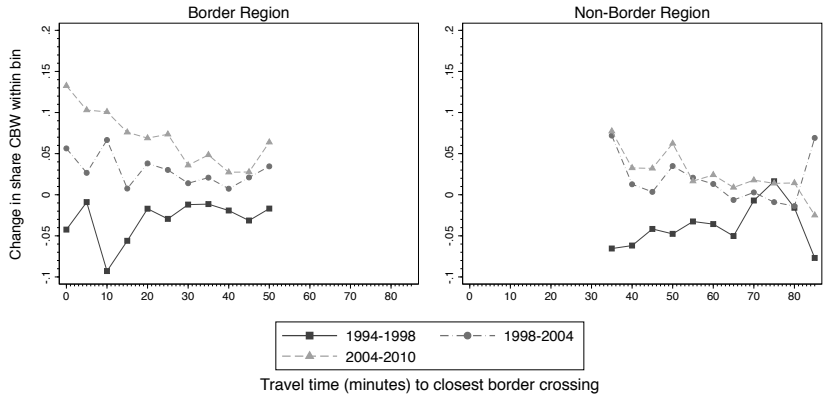
## A Appendix Results

Figure A1: Employment share of new immigrants in distance bins

A. Share of new immigrants on total employment 1998




B. Change in share of new immigrants on total employment




*Notes:* The figure plots the share of new immigrants (new resident immigrants + cross-border workers) on total employment in 1998 in panel A and the change between those shares in panel B, separately for the border region and the non-border region. Municipalities are grouped into bins of 5 minutes according to their road travel time to the next border crossing. Distance bins with a small number of total workers are omitted, i.e. those with travel time above 50 minutes in the border region and below 35 or above 85 minutes in the non-border region. SESS data.

*Andreas Beerli: KOF Swiss Economic Institute, ETH Zurich, Leonhardstrasse 21, 8092 Zurich, Switzerland, beerli@kof.ethz.ch; Giovanni Peri: Department of Economics, UC Davis, One Shields Avenue, Davis Ca 95616, USA, gperi@ucdavis.edu.

Table A1: Effect of free movement policy on monthly wages of natives

Dependent variable: Average monthly wages of natives by education group

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| A. All education groups | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.026 | -0.026 | | |
| | (0.038) | (0.038) | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.002 | 0.002 | | |
| | (0.013) | (0.013) | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | -0.018 | -0.018 |
| | | | (0.030) | (0.030) |
| R-squared | 0.600 | 0.594 | 0.599 | 0.594 |
| Observations | 11706 | 17591 | 11706 | 17591 |
| B. Highly educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.052 | 0.056 | | |
| | (0.021)** | (0.019)*** | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.044 | 0.046 | | |
| | (0.017)** | (0.015)*** | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | 0.054 | 0.058 |
| | | | (0.019)*** | (0.017)*** |
| R-squared | 0.553 | 0.547 | 0.553 | 0.546 |
| Observations | 8769 | 12990 | 8769 | 12990 |
| C. Middle educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.030 | -0.033 | | |
| | (0.034) | (0.034) | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.008 | -0.009 | | |
| | (0.012) | (0.012) | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | -0.023 | -0.026 |
| | | | (0.026) | (0.026) |
| R-squared | 0.547 | 0.542 | 0.547 | 0.541 |
| Observations | 11268 | 16925 | 11268 | 16925 |
| D. Low educated | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.057 | -0.044 | | |
| | (0.030)* | (0.030) | | |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.055 | -0.040 | | |
| | (0.032)* | (0.033) | | |
| $FREE_{m,t} \cdot I(dist_m \leq 15)$ | | | -0.053 | -0.039 |
| | | | (0.024)** | (0.024)* |
| R-squared | 0.472 | 0.457 | 0.472 | 0.457 |
| Observations | 9327 | 13809 | 9327 | 13809 |
| Including NBR Sample | | √ | | √ |
| Year/Area fixed effects | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. SESS data.

Table A2: Effect of free movement policy on wage levels of natives, robustness with respect to panel selection

Dependent variable: Average log hourly wages of natives by education group

| *Sample selection criterion* | Top yearly 80% (of aggregate) | | Balanced panel (of aggregate) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | A. All education groups | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.020 | -0.019 | -0.019 | -0.018 |
| | (0.024) | (0.024) | (0.024) | (0.024) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.004 | 0.006 | 0.005 | 0.007 |
| | (0.008) | (0.008) | (0.008) | (0.008) |
| R-squared | 0.779 | 0.774 | 0.792 | 0.785 |
| Observations | 9330 | 13968 | 7116 | 10338 |
| | B. Highly educated | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.033 | 0.034 | 0.035 | 0.036 |
| | (0.011)*** | (0.010)*** | (0.011)*** | (0.010)*** |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.029 | 0.031 | 0.031 | 0.031 |
| | (0.010)*** | (0.009)*** | (0.010)*** | (0.009)*** |
| R-squared | 0.639 | 0.620 | 0.638 | 0.616 |
| Observations | 8012 | 11853 | 6236 | 9049 |
| | C. Middle educated | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.025 | -0.025 | -0.025 | -0.025 |
| | (0.022) | (0.022) | (0.022) | (0.022) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.002 | -0.001 | -0.001 | -0.000 |
| | (0.008) | (0.008) | (0.008) | (0.009) |
| R-squared | 0.695 | 0.693 | 0.708 | 0.706 |
| Observations | 9247 | 13823 | 7029 | 10212 |
| | D. Low educated | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.031 | -0.026 | -0.033 | -0.027 |
| | (0.015)** | (0.016) | (0.015)** | (0.016)* |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.020 | -0.014 | -0.021 | -0.016 |
| | (0.015) | (0.016) | (0.015) | (0.017) |
| R-squared | 0.545 | 0.517 | 0.541 | 0.509 |
| Observations | 8313 | 12394 | 6555 | 9535 |
| Including NBR Sample | | √ | | √ |
| Year/Area fixed effects | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ |

*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. In columns (1)-(2), municipalities below the bottom 20th percentile of local employment are dropped. Column (3)-(4) restrict the sample to those municipalities that have non-missing aggregate employment each year. SESS data.

