Working Paper No. 193

How Middle-Skilled Workers Adjust to Immigration: The Role of Occupational Skill Specificity

Damiano Pregaldini and Uschi Backes-Gellner

Universität Zürich
IBW – Institut für Betriebswirtschaftslehre

UNIVERSITÄT BERN

Working Paper No. 193

How Middle-Skilled Workers Adjust to Immigration: The Role of Occupational Skill Specificity

Damiano Pregaldini and Uschi Backes-Gellner

June 2024 (first version: December 2021)

Published as: "How middle-skilled workers adjust to immigration: the role of occupational skill specificity." *International Journal of Manpower,* 45(2024)8: 1607-1625. By Damiano Pregaldini and Uschi Backes-Gellner.

DOI: https://doi.org/10.1108/IJM-09-2023-0519

The Swiss Leading House on Economics of Education, Firm Behavior and Training Policies is a Research Program of the Swiss State Secretariat for Education, Research, and Innovation (SERI).

www.economics-of-education.ch

How Middle-Skilled Workers Adjust to Immigration: The Role of Occupational Skill Specificity*

Damiano Pregaldini† Uschi Backes-Gellner‡

June 17, 2024

Abstract

Our study explores the effects of immigration on the employment of native middle-skilled workers, focusing on how this effect varies with the specificity of their occupational skill bundles. Exploiting the 2002 opening of the Swiss labor market to EU workers and using register data on the location and occupation of these workers, our findings provide novel results on the labor market effects of immigration. We show that the inflow of EU workers led to an increase in the employment of native middle-skilled workers with highly specific occupational skills. This finding could be attributed to immigrant workers reducing existing skill gaps, enhancing the quality of job-worker matches, and alleviating firms' capacity restrictions. This allowed firms to create new jobs, thereby providing increased employment options for middle-skilled workers with highly specialized skills. Previous literature has predominantly highlighted the disadvantages of specific occupational skills compared to general skills in the context of labor market shocks. However, our findings reveal that workers with specific occupational skills can benefit from an immigration-driven labour market shock. These results suggest that policy conclusions regarding the role of specific occupational skills should be more nuanced.

JEL Classification: J15, J24, J62
Keywords: migration, cross-border workers, occupational skill specificity.

*This study was partly funded by the Swiss State Secretariat for Education, Research and Innovation through its "Leading House VPET-ECON: A Research Center on the Economics of Education, Firm Behavior and Training Policies." We would like to thank Simone Balestra, Andreas Beerli, Eric Bettinger, David Dorn, Simon Janssen, Edward Lazear, Guido Schwerdt, Martina Viarengo, participants at the CVER Conference 2019, seminar participants at the University of Zurich, and at the Stanford Graduate School of Education for their valuable comments on this as well as earlier versions of this study. We would also like to thank Marco Pereira for his excellent research assistance. Declarations of interest: none

†University of Zurich, Plattenstrasse 14, 8032 Zurich, damiano.pregaldini@business.uzh.ch (corresponding author)

‡University of Zurich, Department of Business Administration

1 Introduction

Despite widespread concern that opening borders to immigrant workers might deteriorate the labor market prospects of a country's native workforce (e.g., Borjas, 2003), empirical evidence supporting this concern remains inconclusive. Recent studies on the labor market effects of immigration show that the opposite could be true. For example, Basten and Siegenthaler (2019), Beerli et al. (2021), Cattaneo et al. (2015), Foged and Peri (2015), Peri and Sparber (2009) show that workers adjust to immigration by moving to more complex, higher-skilled, managerial, and (ultimately) better-paid jobs. Other studies have argued that immigrants can generate new jobs for native workers by decreasing firms' wage costs (Albert, 2021; Chassamboulli & Palivos, 2014).

So far, research has mainly considered the effects of immigration on native workers with different levels of education, often measured in years of schooling or secondary vs. tertiary education (e.g., Peri and Sparber, 2009; Ortega & Polavieja, 2012). Other studies also distinguish how the effect of immigration varies depending on the level of education of immigrants (e.g., Hainmueller and Hiscox, 2010). Typically, these studies differentiate native and immigrant workers according to their educational attainment (i.e., years of education) or the type of task native workers perform (e.g., communication vs. manual tasks). However, little is known so far about how native workers with the same level of education but systematically different bundles of single skills are affected by immigration.

In this study, we close this gap by studying how middle-skilled native workers with different bundles of single skills, i.e., occupational skill bundles that vary in their degree of skill specificity, are affected by an immigration shock. Our study focuses on native middle-skilled workers, that is, workers with an upper-secondary VET diploma. In Switzerland, these workers constitute roughly 60 percent of the total workforce and acquire well-defined bundles of skills through vocational education and training (VET) programs. Another reason for focusing on middle-skilled workers is that we can precisely measure their occupational skill specificity using the training curricula of VET programs. We use Eggenberger et al.'s (2018) skill specificity measure, which has provided a meaningful categorization of occupational skill bundles according to their specificity (Eggenberger et al., 2022, 2018). To construct this measure, Eggenberger et al. (2018) analyze well-defined and nationally binding VET curricula (based on Geel et al., 2011; Lazear, 2009). While specific occupational skill bundles contain skills useful in only a few other occupations, less specific skill bundles contain skills widely used across many occupations.

To identify the causal effect of immigration on workers with different degrees of occupational skill specificity, we exploit the 2002 introduction of the Agreement on the Free Movement of People (AFMP) between Switzerland and the European Union (EU). The AFMP opened the Swiss labor market to workers from the EU and led to an immediate sharp increase in the number of Cross-Border Workers (CBWs) in Switzerland. Unlike permanent migrants, CBWs commute to Switzerland for work but keep their residency in their home country. While economic studies on migration have traditionally focused on the labor market effects of permanent migrants, there is an increasing interest in studying the effects of such temporary migration (e.g., Beerli et al., 2021; Dustmann et al., 2017). Temporary migrants such as CBWs constitute an increasing fraction of the total number of migrants across OECD countries (OECD, 2019) and, therefore, constitute an important area of research. Moreover, unlike permanent migrants, CBWs do not live in the country in which they work. Therefore, the inflow of CBWs constitutes a clean shock affecting the labor supply, while the demand for non-tradable goods and services remains largely unaffected.

Between 2002 and 2009, the AFMP led to an increase in the fraction of CBWs in the total Swiss workforce[1] by roughly 40 percent, constituting a substantial immigration-driven labor supply shock. As Beerli et al. (2021) point out, the increase was particularly strong among high-skilled (i.e., tertiary educated) CBWs. However, middle-skilled CBWs still constitute the largest fraction of CBWs, accounting for roughly 50 percent of the total CBWs. Therefore, middle-skilled CBWs also constituted a significant fraction of the inflow of CBWs.

We use this sudden increase in the labor supply of CBWs and their distribution across narrowly defined region-by-occupation cells in 1999—i.e., before the reform—to construct a shift-share instrument (Card, 2001) for identification. Using register data on the universe of CBWs in Switzerland between 1999 and 2009, we can precisely measure both the distribution of CBWs across these region-by-occupation cells before the AFMP and the increase in the number of CBWs after it.

To analyze how workers adjust to immigration, we use individual workers' panel data from 2000 through 2009 from the Swiss Labor Force Survey matched with register data.

[1] In this paper, "Swiss workforce", "Swiss workers", and "native workers" include both Swiss nationals and permanent non–Swiss residents in Switzerland.

We focus on two outcomes for middle-skilled native workers: employment probability and wages. Similar to Cattaneo et al. (2015) and Foged and Peri (2015), the panel structure of the data allows us to isolate the within-worker variation in exposure to immigration.

