CESifo
CONFERENCES 2020

CESifo and AUEB-LINER Conference on
The Role of Institutions and Policies in Firm Exporting
Munich, 5–6 November 2020

Foreign Workers, Product Quality, and Trade: Evidence from a Natural Experiment

Andrea Ariu

CESifo

Foreign Workers, Product Quality, and Trade: Evidence from a Natural Experiment*

Andrea Ariu†

October 20, 2020

Abstract

This paper shows that international labor mobility attenuates information frictions, and leads to higher-quality products, more trade, and more effective global value chains. Exploiting variation in the time and intensity at which Swiss postal codes were hit by the increasing availability of foreign workers due to the implementation of the Swiss-EU Agreement on the Free Movement of Persons, I find that the inflow of high-skilled European workers led to an upgrade in the quality of inputs imported from their origin countries. Better intermediates improved the quality of output, making Swiss products more appealing for international markets and boosting exports. Therefore, the efficacy of Swiss global value chains improved both upstream—thanks to higher-quality intermediate inputs brought by the intensification of the existing buyer-seller relations—and downstream—because higher-quality products eased increasing exports to existing buyers and helped finding new customers, especially in distant destinations.

Keywords: Information Frictions, Labor Mobility, Innovation, Trade, GVCs.
JEL Classification: F14, F16, F22.

*This research was supported by the National Center of Competence in Research NCCR - On The Move funded by the Swiss National Science Foundation and by the CRC TRR 190 "Rationality and Competition." All views expressed in this paper, as well as the errors, are solely my own. I thank Jan Ruffner and Michael Siegenthaler for sharing the code to compute time distances; Andreas Beerli, Davide Cantoni, Miguel Cardoso, Rosario Crinò, Carsten Eckel, Robert C. Johnson, Ariell Reshef, Michael Siegenthaler, Mara P. Squicciarini, Martin Watzinger and the participants at various seminars and conferences for helpful suggestions.

†University of Milan, Luca d'Agliano and CRENOS, Italy; CEPR, UK; ifo and CESifo, Germany; E-mail: `andrea.ariu@unimi.it`

1 Introduction

Information frictions represent a major obstacle for the organization of effective global value chains by making the quest for appropriate intermediate inputs and potential clients costly. Existing contributions analyze how different technologies ease the flow of information between distant markets, thus leading to trade growth and integration (e.g., Jensen, 2007; Allen, 2014; Steinwender, 2018). At the same time, a number of studies argue that immigration is related to more trade (e.g., Head and Ries, 1998; Rauch, 1999; Felbermayr and Toubal, 2012; Parsons and Vézina, 2018) and suggest that foreign workers can provide up-to-date information about technology, taste, institutions, and economic environment on their origin markets to host countries. Yet, there is hardly any causal evidence on *whether* and *how* cross-country labor mobility favors these information flows to the benefit of production organization and international trade performance. The major obstacle is represented by the fact that the responsiveness of foreign workers' flows is typically not independent from trade flows and the economic environment.

This paper circumvents this issue by exploiting the exogenous variation arising from a natural experiment: the staggered opening of the Swiss labor market to European workers mandated by the Swiss-EU Agreement on the Free Movement of Persons (AFMP). The agreement removed quotas and the bureaucratic procedures needed to hire EU workers in Switzerland, thus making them comparable to native workers. Two features allow for causal inference. First, the agreement was implemented at different times in the different Swiss regions. Second, within the same region the increase in the share of foreign workers varied depending on the distance from the border. This is because most of the increase was accounted by cross-border workers, which need to commute daily from a border country to their Swiss employer.

I find that the large number of high-skilled European workers that arrived in Switzerland following the implementation of the AFMP led to an increase in the quality of imported intermediate inputs coming from their origin country. This suggests that they brought novel knowledge about existing suppliers from their home countries that lowered upstream information frictions. The use of better inputs improved the quality of exported products and fostered growth especially with extra-EU destinations by increasing exports to existing customers and by reaching new ones. Since export growth was not especially directed toward the foreign workers' origin countries, their increasing availability does not seem to have decreased downstream information frictions. Therefore, quality upgrading represents the main determinant of export expansion. These

results clearly show that new foreign workers do not merely represent additional labor for the receiving countries. They bring with them up-to-date information about their origin countries that is crucial for optimizing the organization of global value chains (GVC), for producing quality products, and for reaching distant markets. In other words, they possess specific human capital in the form of knowledge about their origin country that is useful for firms in the host country. Therefore, any occurrence of labor market jeopardization due to reduced labor mobility, such as Brexit or the current COVID-19 pandemic, can increase information frictions and harm the capability of improving quality and organizing production and sales internationally.

The AFMP was signed in 1999. It was implemented in Switzerland in 2004 for the postal codes in the border region, and in 2007 for those in the central region. The agreement was hugely successful in attracting foreign workers to Switzerland. Following its implementation, cross-border workers almost doubled and resident immigrant workers increased by 29%. The incoming flows were composed mostly by high-skilled workers coming from border countries and landed working for high-tech industries. The increase in resident immigrants did not show any geographical pattern, and the time discontinuity attributable to the agreement is rather mild. Instead, because cross-border workers have a limited propensity to spend long times getting to work, their share increased substantially only in postal codes within 15 minutes drive from the border crossing. Postal codes 15 to 30 minutes from the border were only mildly affected, and those more than 30 minutes remained practically untouched. Moreover, these changes closely follow the timing of the agreement implementation. Exports experienced a similar pattern: they grew more in postal codes closer to the border. This growth was especially strong for high-tech products and for extra-EU destinations, and it is mostly explained by an increase in the average exports per destination and product, while the extensive margins (i.e., number of products and destinations) did not play any role.

To provide causal evidence on the effects of the agreement, I exploit variation in both the timing and the intensity at which postal codes were affected by the inflow of cross-border workers. I implement a difference-in-differences analysis comparing exports of a certain product to a particular destination between exposed and unaffected postal codes before and after the implementation of the agreement.[1] I find that highly treated postal codes (i.e., those within 15 minutes of the border) increased exports more

[1]This setting is particularly appealing because compositional differences in terms of products and destinations across treated and control postal codes do not play any role. This comes at the expense of not being able to identify a causal effect on the extensive margins, however, the descriptive analysis shows that they did not play any role in the export growth of affected postal codes.

than unaffected ones (i.e., those more than 30 minutes from the border) but I do not observe any differential effect for postal codes only mildly affected (i.e., those 15 to 30 minutes from the border).[2] Under the assumption that the AFMP did not have indirect effects on the trade flows of the control group, its implementation increased exports in the border region of 5.5%—representing 9.4% of the overall export expansion observed in the 1996–2010 period. This export growth was mostly concentrated on extra-EU destinations. Therefore, it is unlikely that foreign workers lowered downstream information frictions by providing export-relevant information about their origin countries. Instead, by decomposing exports into quantities and prices, I find that an increase in the former is not followed by a decrease in the latter. This suggests that the quality of Swiss products produced in border postal codes increased. To dig deeper into this finding, I construct a measure of perceived quality based on the methodology developed in Khandelwal et al. (2013) and I find evidence that the appeal of Swiss products produced in affected postal codes increased following the AFMP. Therefore, quality upgrading is the driving force behind export growth and it helped penetrating distant destinations.

How could foreign workers improve the quality of exports? The most direct way is by bringing new skills or technologies from their home countries. However, I find that export growth was not concentrated on the products for which neighboring countries have a comparative advantage, thus suggesting that foreign workers did not bring origin-specific skills or technologies that improved existing products. A second way to improve the quality of exported products is by using better intermediate inputs. Indeed, I observe that postal codes which experienced an increase in the quality of exports also improved the quality (measured as unit prices) of inputs employed in the production of exported products coming from the foreign workers' origin countries. To assess whether better inputs affected the quality of exported products, I use the same difference-in-differences strategy and compare the role of input prices for export prices and quality. I find that only the increase in prices of foreign workers' origin-country inputs is positively and significantly related to export price and quality growth. Conversely, the prices of inputs from other countries are not. Therefore, input quality upgrading is the driving force underneath export growth, and information frictions decreased upstream thanks to the knowledge of foreign workers arriving from border countries. Importantly, I do

[2]These results hold when controlling for heterogeneous responses to the same shock within treated and control regions by using industry-region trends; discarding from the estimation products that are involved in the implementation of other concurrent agreements; restricting the analysis to the border region (as in Beerli et al., 2018); the years before the great trade collapse; using alternative clustering for standard errors; controlling for product-destination shocks; and when checking the quality of the variation exploited by using a placebo test.

not claim that this is the only mechanism that could explain export growth in the context of the AFMP. Labor-constrained firms, local spillovers, specific human capital, and complementarity between high-skilled labor and high-quality intermediate products can represent additional channels. However, upstream information frictions decreased *specifically* with respect to foreign workers' origin countries, and only inputs imported from these countries were responsible for the increase in export quality. It is therefore hard to argue that the empirical results can be rationalized by mechanisms that do not involve country-specific information frictions.

Finally, using disaggregated custom-level data for China and France, I provide descriptive evidence on the global value chains changes implied by the AFMP. Analyzing import flows, I find that the increase in product quality fostered Swiss exports to China more than it did to France, and made it possible to sell more to existing customers and to find new ones. Looking at export flows, I find that the quality of intermediate inputs sold to Switzerland increased more in France than in China. This quality growth is driven mostly by existing suppliers and products. Therefore, this anecdotal evidence further indicates that the AFMP helped in hiring workers with knowledge about existing French suppliers that was instrumental to improving the quality of inputs. It is likely that these workers were previously employed by the suppliers or they had previous relations with them, for example, working for another competing customer or simply in another firm in the same industry.

My paper contributes to the literature analyzing how information frictions hamper trade. These works study how communication technologies, such as the telegraph (Steinwender, 2018; Juhasz and Steinwender, 2018), mobile phones (Jensen, 2007; Allen, 2014), web hosts (Freund and Weinhold, 2004), Internet broadband access (Leuven et al., 2018), and telephone call rates (Fink et al., 2005; Portes and Rey, 2005) have fostered trade by lowering the burden of communication. To my knowledge, this is the first paper showing that facilitating labor mobility can soften information frictions and lead to higher-quality products, more trade, and more efficient global value chains. Other contributions analyze more generally the role of workers' experience for export performance and firm productivity (Balsvik, 2011; Mion and Opromolla, 2014; Parrotta et al., 2014; Mion et al., 2016; Parrotta et al., 2016). My paper quantifies the role of foreign workers' knowledge and identifies the mechanism by which they foster trade. Consistent with Martin and Mayneris (2015), quality upgrading matters for trade growth, especially to distant destinations. Finally, together with Egger et al. (2019), my paper brings a new perspective to the literature analyzing the determinants

of global value chains (e.g., Antràs et al., 2012; Antràs and Chor, 2013; Alfaro et al., 2019) by demonstrating that labor mobility is crucial for the efficacy of global value chains. Using an instrumental strategy to assess causality, Egger et al. (2019) show that immigration leads to a decline in the number of suppliers that are contracted within a given source-country-product-group, an intensification of the remaining relationships, and a greater stability of these matches. My paper instead uses a natural experiment to analyze the mechanisms by which foreign workers can affect the structure of the international production and distribution network and the quality of inputs and output.

Most contributions analyzing the link between migration and trade (e.g., Head and Ries, 1998; Rauch, 1999, 2001; Rauch and Trindade, 2002; Felbermayr and Toubal, 2012) fail to convincingly assess a causal relation due to endogeneity issues and poor data quality (Felbermayr et al., 2015). Only few recent papers use an instrumental variable strategy (Ottaviano et al., 2018; Marchal and Nedoncelle, 2019) or natural experiments (Parsons and Vézina, 2018; Bahar et al., 2019; Olney and Pozzoli, 2020) to assess causality. However, most of these works either do not consider the skill of the immigrant or tend to focus on the effects of low-skilled immigration on trade for developed countries. My paper provides new insights by analyzing the case in which a developed country receives a large number of high-skilled workers from other developed countries. Thanks to this novel setting, I am able to identify a new mechanism by which foreign workers can foster trade and to show that information frictions can be substantial for trade also among developed countries.

More broadly, this paper contributes to the literature pointing at the positive effects of foreign workers on the economy. This research strand focuses on FDI activity (Burchardi et al., 2019), productivity (Kerr and Lincoln, 2010; Ghosh et al., 2014; Hornung, 2014; Ruffner and Siegenthaler, 2016; Mayda et al., 2018; Mitaritonna et al., 2018), and innovation (Gray et al., 2020). My analysis provides another dimension in which foreign workers are beneficial to the economy and qualifies the results of Ruffner and Siegenthaler (2016) in so that part of the increase in sales and productivity for Swiss firms that they observe following the implementation of the AFMP is due to exports and input quality growth.

The rest of this paper is organized as follows. Section 2 describes the Swiss-EU agreement. Section 3 presents the data and provides some stylized facts. Section 4 outlines the empirical strategy and discusses the results. Section 5 analyzes the possible mechanisms. Section 6 studies the GVCs implications of the AFMP. Section 7 concludes.

2 The Swiss-EU Agreement on the Free Movement of Persons

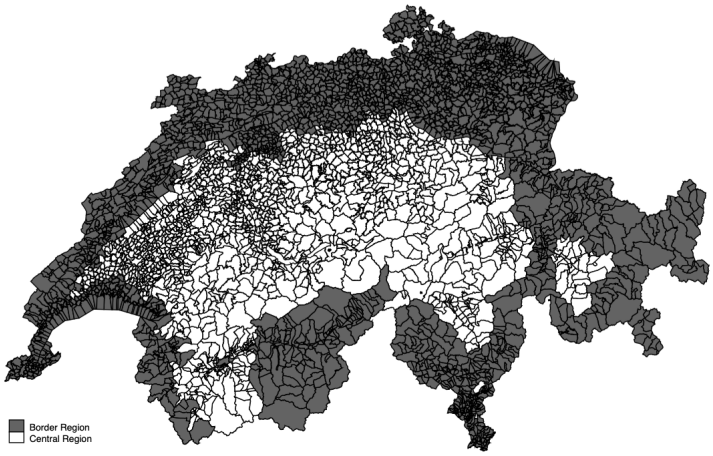
Switzerland and the EU signed a bilateral agreement on the free movement of persons in June 1999. The objective of the AFMP was to gradually introduce free access to each others' labor markets and it included provisions for the free movement of economically active and inactive persons and the cross-border provision of services by natural persons and legal entities. The AFMP was part of a package of bilateral agreements on different issues that comprised air transport, international trade, mutual recognition of conformity assessment, government procurement and scientific and technological cooperation.[3] Details of the agreement were first released in 1998, it was signed and approved by the Swiss parliament in 1999, it was ratified in May 2000 by a Swiss referendum and the parliamentary vote of each of the EU member states, and it was gradually implemented starting in 2002.