Table A3: Effect of free movement policy on hours worked of natives, robustness with respect to panel selection

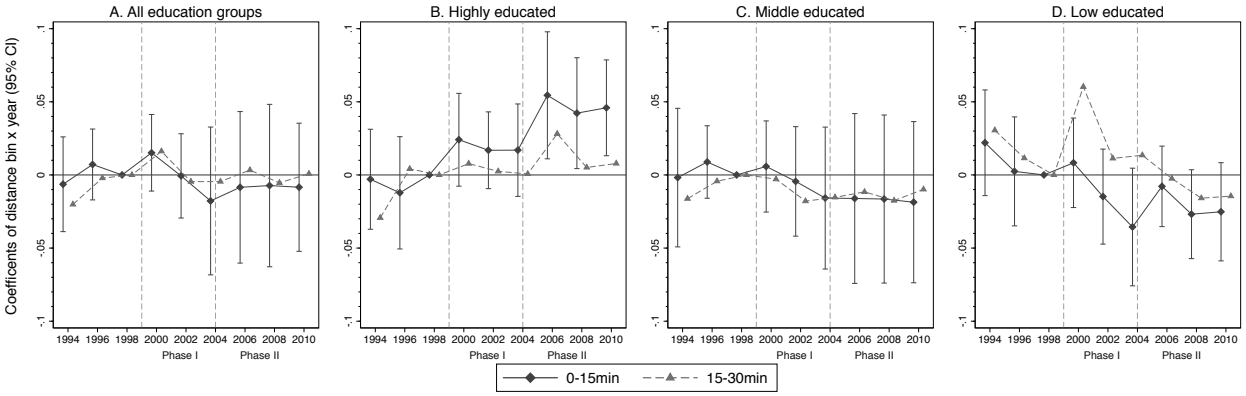
Dependent variable: Log total hours worked by natives, by education group

| *Sample selection criterion* | Top yearly 80% (of aggregate) | | Balanced panel (of aggregate) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | A. All education groups | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.035 | 0.030 | 0.022 | 0.018 |
| | (0.054) | (0.053) | (0.053) | (0.052) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.036 | -0.039 | -0.033 | -0.035 |
| | (0.046) | (0.047) | (0.046) | (0.048) |
| R-squared | 0.977 | 0.974 | 0.977 | 0.974 |
| Observations | 9330 | 13969 | 7119 | 10341 |
| | B. Highly educated | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.056 | 0.051 | 0.047 | 0.043 |
| | (0.036) | (0.031) | (0.034) | (0.029) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | 0.030 | 0.025 | 0.038 | 0.035 |
| | (0.078) | (0.075) | (0.078) | (0.075) |
| R-squared | 0.975 | 0.973 | 0.976 | 0.973 |
| Observations | 8032 | 11879 | 6251 | 9069 |
| | C. Middle educated | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.008 | -0.013 | -0.023 | -0.028 |
| | (0.051) | (0.049) | (0.050) | (0.048) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.052 | -0.054 | -0.047 | -0.049 |
| | (0.042) | (0.043) | (0.043) | (0.043) |
| R-squared | 0.974 | 0.970 | 0.974 | 0.971 |
| Observations | 9247 | 13823 | 7031 | 10214 |
| | D. Low educated | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.236 | 0.226 | 0.220 | 0.220 |
| | (0.159) | (0.156) | (0.160) | (0.158) |
| $FREE_{m,t} \cdot I(10 < dist_m \leq 20)$ | -0.001 | -0.010 | -0.012 | -0.012 |
| | (0.069) | (0.068) | (0.071) | (0.071) |
| R-squared | 0.924 | 0.915 | 0.924 | 0.913 |
| Observations | 8313 | 12394 | 6555 | 9535 |
| Including NBR Sample | | √ | | √ |
| Year/Area fixed effects | √ | √ | √ | √ |
| Bartik | √ | √ | √ | √ |
| Nuts II trend | √ | √ | √ | √ |

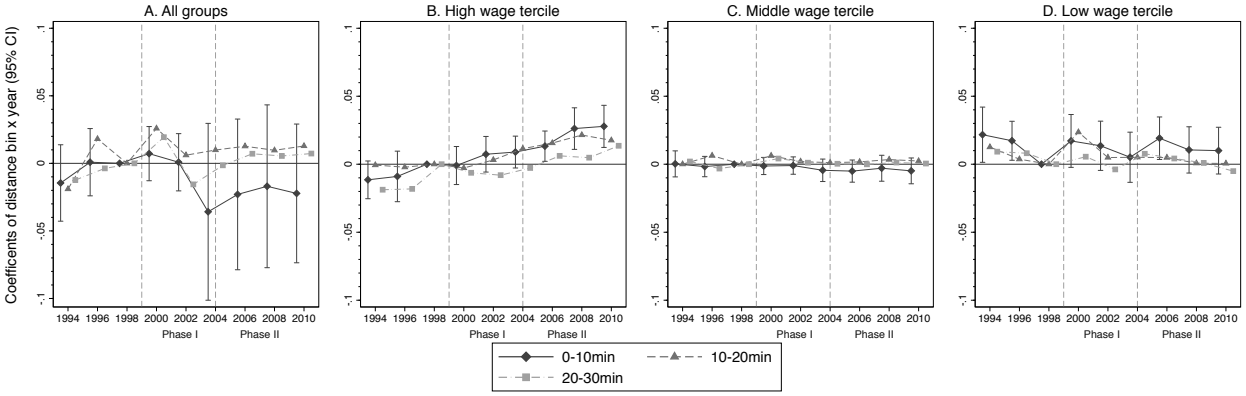
*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004 and in the non-border region after 2007. ($dist_m \leq x$) and ($y < dist_m \leq z$) indicate whether a municipality is located less than $x$ travel minutes or between $y$ and $z$ travel minutes from the next border crossing, respectively. Regressions are weighted using the total number of natives in a cell. In columns (1)-(2), municipalities below the bottom 20th percentile of local employment are dropped. Column (3)-(4) restrict the sample to those municipalities that have non-missing aggregate employment each year. SESS data.