Our results show that the inflow of CBWs increased the employment probability of workers with specific occupational skills. However, we find that workers' wages were not affected by the inflow of CBWs. Overall, these results imply that CBWs did not substitute native middle-skilled workers with specific occupational skills but instead complemented them. Indeed, the inflow of CBWs increased the demand for Swiss workers in specific occupations, in turn increasing their employment probability. One possible explanation for these results is that opening the Swiss borders provided Swiss firms with skilled EU workers to fill vacancies in jobs and occupations that were previously experiencing skill shortages, thereby improving the job-worker match quality and generating opportunities for firms to create new jobs. Therefore, the opening of the Swiss labor market improved the allocation of workers to jobs, increasing the economic activity of firms and the total number of jobs, particularly for workers with specific occupational skills.

2 Theoretical considerations

In theory, occupational skill specificity can affect how workers adjust to immigration in two opposing ways. On one hand, human capital theory (Becker, 1962; Lazear, 2009) predicts that workers with specific skills (i.e., skill bundles that are idiosyncratic to one or few firms or occupations) are less able to adjust to negative labor market shocks because their skill bundles are less transferable across occupations. Therefore, we would expect workers with specific occupational skills to be less able to adjust to an immigration-driven labor supply shock because, for example, they are less able to change their firm or occupation and move towards better-paid jobs (Peri & Sparber, 2009). A number of studies indeed seem to support the argument that workers with specific skills are more heavily affected by macroeconomic shocks (Lamo et al., 2011) and technological change (Hanushek et al., 2017).

On the other hand, specific skills could become relatively more valuable after a shock because they are scarce in the labor market. In a recent study using German data, Eggenberger et al. (2022) show that workers with specific occupational skills benefit more from a positive trade shock than workers with general occupational skills, an effect that they attribute to an increased demand for workers with specific occupational skills.

Ultimately, which one of the two effects dominates is an empirical question. Our paper addresses this question by analyzing how immigration affects middle-skilled workers with different degrees of occupational skill specificity.

3 Institutional framework

Since Switzerland is not a member of the EU, the Swiss government has negotiated a series of agreements regulating bilateral relations with the EU—including the movement of persons between Switzerland and the EU. These agreements have undergone substantial changes over the past three decades, changes that considerably improved the ability of Swiss firms to recruit foreign workers and expanded the locally available supply of labor.

Before 2002, Swiss firms faced two major constraints in the recruitment of CBWs. First, firms had to prove that no Swiss worker was available for the particular job under consideration—a constraint known as the "priority requirement for Swiss workers." Under this requirement, before firms were allowed to hire foreign workers, they had to prove that they had engaged in an unsuccessful search for a local worker and that they had registered their open position at the local unemployment office.[2] Second, the cantonal authority[3] would only issue a work permit for a foreign worker if the job met or was above the industry's minimum salary and working conditions (SECO, 2014). Although these restrictions were aimed at protecting Swiss workers from competition, they also generated substantial administrative costs for hiring firms, along with legal barriers to the recruitment of foreign workers (Abberger et al., 2015).

In addition to these requirements, the pre-2002 Swiss immigration law restricted both the geographical mobility and the length of stay of CBWs in Switzerland. CBWs were not allowed to stay in Switzerland for more than one day, so they had to commute daily between their country of residence and their Swiss workplace.

Moreover, the CBWs' mobility was regionally restricted to areas along the borders between Switzerland and its neighboring countries (Austria, France, Germany, and Italy). CBWs had legal permission to work only in a predefined set of Swiss municipalities within a specific distance from the border, known as the "border region." This set of municipalities in the border region was defined by a finite list that unambiguously distinguished the

[2] Art. 7, Verordnung über die Begrenzung der Zahl der Ausländer (1986) AS 1986 1791 (CH)
[3] In Switzerland, cantons are administrative subdivisions similar to states in the U.S.

"border region," where CBWs were allowed to work, from the "non-border region," where CBWs were not allowed to work. The precise definitions of the border and non-border regions were based on the bilateral agreements regulating transportation between Switzerland and its neighboring countries. For example, the border region between Switzerland and France extended for roughly 10 km (6.2 miles) on each side of the border.

In addition to regulating the set of Swiss municipalities to which CBWs were allowed to commute for work, Swiss law also clearly defined the set of foreign municipalities where CBWs had to have resided for at least the preceding six months. These municipalities were also within roughly 10 km (6.2 miles) (depending on the region) from the Swiss border. Workers living farther from the Swiss border in their home country (e.g., French workers living in Paris or Italian workers living in Rome) were thus not eligible for CBW work permits.

However, this situation changed substantially when Switzerland and the EU signed the Agreement on the Free Movement of Persons (AFMP) in 1999. After long and complex negotiations, the new regulations became effective in 2002. The AFMP marked a substantial shift in Swiss migration policy: It aimed at gradually lifting restrictions against EU citizens working and living in Switzerland, thereby gradually opening the Swiss labor market and guaranteeing a completely free movement of labor in and out of Switzerland with the EU. The reform was implemented in three phases between 2002 and 2014, making the liberalization of the Swiss labor market more gradual.

The first phase of the reform, 2002–2004, extended the CBWs' mandatory daily commute to a weekly one. This extension allowed CBWs to stay in Switzerland during the week and return to their home country on weekends, thereby increasing their possibilities for working in municipalities farther from the border but still within the predefined set of municipalities in the border region.

The second phase of the reform, 2004–2007, eliminated both the priority requirement granted to Swiss workers and the cantonal authorities' inspection of salary and working conditions, thereby significantly reducing firms' costs for recruiting CBWs. However, both reform steps affected only firms in the border region because firms in the non-border region still had no unrestricted permission to hire CBWs.

The third phase of the reform, 2007–2014, eliminated all regional restrictions, extinguishing the distinction between border and non-border regions. Therefore, starting in 2007, firms in the former non-border region were also free to hire CBWs.

In our study, we exploit the sharp increase of roughly 40 percent in the supply of CBWs generated by the introduction of the free movement of persons throughout its three phases, together with the distribution of CBWs across both regions and occupations before the reform. Figure 1 shows the increase in the number of CBWs over time in the border and non-border regions. This number was roughly 150,000 until 2000 (4 percent of the total employment in Switzerland). Because the 2002 reform removed several restrictions on the employment of CBWs in the Swiss border region, the number of CBWs sharply increased and kept increasing throughout the three phases of the reform, reaching 250,000 in 2009 (6 percent of the total employment in Switzerland). Figure 1 shows that this increase took place exclusively in the border region.