To understand the changes implied by the agreement, it is useful to describe the situation of the labor market before its implementation. Switzerland distinguishes two main types of foreign workers: resident immigrants (RI) and cross-border workers (CBW). The RI are foreign workers who live and work in Switzerland. The CBW are foreign citizens working in Switzerland but residing in one of the border EU countries (i.e., Austria, France, Germany, and Italy). Before the agreement, both RI and CBW were subject to national quotas set by the Swiss federal government, and they could be employed by Swiss firms only if the priority requirement was satisfied, i.e., if no equally qualified Swiss worker could be found. Additionally, CBW had to return to their residence every day after work and they could not work in the central region of Switzerland. The definition of the border and central regions was stipulated between Switzerland and its neighboring countries well before the AFMP: Italy in 1928, France in 1946, Germany in 1970, and Austria in 1973. This remained stable over time and, importantly, it does not overlap with any language, cultural, or political border (Ruffner and Siegenthaler, 2016). Figure 1 illustrates this repartition.

The AFMP implementation was gradual and affected the two categories of foreign workers and Swiss postal codes differently. Table 1 represents the steps that I describe in the following. Since 2002, RI enjoyed higher quotas, prolonged residency permits, facilitated family reunions, and simpler admission processes. Since 2007, when quotas and the admission process were abolished, RI have been fully comparable to Swiss

[3] I will discuss the role of these other agreements as potential confounding factors in Section 4.

Figure 1: Border and Central Postal Codes of Switzerland



Note: This figure represents the repartition of Swiss postal codes into the border region (dark gray) and central region (white).

workers. For CBW the liberalization brought by AFMP varied not only over time but also across regions. The impediment to working in the central region persisted until 2007. In border regions, access to CBW came earlier and more gradually. From 1999 to 2002 cantonal offices gained more flexibility in handing CBW applications (Beerli and Peri, 2017). From 2002 to 2004, some restrictions were lifted. Quotas increased and the foreign residence requirement was relaxed, allowing CBW to commute back to their residence weekly instead of daily. In addition, the working permit was granted for at least 5 years instead of being tied to the contract duration. Finally, in 2004 the priority requirement was lifted and CBW could be freely hired in the border region. The elimination of this last impediment made hiring a CBW easier and faster because it reduced the uncertainty related to the possibility of hiring the chosen worker and cut to zero the delay between filing the file to the immigration office and receiving an answer.[4]

Table 1: Implementation of the Swiss-EU Agreement on the Free Movement of Persons

	Region	Before AFMP	2002–2003	2004–2007	From 2007
Resident immigrants (RI)	BR & CR	Subject to national quotas	Higher quotas	Higher Quotas	Free
	BR & CR	National priority requirement	National priority requirement	National priority requirement	Free
Cross-border workers (CBW)	BR	Subject to national quotas	Higher quotas	Free	Free
	BR	National priority requirement	National priority requirement	Free	Free
	BR	Daily return to foreign domicile	Weekly return to foreign domicile	Free	Free
	CR	No Access	No Access	No Access	Free

Note: This table shows the evolution in the implementation of the AFMP for resident immigrant workers and cross-border workers for the border region of Switzerland (BR) and for the central region (CR).

[4]For the countries that joined the EU in 2004, workers from Cyprus and Malta were promptly granted the same rights as those of EU15. For the other new EU countries the AFMP became effective in 2011.

3 Data and Stylized Facts

In this section, I describe the data used for the analysis and I outline the three stylized facts that will guide the empirical strategy.

3.1 Data

The data I use in this paper come from the Swiss Federal Customs Administration (EDEC) and cover the 1996–2010 period. Both exports and imports are available at the postal code level, with indication of the type of product at the Harmonized System six-digit level, the destination or origin country, the quantities, the value and the year.[5] To prevent the estimates from being sensitive to small numbers, I restrict the analysis to flows worth at least 1,000 Swiss Francs and having non zero quantities.

To understand whether and how foreign workers' flows changed in Switzerland following the AFMP agreement, I use the Swiss Wage Structure Survey (SESS) provided by the Swiss Federal Statistical Office (FSO). These data are composed by a cross-sectional survey conducted every two years since 1994 on a representative sample of workers. The survey does not contain information on the workers' countries of birth, but it contains information about the work permit and it allows me to distinguish between Swiss and foreign workers. Moreover, it contains information on the education of the workers and on the workplace at the MS region level.[6] I focus on workers aged between 18 and 65 years employed in the private sector. Using this dataset, I can analyze how the presence of foreign workers in Switzerland varied over time and across regions. To complement this data with indications of the workers' nationalities, I use aggregate information from the "Statistique des Frontaliers" (STAF) for cross-border workers and from the "State Secretariat for Migration" (ZEMIS) for resident immigrants. Both STAF and ZEMIS contain information on the universe of cross-border workers and resident immigrants present in Switzerland.

Since the EDEC data does not provide information on foreign partner firms, I use alternative sources to understand the GVC implications of the AFMP. More precisely, I exploit firm-product imports and exports with China and France. The Chinese data report imports and exports by product and country for the years 2000 to 2009 with

[5] Firm-level data are available in Switzerland only from 2006 onward. Therefore, they do not cover the AFMP period that I analyze in this paper. For more details, see Egger and Lassmann (2015) and Egger et al. (2019).

[6] MS is the acronym for "spatial mobility areas." These represent 106 local labor markets defined by the Swiss Federal Statistical Office (FSO).

details of the values and the quantities. French imports and exports have the same structure but they cover the period 1996–2010. For both sources, I restrict the analysis to flows from or to Switzerland, having positive values and quantities and I use the HS classification at the 6-digit level to be consistent with the EDEC data. These data have been largely used for research purposes in many studies and a more careful description of all the details can be found, for example, in Eaton et al. (2011) and Manova and Zhang (2012).

3.2 Stylized facts

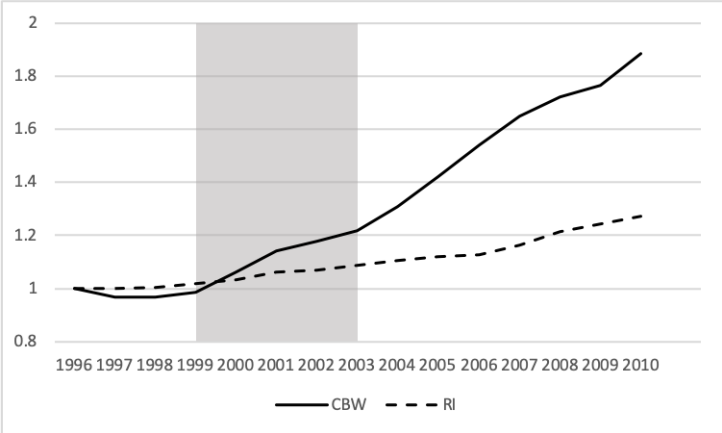
In this subsection I present three stylized facts that characterize the changes in foreign workers and trade patterns after the implementation of the AFMP.

- ***Stylized fact 1:*** *The AFMP was highly effective in attracting EU workers.*

Using the STAF and ZEMIS data, I first analyze the evolution in the presence of foreign workers. Table 2 shows, for selected years, the number of CBW (Panel a) and RI (Panel b), together with the average net yearly inflows in the period preceding the AFMP (1996–1999), the transition period (2000–2003) and the implementation period (2004–2010). The number of CBW almost doubled in the period 1996–2010, increasing from more than 145 thousand to more than 268 thousand. Most of this huge increase was largely due to an inflow of workers with the nationality of one of Switzerland's border countries. CBW with other nationalities increased at a similar pace, but their share remained at less than 7% of incoming inflows. Table 2 and Figure 2 reveal that the timing of the increase corresponds with the different phases of the implementation of the AFMP. Before the agreement, Switzerland lost, on average, 500 CBW per year; instead, in the transition period we observe an increase of around 5,409 CBW arrivals per year and of 12,175 in the period of the implementation. As expected, the number of CBW coming from outside the EU25 was negligible and it did not increase between the transition and the implementation periods.

Panel b of Table 2 shows that the number of RI increased less than that of CBW, with a growth of 29% in 15 years. Moreover, Figure 2 shows that the evolution of RI shows only a mild discontinuity following the RI liberalization in 2007. The yearly net inflows increased from more than 9 thousand RI in the pre-agreement period, to more than 19 thousand in the transition period and to more than 34 thousand in the implementation phase. Importantly, the composition of incoming flows changed

Figure 2: CBW and RI Growth, 1996–2010



Note: This figure represents the over time evolution of the number of cross border workers (Permit G) and the number of resident immigrants (permits B, C and L) normalized with respect to 1996. The gray area represents the transition period before the full implementation of the AFMP. Data Sources: STAF for CBW and ZEMIS for RI.

dramatically following the AFMP. Extra-EU25 flows represented the only source of growth for RI in the period 1996–1999. Starting from the signing of the agreement the situation reversed and the RI arriving from EU25 countries increased substantially, accounting for almost 90% of incoming inflows. In contrast, inflows from outside the EU25 decreased substantially. Therefore, while the increase in absolute numbers can be influenced by a period of florid economic growth in Switzerland after a few years of relatively poor performance, the change in composition can be reasonably attributed to the AFMP-facilitated immigration policy.

The skill level of incoming workers is another key element of the AFMP. Using the SESS data, I analyze the educational composition of foreign and Swiss workers over time in Figure 3. The graph shows that the share of tertiary educated Swiss workers among all Swiss workers, the share of CBW with tertiary education among all CBW and the share of RI with tertiary education among all RI increased quite substantially over the period of analysis. While for Swiss workers and RI this is part of a general upward trend, for CBW there is a clear sign of discontinuity starting with the implementation of the AFMP. This means that following the agreement tertiary educated started dominating incoming flows of CBW, and this led to the composition of skilled CBW becoming more tertiary educated than that of Swiss workers. Therefore, the agreement was particularly successful in attracting tertiary educated workers. This makes this setting unique, and it differs from other natural experiments in which the exogenous increase of foreign workers is characterized by an inflow of low-skilled workers from developing countries (e.g., Barsbai et al., 2017; Dustmann et al., 2017; Parsons and Vézina, 2018; Bahar

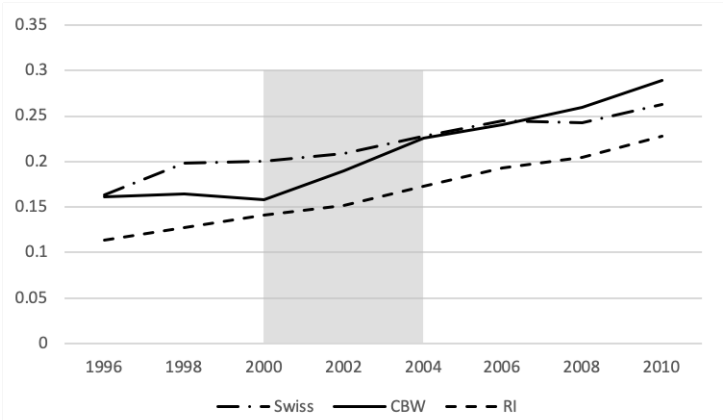
Table 2: Foreign Workers Growth by Resident Permit and Nationality

Panel a: Cross-Border Workers									
	Stocks						**Average Net Yearly Inflows**		
	1996	1999	2000	2003	2004	2010	1996–1999	2000–2003	2004–2010
Total	**147,316**	**145,195**	**156,455**	**179,659**	**193,146**	**278,371**	**-530**	**5,801**	**12,175**
Border	**145,823**	**143,241**	**154,142**	**175,776**	**188,556**	**268,632**	**-646**	**5,409**	**11,439**
Austria	*7,697*	*7,201*	*7,352*	*6,801*	*6,873*	*8,315*	*-124*	*-138*	*206*
France	*72,813*	*73,458*	*79,124*	*92,166*	*99,683*	*136,654*	*161*	*3,261*	*5,282*
Germany	*30,964*	*30,164*	*32,475*	*36,247*	*38,323*	*58,369*	*-200*	*943*	*2,864*
Italy	*34,349*	*32,418*	*35,191*	*40,562*	*43,677*	*65,294*	*-483*	*1,343*	*3,088*
Other EU25	**1,162**	**1,538**	**1,811**	**3,041**	**3,666**	**8,224**	**94**	**308**	**651**
UK	*247*	*348*	*396*	*628*	*817*	*1,994*	*25*	*58*	*168*
Portugal	*123*	*168*	*204*	*423*	*548*	*1,596*	*11*	*55*	*150*
Poland	*6*	*14*	*15*	*30*	*38*	*226*	*2*	*4*	*27*
Other	*455*	*592*	*694*	*1,118*	*1,339*	*2,893*	*34*	*106*	*222*
Outside EU25	**331**	**416**	**502**	**842**	**924**	**1,515**	**21**	**85**	**84**
Panel b: Resident Immigrants									
	Stocks						**Average Net Yearly Inflows**		
	1996	1999	2000	2003	2004	2010	1996–1999	2000–2003	2004–2010
Total	**1,369,494**	**1,406,630**	**1,424,370**	**1,500,907**	**1,524,663**	**1,766,277**	**9,284**	**19,134**	**34,516**
Border	**530,714**	**521,826**	**522,459**	**538,881**	**549,279**	**683,057**	**-2,222**	**4,106**	**19,111**
Austria	*28,385*	*28,473*	*29,191*	*31,912*	*32,726*	*37,013*	*22*	*680*	*612*
France	*55,974*	*59,879*	*61,688*	*66,917*	*68,850*	*95,643*	*976*	*1,307*	*3,828*
Germany	*93,686*	*103,701*	*109,785*	*134,681*	*145,967*	*263,271*	*2,504*	*6,224*	*16,758*
Italy	*352,669*	*329,773*	*321,795*	*305,371*	*301,736*	*287,130*	*-5,724*	*-4,106*	*-2,087*
Other EU25	**313,146**	**302,058**	**301,166**	**317,199**	**326,360**	**405,710**	**-2,772**	**4,008**	**11,336**
UK	*19,755*	*21,216*	*22,309*	*25,020*	*25,688*	*37,273*	*365*	*678*	*1,655*
Portugal	*137,848*	*135,725*	*135,449*	*150,448*	*160,249*	*212,586*	*-531*	*3,750*	*7,477*
Poland	*4,627*	*4,190*	*4,183*	*4,884*	*5,084*	*11,682*	*-109*	*175*	*943*
Other	*150,916*	*140,927*	*139,225*	*136,847*	*135,339*	*144,169*	*-2,497*	*-595*	*1,261*
Outside EU25	**525,634**	**582,746**	**600,745**	**644,827**	**649,024**	**677,510**	**14,278**	**11,021**	**4,069**

Note: This table shows for selected years the number of Cross-Border Workers (Permit G) and Resident Immigrants (Permits B,C,L) by nationality, and the average net yearly inflows for the pre-AFMP period (1996–1999), the transition period (2000-2003) and the implementation period (2004–2010). Data Sources: STAF for CBW and ZEMIS for RI.

et al., 2019; Gray et al., 2020; Olney and Pozzoli, 2020).