Figure A2: Event analysis of effect of free movement policy on wage levels of natives

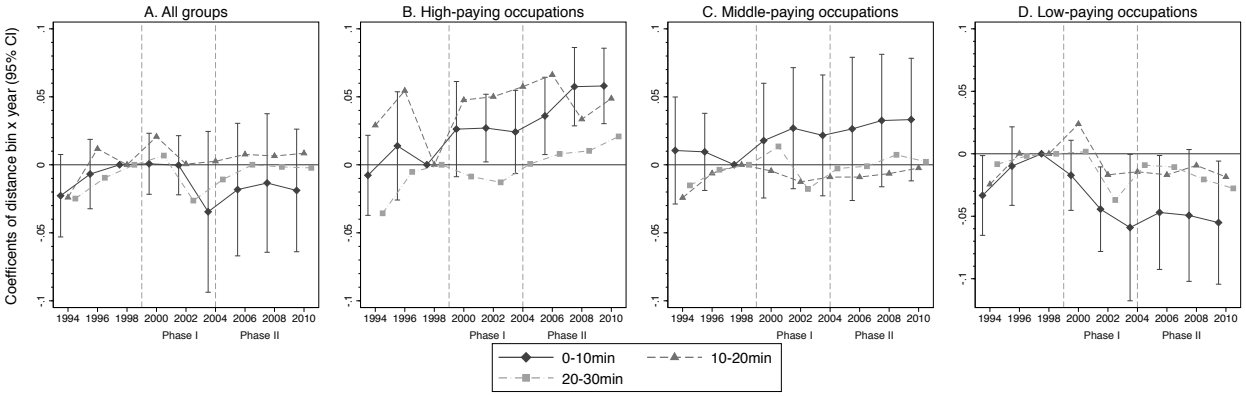
I. 15min distance bins




II. Wage tercile groups



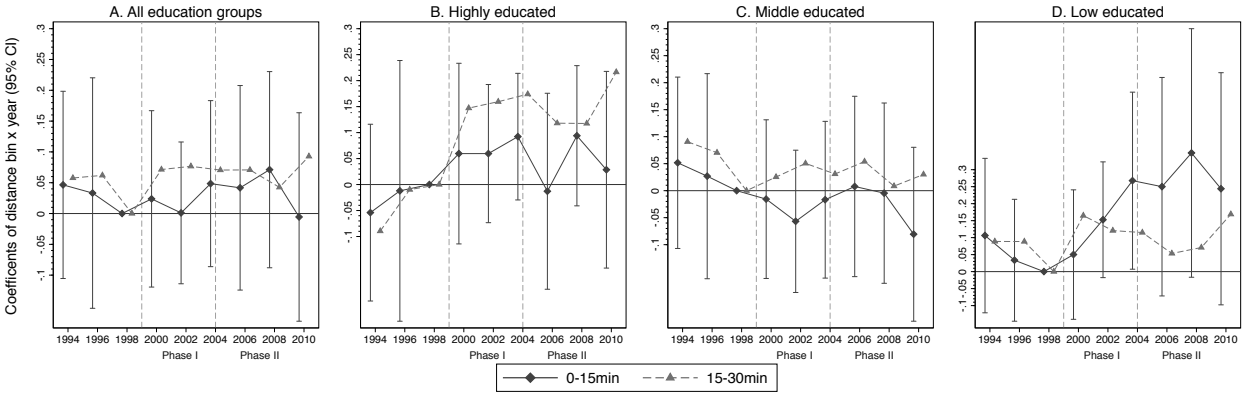

III. Occupation groups



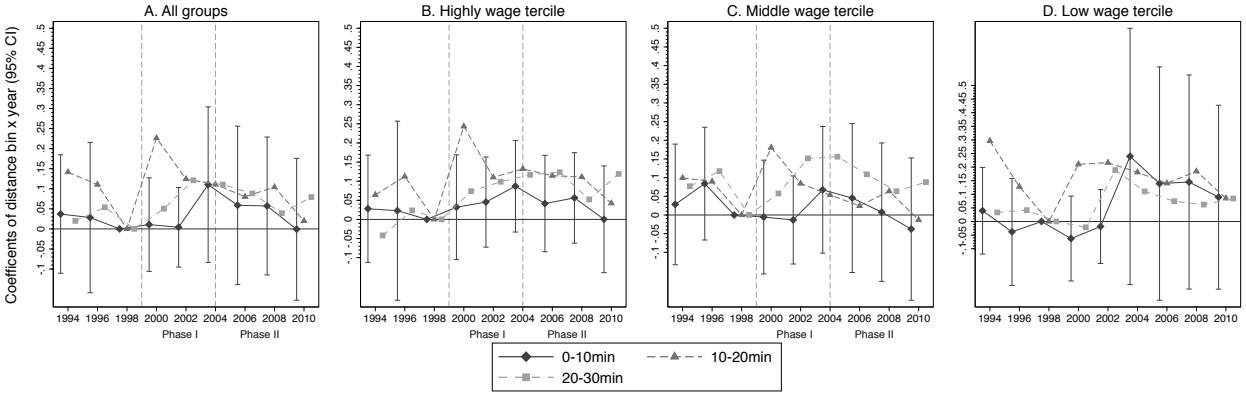

*Notes:* The figure plots the coefficients (and the 95% confidence interval for the 0-15min or 0-10min distance bin) of a regression based on equation (3) with the average log hourly wage of an education group of native workers as dependent variable. Regressions are weighted using the number of native in a cell and include Nuts II trends and the education specific Bartik measure. Standard errors are clustered on the CZ level. The sample includes only municipalities in the border region. In panel II, a skill group is defined as the wage tercile (computed yearly with aggregate employment) to which an individual's wage belongs. In panel III, skill groups represent occupations are ranked into high-paying (Management, R&D, Analysis/Programming/Operating, Evaluation/Consultancy/Certification, Logistics, Trading, Education, Planning/Design), middle-paying (Accounting/Human Resources, Culture/Information/Recreation, Clerks, Security, Machine Operators, Medical/Nursing/Social Work) or low-paying occupations (Construction, Transport, Manufacturing/Processing, Restoration/Craft, Retail, Cleaning, Hotel/Catering, Hygiene) based on their mean wage in 1998. SESS data.