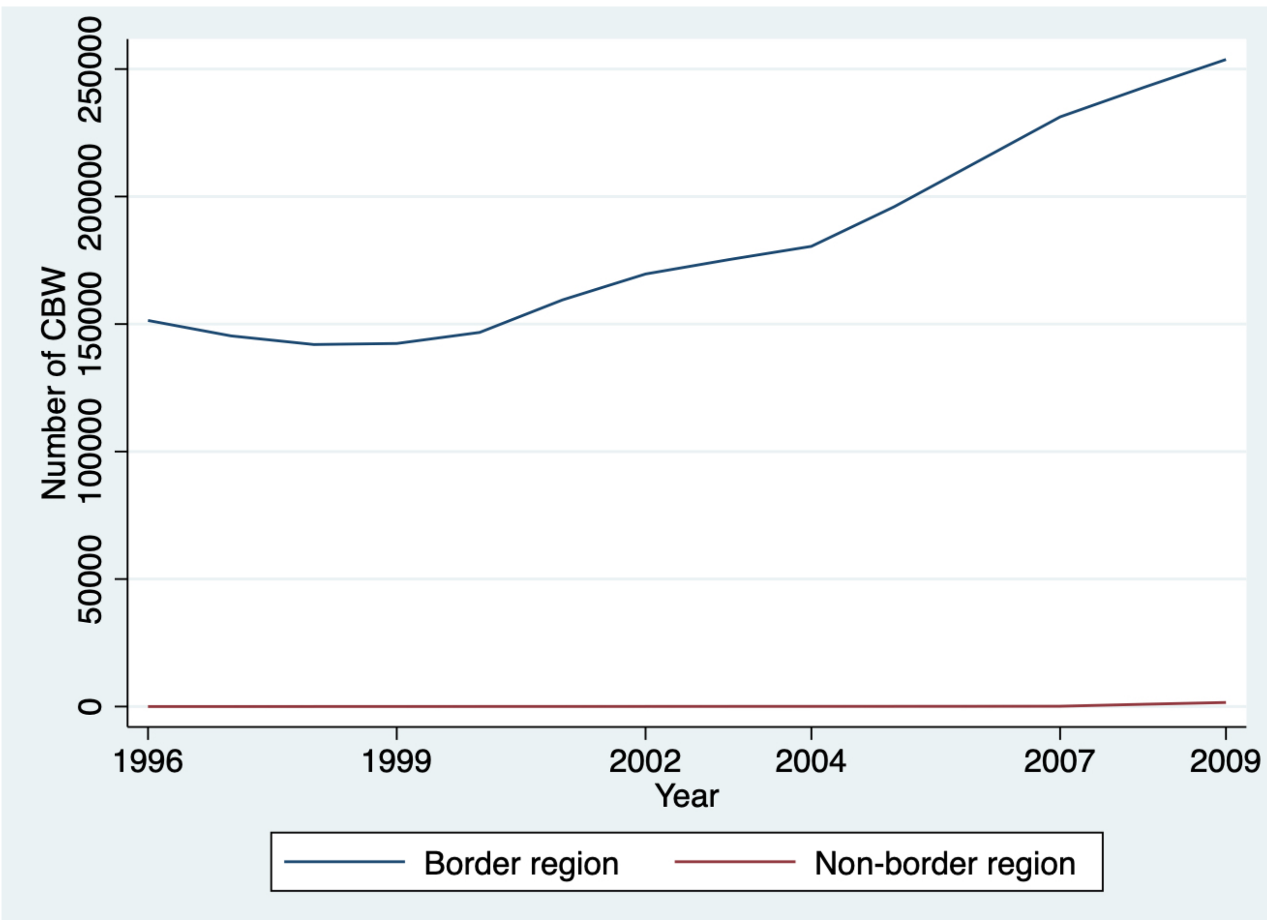

Figure 1: Number of CBWs on total employment in the border region and in the non-border region. Authors' calculations based on data from the Cross-Border Commuters Statistics (FSO).

4 Data sets, sample selection, and descriptive statistics

4.1 The SESAM data

The SESAM project links data from the Swiss Labor Force Survey (SLFS) with information from different social insurance registers (i.e., old age, survivors' and disability insurance, disability pensions, complementary benefits, and unemployment insurance). This linkage augments the SLFS with accurate register data on each individual's employment status and wages. We use the SLFS data for 2000 through 2009.

The panel structure of the data allows us to follow these individuals for a maximum of five years and, therefore, observe their employment histories during these five years. The average number of observations per individual is 3.6. Although attrition is not a major concern (only about 13 percent of the individuals leave the panel after the first interview, and about 48 percent remain in the panel for five years), the Federal Statistical Office provides weights that account for attrition, post-stratification adjustment, and the probability of being included in the sample. We use these weights in our analysis.

For the analysis of worker wages, we restrict the initial sample to employees and the self-employed between the ages of 18 and 65 (for men) and 18 and 64 (for women) to exclude upper-secondary school[4] students and retirees. Moreover, to ensure that outliers do not drive our results, we exclude individuals working less than 10 percent (fewer than 4.25 working hours per week) or with an annual wage below the 1st percentile or above the 99th percentile.

Finally, we restrict the sample to middle-skilled workers with a VET diploma, thereby excluding those who acquired further formal education after receiving that diploma. We need this restriction to ensure that the specificity measure we derive from the VET occupation correctly matches the workers' occupational skills and is not contaminated by the later acquisition of a tertiary degree.[5] The final sample for the analysis of wages (wage

---

[4] In Switzerland, upper-secondary education includes baccalaureate schools/*Gymnasium* (college-preparatory high schools) and VET, which combines curriculum-based on-the-job training in a firm with classroom education in vocational schools. These programs are also known as "apprenticeship programs."

[5] Workers who earn higher educational degrees after their initial VET training—e.g., by acquiring a university of applied sciences degree or a professional education degree—are not included in our sample because they may have complemented their initial skill bundles with additional skills that we cannot measure. Eggenberger et al.'s (2018) skill specificity measure is based on nationally binding VET curricula on the upper-secondary level. Given that tertiary education has no comparable nationally regulated curricula, our skill specificity measure cannot be transferred to tertiary education.

sample) consists of 21,549 individuals and 66,947 observations. Using the annual wage reported in the SESAM data from the social benefit register and the information on hours worked per week at the time of the interview, we calculate wages in full-time equivalents. To control for inflation, we deflate the wages by 2000 prices. The average annual wage in the wage sample was roughly 68,000 Swiss Francs (80,000 USD in 2020 prices).

For the analysis of employment, we again exclude workers who acquired further formal training after the VET diploma from the initial sample, but we include individuals with no employment. After accounting for missing values and singleton observations, the employment sample includes 28,450 individuals and 91,663 observations. We define employment as a binary variable, taking the value 1 if an individual was officially employed in the month of the interview and 0 otherwise. Table 2 in the Appendix reports descriptive statistics for the sample.

4.2 Data on occupational skill specificity

To measure the occupational skill specificity of each worker in the SESAM data, we use the measure developed by Eggenberger et al. (2018), who define skill specificity at the occupational level in a two-step approach. In the first step, they select the 111 most common Swiss VET occupations.[6] In Switzerland, each training occupation has a nationally binding training curriculum defining the set of skills to be taught. Upon successful completion of the training—typically lasting three to four years—graduates receive a federal diploma certifying their proficiency in the skills of their chosen occupation. Eggenberger et al. (2018) use the information in the training curricula to define the bundle of skills taught in each occupation and the relative importance of each skill (i.e., the weight of the skill) in the bundle.[7]

In the second step, drawing on Lazear's (2009) skill-weights approach, Eggenberger et

[6] In total, there are roughly 220 VET occupations in Switzerland. Eggenberger et al. (2018) consider the 111 most common occupations, covering roughly 91 percent of all active Swiss VET-educated workers.

[7] The weight of each skill is determined by the proportion of the curriculum that is dedicated to that skill. For more detail, see Eggenberger et al. (2018).

al. (2018) measure the specificity of a given occupation by comparing it to the overall labor market. Specifically, they define specificity as the degree of overlap of the occupation's skill bundle and weights with the average skill bundle and weights in the overall labor market.[8]

To account for differences in the potential demand for different occupations, they weigh the specificity of each occupation for the size of the occupation. In this approach, workers trained in a specific occupation have a bundle of skills that are required in few other jobs in the labor market. In contrast, workers trained in a general occupation have a bundle of skills that can be used in many other jobs.

We match Eggenberger et al.'s (2018) measure of occupational specificity to the training occupation of each worker in the SESAM data. To identify occupations in both the skill specificity and SESAM data, we use the 5-digit Swiss Standard Classification of Occupations 2000. This approach allows us to assign a degree of specificity to the training occupation of each worker who received formal VET training in one of the 111 occupations contained in the skill specificity data.