Figure 3: Share of Tertiary Educated Workers in Switzerland



Note: This figure represents the evolution over time of the share of tertiary educated Swiss workers among Swiss workers, the share of cross-border workers with tertiary education among all cross border workers (Permit G) and the share of resident immigrant workers with tertiary education among all resident immigrant workers (permits B, C and L). The gray area represents the transition period before the full implementation of the AFMP. Data source: SESS.

The distribution of foreign workers across different industries represents another interesting feature that can be analyzed using the SESS data. Approximately 70% of

Table 3: Share of Foreign Workers by Industry

	All Foreign Workers			Cross-Border Workers			Resident Immigrants		
Industry	**1996**	**2010**	**Difference**	**1996**	**2010**	**Difference**	**1996**	**2010**	**Difference**
Manufacturing	0.37	0.39	0.03	0.11	0.13	0.02	0.25	0.26	0.01
Tobacco	0.22	0.38	0.16	0.03	0.04	0.01	0.19	0.34	0.15
Pharmaceutical	0.45	0.57	0.12	0.31	0.31	0.00	0.14	0.26	0.12
Watch	0.32	0.42	0.10	0.08	0.18	0.09	0.24	0.24	0.01
Vehicles	0.34	0.45	0.10	0.12	0.16	0.04	0.22	0.29	0.07
Services	0.25	0.31	0.05	0.04	0.06	0.02	0.21	0.25	0.04
R&D	0.27	0.48	0.21	0.07	0.16	0.09	0.20	0.32	0.12
Management Services	0.38	0.53	0.15	0.03	0.05	0.01	0.34	0.48	0.14
Technical Services	0.21	0.29	0.08	0.03	0.06	0.03	0.18	0.22	0.05

Note: This table shows the average share of foreign workers in 1996 and 2010 and their percentage change for aggregate manufacturing and service industries, selected sub-industries and for cross-border workers and resident immigrants. Data source: SESS.

foreign workers are in service industries, while 30% are in manufacturing. They represent about 30% of the workforce in the former and more than 35% in the latter. During the study period, the share of foreign workers increased, on average, by about three percentage points in the manufacturing sector and five percentage points in the services sector, meaning that Swiss firms increasingly relied on the foreign workforce to produce. The share of foreign workers increased especially in the tobacco, pharmaceutical, watch and automotive industries for the manufacturing sector and in the R&D, management, and technical services industries for the services sector. These are all high-tech sectors, and most of the increase is explained by a higher number and share of foreign high-skilled workers. Other more traditional sectors, such as textiles, furniture, and construction experienced a decrease in the number and importance of foreign workers. Distinguishing between cross-border workers and resident immigrants, it is interesting to observe that for the R&D, automotive and technical services sectors, the increase is due to both categories of workers. But, for the other industries, the increase is concentrated in only one of them. For example, the increase in the share of foreign workers for the watch industry is mostly thanks to cross-border workers, while for the management, pharmaceutical and tobacco industries it is due to resident immigrants.

- ***Stylized fact 2:*** *The change in the presence of foreign workers was inversely proportional to the time distance to the border.*

Another peculiar feature of the AFMP agreement is that the intensity of the foreign workers arrival varied depending on the border-time distance (Beerli et al., 2018). Table 4 shows for the border region and the central region, the share of CBW for the years 1996 (i.e., before the agreement) and 2010 (i.e., after the agreement) by the driving

Table 4: Presence of Foreign Workers by Border-Time Distance

		CBW		RI + CBW	
	Border-Time Distance	1996	2010	1996	2010
Border Region	≤15 min	19%	24%	46%	50%
	>15≤30 min	5%	6%	32%	33%
	>30 min	1%	2%	26%	28%
Central Region	≤15 min	-	-	-	-
	>15≤30 min	0%	1%	23%	26%
	>30 min	0%	0%	20%	22%

Note: This table shows the share of CBW and the share of all foreign workers (BCW + RI) in 1996 and 2010 with respect to total employment for MS regions within 15 minutes from the border, regions between 15 and 30 minutes and regions beyond 30 minutes in the border (BR) and central (CR) regions. Data source: SESS.

distance (in minutes) to the closest border crossing.[7] It is evident that the share of CBW increased more heavily in the border region, while the central region remained practically unaffected. Moreover, the magnitude of the increase crucially depends on the distance from the border. The border region comprised within 15 minutes of the border crossing experienced an increase of five percentage points. The portion of the border region located between 15 to 30 minutes and that beyond 30 minutes increased their share of CBW of only one percentage point. For the central region, the increase was of about one percentage point in the portion located 15 to 30 minutes from the border and zero for that beyond 30 minutes. This pattern simply reflects the fact that CBW are disinclined to travel far to get to their job. The right side of Table 4 shows that most of the increase in the share of foreign workers in the border region is actually due to CBW. In the central region, the magnitude of the increase in the share of foreign workers was smaller than for the border region and mostly due to RI. The increase of RI, however, does not seem to be correlated with the border-time distance. These patterns highlight that the agreement affected postal codes depending on distance from the border and that the increase in the presence of foreign workers was due mostly to CBW. I will exploit these salient points in the empirical strategy.

- ***Stylized fact 3:*** *Export growth was inversely proportional to the time distance from the border.*

To provide evidence on how trade reacted to the AFMP implementation, I compare the evolution of exports before and after the implementation depending on border travel time. Specifically, I test whether the 1996–2010 export growth for each postal code is

[7] Figure A-1 in Appendix A depicts the time distance from the border for all postal codes in Switzerland.

Table 5: Export Growth by Time Distance from the Border

	(1) Δ Log Exp$_i$	(2) Δ Log #Dest$_i$	(3) Δ Log #Prod$_i$	(4) Δ Log Dens$_i$	(5) Δ Log Int$_i$
D1$_i$	0.1899^b	-0.0493	-0.0384	-0.0193	0.2776^a
	(0.096)	(0.041)	(0.037)	(0.050)	(0.067)
D2$_i$	0.1252	-0.0163	0.0310	0.0477	0.1106^c
	(0.091)	(0.039)	(0.036)	(0.048)	(0.064)
Observations	2,793	2,793	2,793	2,793	2,793
R^2	0.0016	0.0005	0.0009	0.0005	0.0062

Note: Robust standard errors in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. D1$_i$ indicates postal codes within 15 minutes from the border crossing and D2$_i$ indicates postal codes between 15 and 30 minutes from the border crossing. Δ Log Exp$_i$, Δ Log #Dest$_i$, Δ Log #Prod$_i$, Δ Log Dens$_i$, Δ Log Int$_i$ indicate the change between 1996 and 2010 in the log exports, number of destinations, number of products, density and average exports per product and destination effectively served. Data Source: EDEC.

stronger for those within 15 minutes and those 15 to 30 minutes from the border (i.e., those affected by the inflow of CBW), with respect to postal codes beyond 30 minutes from the border (i.e., those not affected by the inflow of CBW). I regress the 1996–2010 change in log exports of locality i, Δ Log Exp$_i$ on dummies identifying postal codes within 15 minutes of the border, D1$_i$, and postal codes 15 to 30 minutes from the border, D2$_i$. Column 1 of Table 5 shows that only localities within 15 minutes of the border observed stronger export growth compared to the regions beyond 30 minutes from the border. This simple positive correlation is actually encouraging, because it says that postal codes most affected by the increased availability of foreign workers were also those experiencing the fastest export growth.

To better understand the features of the increase in total exports just observed, I decompose the change in exports of locality i into the change in the number of destinations, Δ Log #Dest$_i$, number of products, Δ Log #Prod$_i$, density, Δ Log Dens$_i$ and average exports per product and destination effectively served, Δ Log Int$_i$.[8] Results in columns 2 to 5 of Table 5 indicate that the only factor explaining the differential export growth is the intensive margin. This means that export growth during 1996–2010 is due not to an increase the number of destinations or an increased number of products, but rather to an increase in the average export per destination and product.

These results provide descriptive evidence that postal codes affected by the inflow of foreign workers also experienced a differential increase in exports, led mostly by the intensive margin, i.e., their average exports per country/product. Therefore, this is the key margin in the differential reaction to the AFMP. These results do not provide a

[8]The density is defined as the log number of products-destinations effectively observed by locality i divided by the number of possible destinations served by i: $LogDens_{it} = \frac{LogObs_{it}}{Log\#Dest_{it} * Log\#Prod_{it}}$, and the intensive margin is defined as the total exports of locality i divided by the number of log number of products-destinations effectively observed by locality i: Log Int$_{it}$=$\frac{LogExp_{it}}{LogObs_{it}}$.

Table 6: 1996–2010 Export Growth by Product and Border-Time Distance

HS Code	Product Name	≤15mins	<15≤30mins	>30mins
1	Animal Products	132%	184%	20%
2	Vegetable Products	31%	102%	2,206%
3	Animal and Vegetable Fats and Oils	436%	9,806%	-63%
4	Beverages and Tobacco	304%	219%	53%
5	Mineral Products	60%	-24%	1,011%
6	Chemical Products	101%	317%	214%
7	Plastic and Rubber Products	26%	69%	71%
8	Leather Products	359%	11%	46%
9	Wood and Cork Products	3%	2%	66%
10	Paper Products	16%	12%	24%
11	Textiles	-5%	10%	-33%
12	Apparel	214%	518%	-71%
13	Stone, Ceramic, Glass Products	48%	56%	43%
14	Jewelry	183%	627%	157%
15	Base Metals	44%	53%	60%
16	Machinery	37%	37%	33%
17	Vehicles	49%	28%	20%
18	Optical and Precision Instruments	207%	299%	72%
19	Arms and Ammunition	23%	171%	739%
20	Miscellaneous Manufacturing	43%	-20%	-27%
21	Art Products	3%	-45%	127%

Note: This table reports the export growth in percent between 1996 and 2010 by product differentiating across postal codes within 15 minutes from the border, postal codes between 15 and 30 minutes from the border and postal codes beyond 30 minutes from the border. Data source: EDEC.

causal link between the inflow of foreign workers and the export increase, because they ignore demand and supply determinants and because of differences between treated and control localities in the composition of export flows in terms of types of products and destinations. However, they clearly show a differential response of aggregate export values and average exports per product and destination that is related to the geographical discontinuity observed for CBW.

Table 6 shows that, in most of the product categories, postal codes closer to the border experienced higher export growth than the postal codes farther away. This is true for more high-tech products such as machinery, vehicles, optical and precision instruments, jewelry, and chemicals, and also for more traditional products such as animal, food, leather, textile, apparel, and stone, ceramic and glass products. This means that sectors in which there was a higher inflow of foreign workers also experienced higher export growth. Of course, this could be due to demand; in the next section, I will develop an empirical strategy to understand whether this link can be considered as causal. In contrast, localities farther from the border (i.e., less affected by the inflow of foreign workers) experienced stronger growth only for more traditional products such as vegetables, minerals, plastic and rubber, wood and cork, paper, base metals, and arms and ammunition.

By distinguishing export growth by destination country and time distance from the border, I find that exports to extra-EU15 countries grew more than exports to

Table 7: 1996–2010 Export Growth by Country and Border-Time Distance

Country Group	**≤15mins**	**<15≤30mins**	**>30mins**
Border Countries (Italy, France, Germany and Austria)	62%	74%	49%
EU15 (Excluding Border Countries)	94%	95%	76%
EU25(Excluding EU15 Countries)	165%	213%	161%
OECD (Excluding EU25 Countries)	122%	87%	79%
Non-OECD Countries	150%	155%	107%

Note: This table reports the export growth in percent between 1996 and 2010 by destination differentiating across postal codes within 15 minutes from the border, postal codes between 15 and 30 minutes from the border and postal codes beyond 30 minutes from the border. Data source: EDEC.

border and EU15 countries (Table 7). Moreover, postal codes closer to the border experienced more sustained growth than postal codes farther away for all the destination markets. Therefore, localities closer to the border performed better following the AFMP implementation in terms of export growth. However, there does not appear to be a significant relation between the origin country of the foreign workers and export growth. Since Gould (1994), most of the literature states that migration fosters trade toward foreign workers' origin countries. Therefore, it is quite surprising to see that exports of localities affected by the AFMP did not especially grow toward EU destinations. In Section 5, I will dig deeper into this issue by analyzing the mechanisms at play.

This section shows that the AFMP was really successful in increasing the availability of foreign workers in Switzerland, by attracting a great number of cross-border tertiary-educated EU workers. This increase was heterogeneous depending on the time distance from the border and benefited mostly localities within 15 minutes of the border and, to a lesser extent, localities 15 to 30 minutes from the border. However, it left those beyond 30 minutes practically unaffected. At the same time, exports grew more, especially for the regions mostly affected by the increase in foreign workers. This growth is explained solely by an increase in the average exports per product and destination, while the extensive margins (i.e., the number of products and destinations) do not play any role. For the affected regions, this growth was especially strong for high-tech products and especially to extra-EU destinations. These results offer precious guidance for the empirical strategy that I outline in the next section.

4 Empirical Strategy and Results

In this section, guided by the stylized facts presented in the previous section, I outline the empirical strategy used to establish causality, and I present the results.