Figure A3: Event analysis of effect of free movement policy on hours worked by natives

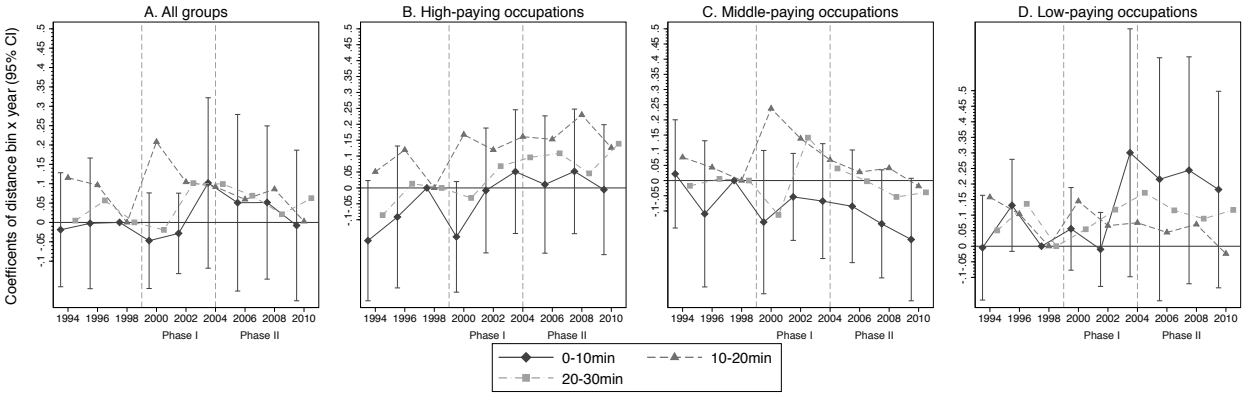
I. 15min distance bins




II. Wage tercile groups




III. Occupation groups




*Notes:* The figure plots the coefficients (and the 95% confidence interval for the 0-15min or 0-10min distance bin) of a regression based on equation (3) with the log total hours worked of an education group of native workers as dependent variable. Regressions are weighted using the number of native in a cell and include Nuts II trends and the education specific Bartik measure. Standard errors are clustered on the CZ level. The sample includes only municipalities in the border region. In panel II, a skill group is defined as the wage tercile (computed yearly with aggregate employment) to which an individual's wage belongs. In panel III, skill groups represent occupations are ranked into high-paying (Management, R&D, Analysis/Programming/Operating, Evaluation/Consultancy/Certification, Logistics, Trading, Education, Planning/Design), middle-paying (Accounting/Human Resources, Culture/Information/Recreation, Clerks, Security, Machine Operators, Medical/Nursing/Social Work) or low-paying occupations (Construction, Transport, Manufacturing/Processing, Restoration/Craft, Retail, Cleaning, Hotel/Catering, Hygiene) based on their mean wage in 1998. SESS data.

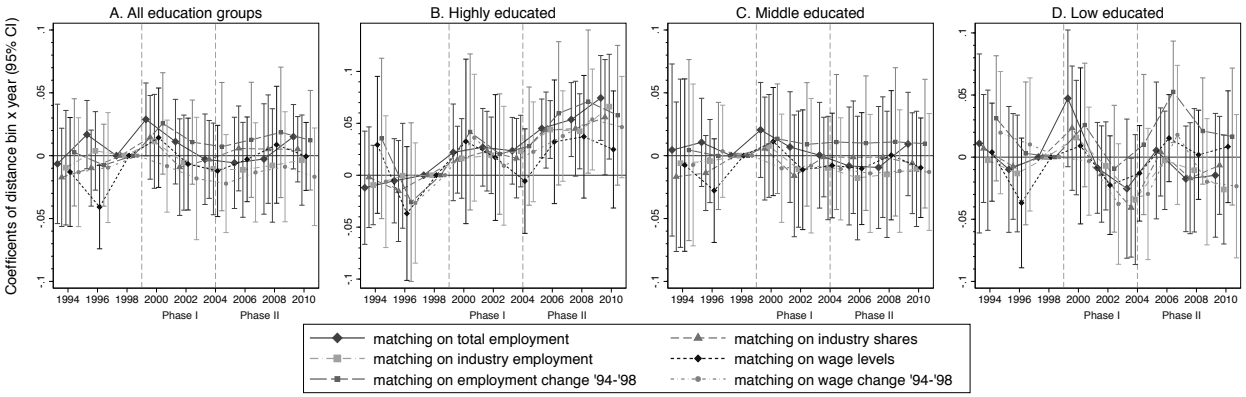
Table A4: Effect of the free movement policy on wages and total hours worked by natives in matched municipalities in the border region