Following Eggenberger et al. (2018), we match the skill specificity measure to the training occupation (i.e., the one in which a worker has been trained) rather than to the current occupation (i.e., the one in which a worker is employed) for two reasons. First, because the worker has received formal training in this occupation, the specificity of the training occupation closely reflects the specificity of a worker's skill bundle. Second, matching the specificity measure to the training occupation reduces the concern of reverse causality. Indeed, for most workers in our sample, the training occupation is predetermined relative to the 2002 reform and is therefore not affected by the inflow of CBWs after the reform.

Before matching Eggenberger's (2018) occupational skill specificity measure to the SESAM data, we standardize it to have zero mean and unit variance. Table 3 in the appendix provides examples of occupations and shows how they are ranked according to

[8] Formally, (Eggenberger et al., 2018) define the overlap between the skill bundles of two occupations, say *O* and *P*, as angular distance between the two skill weights vectors of these occupations (Eggenberger et al., 2018, p.100). Specifically, this distance is given by $AngularDist_{OP} \frac{\sum_{i=1}^{n} x_{Oi} * x_{Pi}}{\sqrt{\sum_{i=1}^{n} x_{Oi}^2 * x_{Pi}^2}}$ where x_{Oi} and x_{Pi} are the weights attached to skill *i* in the skill bundle of occupation *O* and *P* respectively. The average angular distance of an occupation to all other occupations measures the specificity of that occupation.

their occupational specificity.

4.3 Cross-Border Commuters Statistics

To model the inflow of CBWs across Swiss regions and occupations, we draw on data from the Cross-Border Commuter Statistics (CBCS). This data includes annual individual-level information on the entire population of CBWs in Switzerland. Starting from 1999, we observe both the municipality of the workplace and the occupation of each CBW at first entry into Switzerland.

To provide an accurate measure of the exposure of each Swiss worker in our sample to the immigration-driven labor supply shock, we measure the inflow of CBWs at both regional and occupational levels. To do so, we first divide Switzerland into its official 106 commuting zones, which the Federal Statistical Office defines according to the commuting behavior of the resident population (BFS, 2019). We further divide each commuting zone into the 111 occupations we observe in the specificity data, obtaining 11,766 commuting zone-by-occupation cells. We opt for such a narrow definition of cells for two reasons. First, immigration in narrowly defined occupational groups is relevant for immigration policies because competition for jobs mainly occurs at the occupational level. Second, given that we observe the universe of CBWs in Switzerland, we can precisely measure the number of CBWs in narrowly defined cells. We fully exploit this valuable information in our analysis. We assign each worker in the SESAM data to a commuting zone-by-occupation cell according to the worker's training occupation and the commuting zone of residence. Because the commute statistics contain data on the entire population of CBWs in Switzerland, the representativity of the data in narrowly defined cells is not a concern. About 45 percent of the workers in the wage sample are in cells with no CBWs, because their training occupation experienced no inflow of CBWs in the commuting zone where they live. For workers in commuting zone-by-occupation cells with a strictly positive number of CBWs, the average number of CBWs is 252 (wage sample). However, the distribution of the number of CBWs is highly skewed, with 50 percent of the workers in commuting zone-by-occupation cells with fewer than 19 CBWs. This low number is not surprising, given the narrow definition of the commuting zone-by-occupation cells. Moreover, substantial variation exists in the number of CBWs (sd: 550

CBWs).

5 Empirical model

To analyze how Swiss workers with different degrees of occupational skill specificity are affected by an immigration-driven labor supply shock, we exploit the 2002 opening of the Swiss labor market to workers from the EU. As described in Chapter 3, the 2002 reform led to a sharp increase in the number of CBWs commuting to Switzerland for work. Our empirical strategy exploits the variation in the exposure to CBWs across commuting zones and occupations. Specifically, we estimate the following model:

$$y_{irot} = \beta_0 + \beta_1 M_{rot} * S_{ot} + \lambda_i + \phi_r + \sigma_o + \delta_t + \rho_s + \epsilon_{irot} \quad (1)$$

Where y_{irot} is one of two outcomes (log wages and employment[9]) of individual *i*, living in commuting zone *r*, trained in occupation *o*, and in year *t*. M_{rot} is the number of CBWs (in hundreds) in commuting zone *r*, occupation *o*, and at time *t*.[10]

As described in section 2, occupational skill specificity can affect how workers adjust to immigration differently. To study how workers with different degrees of occupational skill specificity adjust to an immigration shock, we first need to define groups of workers with high or low occupational skill specificity. To do so, we divide training occupations into quartiles according to the occupational skill specificity measure by Eggenberger et al. (2018). Workers in the lower quartiles of the occupational skill specificity distribution (e.g., commercial employees) have skills that can be easily employed in other occupations, while workers in the higher quartiles (e.g., electricians and tailors) have skills that are idiosyncratic to their own and few other occupations. The latter have, therefore, skills that are less transferable than the former because there are fewer occupations and jobs that require similar skills (Table 3 in the appendix provides examples of occupations and shows how they are ranked according to their occupational specificity).

In the second step, we want to study how workers with different degrees of specificity

[9] We use a linear probability model for the binary outcome employment.

[10] Given that we do not have information on the total number of persons employed in a given commuting zone-by-occupation cell, the main explanatory variable in our empirical model is the number rather than the share of CBWs in that cell.

are affected by an immigration shock. Therefore, we built an interaction term between the number of CBWs (M_{rot}) and the four quartiles of the skill specificity distribution.

To control for time-invariant observed and unobserved differences across individuals, we also include individual fixed effects λ_i , allowing us to identify the impact of the inflow of CBWs within individuals. To account for systematic differences in different years, regions, occupations, and industries, we include year-fixed effects δ_t, commuting zone-fixed effects ϕ_r, two-digit training occupation-fixed effects σ_o, and one-digit industry-fixed effects ρ_s. Finally, we cluster the standard errors at the commuting zone level.[11]

In all regressions, we standardize M_{rot} to mean zero and unit variance.[12] We are interested in the parameter β_1 representing the change in the outcome of interest for a one-unit change in M_{rot} (i.e., a one-standard deviation increase in the occupation- and region-specific number of CBWs, corresponding to roughly 550 CBWs).

5.1 Instrumental variable estimation

When we estimate Equation 1, we are concerned that β_1 might capture the non-random sorting of CBWs across commuting zone-by-occupation cells, generating a spurious correlation between M_{rot} and the outcome variable y_{irot}. For example, commuting zone- and occupation-specific labor demand shocks are likely to positively affect the outcomes of Swiss workers and simultaneously attract more CBWs. As a result of these demand shocks, one would observe a positive relationship—that would not necessarily be causal—between the outcomes and the inflow of CBWs.

To deal with the potential endogeneity of the CBWs' choice of location, Card (2001) proposes a shift-share instrument that builds on the insight that newly arriving immigrants tend to settle in regions with a larger number of co-nationals—what he calls the "nationality-pull factor." Combining the distribution of earlier immigrants across U.S. metropolitan areas and the later inflow of newly arriving immigrants, he builds the shift-share instrument by assuming that these newly arriving immigrants mirror the distribution

[11] Similar to Foged and Peri (2015), we cluster the standard errors at the level of the initial commuting zone, i.e., the commuting zone of residence at the time of the first interview. The reason is that roughly 6.5 percent of the individuals changed their commuting zone during the observation period.