4.1 Empirical Strategy

To provide causal evidence about the impact of the AFMP on trade, I use the exceptional features highlighted in the previous section. In particular, I use the time variation in the implementation of the AFMP across regions and the extent to which the agreement affected postal codes within each region depending on the time distance from the border. This means that I compare the exports of the same product to the same destination before and after the reform, across localities (i.e., postal codes) within 15 minutes of the border crossing (highly treated), localities 15 to 30 minutes of the border crossing (lowly treated) and localities beyond 30 minutes from the border crossing (control). I implement this by using a simple difference-in-differences model:

$$log\, Exp_{ipct} = \alpha_0 + \alpha_1 R_{it} + \alpha_2 R_{it} * D1_i + \alpha_3 R_{it} * D2_i + \lambda_{ipc} + \sigma_t + \epsilon_{ipct} \tag{1}$$

where $log\, Exp_{ipct}$ represents log exports of postal code i of product p to country c at time t; R_{it} captures the timing difference in the AFMP implementation across postal codes located in the central and border regions and takes value one for localities in border regions from 2004 and from 2007 for the localities in central region (until 2010 for both). $D1_i$ identifies localities within 15 minutes of the border, and $D2_i$ identifies localities 15 to 30 minutes from the border. λ_{ipc} and σ_t represent, respectively, locality-product-country and year dummies.

A similar approach was implemented by Bigotta (2015) and Beerli et al. (2018) to understand, respectively, the effect of the same agreement on labor market outcomes and on the size and productivity of firms. A key element of these works that further supports the credibility of my strategy is that labor markets and firms do not differ significantly across treated and control localities before the AFMP implementation. By comparing the exports of the same product to the same destination across treated and control localities, the estimates have the advantage of not depending on the composition of exports in terms of destinations or products. The limitation is that I cannot identify the effect on entry and exit patterns. However, Section 3 highlighted that the extensive margins did not play any role in the adjustment, so I am confident that I am not ignoring a key element of AFMP trade consequences.

In the absence of detailed data on foreign workers at the postal code level, I cannot directly relate changes in their presence to export or import growth. The problem is that the SESS data has this information only at a more aggregate level (MS region). This means that it not possible to clearly define treatment and control since several MS

regions contain both postal codes that are in the border and central areas. Similarly, it is not possible to make a precise time-to-border classification of MS regions because many of them contain postal codes that are in different time-to-border bins. Moreover, even if possible, I would need to implement a 2SLS to correct for the non-random allocation of foreign workers within Switzerland. The variation in the implementation of the AFMP would be a natural candidate as a potential instrumental variable. While it would represent a valid instrument in this setting, it is important to highlight that it would not only capture a pure labor supply shock. Indeed, by reducing the administrative burden involved in hiring foreign workers, the policy might have also increased their demand for foreign workers among Swiss firms and affected also CBW workers already working in Switzerland (Beerli et al., 2018). Thus, both my reduced-form results and those arising from a 2SLS using the AFMP as instrument would embed these elements into the estimated coefficients.

4.2 Results

Column 1 of Table 8 shows that postal codes within 15 minutes of the border increased their exports of product p in country c 7% more than localities farther than 30 minutes from the border. The same differential effect for localities 15 to 30 minutes from the border is smaller, about 2%, and only mildly significant. Therefore, the AFMP caused divergence in export growth between treated and control postal codes. Under the assumption that the coefficient of R_{it} is correctly estimated, we can get the aggregate effect of the agreement for both regions by summing the coefficient of R_{it} with that of the interaction with the time-to-border dummies, e.g., R_{it}*$D1_i$ or R_{it}*$D2_i$. For the region within 15 minutes of the border, this amounts to about 5.5%, suggesting that the reform significantly increased the exports of localities closest to the border. This means that 9.4% of the observed increase in exports from 1996 to 2010 in postal codes within 15 minutes from the border, i.e., 58.3%, could be attributable to the AFMP. In constrast, the sum of the coefficients is not significantly different from zero for the localities 15 to 30 minutes from the border. Therefore, the AFMP seem to have affected export growth only for highly treated postal codes. As highlighted by Muendler (2017) this quantification can be considered correct only if the shock did not have any direct or indirect effect on the control group. While the next subsection will provide evidence that direct effects should not be an issue, given the difference-in-differences setting, I cannot entirely rule out the possibility of general-equilibrium indirect effects.

This empirical specification provides lower-bound estimates, since it does not ac-

Table 8: Effect of the AFMP on Exports

	(1) Log Exp_{ipct}	(2) Log Exp_{ipct}	(3) Log Exp_{ipct}
R_{it}	-0.0185^b		
	(0.009)		
R_{it}*$D1_i$	0.0733^a	0.0798^a	0.1098^a
	(0.016)	(0.016)	(0.022)
R_{it}*$D2_i$	0.0181^c	0.0212^b	0.0430^a
	(0.010)	(0.010)	(0.015)
A_t*$D1_i$			0.0419^b
			(0.018)
A_t*$D2_i$			0.0304^b
			(0.013)
Obs.	5,136,193	3,909,665	3,909,665
R^2	0.7589	0.7588	0.7588

Notes: Column 1 reports results for the complete sample, and columns 2 and 3 report for the sample that excludes the central region and the years after 2007. All regressions include locality-product-destination and time fixed effects. R_{it} indicates postal codes in the border region from 2004 and in the central region from 2007. $D1_i$ indicates postal codes within 15 minutes from the border crossing and $D2_i$ indicates postal codes between 15 and 30 minutes from the border crossing. A_t indicates years between 1999 and 2004. Standard errors clustered at the postal code-year level in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

count for possible anticipatory effects between 1999 and 2004. Moreover, my estimates could be biased if the implementation of the agreement is correlated with any unobserved shock that had differential effects on the treated and control postal codes. Finally, the sample includes the years of the Great Trade Collapse which could have had differential effects depending on the distance from the border. To account for these factors, I restrict the analysis to the border postal codes, to the years before 2007, and I account for potential anticipatory effects by interacting a dummy that identifies the years 1999 to 2004, A_t, with the time-to-border dummies.[9] Column 2 of Table 8 shows that when restricting the analysis to the border region and the years before 2007, the results remain the same. This further confirms that the positive effect of foreign workers on trade is actually due to CBW rather than RI because the latter achieved free access to the Swiss labor market only from 2007 onward. Moreover, the results do not depend on time-varying differences across the border and central regions or on possible heterogenous effects across postal codes due to the Great Trade Collapse. Finally, column 3 of Table 8 evinces positive differential effects also during the transitional phase

[9]Both R_{it} and A_t are absorbed by the time fixed effects in this specification.

that are particularly strong, especially for the postal codes closer to the border. As expected, when I control for the anticipatory effects, the positive differential effect of the AFMP increases substantially.

An interesting exercise that I cannot directly perform due to the absence of detailed information on the number of foreign workers per postal code is to estimate the elasticity of exports to foreign workers. To provide an approximation, I can perform a simple back of the envelope calculation. Beerli et al. (2018) quantify that the AFMP increased the presence of cross-border workers in the municipalities within 15 minutes from the border by 3.9 percentage points. Re-estimating the specification in column (3) of Table 8 normalizing the dependent variable with respect to 1998 to make my estimations comparable to theirs, I can then take the ratio of the two coefficients to compute the elasticity. This amounts to 0.0086 (i.e., the new estimated coefficient) divided by 0.038 (column 5 of Table in Beerli et al., 2018), which is equal to 0.0023. In other words, an increase of one percentage point in the number of foreign workers, which corresponds to about 1,430 cross-border workers if taking for reference the year 1998, leads to an increase in exports for the postal codes within 15 minutes from the border of 0.22 percentage points, which is roughly 78 million Swiss Francs. Also in this case, this quantification is valid only if the AFMP did not directly or indirectly affect postal codes in the control region.

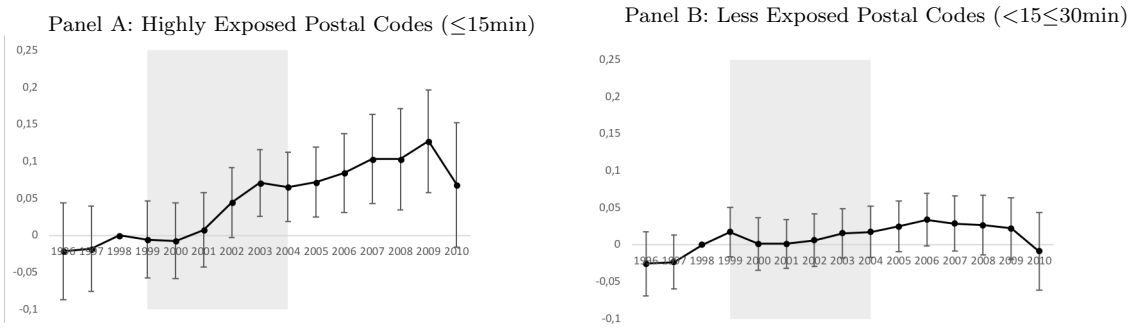
4.3 Robustness Checks

In this subsection, I test the robustness of the previous results to a series of potential threats.

4.3.1 Parallel Trends

My results can be considered as causal only if the control group is a valid counterfactual. One way to supply supporting evidence on this matter is to use an event-study approach to test whether trends between treated and control localities are parallel before the AFMP implementation. This is possible by regressing the log exports of locality i of product p in country c in year t on locality-product-country and year fixed effects, and the interaction between year dummies and dummies that identify localities within 15 minutes of the border, $D1_i$, and localities 15 to 30 minutes from the border, $D2_i$. I normalize results with respect to 1998, the last year before the agreement was announced. Tables A-2 and A-3 in the appendix present the results. Panel A of Figure 4 provides their visual representation for the localities within 15 minutes of the border,

Figure 4: Yearly Effect of the AFMP on Exports



Note: Both figures plot the coefficients and the 95% confidence intervals of the interaction between year dummies and dummies that identify localities within 15 minutes of the border, $D1_i$ (Panel A), and localities 15 to 30 minutes from the border, $D2_i$ (Panel B). Data source: EDEC.

and Panel B depicts the results for postal codes 15 to 30 minutes from the border. For both, it is clear that export growth did not differ across treated and control localities in the pre-AFMP period. Therefore, trends in export values are not significantly different across treated and control localities in the period before the AFMP implementation. Starting in 2002, export growth significantly increased, but only for highly treated localities (Panel A), leading to higher exports also in the years after the full implementation. The anticipation of the positive effect with respect to full implementation in 2004 is reasonably due to more generous quotas and a less stringent handling of the application process that I highlighted in section 2 (Beerli and Peri, 2017).

4.3.2 Concurrent Agreements

A potential threat to identification is represented by the concurrent implementation of other agreements together with the AFMP. These included provisions on air transport, international trade, mutual recognition of conformity assessment, government procurement, and scientific and technological cooperation. Most of them could not play a role for international trade, at least in the short term.[10] Instead, the mutual recognition of conformity assessment and the international trade agreements could have affected trade also in the short term because they specifically affected products produced in Switzerland. Since I am comparing export growth of the same product to the same destination across treated and control postal codes, their effects should be symmetric and should

[10]The agreement on government procurement decreased the requirements for a tender to be of an international dimension enlarging its scope to include Swiss communes. The scientific and technological cooperation agreement allowed Swiss universities and research centers to be part of ERC research networks. The air transport agreement extended to Swiss airline companies the same rights of EU carriers.

Table 9: Robustness Checks

	(1) Log Exp_{ipct}	(2) Log Exp_{ipct}	(3) Log Exp_{ipct}	(4) Log Exp_{ipct}	(5) Log Exp_{ipct}	(6) Log Exp_{ipct}	(7) Log Exp_{ipct}
R_{it}	-0.0047	-0.0236^b	-0.0197^b	-0.0157	-0.0157	-0.0157	0.0040
	(0.014)	(0.009)	(0.009)	(0.012)	(0.010)	(0.011)	(0.003)
R_{it}*$D1_i$	0.0793^a	0.0565^a	0.0524^a	0.0729^b	0.0729^a	0.0729^c	0.0018
	(0.023)	(0.013)	(0.012)	(0.037)	(0.020)	(0.040)	(0.002)
R_{it}*$D2_i$	0.0087	0.0342^a	0.0316^a	0.0199	0.0199	0.0199	-0.0015
	(0.014)	(0.010)	(0.010)	(0.018)	(0.013)	(0.013)	(0.002)
Obs.	2,623,422	4,488,926	4,488,926	5,136,193	5,136,193	5,136,193	5,136,193
R^2	0.7672	0.7950	0.7956	0.7589	0.7589	0.7589	0.7589

Notes: Column 1 reports the results for the sample of products not related to other agreements. Column 2 includes destination-product-year dummies. Column 3 also includes labor market area-product trends. Column 7 performs a placebo test in which postal codes are randomly assigned to time distance bins. All regressions include locality-product-destination and time fixed effects. R_{it} indicates postal codes in the border region from 2004 and in the central region from 2007. $D1_i$ indicates postal codes within 15 minutes from the border crossing and $D2_i$ indicates postal codes between 15 and 30 minutes from the border crossing. Standard errors in parentheses are clustered at the postal code-year in columns 1–3, at the postal code level in column 4, at the regional-time level in column 5, and at the regional level in column 6. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

not affect my results. However, if any geographical variation related to their effects is correlated with the time distance from the border, my estimates could be biased. To assuage this doubt, I removed from the estimation sample all the products included in these agreements.[11] Column 1 of Table 9 shows that all the results remain practically unchanged. Therefore, the estimated effect of the AFMP on trade does not depend on the concurrent implementation of other agreements with the EU. To the best of my knowledge, there is no other policy that was implemented during that period that was meant to favor trade in the border regions or that could have potentially led to geographic heterogeneous effect across the border and central areas. In any case, I show in the next subsection that controlling for industry-regional trends results remain the same.

4.3.3 Heterogeneous Demand and Supply Shocks

Demand and supply shocks could represent potential unobserved factors in my setting. If these shocks affect symmetrically treated and control localities, my estimates are safe. If instead the shock is specific to the treated or control postal codes, my estimates are biased. For example, if the demand decreases coincidentally with the AFMP especially for producers located in the control postal codes, my difference-in-differences specification would show a positive effect of the AFMP that is instead driven by the location-specific demand drop. Technological or more in general supply-side shocks can

[11] The complete list appears in Table A-4 in the Appendix.

have similar consequences for my estimates. To control for general demand shocks, I added to the main specification destination-product-year fixed effects (column 2 of Table 9).[12] To further account for the possible heterogenous impact of demand and supply shocks, I performed two main exercises. In the first, I regress population changes between 1990 and 2010 for each municipality m using Swiss Census data on dummies identifying their distance from the border, $D1_m$ for within-15 minutes, and $D2_m$ for 15 to 30 minutes.[13] This exercise will be able to assess whether municipalities within 15 minutes of the border or 15 to 30 minutes from the border experienced differential changes in population growth with respect to municipalities beyond 30 minutes from the border. The idea is that if the rise in exports is due to an increase in demand for products produced close to the border, I should observe an increase in both the number of foreign and the number of native workers. Table A-5 in the Appendix shows instead that there is not a significant differential increase in the population across municipalities depending on distance from the border. Moreover, by distinguishing between Swiss nationals and foreigners, the results are very much in line with the descriptive statistics in Section 3. The number of foreigners increased differentially more only for the postal codes closer to the border. Moreover, the increase in the number of Swiss nationals between 1990 and 2010 did not grow at different paces depending on the distance from the border.