| Dependent variable | Average log hourly wage | | | | | | Log total hours | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| | | | | | A. All education groups | | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.011 | 0.006 | -0.009 | 0.004 | 0.004 | -0.006 | 0.039 | -0.027 | 0.015 | 0.035 | 0.056 | -0.036 |
| | (0.009) | (0.006) | (0.009) | (0.012) | (0.016) | (0.012) | (0.029) | (0.028) | (0.031) | (0.034) | (0.039) | (0.042) |
| R-squared | 0.815 | 0.804 | 0.803 | 0.820 | 0.807 | 0.805 | 0.976 | 0.977 | 0.978 | 0.974 | 0.973 | 0.975 |
| Observations | 3510 | 3513 | 3511 | 3511 | 3513 | 3507 | 3511 | 3514 | 3512 | 3511 | 3513 | 3507 |
| | | | | | B. Highly educated | | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | 0.037 | 0.031 | 0.035 | 0.010 | 0.034 | 0.031 | 0.001 | 0.008 | -0.003 | 0.095 | 0.043 | 0.012 |
| | (0.010)*** | (0.014)** | (0.010)*** | (0.012) | (0.015)** | (0.011)*** | (0.026) | (0.028) | (0.019) | (0.072) | (0.070) | (0.056) |
| R-squared | 0.683 | 0.647 | 0.658 | 0.670 | 0.666 | 0.656 | 0.974 | 0.975 | 0.975 | 0.970 | 0.967 | 0.971 |
| Observations | 3010 | 3092 | 2967 | 3044 | 3075 | 3063 | 3021 | 3102 | 2973 | 3053 | 3083 | 3070 |
| | | | | | C. Middle educated | | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.011 | 0.006 | -0.010 | -0.001 | 0.004 | -0.007 | 0.030 | -0.054 | 0.003 | -0.004 | 0.019 | -0.057 |
| | (0.009) | (0.007) | (0.009) | (0.012) | (0.015) | (0.012) | (0.027) | (0.029)* | (0.032) | (0.032) | (0.038) | (0.035) |
| R-squared | 0.764 | 0.746 | 0.746 | 0.764 | 0.752 | 0.754 | 0.972 | 0.974 | 0.974 | 0.971 | 0.970 | 0.970 |
| Observations | 3459 | 3469 | 3465 | 3463 | 3464 | 3462 | 3461 | 3471 | 3467 | 3463 | 3466 | 3463 |
| | | | | | D. Low educated | | | | | | | |
| $FREE_{m,t} \cdot I(dist_m \leq 10)$ | -0.021 | -0.017 | -0.017 | 0.012 | 0.018 | -0.008 | 0.194 | 0.025 | 0.127 | 0.139 | 0.224 | 0.127 |
| | (0.010)** | (0.011) | (0.011) | (0.016) | (0.014) | (0.017) | (0.077)** | (0.047) | (0.066)* | (0.061)** | (0.103)** | (0.126) |
| R-squared | 0.613 | 0.660 | 0.631 | 0.664 | 0.654 | 0.642 | 0.946 | 0.949 | 0.950 | 0.947 | 0.942 | 0.945 |
| Observations | 3218 | 3218 | 3207 | 3230 | 3247 | 3252 | 3218 | 3218 | 3207 | 3230 | 3247 | 3252 |
| Matching on | Employment | Industry shares | Industry employment | Wage level | Employment change | Wage change | Employment | Industry shares | Industry employment | Wage level | Employment change | Wage change |
| Year & Area fixed effects | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Bartik & Nuts II trends | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| $FREE_{m,t} \times$ Pair fixed effects | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

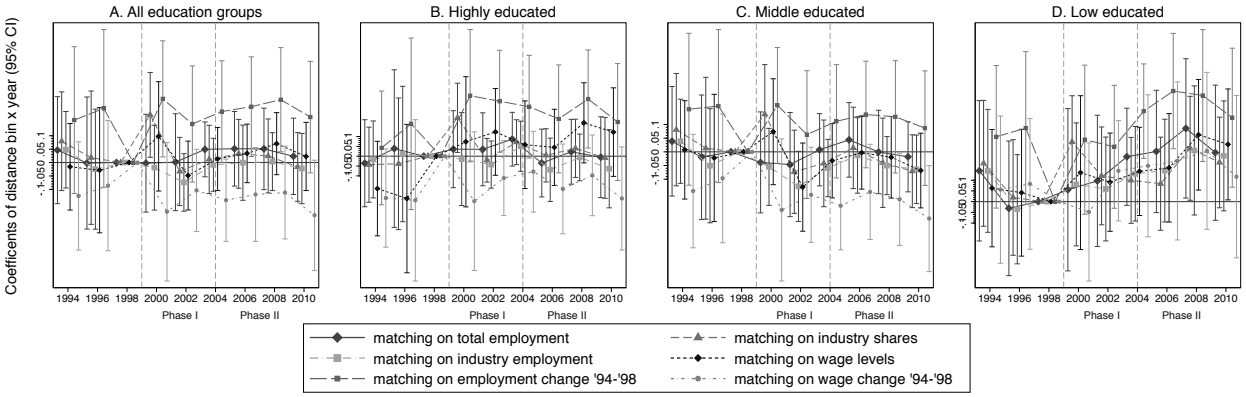
*Notes:* ***, **, *, denote statistical significance at the 1%, 5% and 10% level, respectively. Robust standard errors, clustered by commuting zone, are given in parentheses. $FREE_{m,t}$ is one for municipalities in the border region after 2004. ($dist_m \leq 10$) indicates that a municipality is located less than 10 travel minutes next border crossing. Regressions are weighted using the total number of natives in a cell in 1998. The sample includes 196 municipalities 0-10min bin in the border region matched with one municipality in the border region 30 minutes or more from the border. Matching is based on minimizing the following variable: column (1) and (7), the squared difference in employment 1996-1998; column (2) and (8), the sum of squared differences in 13 industry shares 1996-1998; column (3) and (9), the sum of squared differences in employment levels in 13 industries 1996-1998; column (4) and (10), the squared difference in wage levels 1996-1998; column (5) and (11), the squared difference in employment growth 1994-1998; column (6) and (12), the squared difference in wage growth 1994-1998. SESS data.

Figure A4: Event analysis of effect of free movement policy on wages and total hours worked by natives in matched municipalities in the border region