[12] We do so by subtracting the mean of the overall sample and dividing by the standard deviation of the overall sample.

of the earlier immigrants.[13] In our setting, the shift-share instrument exploits the greater likelihood that CBWs coming to Switzerland after the 2002 reform will work in commuting zones that already had a large number of CBWs before the reform. In our case, the linguistic differences across commuting zones largely drive the nationality-pull factor: Most CBWs from Austria and Germany work in the German-speaking commuting zones; most CBWs from France work in the French-speaking commuting zones; and most CBWs from Italy work in the Italian- speaking commuting zones.[14]

To build our shift-share instrument (see Eq. 2), we exploit the pre-reform distribution of nationalities across commuting zones (λ_{gr}^{1999}) and pre-reform occupations (τ_{go}^{1999}). This approach builds on the insights of the labor and personnel literature that many workers find their jobs through social contacts and employee referrals (Burks et al., 2015; Calvó-Armengol & Zenou, 2005; Corcoran et al., 1980; Granovetter, 1983; Montgomery, 1981). In our setting, CBWs who entered Switzerland after the 2002 reform likely found work through other CBWs who had been working in Switzerland in the same occupation before the reform. In other words, occupations that already had many CBWs before the 2002 reform were more likely to experience a large inflow of CBWs after it.

To construct the distribution of earlier CBWs across commuting zones and occupations, we use the CBCS data from 1999, the first year in the data in which we observe both the commuting zone of the workplace and the occupation. We construct two variables: λ_{gr}^{1999} is the proportion of CBWs with nationality g working in commuting zones r in 1999, and τ_{go}^{1999} is the proportion of CBWs with nationality g working in occupation o in 1999. These two fractions constitute the "share" part of the instrument. We then predict the number of CBWs in commuting zone r and occupation o for 2000 2009 according to equation (2):

$$\widehat{M_{rot}} = \sum_{g} \lambda_{gr}^{1999} * \tau_{go}^{1999} * M_{gt} \qquad (2)$$

[13] For example, assume that in year t-1 out of the total population of immigrants from country g living in the U.S., the fraction x_{t-1} lives in the metropolitan area r. Moreover, assume that in year t the U.S. experiences a total inflow M_g of individuals from country g, M_{rg} of which settle (potentially endogenously) in metropolitan area r. The shift-share instrument uses the product of the fraction x_{t-1} (share) and the total inflow from country g, M_g (shift), to predict the inflow from country g into metropolitan area r in year t, $\widehat{M}_{rg}$.

[14] In 1999, only about three percent of the CBWs working in Switzerland and living in one of Switzerland's neighboring countries were not nationals of that country.

Where M_{gt} is the total inflow of CBWs with nationality g in year t. This instrument is similar to Card's (2001) shift-share instrument. However, while he uses the contemporaneous distribution of immigrants across occupations, we use the distribution prior to the reform.

To illustrate the 1999 geographical distribution of CBWs in Switzerland, Figure 2 shows the distribution of CBWs across commuting zones in 1999.

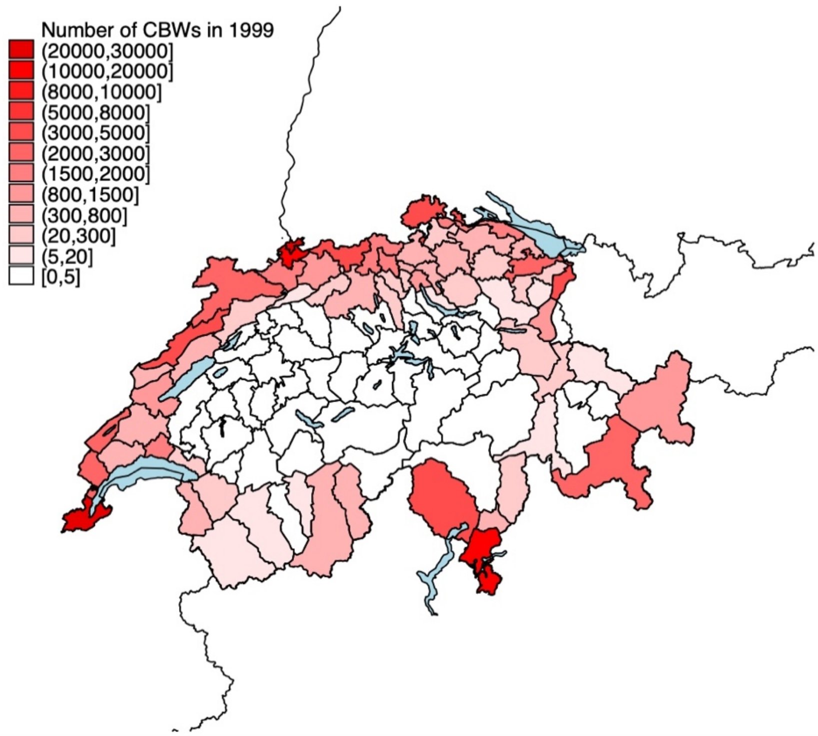

Figure 2: Number of CBWs on local employment in 1999. Source: Authors' calculations based on data from the Cross-Border Commuters Statistics (FSO)

5.2 Validity of the identification strategy

To solve the endogeneity of M_{rot}, $\widehat{M_{rot}}$ has to fulfil two conditions. First, $\widehat{M_{rot}}$ must be correlated with the actual number of CBWs (first stage). Figure 3 plots the predicted number of CBWs, $\widehat{M_{rot}}$ versus the actual number of CBWs, M_{rot} and shows that the two measures are highly correlated (i.e., the dots are close to the 45-degree line), thus suggesting a strong first stage.

Second, $\widehat{M_{rot}}$ must be uncorrelated with the error term ϵ_{irot} (exogeneity) conditional on the fixed effects we include in our model given by equation (1). We argue that $\widehat{M_{rot}}$ is unlikely to be correlated with commuting zone- or occupation-specific shocks for two reasons. First, in $\widehat{M_{rot}}$, the variable M_{gt} *represents* the *total* inflow of CBWs with nationality g in Switzerland in a given year t. The *total* inflow is less likely to be driven by commuting zone- or occupation-specific shocks. Second, we assume that commuting zone-specific demand shocks and occupation-specific demand shocks are not persistent so that the fractions λ_{gr}^{1999} and τ_{go}^{1999} in formula (2) are uncorrelated with ϵ_{irot}. In other words, we assume that the factors determining the 1999 distribution of CBWs across commuting zones and occupations are uncorrelated with the inflow of CBWs into commuting zones and occupations in subsequent years.

Although we are aware that recent work challenged the exogeneity assumption of shift-share instruments (e.g., Jaeger et al., 2018), we argue that, in our case, the sharp increase in CBWs generated by the 2002 reform is likely to make any demand shock less persistent making the exogeneity assumption more likely to hold in our setting. To substantiate this argument, we analyze whether pre-trends in our outcome variables in the years before the reform predict changes in the instrument after the reform. The results (see Table 4 in the Appendix) show no systematic correlation between pre-trends and changes in the instrument. We interpret this evidence as supportive of the instrument exogeneity assumption.