In the second exercise, I added to the main specification industry-labor market area trends.[14] These trends control also for possible economic geography forces such as labor market pooling, the presence of intermediate input suppliers and knowledge spillovers, which could potentially induce agglomeration economies, increase productivity (especially in the border region) and boost exports. Column 3 of Table 9 shows that my estimates decrease slightly in magnitude but remain highly significant. Therefore, both exercises lessen the possibility that my results could be driven by heterogeneous demand or supply shocks that depend on distance from the border or from agglomeration economies alone.

[12] Please, note that a major difference with respect to the main specification is that now the coefficient on the interaction between R_{it} and $D2_i$ becomes significant, pointing at a positive differential effect. However, the sum of the coefficient of R_{it} with that of the interaction of R_{it} and $D2_i$ is not, confirming that the AFMP did not have a strong effect on the region between 15 and 30 minutes from the border.

[13] Unfortunately, yearly information at the postal code level becomes available only in 2010. That is why I cannot run the same difference-in-differences exercise as in the rest of the paper. I need to aggregate the analysis at the municipal level, and I rely on the long difference between 1990 and 2010.

[14] By industry I mean the HS product code at the 3-digit level and for the labor market area I use the MS regions.

4.3.4 Alternative Clustering

In the main specification, I use standard errors clustered at the same level as the variable of interest (i.e., postal code-year level). However, it could be that errors are correlated within the same postal code or region. To control for this potential bias, I clustered standard errors at the postal code level (column 4 of Table 9), at the regional-time level (column 5 of Table 9), and at the regional level (column 6 of Table 9). In all cases, I observe a positive differential effect of the AFMP for the region within 15 minutes of the border, meaning that the significance of the results does not depend on the correlation of errors within the same postal code or region.

4.3.5 Placebo

To dissipate doubts about the fact that it is not random noise that is driving the results, I randomly assign postal codes to the three time-to-border distance bins (column 7 of Table 9). Results indicate that my identification does not come from random noise present in the data but rather from the variation provided by the AFMP.

4.3.6 Firm Relocation

The potential relocation of economic activity across treated and control localities represents a further threat for my estimates. This would violate the stable unit treatment value assumption (SUTVA) and lead to biased estimates. This would be possible if firms left the control localities to relocate in the treated ones to enjoy earlier access to foreign workers. This potential issue should not be important in my setting for two reasons. First, if the relocation of a firm is associated with a new product exported or a new destination for exports, this is out of my estimations because I am focusing the analysis on the time variation in the exports of the same product to the same destination. Second, relocating a firm is very costly and risks would not be justified by the potential gains from enjoying the earlier AFMP implementation in the border postal codes. To provide a formal test that firms did not relocate from control postal codes to treated ones, I exploit the information on plants' location contained in the Industrial Census for the years 1991, 1995, 1998, 2001, 2005, and 2008. With these data, I can count for each postal code and year the number of plants that relocated. Table A-6 in the Appendix shows indeed, that plant relocation did not differ between treated and control postal codes following the AFMP implementation.

5 Understanding the Mechanisms

In this section, I explore the possible mechanisms behind the increase in exports for the localities within 15 minutes of the border observed in the previous section.

5.1 How Could Foreign Workers Increase Exports?

Language, tastes, culture, and institutions all affect the ability to reach foreign consumers. Foreign workers can help firms in the host country by bringing trade-specific knowledge about their origin countries that would otherwise be costly to obtain (e.g., Gould, 1994; Rauch, 2001; Rauch and Trindade, 2002; Felbermayr and Toubal, 2012; Parsons and Vézina, 2018). In my context, this would mean that the increase in exports highlighted in the previous section should be directed especially to the foreign workers' origin countries. Given that the AFMP led to a shift toward more foreign workers coming to Switzerland from border and EU countries, most of the increase in exports should be directed toward these countries.

To test for this mechanism, I interact R_{it}*$D1_i$ and R_{it}*$D2_i$ with a dummy that identifies particular sets of destination countries: $Border_c$ for the border countries (France, Italy, Germany, and Austria), $EU15_c$ for EU15 countries, and $EU25_c$ for EU25 countries. Table 10 shows that all these interactions are negative. This means that exports grew less toward destinations from which foreign workers came than for other destinations. In other words, the differential increase in exports of border localities did not direct more toward the countries from which the foreign workers came. Therefore, it is unlikely that a decrease in downstream information frictions played a substantial role in the differential increase in exports of the localities within 15 minutes of the border. This is not surprising given that most of the foreign workers came from Switzerland's main trade partners. With these historical destinations for Swiss products, the extent to which information frictions can still play a substantial role is quite limited. I must highlight is that this does not mean that exports toward border or EU destinations decreased. The sums of the interactions suggest that the AFMP had an overall positive effect also for border and EU countries, but smaller than for extra-EU ones. In other words, this channel is less important for trade between developed countries than in a developed-developing country context (e.g., Parsons and Vézina, 2018; Bahar et al., 2019; Olney and Pozzoli, 2020).

Another key element of the AFMP can help identify the mechanism at play. Because the AFMP led to a sharp increase in the stock of foreign skilled workers in Switzerland,

Table 10: Effect of the AFMP on Exports by Destination Country

		(1)		(2)		(3)
Dep. Var.		Log Exp_{ipct}		Log Exp_{ipct}		Log Exp_{ipct}
R_{it}		0.0130		0.0539^a		0.0454^a
		(0.010)		(0.011)		(0.011)
R_{it}*$D1_i$		0.0866^a		0.0913^a		0.1033^a
		(0.021)		(0.023)		(0.024)
R_{it}*$D2_i$		0.0101		0.0233^c		0.0206
		(0.012)		(0.014)		(0.015)
R_{it}*$D1_i$	*Border_c	-0.0364^b	*EU15_c	-0.0376^b	*EU25_c	-0.0540^a
		(0.016)		(0.017)		(0.017)
R_{it}*$D2_i$	*Border_c	0.0223^c	*EU15_c	-0.0063	*EU25_c	-0.0022
		(0.011)		(0.013)		(0.013)
Observations		5,136,193		5,136,193		5,136,193
R^2		0.7590		0.7591		0.7591
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$	*Border_c	0.0632^a	*EU15_c	0.0947^a	*EU25_c	0.1031^a
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$	*Border_c	0.0454^a	*EU15_c	0.0638^a	*EU25_c	0.1086^a

Notes: All regressions include locality-product-destination, year fixed effects and the interaction of $D1_i$ with Border_c or EU15_c or EU25_c dummy. R_{it} indicates postal codes in the border region from 2004 and in the central region from 2007. $D1_i$ indicates postal codes within 15 minutes from the border crossing and $D2_i$ indicates postal codes between 15 and 30 minutes from the border crossing. Border_c indicates border countries, EU15_c identifies EU15 countries and EU25_c EU25 countries. Standard errors clustered at the postal code-year level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

it is possible that high-skilled workers might have helped firms in developing better products, making them more appealing for international markets. If this is the case, the positive effect in export values observed in Table 8 should be driven both by quantities and by prices. By decomposing the increase in export values into quantities and prices (columns 2 and 3 of Table 11), I observe that both are positive and significant. Increasing prices despite observing increasing quantities provides evidence that the appeal of the same product increased. This means that the labor supply shock increased the quality of Swiss products and positively shifted their foreign demand. To provide further evidence of the quality improvement, I build a measure of perceived quality following Khandelwal et al. (2013). Supposing CES preferences and for a given value of σ,[15] the residual from the OLS estimation of the following demand equation (divided by $\sigma - 1$) measures the increased amount that localities sell, conditional on prices and demand:

$$log\, q_{ipct} + \sigma\, logp_{ipct} = \delta_{pct} + \xi_{ipct}$$

The estimated perceived quality $\hat{\eta}_{ipct} = \frac{\hat{\xi}_{ipct}}{\sigma - 1}$ can be used as a dependent variable to understand if the AFMP had a differential positive effect on the perceived quality of goods produced in the localities within 15 minutes of the border.[16] Column 4 of Table

[15] I use the estimates of σ from Broda et al. (2006).

[16] Please, note that since $\hat{\eta}_{ipct}$ is an estimated dependent variable, problems of heteroskedasticity can arise (Saxonhouse, 1976). To correct for this issue, standard errors presented in Table 11 are robust.

Table 11: Decomposition of the Effect of the AFMP on Exports

	(1) Log Exp_{ipct}	(2) Log Q_{ipct}	(3) Log P_{ipct}	(4) $\hat{\eta}_{ipct}$	(5) Log Exp_{ipct}
R_{it}	-0.0185^b	-0.0198^b	0.0013	-0.0038	-0.0207^c
	(0.009)	(0.010)	(0.004)	(0.006)	(0.012)
R_{it}*$D1_i$	0.0733^a	0.0631^a	0.0102^c	0.0276^a	0.129^a
	(0.016)	(0.016)	(0.006)	(0.008)	(0.018)
R_{it}*$D2_i$	0.0181^c	0.0262^b	-0.0081^c	0.0006	0.0195
	(0.010)	(0.011)	(0.005)	(0.006)	(0.014)
R_{it}*$D1_i$*CA_p^{Bord}					-0.0949^a
					(0.016)
R_{it}*$D2_i$*CA_p^{Bord}					0.0002
					(0.013)
Obs.	5,136,193	5,136,193	5,136,193	4,303,419	5,136,193
R^2	0.7589	0.8564	0.9187	0.6408	0.759
R_{it}+R_{it}*$D1_i$	0.0548^a	0.0433^a	0.0115^b	0.0238^a	
R_{it}+R_{it}*$D2_i$	-0.0004	0.0064	-0.0068	-0.0032	

Notes: All regressions include locality-product-destination and time fixed effects. Standard errors are robust to hereroskedasticity and clustered at the postal code-year level are in parentheses. R_{it} indicates postal codes in the border region from 2004 and in the central region from 2007. $D1_i$ indicates postal codes within 15 minutes from the border crossing and $D2_i$ indicates postal codes between 15 and 30 minutes from the border crossing. CA_p^{Bord} indicates products for which border countries have a comparative advantage. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

11 shows that Swiss products produced in these localities were more appealing after the implementation of the Swiss-EU agreement. Therefore, quality upgrading is the main mechanism by which foreign workers made exports grow. This means that they can be seen as an innovation source, and the effect that they exert on exports is similar to that of an input trade liberalization (e.g., Amiti and Khandelwal, 2013).

5.2 How Could Foreign Workers Improve Swiss Products?

The most intuitive way that foreign workers could improve the quality of Swiss products is by bringing with them a set of technical skills that improved their characteristics. However, testing whether the innovation was performed effectively by the new foreign workers and whether the upgraded product was responsible for the differential response in exports is an impossible task due to the lack of firm-level information on trade and detailed information on the person that actually undertook the innovation. Moreover, Ruffner and Siegenthaler (2016) show that localities highly exposed to the labor supply shock did not experience any product innovation and that the likelihood of improving existing products increased only for the subset of firms that experienced difficulties in hiring qualified R&D personnel. Therefore, this channel is unlikely to represent the main

cause of the quality improvement. To provide further evidence, I check whether the increase in exports is driven by products for which border countries have a comparative advantage by interacting R_{it}*$D1_i$ and R_{it}*$D2_i$ with a dummy identifying such products, CA_p^{Bord}, constructed following the Balassa (1965) methodology. Column 5 of Table 11 shows that the differential effect is actually negative for the products for which border countries have a comparative advantage. This means that most of the export growth is due to products for which border countries do not have a comparative advantage. Thus, the extent to which foreign workers brought origin-specific technologies to improve exported products is rather low.

Another way that foreign workers could upgrade the quality of Swiss products is by decreasing upstream information frictions. Specifically, they could have used their knowledge about their origin-country suppliers to improve quality of the intermediate inputs used in production. Using data on imports, I can test whether the quality of imported intermediates inputs increased due to the AFMP, by looking at their prices and quantities.[17] I run the same specification as in equation 1 with import values, quantities and prices as dependent variables. Columns 1–3 of Table 12 show that the agreement led to a differential increase in imports for treated localities. Consistent with the proposed mechanism, for the localities within 15 minutes of the border, this is driven by an increase in both quantities and prices. Moreover, the positive effect on import prices is especially strong for intermediate inputs coming from border countries (column 4 of Table 12) and for the intermediate inputs coming from border countries used in the production of the exported products (column 5 of Table 12).[18] Moreover, the positive effect on intermediates becomes weaker and weaker as I enlarge the set of origin countries to the EU15 and the EU25 countries (columns 6–7 of Table 12). These results provide evidence that localities that experienced a strong increase in exports started purchasing more expensive inputs from the foreign workers' origin countries following the AFMP.

To understand whether the increase in the prices of inputs led to an increase in the quality of output, I perform a simple horse race between intermediate inputs coming from the origin countries of the foreign workers and those coming from other countries.

[17]For imports, it is not possible to apply the methodology of Khandelwal et al. (2013), because we lack information on the seller firm, and thus the estimated quality would vary across origin countries and time but not across postal codes.

[18]I use information on the IO table for Switzerland in 2000 (the first available) to identify intermediate inputs used in the production of exported products. Since IO tables are quite aggregated and account for only 22 products, the difference between all imported inputs (column 4 of Table 12) and those that are actually used for the exported products is very small (column 5 of Table 12).