I. Dependent variable: Average log hourly wages



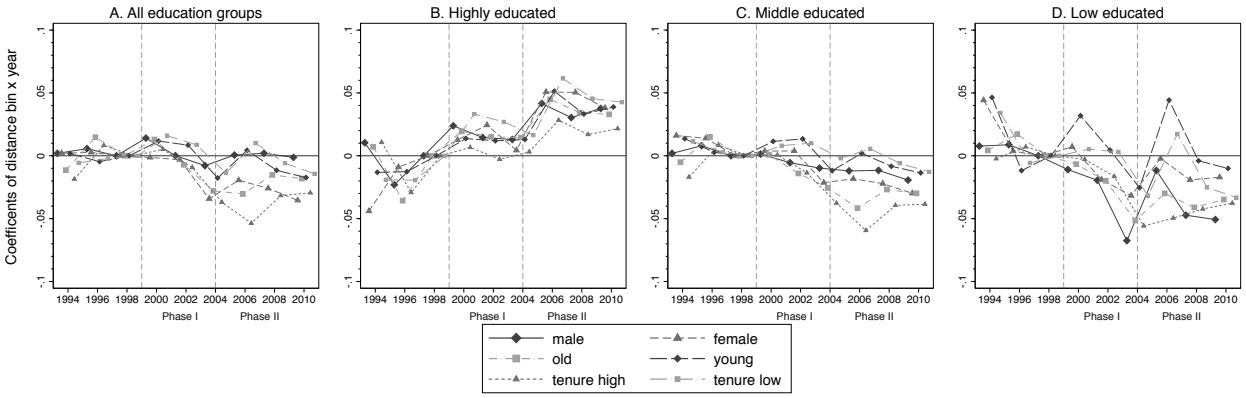

II. Dependent variable: Log total hours worked



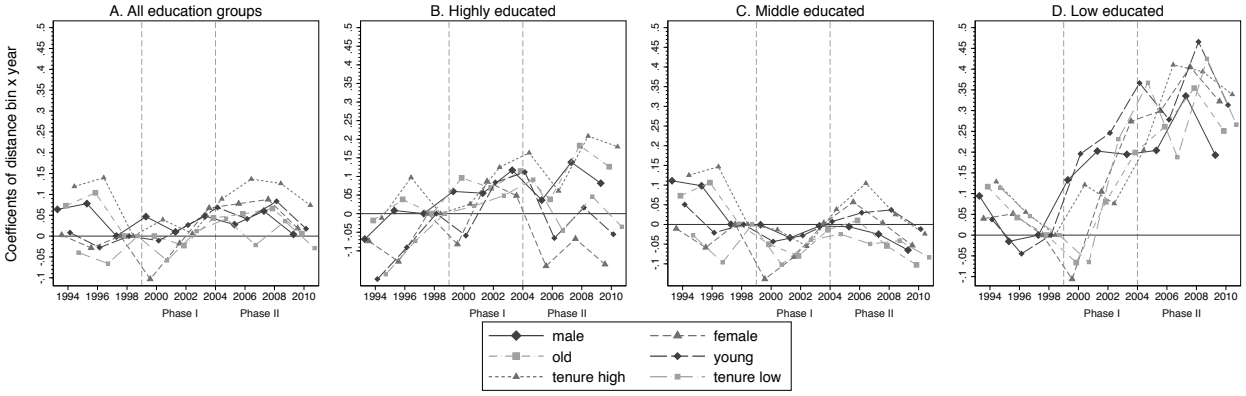

*Notes:* The figure plots the coefficients and the 95% confidence interval of a regression based on equation (3) with average log hourly wages (Panel I) or log total hours worked by natives (Panel II) as dependent variable, respectively. Vertical lines indicate the beginning of *Phase I* in 1999 and *Phase II* in 2004. The sample includes 196 municipalities 0-10min bin in the border region matched with one municipality in the border region 30 minutes or more from the border. Matching is based on minimizing the following variable: Large diamonds and straight line, the squared difference in employment 1996-1998; Large squares and dashed line, the sum of squared differences in 13 industry shares 1996-1998; Large circles and dash/dotted line, the sum of squared differences in employment levels in 13 industries 1996-1998; Small diamonds and short dashed line, the squared difference in wage levels 1996-1998; small squares and long-dashed line, the squared difference in employment growth 1994-1998; small circles and short dash/dotted line, the squared difference in wage growth 1994-1998. Regressions are weighted using the total workforce in 1998 in a cell and include Nuts II trends, the Bartik measure and an interaction of an indicator for each matched pair with $FREE_{m,t}$ dummy. Standard errors are clustered at the CZ level. SESS data.

Figure A5: Event analysis of effect of free movement policy on wages and total hours worked by natives, by demographic group

I. Dependent variable: Average log hourly wages




II. Dependent variable: Log total hours worked




*Notes:* The figure plots the coefficients (95% confidence interval omitted for compactness) of the 0-10min bin interacted with year dummies of a regression based on equation (3) with average log hourly wages (Panel I) or log total hours worked by natives (Panel II) as dependent variable, respectively. Vertical lines indicate the beginning of *Phase I* in 1999 and *Phase II* in 2004. Large diamond (solid line) represent estimates for males, large triangles (dashed line) estimates for females, large squared (dash dotted line) estimates for old individuals, small diamond (long dashed line) estimates for young individuals, small triangle (short dashed line) estimates for individuals with high tenure, small squares (long dashed dotted line) estimates for individuals with low tenure. For age and tenure groups, workers are split by the median values (38 and 6, respectively) in 1998. SESS data.

Table A5: Distribution of cross-border workers across work-places with different majority languages in Switzerland

| | Share of origin country group working in municipality with majority language | | | |
|---|---|---|---|---|
| | German | French | Italian | Romansh |
| *Cross-Border Workers from* | | | | |
| France | 0.246 | 0.753 | 0.001 | 0.000 |
| Italy | 0.083 | 0.018 | 0.891 | 0.008 |
| Germany | 0.983 | 0.012 | 0.004 | 0.000 |
| Austria | 0.973 | 0.008 | 0.002 | 0.017 |

*Notes*: The origin country shares of the four neighbouring countries were calculated using data on cross-border workers from the Federal Statistical Office in 1998 and 2010 (the official name for this dataset is ''Grenzgängerstatistik''). Note that an 'origin country' is the nationality of a worker in the cross-border worker.

# B Data Appendix

## B.1 Matching

We match each of the municipalities the high-treatment area between zero and 10 minutes to the national border to a municipality in the border region more than 30 minutes from the border (control group). As we only consider municipalities that have non-missing total employment in each year 1994-2010, we only have 196 municipalities in the 0-10min bin. To each of these 196 municipalities we match the municipality in the control group with the smallest sum of squared differences of a variable. We consider six criteria:

For the first four criteria, we collapse the SESS data on the municipality level, pooling over the years 1996-1998. First, we match based on the smallest difference in total employment. Second, we match based on the smallest sum of differences between 13 sector shares. Third, we match based on the smallest sum of differences in employment levels 1994-1998. Fourth, we match on the smallest difference in wage levels. For criterion five (six), we match municipalities with respect to the smallest difference in their growth rate of aggregate employment (average wage level) between 1994 to 1998.