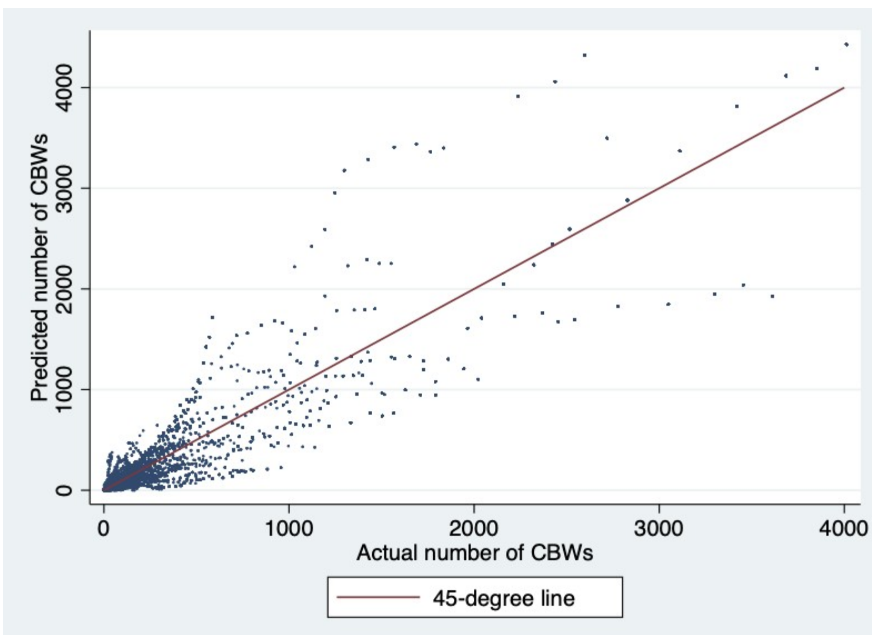

Figure 3: Predicted vs. actual number of CBWs. Source: Authors' calculations based on data from the Cross-Border Commuters Statistics (FSO).

6 Results

6.1 Main results

Table 1 reports the OLS and 2SLS estimates of the coefficients of M_{rot} on wages and employment in different quartiles of the occupational skill specificity distribution. In the OLS estimation, we use the actual number of CBWs in a given commuting zone-by-occupation cell and year, M_{rot}, and we interact this variable with S_{ot} containing the quartiles of the occupational skill specificity distribution. In the 2SLS, we instrument each interaction term $M_{rot} * S_{ot}$ by the respective interaction with the predicted number of CBWs in a specific commuting zone-by-occupation cell, that is $\widehat{M_{rot}} * S_{ot}$. The coefficients represent the estimates of the effect of a one-standard-deviation increase in the commuting zone- and occupation-specific number of CBWs (i.e., roughly 550 CBWs)[15] on the respective outcome.

For employment, the 2SLS estimate of the effect of the inflow of CBWs on employment probabilities is positive for workers with the highest degree of occupational skill specificity (4th quartile). In contrast, the estimates do not show any effect for workers in the other quartiles of the occupational skill specificity distribution. These effects imply that the inflow of CBWs increased the employment probability of workers with the most specific occupational skills by 7.5 percentage points, while it did not significantly affect the employment probability of workers with less specific occupational skills. For wages, the estimates are not significant.[16]

In the 1st and 2nd quartiles, the OLS estimates for employment tend to be more positive than the IV estimates, while the opposite is true for the 3rd and 4th quartiles. These differences between OLS and IV estimates could indicate different selection patterns of CBWs across occupations with different degrees of occupational skill specificity. However, given that OLS and IV estimate different parameters (with IV estimating a local average treatment effect), a direct comparison of OLS and IV estimates could be misleading.

[15] The average increase in the number of CBWs for native workers in the wage sample experiencing a strictly positive increase was 70 (SD = 230). Some native workers experienced an increase as high as 1057 CBWs (99th percentile), whereas others experienced an increase as low as 1 CBW (1st percentile).
[16] As one could argue that the high number of commuting zone-by-occupation cells without any CBWs might generate problems for our analysis, we run a robustness test in which we exclude all cells without any CBW. The results of this test are reported in Table 6 and are largely consistent with our main results. Small differences in the estimates likely result from differences in sample sizes.

Table 1: OLS and 2SLS estimates on employment and wages

	Employment		Wages	
	OLS	2SLS	OLS	2SLS
1st quartile	0.003	-0.001	0.011**	0.009
	(0.003)	(0.015)	(0.005)	(0.009)
2nd quartile	0.007**	0.004	0.009*	0.005
	(0.003)	(0.014)	(0.005)	(0.008)
3rd quartile	-0.055*	-0.045	-0.057*	-0.090
	(0.030)	(0.047)	(0.034)	(0.054)
4th quartile	0.017	0.075*	-0.043	-0.049
	(0.031)	(0.043)	(0.027)	(0.061)
Year FE	yes	yes	yes	yes
Commuting zone FE	yes	yes	yes	yes
Occupation FE	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Individual FE	yes	yes	yes	yes
F-stat 1st quartile		454.69		411.18
F-stat 2nd quartile		67.17		82.73
F-stat 3rd quartile		125.92		171.82
F-stat 4th quartile		110.65		66.22
Obs.	91663	91663	66947	66947
Ind.	28450	28450	21549	21549

Note: The dependent variables are an indicator of employment and the natural logarithm of annual wages in full-time equivalents. The coefficients represent the estimates of the effect of a one-standard-deviation increase in the commuting zone- and occupation-specific number of CBWs. The estimated effects are obtained by interacting the treatment variable M_{rot} with the variable S_{ot} containing the different quartiles of the occupational skill specificity distribution. In the 2SLS estimations, the interaction terms $M_{rot} * S_{ot}$ are instrumented by $\hat{M}_{rot} * S_{ot}$. Industry FE are at the one-digit industry level. Occupation FE are at the two-digit occupational level. Standard errors in parentheses clustered at the levels of the initial commuting zone. * p< 0.10, ** p< 0.05, *** p< 0.01. Source: Authors' calculations based on the SESAM/SLFS data and data from the Cross-Border Commuters Statistics (FSO)

6.2 Discussion and contributions

In our main analysis, we find a positive effect of the inflow of CBWs on the employment probability of workers in the most specific occupations.[17] This result is consistent with the results of Basten and Siegenthaler (2019) who find that immigration reduces the unemployment of native workers. However, it goes beyond their results and shows that

[17] An alternative explanation for our main results could be that complementarities with high-skilled CBWs drive the positive employment effects for middle-skilled workers with specific occupational skills. Additional analyses in the appendix (Table 4) do not support this explanation. Beerli et al. (2021) show that a large fraction of the total increase in immigration (including CBWs) after the AFMP is high-skilled. We investigate whether these complementarities can drive our results by testing whether our instrument $\widehat{M_{rot}}$ correlates with the immigration of high-skilled CBWs into the same commuting zone. The coefficients reported in Table 4 in the appendix are not significant when year FE and commuting zone FE are included, as in our main model. We, therefore, conclude that complementarities with high-skilled CBWs are unlikely to explain our results.

the positive effects are not homogeneously distributed across workers with different skill bundles but rather concentrated in the most specific occupations. To explain the positive employment effect for workers with specific occupational skills, we draw on recent work analyzing the effects of immigration in a search model (e.g., Albert, 2021; Battisti et al., 2018; Chassamboulli & Palivos, 2014).

In these models, immigration has two opposing effects. On one hand, immigration can lead to the substitution of native workers with immigrant workers, thus decreasing the employment probabilities of native workers. On the other hand, immigration can lead to a job creation effect by improving firms' productivity. For example, Albert (2021) argues that immigrant workers typically accept lower wages than incumbent workers. By hiring immigrant workers at a lower wage, firms can reduce their production costs, increase their profits, and create new jobs, in turn increasing the employment probabilities of native workers. In line with the latter mechanism, Orefice and Peri (2020) show that immigration increases the quality of firm-worker matches, which also leads to higher productivity. The increased productivity, in turn, allows firms to create new jobs. As a result of this job creation process, the employment probability of native workers increases. Whether the substitution effect or the job creation effect dominates remains an empirical question.