Table 12: Effect of the AFMP on Imports

	(1) Log Imp_{ipct}	(2) Log Q^{Imp}_{ipct}	(3) Log P^{Imp}_{ipct}	(4) Log P^{Imp}_{ipct}	(5) Log P^{Imp}_{ipct}	(6) Log P^{Imp}_{ipct}	(7) Log P^{Imp}_{ipct}
R_{it}	-0.0279^a	-0.0350^a	0.0071^a	-0.0092^a	-0.0091^a	-0.0138^a	-0.0156^a
	(0.005)	(0.005)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
R_{it}*$D1_i$	0.0468^a	0.0315^a	0.0153^a	0.0058^c	0.0057^c	0.0055	0.0057
	(0.007)	(0.008)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
R_{it}*$D2_i$	0.0415^a	0.0525^a	-0.0110^a	-0.0226^a	-0.0226^a	-0.0268^a	-0.0276^a
	(0.006)	(0.007)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
R_{it}*$D1_i$*Interm&$Border_{pc}$				0.0214^a			
				(0.005)			
R_{it}*$D2_i$*Interm&$Border_{pc}$				0.0229^a			
				(0.005)			
R_{it}*$D1_i$*IntermExp&$Border_{pct}$					0.0218^a		
					(0.005)		
R_{it}*$D2_i$*IntermExp&$Border_{pct}$					0.0230^a		
					(0.005)		
R_{it}*$D1_i$*IntermExp&$EU15_{pct}$						0.0196^a	
						(0.005)	
R_{it}*$D2_i$*IntermExp&$EU15_{pct}$						0.0276^a	
						(0.004)	
R_{it}*$D1_i$*IntermExp&$EU25_{pct}$							0.0190^a
							(0.005)
R_{it}*$D2_i$*IntermExp&$EU25_{pct}$							0.0284^a
							(0.005)
Obs.	13,466,440	13,466,440	13,466,440	9,908,975	9,908,975	9,908,975	9,908,975
R^2	0.7001	0.8253	0.8892	0.8809	0.8872	0.8509	0.8809
R_{it}+R_{it}*$D1_i$	0.0217^a	-0.0034	0.0250^a				
R_{it}+R_{it}*$D2_i$	0.0140^b	0.0187^b	-0.0047				
R_{it}+R_{it}*$D2_i$+R_{it}*$D1_i$*Interm&$Border_{pct}$				0.0180^a			
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*Interm&$Border_{pct}$				-0.0089^b			
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$*IntermExp&$Border_{pct}$					0.0184^a		
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*IntermExp&$Border_{pct}$					-0.0087^b		
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$*IntermExp&$EU15_{pct}$						0.0113^b	
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*IntermExp&$EU15_{pct}$						-0.0130^b	
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$*IntermExp&$EU25_{pct}$							0.0091^c
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*IntermExp&$EU25_{pct}$							-0.0148^a

Notes: All regressions include locality-product-destination and time fixed effects. Columns 4 to 8 also have the interaction of D1 and D2 with the dummy indicating the intermediate inputs coming from the different origin countries considered. R_{it} indicates postal codes in the border region from 2004 and in the central region from 2007. $D1_i$ indicates postal codes within 15 minutes from the border crossing and $D2_i$ indicates postal codes between 15 and 30 minutes from the border crossing. Interm&$Border_{pc}$ identifies intermediate products imported from border countries and IntermExp&$Border_{pct}$ indicates intermediate products imported from border countries used in the production of exported products. Standard errors clustered at the postal code-year level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

I interact R_{it}*$D1_i$ and R_{it}*$D2_i$ with the weighted average prices of inputs used in the production of exported products coming from border countries, P^{ior}_{it}, and those coming from other countries, P^{iot}_{it}. The interaction R_{it}*$D1_i$*P^{ior}_{it} is able to tell whether, following the AFMP, the price (and quality) of the exported products for the postal codes within 15 minutes of the border increased due to the quality improvement of inputs coming from border countries. In other words, whether the inputs coming from the border countries are responsible for the increase in the quality of exported products. R_{it}*$D1_i$*P^{iot}_{it} instead will assess whether the same holds for inputs coming from other countries. The assumption in this exercise is that any omitted variable that can drive both input and export prices symmetrically affects both the treated and the control localities (i.e., it is orthogonal to the shock).

Table 13 shows that, indeed, the prices of intermediate inputs coming from border countries are positively related to the prices and quality of exports for the region within

Table 13: Effect of Input Prices on Export Prices and Quality

VARIABLES	(1) Log P_{ipct}	(2) Log P_{ipct}	(3) $\hat{\eta}_{ipct}$	(4) $\hat{\eta}_{ipct}$
R_{it}	0.0007	-0.0009	-0.0038	-0.0055
	(0.004)	(0.004)	(0.006)	(0.006)
R_{it}*$D1_i$	0.0068	0.0033	0.0250^a	0.0253^a
	(0.006)	(0.006)	(0.008)	(0.008)
R_{it}*$D2_i$	-0.0100^b	-0.0074	0.0002	0.0018
	(0.005)	(0.005)	(0.006)	(0.006)
R_{it}*$D1_i$*P_{it}^{ior}	0.0016^a	0.0015^a	0.0021^a	0.0022^a
	(0.001)	(0.001)	(0.001)	(0.001)
R_{it}*$D2_i$*P_{it}^{ior}	0.0018^b	0.0012	0.0006	-0.0000
	(0.000)	(0.001)	(0.001)	(0.001)
R_{it}*$D1_i$*P_{it}^{iot}		-0.0022^c		-0.0036^a
		(0.001)		(0.001)
R_{it}*$D2_i$*P_{it}^{iot}		0.0001		0.0004
		(0.003)		(0.003)
Observations	5,134,111	5,128,745	4,301,751	4,296,997
R^2	0.919	0.918	0.641	0.641
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$*P_{it}^{ior}	0.0074^a	0.0024^a	0.0213^a	0.0197^a
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*P_{it}^{ior}	-0.0089	-0.0084	-0.0036	-0.0038
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$*P_{it}^{iot}		0.0024^a		0.0197^a
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*P_{it}^{iot}		-0.0084		-0.0038

Notes: All regressions include locality-product-destination and time fixed effects and all the interactions of D1 and D2 with the dummy indicating the intermediate inputs and P_{it}^{ior} or P_{it}^{iot} that are not absorbed by the fixed effects. The coefficients of the interaction of R_{it}*$D1_i$ and R_{it}*$D2_i$ with P_{it}^{ior} and P_{it}^{iot} are multiplied by 10,000. R_{it} indicates postal codes in the border region from 2004 and in the central region from 2007. $D1_i$ indicates postal codes within 15 minutes from the border crossing and $D2_i$ indicates postal codes between 15 and 30 minutes from the border crossing. P_{it}^{ior} are the average prices of intermediates used in the production of exported products imported from border regions and P_{it}^{iot} for those from other countries. Robust standard errors clustered at the postal code-year level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

15 minutes of the border. At the same time, the prices of intermediate inputs coming from other regions are not positively correlated to the increase in export prices and quality. While the differential effect is small, this is evidence that higher-quality inputs are related to the increase in the quality of exported products. Therefore, foreign workers used their knowledge to optimize the upstream part of the global value chains of localities close to the border and induced them to buy better inputs. Better intermediate inputs also increased the quality of the output, thus leading to Swiss products produced close to the border being used more intensively used downstream. The insignificant coefficient for R_{it}*$D1_i$ in columns (1) and (2) seems to suggest that most of the effect on export prices is actually due to the increase in the price of inputs rather than from other potential mechanisms. Instead, when using the measure of perceived quality, the same interaction remains positive and significant, meaning that other channels can be at play.

These results provide evidence of a new mechanism by which foreign workers can affect trade. Since Gould (1994) researchers have concentrated on two possible mechanisms: the information channel and the taste channel. The first relates to trade-relevant information that foreigners offer to host countries to boost exports to their origin countries. This mechanism is especially binding for trade from developed to developing

countries (e.g., Olney and Pozzoli, 2020; Parsons and Vézina, 2018; Bahar et al., 2019), but it is less relevant in a setting where trade occurs mostly among developed countries. The second highlights the bias of immigrants preference for purchasing goods from their origin countries and thus increase the exports from their origin to their host countries. The new mechanism that I propose in this paper provides evidence that information frictions can be important also among developed countries. Searching for producers of intermediate inputs is costly, and acquiring information on the quality of their products is not a trivial process. Foreign workers can provide this information and help improve the quality of sourced inputs. Better intermediate inputs improve the quality of the resulting output and make these products more appealing for international markets. In this sense, the quality improvement led by foreign workers is similar to that of the intermediate inputs liberalization described in Amiti and Khandelwal (2013). Moreover, my results qualify the taste mechanism, in that they show that part of the bias toward home-country products is due to better information about better-quality intermediates. Finally, these results highlight that in a world where global value chains are crucial for producing successful products (e.g., Antràs and Chor, 2013), foreign workers can be instrumental in organizing them effectively by providing information on upstream producers and making products more appealing downstream. Section 6 will dig deeper into the GVC implications of the AFMP.

5.3 Discussion

In this subsection, I discuss potential alternative mechanisms that could explain my results.

- *Compositional changes*

Can the increase in import prices be due to an increase in wages in border countries caused by the workers outflow? In this scenario, we should have observed a consequent decrease in imported quantities from the origin countries of foreign workers and potentially an increase from other origin countries. At the same time, the increase in import prices for goods arriving from border countries should not be related to an increase in quality of exports. However, my results show that both the quantities and the prices of imports increased and that the prices of inputs are positively related to the prices and quantities of exports. Therefore, my result cannot be driven by an increase of wages in border countries.

- *Constrained firms*

Suppose that due to immigration restrictions, firms were not able to hire enough workers and thus operated at an inefficient scale. In this case, the labor supply shock due to the AFMP could have solved this issue by enabling firms to hire the necessary workers. This could have led to both more imports and more exports. If a minimum scale is required for producing higher-quality goods, it also explains higher export quality and, to the extent that higher input quality is needed to increase the quality of output, the increase in import quality could also be a potential mechanism at work. However, my findings clearly point out that the increase in import quality comes from the origin countries of the foreign workers and that only those inputs are responsible for the increase in the quality of exports. Therefore, a simple explanation based on constrained firms is not enough to rationalize the findings of this paper.

- *Rybczynski effect*

The increase in the supply of highly skilled workers from the EU represents an increase of a factor of production that could have led to more exports. Moreover, if more high-skilled workers are complementary to higher-quality inputs, employing relatively more high-skilled workers in production could have led to import higher-quality inputs, and to higher-quality exports (because products are now more high-skilled intensive). However, similar to the previous point, such an explanation would not be able to explain why higher-quality inputs came mostly from the origin countries of the foreign workers and why only those are responsible for the increase in export quality. Therefore, this mechanism cannot fully explain my empirical results.

- *Swiss emigrants*

If the agreement had prodded more Swiss workers to emigrate to the EU, their presence might have facilitated the exports of intermediates of higher-quality from European countries to Switzerland, thus causing the quality and value of Swiss exports to increase. This mechanism would align exactly with my results, except for two reasons. First, in this case there should also have been an increase in Swiss exports, especially toward the countries hosting Swiss workers. Second, the AFMP had a very asymmetric effect, because while it led to an important inflow of EU workers to Switzerland, it did not induce Swiss workers to leave for the EU. Swiss emigration patterns remained the same before and after the agreement. More specifically, the stock of Swiss emigrants (Table A-1 in Appendix A) and net emigration flows (Secretariat d'Etat, 2017) increased steadily but only mildly. Moreover, their location choices did not significantly change

after the AFMP implementation. Thus, the AFMP had asymmetric effects, increasing the number and share of EU workers in Switzerland but not fostering Swiss emigration to the EU. Therefore, it is unlikely that this mechanism can be a major explanation of my results.

6 AFMP Global Value Chains Implications

This section analyzes how the AFMP changed the Swiss international organization of production. On the import side, it is important to understand how the quality of intermediate inputs improved. Did foreign workers bring information on new suppliers or help improve the relations with existing ones? On the export side, the question is whether the increase in quality led to the acquisition of new customers or to the intensification of the existing buyer-seller relations? As specified in Section 3, the Swiss trade data does not contain the details of the customer or the supplier firm, and therefore, it is not possible to exploit this data source to analyze these questions. Instead, I use detailed custom-level data for France and China that provide information on customers and suppliers of Swiss exports and imports. With these data, I can test whether the quality of intermediates shipped to Switzerland increased more for France than China following the implementation of the AFMP and if this is due to new suppliers, new products or to existing suppliers-products. At the same time, I can study if import values, quantities and unit values from Switzerland increased more for China than France following the implementation of the AFMP and if this is explained by more customers, more products or to the intensification of existing buyer-seller relations. Since Chinese and French customs data do not record the Swiss postal code, it is not possible to merge them uniquely with the Swiss data and to provide a precise quantification of the effects by exploiting the same regional and time variation used before. However, France is one of the border countries from which we should observe an increase in the average quality of intermediate inputs and China is one of the extra-EU destinations for which we should observe the fastest export growth. This means that it is possible to leverage the across-country differences araising from these data sources to provide at least qualitative evidence on how the exports of French intermediate products to Switzerland and the imports of Chinese firms from Switzerland changed after the implementation of the AFMP.

6.1 Inputs Quality Increase

Section 5 showed that most of the increase in the quality of intermediate inputs originated from bordering countries' imports. Therefore, by comparing the exports of intermediate products of French and Chinese firms, I should observe that the average price of intermediate products sold to Switzerland increased more for France than for China following 2004. Putting together the Chinese and French firms that export to Switzerland, I regress the log unit values of firm j exporting product p at time t on a dummy that takes value one for intermediate products from the implementation of the agreement in 2004, T_{pt}, and on the interaction of this dummy with another one that indicates whether the exporting firm is Chinese, CN_j. All regressions control for firm-product and year fixed effects, therefore, the analysis takes into account only firms that continuously export to Switzerland. Analytically, the equation that I bring to the data is:

$$LogP_{jpt} = \beta_0 + \beta_1 T_{pt} + \beta_2 T_{pt} * CN_j + \delta_{jp} + \sigma_t + \eta_{jpt} \tag{2}$$

Column 1 of Table 14 shows that the coefficient on the interaction term is negative and significant, which means that unit values of French exports of intermediate inputs increased more than Chinese ones. By restraining the dummy to indicate the intermediate products that are used in the production of the goods exported by the region within 15 minutes from the border, $\mathrm{T2}_{pt}$, results in column (2) are very similar. Therefore, this evidence is consistent with the results presented in the previous sections: French intermediate products sold to Switzerland increased their quality (measured as unit values) more than the same products imported from China after the implementation of the AFMP.

Table 14 suggests that the increase in quality of intermediate inputs arose from existing supplier-product relations. However, new suppliers and new products could also have contributed to the increase in quality. To provide evidence of these dynamics, Figure 5 shows the evolution of export values, quantities and unit values of intermediate inputs exported by French firms to Switzerland (normalized with respect to the first year available) for continuing firm-product combinations, products added by continuous exporters, and new exporters.[19] The first row of Figure 5 shows that French exports of intermediate products to Switzerland increased only modestly during the period of

[19]Continuing firm-products are defined as firm-products that are also observed in the following year and new products and new firms refer to products and firms that were not observed in the previous year. Exiting firms and dropped products are excluded from the analysis because they they are not useful for understanding trade growth in this setting.