## B.2 Measurement of employment transitions

To calculate transition rates, we use the Swiss Labor Force Survey (SLFS) and exploit its rolling panel structure, i.e. individuals are called back in the SLFS up to 4 consecutive years after their first interview. However, for our purpose only the panel of two consecutive years is of reasonable size. Using information on the labor force status and municipality of work in the previous year of any individual worker, we can decompose total employment of group $G$ in a municipality $m$, $E^G_{m,t}$, as follows

$$E^G_{m,t} = STAY^G_{m,t-1,t} + IN^G_{m,t-1,t} \tag{1}$$

where $STAY^G_{m,t-1,t}$ is the number of individuals that stayed employed in municipality $m$ between the previous year $t-1$ and this year $t$ and those that moved into employment in municipality $m$ during the same period, $IN^G_{m,t-1,t}$. Inflows can be further disaggregated into inflows from other municipalities, $IN^{G,-m\rightarrow m}_{m,t-1,t}$, or inflows from non-employment, $IN^{G,NE\rightarrow m}_{m,t-1,t}$. In a similar fashion, we can decompose the current total employment with a forward perspective:

$$E^G_{m,t} = STAY^G_{m,t,t+1} + OUT^G_{m,t,t+1} \tag{2}$$

where $STAY^G_{m,t,t+1}$ and $OUT^G_{m,t,t+1}$ constitute the individuals staying employed in $m$ or leaving employment in $m$ from this year $t$ to next year $t+1$, respectively. Analogously, outflows can be decomposed

into outflows to employment in other areas, $OUT^{G,m\rightarrow -m}_{m,t,t+1}$, and to non-employment, $OUT^{G,m\rightarrow NE}_{m,t,t+1}$.

Lastly, the sum of inflow minus outflow constitute the net change of total employment of a group $G$ in a municipality $m$

$$NET^{G}_{m,t,t+1} = IN^{G}_{m,t,t+1} - OUT^{G}_{m,t,t+1} = E^{G}_{m,t+1} - E^{G}_{m,t} \tag{3}$$

As we only have information on the municipality of work in the years 1996 to 2009 in the SLFS, we can calculate inflow rates from 1997 to 2009 and outflow rates from 1996 to 2008, respectively, by calculating the likelihood of each category in a municipality-year-education group cell, e.g. in the first year the outflow rate is $OUT^{G}_{m,96,97}/E_{m,96}$ and the inflow rate is $IN^{G}_{m,96,97}/E_{m,97}$.[1] The net inflow, in turn, is calculated as $NET^{G}_{m,96,97}/\widetilde{E}_{m,96,97} \equiv IN^{G}_{m,96,97}/E_{m,97} - OUT^{G}_{m,96,97}/E_{m,96}$.

For consistency in the regression analysis, inflow rates are always deferred one year back and, thus, are used for the same years as the outflow rates in the regression analysis between 1996 and 2008 where each year refers to the flow between the current year and the next year. Cells are weighted using their total employment in a year, e.g. for outflow rates in the first year this is the employment 1996 in a cell and for inflow rates the employment in 1997 for the same cell. For the net inflow 1996 to 1997, the average number of workers in 1996 and 1997 is used.

[1] In so doing, we use the panel survey weights provided for the OFS for the SLFS data.

# C More Details on Reform and the Institutional Framework

## C.1 Bilateral agreements between Switzerland and the EU

The bilateral agreements I, signed in June 1999 between Switzerland and the EU, included, apart from the free movement policy, six other liberalization agreements (Bundesrat, 1999):

- The agreement on *technical barriers to trade* (or "Mutual Recognition Agreement") aimed at the mutual recognition of conformity tests for a wide range of industrial products.[2] This implies, that the declaration of conformity from a Swiss test centre is also valid in the EU and vice versa reducing the time and costs for trading goods.
- The agreement on *agricultural products* facilitates trade of particular agricultural products by reducing customs duties and non-tariff barriers for selected products.[3]
- With the agreement on *overland transport*, the Swiss government raised the weight limit of heavy goods vehicles gradually to 40 metric tonnes after 2002 and introduced a tax on heavy vehicles, providing incentives for transalpine freight to shift from road to rail. The agreement on *civil aviation* allowed reciprocal access to aviation markets including landing rights and was fully implemented in 2002.
- The agreement on *public procurement* extends the WTO rules and requires larger tenders by municipalities and certain sectors (e.g. telecommunication, rail transport and water and energy) to be subject to compulsory tendering.[4]
- The agreement on *scientific and technological cooperation* allows Swiss researchers to participate in EU research framework programs.

In an assessment to which degree each of the bilateral agreements facilitated market access for a particular industry, Bühler et al. (2011) expect the manufacturing industries to be most affected and, to a lesser extent, some service industries (particularly vehicle trade and wholesale and commission trade). Based on these classification, Bühler et al. (2011) find that employment growth was 1-2 percentage points larger among affected firms after the implementation of the bilateral agreements in 2002.

Based on an assessment to which degree the entire package of bilateral agreements liberalised access to the EU market for a particular 2-digit industry, Bühler et al. (2011) classify firms into three groups of high, low and non-affected sectors.

A second set of bilateral agreements (II) where signed in October 2004 and approved in a referendum with 55% favorable votes on June 5, 2005.[5] The most relevant agreement for our study is the

[2]Conformity tests certify that a product complies with the local regulation (e.g. for toys) and can be offered on its market. Since 1992, Switzerland has adapted its regulation to those of the EU to large degrees. This agreement covers a wide range of products including machines, printers, medical products, motor vehicles, tractors, measuring instruments, telecommunication devices, and, since March 2008, building materials.

[3]Customs duties were reduced for cheese, fruits and vegetables, horticulture, meat and wine. Non-tariff barriers reductions aimed, inter alia, at wine and spirits, organic agriculture, pest control and crop protection, fodder and seeds. The reduction of customs duties was implemented fully for most goods on June 1 2002. For cheese, the reductions were introduced step-wise with a full liberalisation after June 1, 2007.

[4]Public tenders are required only above a certain minimum amount, which is approximately CHF 10 million for buildings, CHF 250'000 for goods and services provided to the Confederation and 380'000 for goods and services provided to municipalities and cantons. This agreement was implemented fully in June 2002.