In our empirical setting, it appears that the job creation effect clearly dominates the substitution effect for workers with specific occupational skill bundles. That is, the new availability of CBWs from the EU after the introduction of the AFMP provided firms with cheaper skilled workers to fill previously existing skill gaps, thus alleviating capacity restrictions, providing better options for growth, and creating new jobs also for native workers. Swiss workers with the most specific occupational skill bundles appear to have benefitted the most from the newly created jobs because their supply is limited. These results are in line with Eggenberger et al. (2022) for Germany, who study the effects of international trade shocks and also find that workers with specific occupational skills benefit the most from positive labor market shocks resulting from increased exports and production growth. Both results are consistent with classical human capital theory (Becker, 1964; Lazear, 2009), which posits that workers with specific skills cannot be easily substituted.

For wages, our estimates do not show any significant effects of the inflow of CBWs.

Therefore, the inflow of CBWs does not appear to have reduced the wages of native workers. This result is in line with Beerli et al. (2021), who also find, on average, no effect on wages after the liberalization of the Swiss labor market, and with Basten and Siegenthaler (2019), who find a reduction in unemployment but only little effect on wages in Switzerland after the 2002 reform.

These findings overall contribute to the existing migration literature by showing that the labor market effects of immigration are heterogeneous across workers with different types of skills. We add occupational skill specificity as one important component of heterogeneity. One important policy implication of our findings is that workers with specific occupational skills have skills that are rather unique in the labor market and, therefore, benefit to a greater extent from positive labor demand shocks than workers with more general skills. This result contrasts with previous literature pointing to the downsides of specific occupational skills due to reduced mobility across occupations (e.g., Lamo et al., 2011; Hanushek et al., 2017). Thus, workers are confronted with a risk-return trade-off when deciding on investing in specific vs. general skills. The optimal decision partially depends on personal risk preferences.

Moreover, we provide a methodological contribution to the literature on the effects of immigration by using a different source of variation compared to previous studies for Switzerland. While for identification, Beerli et al. (2021) use the distance from the border in a DiD framework, and Basten and Siegenthaler (2019) use variation in the number of immigrants across occupation-age cells, our strategy exploits the variation in the number of immigrants across occupation-region cells (similar to Card, 2001).

Our findings also add to the small but growing literature analyzing how skill specificity moderates the effect of globalization on workers. While Eggenberger et al. (2022) have already shown that import and export shocks on the product market have heterogeneous labor market effects on workers with different degrees of skill specificity, we complement this evidence by studying a different type of shock driven by globalization, that is, an immigration-driven labor supply shock. Moreover, similar to Eggenberger et al. (2022), our results also show that workers with specific occupational skills can benefit more from positive demand shocks than workers with less specific occupational skills.

7 Conclusion

In this study, we explore how middle-skilled workers with different degrees of occupational skill specificity are affected by an immigration-driven labor supply shock. To identify the effect of this labor supply shock, we use the 2002 Agreement on the Free Movement of Persons between Switzerland and the EU, which led to a sudden and substantial increase in the number of CBWs in Switzerland.

Our results suggest that opening the Swiss labor market to workers from the EU did not have an adverse effect on the employment of middle-skilled workers, as initially feared in policy discussions. On the contrary, the free movement of persons increased the employment probability of middle-skilled workers in specific occupations and reduced the need for occupational changes.

We interpret these results as evidence that the opening of the Swiss labor market led to better conditions for firms and, consequently, to a better allocation of native workers to jobs (i.e., better job-worker matches), thereby allowing firms to expand and create new jobs for the incumbent Swiss workforce. The creation of new jobs and the resulting increase in labor demand positively affected the employment probability of workers with specific occupational skills, as these workers have skills that are relatively scarce on the labor market. Overall, our results show that not only the level of skills (as shown by previous studies) but also the type of skills (i.e., the specificity of occupational skill bundles) matters when investigating the effects of immigration. Therefore, analyses of the effects of immigration and, more generally, labor market shocks on individual labor market outcomes should factor in occupational skill specificity, particularly when analyzing the heterogeneity of these effects across workers.

References

Abberger, K., Abrahamsen, Y., Bolli, T., Diabiasi, A., Egger, P., Frick, A., Graff, M., Hälg, F., Iselin, D., Sarferez, S., Schläpfer, J. B., Siegenthaler, M., Simmons-Süer, B., Sturm, J.-E., and Tarlea, F. (2015). Der bilaterale weg - eine ökonomische Bestandesaufnahme. Technical report, KOF Konjunkturforschungsstelle, ETH Zürich.

Albert, C. (2021). The labor market impact of immigration: Job creation versus job competition. *American Economic Journal: Macroeconomics*, 13(1):35–78.

Basten, C. and Siegenthaler, M. (2019). Do immigrants take or create residents' jobs? evidence from free movement of workers in Switzerland. *The Scandinavian Journal of Economics*, 121(3):994–1019.

Battisti, M., Felbermayr, G., Peri, G., and Poutvaara, P. (2018). Immigration, search and redistribution: A quantitative assessment of native welfare. *Journal of the European Economic Association*, 16(4):1137–1188.

Becker, G. (1962). Investment in human capital: A theoretical analysis. *Journal of Political Economy*, 70.

Beerli, A., Ruffner, J., Siegenthaler, M., and Peri, G. (2021). The abolition of immigration restrictions and the performance of firms and workers: Evidence from Switzerland. *American Economic Review*, 111(3):976–1012.

BFS (2019). Arbeitsmarktregionen 2018. Erläuterungsbericht. Technical report, BFS.

Borjas, G. (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.

Burks, S. V., Cowgill, B., Hoffman, M., and Housman, M. (2015). The value of hiring through employee referrals. *The Quarterly Journal of Economics*, 130(2):805–839.

Calvó-Armengol, A. and Zenou, Y. (2005). Job matching, social network and word-of-mouth communication. Journal of Urban Economics, 57:500–522.

Card, D. (2001). Immigrant inflows, native outflows, and the local market impacts of higher immigration. Journal of Labor Economics, 19(1):22–64.

Cattaneo, C., Fiorio, C. V., and Peri, G. (2015). What happens to the careers of European workers when immigrants "take their jobs"? Journal of Human Resources, 50(3):655–693.

Chassamboulli, A. and Palivos, T. (2014). A search-equilibrium approach to the effects of immigration on labor market outcomes. International Economic Review, 55(1):111–129.

Corcoran, M., Datcher, L., and Duncan, G. J. (1980). Most workers find jobs through word of mouth. Monthly Labor Review, 103(8):33–35.

Dustmann, C., Schönberg, U., and Stuhler, J. (2017). Labor supply shocks, native wages, and the adjustment of local employment. The Quarterly Journal of Economics, 132(1):435– 483.

Eggenberger, C., Janssen, S., and Backes-Gellner, U. (2022). The value of specific skills under shock: High risks and high returns. Labor Economics, 78(C): S0927537122000781.

Eggenberger, C., Rinawi, M., and Backes-Gellner, U. (2018). Occupational specificity: A new measurement based on training curricula and its effect on labor market outcomes. Labor Economics, 51(C):97–107.

Foged, M. and Peri, G. (2015). Immigrants' effect on native workers: New analysis on longitudinal data. American Economic Journal: Applied Economics, 8(2):1–34.

Geel, R., Mure, J., and Backes-Gellner, U. (2011). Specificity of occupational training and occupational mobility: an empirical study based on Lazear's skill-weights approach. Education Economics, 19(5):519–535.

Granovetter, M. (1983). The strength of weak ties: A network theory revisited. Sociological Theory, 1:201–233.

Hainmueller, J., & Hiscox, M. J. (2010). Attitudes toward highly skilled and low-skilled immigration: Evidence from a survey experiment. *American political science review*, 104(1), 61-84.