Table 14: Chinese and French Export Unit Values to Switzerland

	(1) Log P_{jpt}	(2) Log P_{jpt}
T_{pt}	0.0650^a	
	(0.020)	
T_{pt}*CN_j	-0.3010^a	
	(0.049)	
$T2_{pt}$		0.0406^b
		(0.018)
$T2_{pt}$*CN_j		-0.2830^a
		(0.047)
Observations	1,106,732	1,106,732
R^2	0.881	0.881

Notes: all regressions include firm-product and year fixed effects. T_{pt} indicates intermediate products after the implementation of the agreement, CN_j identifies Chinese firms, and $T2_{pt}$ indicates the intermediate products that are used in the production of the goods exported by the region within 15 minutes from the border. Standard errors clustered at the product-year level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: Chinese and French custom-level data.

analysis and only thanks to firm-product combinations that are continuously traded. In contrast, added products and new firms show a negative contribution to export growth. In line with the previous analysis, all the growth observed in values is due to an increase in unit values that more than compensates for the decrease observed in quantities for continuing firm-products. Figure A-2 in the Appendix shows that these are not just aggregate world-wide trends. By plotting values, quantities and prices of Chinese exports of intermediate products to Switzerland, it is evident that Chinese exports behaved differently. Values increased more substantially and for all firm categories. For continuing firm-products, growth started earlier than 2004, and this is explained mostly by an increase in quantity. Instead, unit values increased substantially for new products and new firms. The positive differential increase in unit values observed for France in Table 14 might thus be explained by the fact that continuing firm-products matter more for aggregates than new products or new firms.

These facts suggest that the increased quality of intermediates coming from border countries observed for postal codes close to the border is likely to be due to existing suppliers-products rather than from new firms or products. In this case, the decrease in information frictions that led to higher quality intermediates on the suppliers side would be channeled within the existing supplier-customer relations. For example, it is

Figure 5: Evolution of French Intermediate Inputs Exports to Switzerland, first year=1

Note: This figure represents the evolution of intermediate inputs export values, quantities and unit values (normalized with respect to the first year) of France to Switzerland for the period 1996–2010 distinguishing across continuing firm-products, added products and new firms. Continuing product-firms are those that I observe for two consecutive years. Added products are products that were not exported in the previous year and new firms are firms that were not exporting the year before. Data source: French Customs data.

possible that the AFMP helped Swiss firms to hire either employees of their French intermediate inputs suppliers or employees with former knowledge and/or relation of these firms. This might have facilitated the passage of knowledge and information to improve the existing intermediates inputs or to make them more suited for the production of a higher quality final good.

6.2 Export Quality Increase

In section 5, I showed that the increase in exports due to the AFMP was directed especially to extra-EU destinations. Using the firm-level imports of China and France I can check whether this differential increase is present in the French and Chinese data and if it is due to an increase in the number of customers, an increase in the number of products or to an increase within the same customer-product pairs. To find evidence of the differential trend, I regress the log import values, quantities or unit values from Switzerland of firm j, product p and year t, Log Y_{jpt}, on the interaction between a dummy that identifies years from 2004, T_t, and a dummy that identifies Chinese importers, CN_j, together with firm-product and year fixed effects:

$$LogY_{jpt} = \eta_0 + \eta_1 T_t * CN_j + \delta_{jp} + \sigma_t + \chi_{jpt} \tag{3}$$

With this strategy, I am comparing the evolution over-time of existing firm-product relations across France and China. Column (1) of Table 15 shows that Chinese firms started importing more from Switzerland than French ones following the implementation of the AFMP. Columns (2) and (3) indicate that this differential increase in imports is explained by both an increase in quantities and prices. Therefore, at least part of the increase in Swiss export quantities and prices seems to be explained by an intensification of the existing buyer-seller relations.

Table 15: Chinese and French Imports from Switzerland

	(1)	(2)	(3)
	Log Imp_{jpt}	Log Q^{Imp}_{jpt}	Log P^{Imp}_{jpt}
T_t*CN_j	0.2100^a	0.0781^a	0.1350^a
	(0.019)	(0.019)	(0.008)
Observations	578,224	566,678	566,676
R^2	0.755	0.874	0.944

Notes: all regression include firm-product and year fixed effects. T_t indicates the years from 2004, and CN_j identifies Chinese firms. Standard errors clustered at the product-year level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: Chinese and French Customs data.

To disentangle aggregate imports growth of Chinese firms from Switzerland, I divide them into: new products, new firms and continuing firm-products. Figure 6 shows that trade values experienced a sustained increase for all categories. The quantity dynamics appear rather flat for continuing firm-products, while they are more positive for added products and new importers, especially following 2004. Instead, prices increased only for continuing firm-products and new firms, while they remained stable for added products. This evidence suggests that most of the increase in unit values of Swiss products was absorbed by continuing firm-products and new importers. In other words, the increase in quality of Swiss firms seems to have led to more in imports from established buyer-seller relations and from new Chinese customers. By looking at the French imports from Switzerland, I can check whether these are just general trends or if we observe the same heterogeneity highlighted in Section 5. Figure A-3 in the Appendix shows that the increase in imports and unit values is more modest than for China and it is entirely absorbed by existing firm-products, while new products and new firms do not display a definite trend. Therefore, the comparison of imports between France and

Figure 6: Evolution of Chinese Imports from Switzerland, first year=1

Note: This figure represents the evolution of import values, quantities and unit values (normalized with respect to the first year) of China from Switzerland for the period 1996–2010 distinguishing across continuing firm-products, added products and new firms. Continuing product-firms are those that I observe for two consecutive years. Added products are products that were not imported the previous year and new firms are firms that were not importing the year before. Data source: Chinese Customs data.

China suggests that the increase in the quality of Swiss products led to more trade with existing customers and to more customers.

In summary, by comparing the dynamics of French and Chinese trade, the increase in the value of intermediate inputs coming from border countries seems to be driven by the intensification of the relation with existing suppliers and products. This would mean that foreign workers lowered information frictions by providing information regarding how to obtain better products from existing suppliers. This could be potentially driven by Swiss firms being able to attract employees from their suppliers or workers related to them thanks to the AFMP. On the export side, the increase in the quality of products seems to have led to more exports to existing firm-products and to the acquisition of new customers in distant destinations, while for close destinations this channeled only through more exports to existing firm-products. Without being able to match Swiss, French and Chinese data it is not possible to offer a precise quantification of these two channels. However, the descriptive evidence points at these mechanisms as likely culprits for explaining the global value chain implications of the AFMP. Moreover, my results further qualify the increased intensification of the buyer-seller relation due to immigration observed in Egger et al. (2019), by showing that this intensification leads to better quality inputs, to better quality output and higher sales to existing customers and new ones especially in distant destinations.

7 Conclusion

In times in which international labor mobility is considered to be a threat to domestic workers and the economy, it is important to highlight what we would lose without it. This paper uses the gradual opening of the Swiss labor market to EU citizens to show that high-skilled foreign workers led to lower information frictions, better products, and thus more trade and more effective global value chains. Their increasing presence in Switzerland due to the AFMP helped affected postal codes find higher-quality intermediate inputs from their origin countries by intensifying their relation with existing foreign suppliers. Better intermediates improved the appealing of Swiss products and led to export growth, by increasing exports to existing customers and facilitating the acquisition of new ones. Importantly, this new mechanism is binding also in contexts in which information frictions are wrongly perceived as not being salient, i.e., for trade between developed countries. Therefore, episodes of labor-market jeopardizations such as Brexit or the current COVID-19 pandemic, can harm the capacity to innovate and exchange goods internationally, which in turns can hurt domestic firms and workers.

References

Alfaro, L., Antràs, P., Chor, D., and Conconi, P. (2019). Internalizing Global Value Chains: A Firm Level Analysis. *Journal of Political Economy*, 127(2):509–559.

Allen, T. (2014). Information Frictions in Trade. *Econometrica*, 82:2041–2083.

Amiti, M. and Khandelwal, A. K. (2013). Import Competition and Quality Upgrading. *The Review of Economics and Statistics*, 95(2):476–490.

Antràs, P. and Chor, D. (2013). Organizing the Global Value Chain. *Econometrica*, 81(6):2127–2204.

Antràs, P., Chor, D., Fally, T., and Hillberry, R. (2012). Measuring the Upstreamness of Production and Trade Flows. *American Economic Review*, 102(3):412–16.

Bahar, D., Hauptmann, C., Ozguel, C., and Rapoport, H. (2019). Migration and Post-Conflict Reconstruction: The Effect of Returning Refugees on Export Performance in the Former Yugoslavia. Iza dp no. 12412.

Balassa, B. (1965). Trade Liberalisation and Revealed Comparative Advantage. *The Manchester School*, 33:99–123.

Balsvik, R. (2011). Is labor mobility a channel for spillovers from multinationals? evidence from norwegian manufacturing. *The Review of Economics and Statistics*, 93(1):285–297.

Barsbai, T., Rapoport, H., Steinmayr, A., and Trebesch, C. (2017). The Effect of Labor Migration on the Diffusion of Democracy: Evidence from a Former Soviet Republic. *American Economic Journal: Applied Economics*, 9(3):36–69.

Beerli, A. and Peri, G. (2017). The Labor Market Effects of Opening the Border: Evidence from Switzerland. KOF Working papers 17-431, KOF Swiss Economic Institute, ETH Zurich.

Beerli, A., Ruffner, J., Siegenthaler, M., and Peri, G. (2018). The Abolition of Immigration Restrictions and the Performance of Firms and Workers: Evidence from Switzerland. NBER Working Papers 25302, National Bureau of Economic Research, Inc.

Bigotta, M. (2015). Priority to Local Workers and its Consequences on Unemployment Duration. LIVES Working Paper 46.

Broda, C., Greenfield, J., and Weinstein, D. (2006). From Groundnuts to Globalization: A Structural Estimate of Trade and Growth. NBER Working Papers 12512, National Bureau of Economic Research, Inc.

Burchardi, K. B., Chaney, T., and Hassan, T. A. (2019). Migrants, Ancestors, and Foreign Investments. *Review of Economic Studies*, 86(4):1448–86.

Dustmann, C., Schnberg, 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.

Eaton, J., Kortum, S., and Kramarz, F. (2011). An Anatomy of International Trade: Evidence From French Firms. *Econometrica*, 79(5):1453–1498.

Egger, P., Erhardt, K., and Lassmann, A. (2019). Immigration and Firms' Integration in International Production Networks. *European Economic Review*, 111:1–34.

Egger, P. H. and Lassmann, A. (2015). The Causal Impact of Common Native Language on International Trade: Evidence from a Spatial Regression Discontinuity Design. *Economic Journal*, 0(584):699–745.

Felbermayr, G., Grossmann, V., and Kohler, W. (2015). Migration, international trade, and capital formation: Cause or effect? In Chiswick, B. R. and Miller, P. W., editors, *Handbook of the Economics of International Migration*, volume 1 of *Handbook of the Economics of International Migration*, pages 913 – 1025. North-Holland.

Felbermayr, G. J. and Toubal, F. (2012). Revisiting the Trade-Migration Nexus: Evidence from New OECD Data. *World Development*, 40(5):928–937.

Fink, C., Mattoo, A., and Neagu, I. C. (2005). Assessing the Impact of Communication Costs on International Trade. *Journal of International Economics*, 67(2):428–445.

Freund, C. L. and Weinhold, D. (2004). The Effect of the Internet on International Trade. *Journal of International Economics*, 62(1):171–189.

Ghosh, A., Mayda, A. M., and Ortega, F. (2014). The Impact of Skilled Foreign Workers on Firms: An Investigation of Publicly Traded U.S. Firms. IZA Discussion Papers 8684, Institute for the Study of Labor (IZA).

Gould, D. M. (1994). Immigrant Links to the Home Country: Empirical Implications for U.S. Bilateral Trade Flows. *The Review of Economics and Statistics*, 76(2):302–316.

Gray, R., Montresor, G., and Wright, G. C. (2020). Processing Immigration Shocks: Firm Responses on the Innovation Margin. *Journal of International Economics*, forthcoming.

Head, K. and Ries, J. (1998). Immigration and Trade Creation: Econometric Evidence From Canada. *Canadian Journal of Economics*, 31(1):47–61.

Hornung, E. (2014). Immigration and the Diffusion of Technology: The Huguenot Diaspora in Prussia. *American Economic Review*, 104(1):84–122.

Jensen, R. (2007). The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector. *The Quarterly Journal of Economics*, 122(3):879–924.

Juhasz, R. and Steinwender, C. (2018). Spinning the Web: The Impact of ICT on Trade in Intermediates and Technology Diffusion. NBER Working papers 24590.

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

Khandelwal, A. K., Schott, P. K., and Wei, S.-J. (2013). Trade Liberalization and Embedded Institutional Reform: Evidence from Chinese Exporters. *American Economic Review*, 103(6):2169–95.

Leuven, E., Akerman, A., and Mogstad, M. (2018). Information Frictions, Internet and the Relationship between Distance and Trade. Mimeo 1/2018, Oslo University, Department of Economics.

Manova, K. and Zhang, Z. (2012). Export Prices Across Firms and Destinations. *The Quarterly Journal of Economics*, 127(1):379–436.

Marchal, L. and Nedoncelle, C. (2019). Immigrants, occupations and firm export performance. *Review of International Economics*, 27(5):1480–1509.

Martin, J. and Mayneris, F. (2015). High-end variety exporters defying gravity: Micro facts and aggregate implications. *Journal of International Economics*, 96(1):55–71.

Mayda, A. M., Ortega, F., Peri, G., Shih, K., and Sparber, C. (2018). The Effect of the H-1B Quota on Employment and Selection of Foreign-Born Labor. *European Economic Review*, 108:105–128.

Mion, G. and Opromolla, L. D. (2014). Managers' mobility, trade performance, and wages. *Journal of International Economics*, 94(1):85–101.

Mion, G., Opromolla, L. D., and Sforza, A. (2016). The Diffusion of Knowledge via Managers' Mobility. CEPR Discussion Papers 11706, C.E.P.R. Discussion Papers.

Mitaritonna, C., Orefice, G., and Peri, G. (2018). Immigrants and Firms' Outcomes: Evidence from France. *European Economic Review*, 96:62–82.

Muendler, M.-A. (2017). Trade, Technology, and Prosperity: An Account of Evidence from a Labor-Market Perspective. WTO Staff Working Papers ERSD-2017-15, World Trade Organization (WTO), Economic Research and Statistics Division.

Olney, W. W. and Pozzoli, D. (2020). The Impact of Immigration on Firm Level Offshoring. *The Review of Economics and Statistics*, forthcoming.