[5]The bilateral agreements II included agreements on border controls and asylum (Schengen & Dublin, operational

*Schengen* agreement which abolished the control of individuals at the border traveling. Yet, persons can still be controlled at the border and border guards remain at the border as Switzerland does not belong to the EU customs union (or in the event of an initial suspicion of a criminal offence. Schengen became effective on December 12, 2008.[6]

## C.2 Taxation and Social Benefits of Immigrants in Switzerland

### C.2.1 Resident immigrants

**Taxation** Taxation of foreign residents in Switzerland depends on the income level and the residency status.[7] Foreign residents with a short-term (B or L) permit with an annual gross income below 120'000 CHF are subject to a *special tax scheme* with 'taxation at the source' (Quellensteuer).[8] Taxes are subtracted directly from the salary by the employer depending on household characteristics (marital status, number of children), the canton of living and the income level (progressivity). For these individuals, a canton-wide tax rate applies which is the weighted average of municipality tax rates within a canton. Thus, these individuals face no variation in their tax burden within a canton. After staying in Switzerland at least five years of uninterruptedly, short-term permit holders can apply for a permanent residency permit.

Permanent residency holders and short-term permit holders with a gross income above 120'000 CHF are subject to the *ordinary taxation scheme*. The ordinary taxation scheme consists of three layers with income taxes set at the federal, the cantonal and the municipality level. The federal and cantonal tax schedules determine how progressive taxes are. In turn, the municipal tax rate is defined as the cantonal tax rate times a tax multiplier (Steuerfuss) set by the municipality. Thus, the overall tax liability depends on household characteristics (marital status and children), the income level (progressivity) and the municipality of living.

**Social benefits** In general, *unemployment benefits* can be claimed in the country where individuals have been employed last. Individuals without employment are allowed to enter and stay in Switzerland conditional on having a health insurance and having sufficient financial funds. Individuals looking for a job can stay for up to six months conditional on having sufficient financial funds (EDA, 2015). Foreign residents with a short-term permit below one year (L or seasonal workers prior to 2002) are entitled for unemployment benefits during the duration of their permit conditional on having contributed at

December 12, 2008), the taxation of savings (operational July 1, 2005), fight against fraud (operational April 8, 2009), environmental cooperation (effective April 1, 2006), liberalisation of processed agricultural goods (effective March 30, 2005), film promotion (effective April 1, 2006), pensions (effective May 31, 2005) and cooperation with statistics (effective January 1, 2007).

[6] The Schengen agreement also entails increased control at the external border (e.g. airports), a common visa policy and cooperation between the police and justice system.

[7] This information is largely based on Schmidheiny & Slotwinski (2015).

[8] This threshold is at an gross annual income of 500'000 in the canton Geneva. Individuals who are married to a Swiss resident or a permanent foreign resident are subject to the ordinary tax scheme explained below.

least for six months. After a transition period of seven years after 2002, short-term permit holder are entitled for benefits like natives conditional on a minimum number of contribution months to which also contributions in other countries are taken into account. For foreign residents with a long-term permit of more than one year past contribution months are taken into account already prior to 2002 (Bundesrat, 1999).

*Other benefits*, like health, accident, disability insurance, pensions schemes largely depend on the country of employment and the time during which contribution have been payed.

### C.2.2 Cross-border workers

**Taxation** Cross-border workers are also subject to the *special tax scheme* with taxation at the source.[9] The introduction of the free movement of persons policy after June 1, 2002, created a new category of cross-border workers which were allowed to commute back only on a weekly basis (rather than daily before). Yet, individuals in this new category ('Wochenaufenthalter') are similarly taxed as cross-border workers prior to the free movement policy. The actual details of this taxation depend on the canton of work and the country of living due to bilateral agreements of Switzerland with each of the neighbouring countries for the taxation of cross-border workers.

CBWs from *Germany* are subject to taxation at their place of residency. Cantons are allowed to tax these individuals at the source at a maximum rate of 4.5% of the gross income.[10] This tax is accounted for when calculating the tax burden in Germany. If a CBW does not return to her residency on more than 60 working days, she gets fully taxed at the source like resident immigrants.

The taxation of CBW from *France* depends on the canton of work. CBWs working in border cantons (SO, BS, BL, VD, VS, NE and JU) and the canton Bern get only taxed at their residency in France. These cantons receive 4.5% of all gross incomes payed to CBWs. In the canton of Geneva, CBWs are fully taxed at the source with the canton transferring 3.5% to the French Department of Ain and Haute-Savoie. All other cantons tax CBWs fully at the source like resident immigrants (see above).[11]

CBW from *Italy* are subject to the full source taxation in all cantons. In return, the cantons of Grisons, Ticino and Valais transfer 40% of the gross tax to the Italian border municipalities.

CBW from *Austria* are subject to the special tax scheme with full source taxation with Switzerland transferring 12.5% of the tax revenue to Austria.

**Social benefits** CBW are entitled for *unemployment benefits* in their country of residence (Bundesrat, 1999). *Other benefits*, like health, accident, disability insurance, pensions schemes largely

[9] This paragraph is largely based on SSK (2009).

[10] This taxation scheme is subject to a proof of residency (Ansässigkeitsbescheinigung) of the CBW to her employer.

[11] To CBWs who get fully taxed at the source French tax authorities grant a tax break amounting to the French tax on the Swiss gross income.

depend on the country of employment and the time during which contribution have been payed.

## References


Bühler, S., Helm, M., & Lechner, M. (2011). Trade Liberalization and Growth: Plant-Level Evidence from Switzerland. Technical report, University of St. Gallen, School of Economics and Political Science.

Bundesrat (1999). Botschaft zur Genehmigung der sektoriellen Abkommen zwischen der Schweiz und der EG vom 23. Juni 1999. `https://www.admin.ch/opc/de/federal-gazette/1999/6128.pdf`.

EDA (2015). Personenfreizügigkeit. Technical report, Eidgenössiches Department für ausswärtige Angelgegenheiten.

Schmidheiny, K. & Slotwinski, M. (2015). Behavioral Responses to Local Tax Rates: Quasi-Experimental Evidence from a Foreigners Tax Scheme in Switzerland. Technical report, CESifo Working Paper No. 5518.

SSK (2009). Die Besteuerung an der Quelle. Technical report, Schweizer Steuerkonferenz - Vereinigung der schweizerischen Steuerbehörden.