Hanushek, E., Schwerdt, G., Woessmann, L., and Zhang, L. (2017). General education, vocational education, and labor-market outcomes over the lifecycle. *Journal of Human Resources*, 52(1):48–87.

Jaeger, D. A., Ruist, J., and Stuhler, J. (2018). Shift-share instruments and the impact of immigration. Technical Report 24285, National Bureau of Economic Research.

Lamo, A., Messina, J., and Wasmer, E. (2011). Are specific skills an obstacle to labor market adjustment? *Labor Economics*, 18(2):240–256.

Lazear, E. P. (2009). Firm-specific human capital: A skill-weights approach. *Journal of Political Economy*, 117(5):914–940.

Montgomery, J. D. (1981). Social networks and labor-market outcomes: Toward an economic analysis. *American Economic Review*, 5:1408–1418.

OECD (2019). International Migration Outlook 2019. OECD Publishing.

Ortega, F., & Polavieja, J. G. (2012). Labor-market exposure as a determinant of attitudes toward immigration. *Labor Economics*, 19(3), 298-311.

Peri, G. and Sparber, C. (2009). Task specialization, immigration, and wages. *American Economic Journal: Applied Economics,* 1(3):135–69.

SECO (2014). 10. Bericht des Observatoriums zum Freizügigkeitsabkommen Schweiz-EU. Technical report, SECO, BFM, BFS, BSV.

Appendix

Table 2: Descriptive statistics

	Obs.	Mean	SD	Min	Max
Annual wage	66947	68339.65	27309.55	1519	524355
Male	66947	0.52	0.50	0	1
Swiss national	66947	0.74	0.44	0	1
Industry					
Agriculture, forestry and fishing	66947	0.02	0.13	0	1
Mining and quarrying	66947	0.00	0.03	0	1
Manufacturing	66947	0.18	0.39	0	1
Electricity, gas, steam and air-conditioning supply	66947	0.01	0.09	0	1
Water supply; sewerage, waste management and remediation activities	66947	0.00	0.06	0	1
Construction	66947	0.08	0.27	0	1
Wholesale and retail trade, repair of motor vehicles	66947	0.19	0.39	0	1
Transportation and storage	66947	0.06	0.23	0	1
Accomod. and food serv. act.	66947	0.04	0.19	0	1
Information and communication	66947	0.03	0.16	0	1
Financial and insurance activities	66947	0.07	0.25	0	1
Real estate activities	66947	0.01	0.08	0	1
Prof., scientific and tech. act.	66947	0.05	0.23	0	1
Admin. and support serv. act.	66947	0.03	0.16	0	1
Public administration and defence	66947	0.06	0.23	0	1
Education	66947	0.02	0.14	0	1
Human health and social work act.	66947	0.12	0.32	0	1
Arts, entertainment and recreation	66947	0.01	0.11	0	1
Other service activities	66947	0.03	0.16	0	1
Act. of households as employers	66947	0.00	0.07	0	1
Act. of extraterritorial org. and bodies	66947	0.00	0.02	0	1
Year	66947	2005	2.46	2000	2009
Employed	91663	0.86	0.35	0	1

Source: Authors' calculations based on the SESAM/SLFS data

Table 3: Examples of occupations in different quartiles of the specificity distribution

1st quartile (least specific)	**2nd quartile**	**3rd quartile**	**4th quartile (most specific)**
Commercial employees	Kitchen staff	Mechanical engineers	Healthcare assistants
Retail clerks	Cabinetmakers	Electricians	Automotive technicians
Janitors	Laboratory assistants	Hairdressers	Architectural and civil drafters
Metal workers	Printing technicians	Farmers	Tailors

Note: The table reports the four most common occupations in each quartile of the specificity distribution (wage sample). Original German in parentheses. In the 1st quartile are the least specific occupations; in the 4th quartile the most specific ones. We assigned each occupation to one of the four quartiles according to the average specificity over the whole observation period. Source: Eggenberger et al.'s (2018) occupational skill specificity data.

Table 4: Do changes in pre-trends predict changes in the instrument?

	$\Delta\widehat{M}_{ro}$	$\Delta\widehat{M}_{ro}$

Δ Employment	19.54 (15.13)	
Δ Wage		0.35 (2.21)
N	1440	1421

Note: The dependent variable is the change in our instrument between 2000 and 2009. Δ wage represents the change in average annual wage (in thousands) in a given commuting zone-by-occupation cell in the pre-treatment period; Δ employment represents the change in the proportion of employed. To increase the number of observations in each commuting zones-by-occupation cell, we pool pre-treatment observations in two periods t_1 (1991-1995) and t_2 (1996-1999). We exclude cells with less than 5 observations as this would lead to an imprecise estimate of the average outcome in the cell. We then compute changes in employment and wages between t_1 and t_2 within commuting zone-by-occupation cells as $\Delta y_{ro} = y_{ro,t=t2} - y_{ro,t=t1}$, where y is one of two outcomes, *r* is an index for the commuting zone, and *o* an index for the occupation. Standard errors in parentheses. $*$ $p < 0.10$, $**$ $p < 0.05$, $***$ $p < 0.01$. Source: Authors' calculations based on the SESAM/SLFS data and data from the Cross-Border Commuters Statistics (FSO)

Table 5: Middle- and high-skilled CBWs

	$\widehat{M}_{rot}$	$\widehat{M}_{rot}$	$\widehat{M}_{rot}$
High-skilled CBWs	-9.140***	1.692	1.273
	(0.563)	(1.166)	(1.169)
Year FE	no	no	yes
Commuting zone FE	no	yes	yes
Obs.	313677	313677	313677

Note: high-skilled CBWs are those CBWs in a given commuting zone that are in the ISCO-08 categories 1 (Managers) and 2 (Professionals). The dependent variable is the instrument. Each observation is a commuting zone-by-occupation-by-year cell. Standard errors in parentheses. *p < 0.10, *p < 0.05, ***p < 0.01. Source: Authors' calculations based on data from the Cross-Border Commuters Statistics (FSO).

Table 6: Exclusion of zone-by-occupation cells with zero CBWs

	Employment		Wages	
	OLS	2SLS	OLS	2SLS
1st quartile	0.005	-0.003	0.018**	0.032*
	(0.005)	(0.022)	(0.007)	(0.017)
2nd quartile	0.010**	0.004	0.017**	0.029*
	(0.004)	(0.020)	(0.008)	(0.016)
3rd quartile	-0.068*	-0.049	-0.051	-0.030
	(0.041)	(0.064)	(0.054)	(0.069)
4th quartile	0.018	0.092**	-0.026	0.028
	(0.038)	(0.043)	(0.031)	(0.055)
Year FE	yes	yes	yes	yes
Commuting zone FE	yes	yes	yes	yes
Occupation FE	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Individual FE	yes	yes	yes	yes
Obs.	49957	49957	36397	36397
Ind.	15598	15598	11781	11781

Note: The dependent variables are an indicator for employment, the natural logarithm of annual wages in full-time equivalents, and an indicator for occupational changes. The coefficients represent the estimates of the effect of a one-standard-deviation increase in the commuting zone- and occupation-specific number of CBWs. The estimated effects are obtained by interacting the treatment variable M_{rot} with the variable S_{ot} containing the different quartiles of the occupational skill specificity distribution. In the 2SLS estimations, the interaction terms $M_{rot} * S_{ot}$ are instrumented by $\widehat{M}_{rot} * S_{ot}$. Industry FE are at the one-digit industry level. Occupation FE are at the two-digit occupationallevel. Standard errors in parentheses clustered at the levels of the initial commuting zone. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: Authors' calculations based on the SESAM/SLFS data and data from the Cross-Border Commuters Statistics (FSO).