Ottaviano, G. I., Peri, G., and Wright, G. C. (2018). Immigration, Trade and Productivity in Services: Evidence from U.K.Firms. *Journal of International Economics*, 112:88 – 108.

Parrotta, P., Pozzoli, D., and Pytlikova, M. (2014). Labor Diversity and firm productivity. *European Economic Review*, 66:144 – 179.

Parrotta, P., Pozzoli, D., and Sala, D. (2016). Ethnic Diversity and Firms' Export Behavior. *European Economic Review*, 89:248 – 263.

Parsons, C. and Vézina, P.-L. (2018). Migrant Networks and Trade: The Vietnamese Boat People as a Natural Experiment. *The Economic Journal*, 128(612):210–234.

Portes, R. and Rey, H. (2005). The Determinants of Cross-Border Equity Flows. *Journal of International Economics*, 65(2):269–296.

Rauch, J. E. (1999). Networks versus markets in international trade. *Journal of International Economics*, 48(1):7–35.

Rauch, J. E. (2001). Business and Social Networks in International Trade. *Journal of Economic Literature*, 39(4):1177–1203.

Rauch, J. E. and Trindade, V. (2002). Ethnic Chinese Networks In International Trade. *The Review of Economics and Statistics*, 84(1):116–130.

Ruffner, J. and Siegenthaler, M. (2016). From Labor to Cash Flow? The Abolition of Immigration Restrictions and the Performance of Swiss Firms. KOF Working papers 16-424, KOF Swiss Economic Institute, ETH Zurich.

Saxonhouse, G. R. (1976). Estimated parameters as dependent variables. *The American Economic Review*, 66(1):178–183.

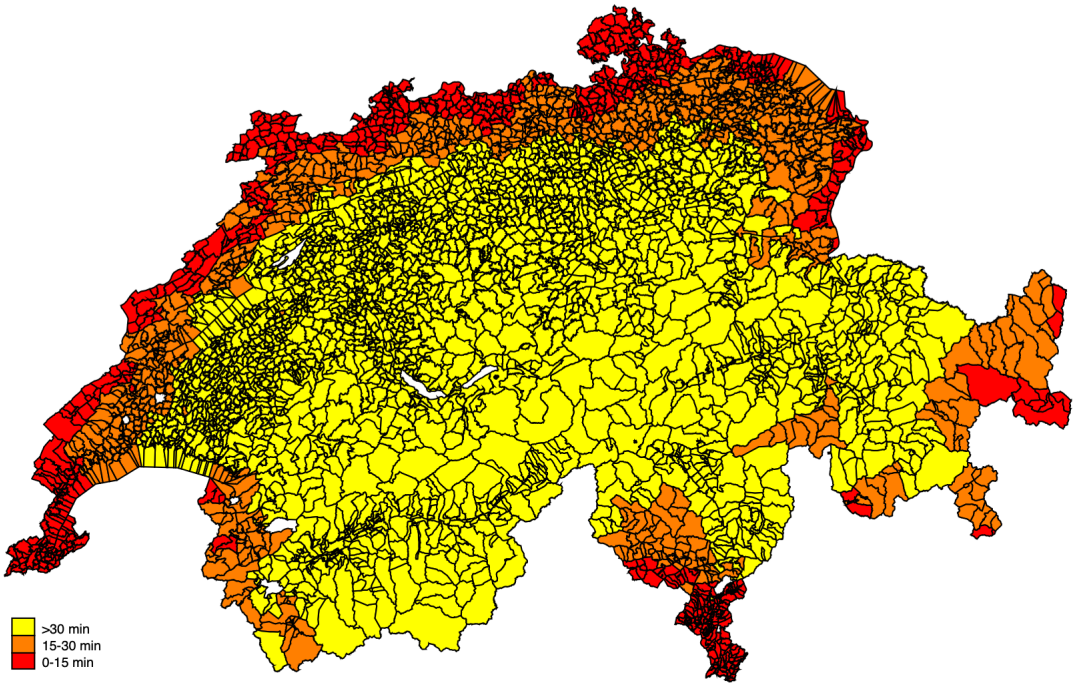
Secretariat d'Etat (2017). Treiziéme rapport. Technical report.

Steinwender, C. (2018). Real Effects of Information Frictions: When the States and the Kingdom Became United. *American Economic Review*, 108(3):657–696.

Appendix

A Additional Tables and Figures

Figure A-1: Distance in Minutes from the Closest Border Crossing



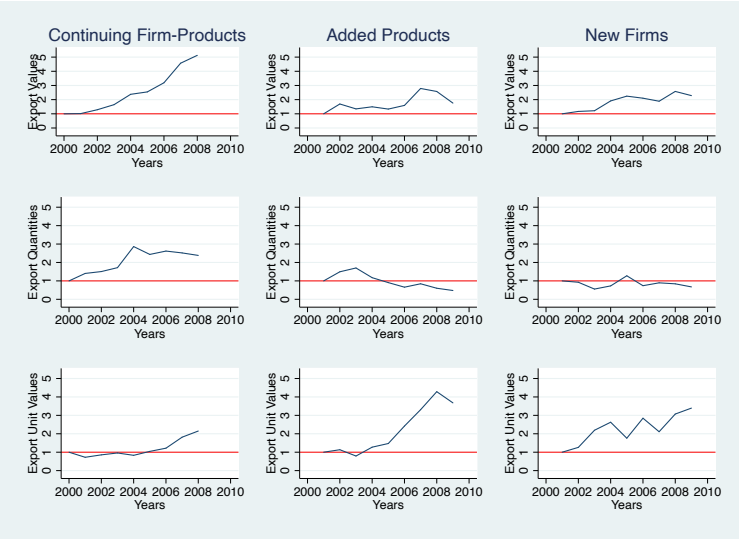
Note: This figure represents the distance from the border for each postal code in Switzerland. The red color depicts postal codes within 15 minutes from the border crossing. The orange color represents the postal codes between 15 and 30 minutes from the border crossing. The yellow color indicates postal codes that are beyond 30 minutes from the border.

Table A-1: Number of Swiss Citizens Abroad

	1996–2001	2002–2010
Total	566,904	648,684
Europe	61.7%	62.1%
Africa	3.0%	2.9%
Americas	6.9%	25.6%
Asia	4.1%	5.1%
Oceania	4.3%	4.3%

Notes: This table presents the average number and share of Swiss citizens living abroad by continent. Source: Swiss Office for National Statistics.

Figure A-2: Evolution of Chinese Intermediate Inputs Exports to Switzerland, first year=1



Note: This figure represents the evolution of intermediate inputs export values, quantities and unit values (normalized with respect to the first year) of China to Switzerland for the period 1996–2010 distinguishing across continuing firm-products, added products and new firms. Continuing product-firms are those that I observe for two consecutive years. Added products are products that were not exported in the previous year and new firms are firms that were not exporting the year before. Data source: Chinese Customs data.

Figure A-3: Evolution of French Imports from Switzerland, first year=1

Note: This figure represents the evolution of import values, quantities and unit values (normalized with respect to the first year) of France from Switzerland for the period 1996–2010 distinguishing across continuing firm-products, added products and new firms. Continuing product-firms are those that I observe for two consecutive years. Added products are products that were not imported the previous year and new firms are firms that were not importing the year before. Data source: French Customs data.

Table A-2: Event-Study Regression, D1

	Log Exp_{ipct}	Log Q_{ipct}	Log P_{ipct}	Log $\hat{\eta}_{ipct}$
D1_i*I_t^{1996}	-0.0211	-0.0204	-0.0008	-0.0061
	(0.033)	(0.033)	(0.012)	(0.014)
D1_i*I_t^{1997}	-0.0182	-0.0163	-0.0018	-0.0147
	(0.029)	(0.028)	(0.011)	(0.014)
D1_i*I_t^{1998}	-	-	-	-
	-	-	-	-
D1_i*I_t^{1999}	-0.0034	-0.0020	-0.0085	
	(0.027)	(0.026)	(0.012)	(0.016)
D1_i*I_t^{2000}	-0.0072	0.0035	-0.0106	-0.0243[c]
	(0.026)	(0.027)	(0.012)	(0.014)
D1_i*I_t^{2001}	0.0075	0.0041	0.0034	-0.0077
	(0.026)	(0.026)	(0.010)	(0.014)
D1_i*I_t^{2002}	0.0445[c]	0.0444[c]	0.0001	0.0012
	(0.024)	(0.026)	(0.010)	(0.012)
D1_i*I_t^{2003}	0.0709[a]	0.0720[a]	-0.0010	0.0161
	(0.023)	(0.025)	(0.011)	(0.012)
D1_i*I_t^{2004}	0.0655[a]	0.0626[b]	0.0029	0.0162
	(0.024)	(0.026)	(0.011)	(0.013)
D1_i*I_t^{2005}	0.0722[a]	0.0660[a]	0.0062	0.0193
	(0.024)	(0.025)	(0.010)	(0.014)
D1_i*I_t^{2006}	0.0844[a]	0.0786[a]	0.0058	0.0162
	(0.027)	(0.027)	(0.011)	(0.015)
D1_i*I_t^{2007}	0.1034[a]	0.0878[a]	0.0156	0.0372[b]
	(0.031)	(0.030)	(0.011)	(0.015)
D1_i*I_t^{2008}	0.1030[a]	0.0909[a]	0.0121	0.0284[c]
	(0.035)	(0.034)	(0.012)	(0.017)
D1_i*I_t^{2009}	0.1273[a]	0.1150[a]	0.0123	0.0299[c]
	(0.035)	(0.034)	(0.012)	(0.016)
D1_i*I_t^{2010}	0.0685	0.0722[c]	-0.0036	0.0099
	(0.043)	(0.043)	(0.015)	(0.019)
Observations	5,429,361	5,429,361	5,429,361	4,545,135
R^2	0.7538	0.8531	0.9171	0.6349

Notes: This table presents the regression coefficients that are depicted in Figure 4. All regressions include locality-destination-product and year fixed effects. Standard errors clustered at the locality-year level are in parentheses. [a] p<0.01, [b] p<0.05, [c] p<0.1. Data Source: EDEC.

Table A-3: Event Study Regression, D2

	Log Exp_{ipct}	Log Q_{ipct}	Log P_{ipct}	Log $\hat{\eta}_{ipct}$
$D2_i$*I_t^{1996}	-0.0257	-0.0288	0.0031	-0.0055
	(0.022)	(0.024)	(0.010)	(0.013)
$D2_i$*I_t^{1997}	-0.0231	-0.0241	0.0010	-0.0088
	(0.019)	(0.020)	(0.010)	(0.012)
$D2_i$*I_t^{1998}	-	-	-	-
	-	-	-	-
$D2_i$*I_t^{1999}	0.0176	0.0242	-0.0066	0.0063
	(0.017)	(0.019)	(0.009)	(0.011)
$D2_i$*I_t^{2000}	0.0014	0.0172	-0.0159^c	-0.0130
	(0.018)	(0.021)	(0.009)	(0.011)
$D2_i$*I_t^{2001}	0.0013	0.0186	-0.0173^c	-0.0054
	(0.017)	(0.019)	(0.009)	(0.012)
$D2_i$*I_t^{2002}	0.0062	0.0187	-0.0125	-0.0006
	(0.018)	(0.019)	(0.009)	(0.012)
$D2_i$*I_t^{2003}	0.0156	0.0261	-0.0105	0.0048
	(0.017)	(0.019)	(0.009)	(0.012)
$D2_i$*I_t^{2004}	0.0174	0.0360^c	-0.0186^b	-0.0040
	(0.018)	(0.020)	(0.009)	(0.012)
$D2_i$*I_t^{2005}	0.0250	0.0449^b	-0.0199^b	0.0005
	(0.018)	(0.020)	(0.009)	(0.011)
$D2_i$*I_t^{2006}	0.0339^c	0.0591^a	-0.0251^a	-0.0020
	(0.018)	(0.020)	(0.010)	(0.012)
$D2_i$*I_t^{2007}	0.0287	0.0537^a	-0.0250^a	-0.0005
	(0.019)	(0.021)	(0.010)	(0.012)
$D2_i$*I_t^{2008}	0.0267	0.0467^b	-0.0200^c	-0.0035
	(0.021)	(0.022)	(0.011)	(0.014)
$D2_i$*I_t^{2009}	0.0221	0.0411^c	-0.0190^c	-0.0077
	(0.021)	(0.023)	(0.011)	(0.013)
$D2_i$*I_t^{2010}	-0.0087	0.0120	-0.0207	-0.0162
	(0.027)	(0.029)	(0.013)	(0.016)
Observations	5,429,361	5,429,361	5,429,361	4,545,135
R^2	0.7538	0.8531	0.9171	0.6349

Notes: This table presents the regression coefficients that are depicted in Figure 4. All regressions include locality-destination-product and year fixed effects. Standard errors clustered at the locality-year level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data Source: EDEC.

Table A-4: Products Involved in Concurrent Agreements

HS 2-digit code	**Name**
30	Pharmaceutical products
84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles
87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof
90	Optical, photographic, cinematographic, measuring, checking, precision, and medical or surgical instruments and apparatus; parts and accessories thereof
95	Toys, games, and sports requisites; parts and accessories thereof

Table A-5: 1990–2010 Population Dynamics

	Δ Total	Δ Swiss	Δ Foreigners
$D1_m$	0.014	0.004	0.017^b
	(0.016)	(0.013)	(0.008)
$D2_m$	-0.015	-0.010	-0.005
	(0.011)	(0.009)	(0.005)
Observations	1,731	1,731	1,731
R^2	0.002	0.001	0.006

Note: Δ Total, Δ Swiss, Δ Foreigners indicate respectively the change at the municipality level between 1990 and 2010 in the resident population, Swiss population and immigrant population. $D1_m$ indicates municipalities within 15 minutes from the border crossing and $D2_m$ indicates municipalities between 15 and 30 minutes from the border crossing. Robust standard errors in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data Source: Swiss Census.

Table A-6: Effect of the AFMP on Plant Relocation

	(1) log # plants
R_{it}	-0.0055
	(0.023)
R_{it}*$D1_i$	-0.0112
	(0.027)
R_{it}*$D2_i$	0.0169
	(0.024)
Observations	19,582
R^2	0.7377

Notes: All regressions include postal code and year fixed effects. R_{it} indicates postal codes in the border region from 2004 and in the central region from 2007. $D1_i$ indicates postal codes within 15 minutes from the border crossing and $D2_i$ indicates postal codes between 15 and 30 minutes from the border crossing. Standard errors clustered at the postal code-year level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: Industrial Census.