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

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Abstract

This paper shows that international labor mobility leads to higher-quality products, more trade, and more effective global value chains. Exploiting variation in the time and intensity at which Swiss localities (identified by their postal codes) were treated by the increasing availability of foreign workers caused by 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 show to be associated with a higher 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, Quality, Trade, GVCs.
JEL Classification: F14, F16, F22.

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1 Introduction

There is large consensus in the international economics literature over the fact that immigration is related to more trade (e.g., Head and Ries, 1998; Rauch, 1999; Felbermayr and Toubal, 2012; Parsons and Vézina, 2018). Yet, there is little causal evidence on *whether* and *how* cross-country labor mobility can benefit production organization and international trade performance. The major obstacles are represented by the fact that the responsiveness of foreign workers' flows is typically not independent from trade flows and the economic environment, and that data is usually not detailed enough to study the mechanisms at play.

This paper circumvents these issues by exploiting micro trade data from Switzerland and 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 is associated with better quality of exported products, and with higher export growth toward extra-EU destinations due to more exports to existing customers and the acquisition of new ones. Since export growth was not especially directed to 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 harm the capability of improving quality and organizing production and sales internationally.

The AFMP was signed in 1999. It was fully implemented in Switzerland in 2004 for localities (i.e., 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 localities within 15 minutes drive from the border crossing. Localities 15 to 30 minutes from the border were only mildly affected, and those more than 30 minutes remained practically untouched. Crucially, 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 evidence on the effects of the agreement, I implement a difference-in-differences strategy that uses the variation in both the timing (across border and central regions) and the intensity (within the same region depending on the distance from the border) at which localities were affected by the inflow of cross-border workers.[1] In particular, I consider as highly treated the localities within 15 minutes from the border, mildly treated those between 15 to 30 minutes from the border and as control those more than 30 minutes from the border. I find that the AFMP increased aggregate exports in treated localities more than in control ones and this effect is almost exclusively due to the average exports per product and destination, while the number of products and the number of destinations played only a marginal role. This result allows me to exploit the granularity of the data to compare the exports of the same product to the same destination across treated and control postal codes before and after the

[1] Unfortunately the implementation of the agreement does not offer variation to capture the role of resident immigrants.

implementation of the agreement. This setting is particularly appealing for two reasons. First, because compositional differences in terms of products and destinations across treated and control localities do not play any role. Second, by discarding product and destination entry and exit, I still keep the bulk of Swiss exports, i.e., 80% of observed trade flows and more than 90% of trade values. With this strategy, I find that highly treated localities (i.e., those within 15 minutes of the border) increased exports more than unaffected ones (i.e., those more than 30 minutes from the border) but I do not observe any differential effect for localities only mildly affected (i.e., those 15 to 30 minutes from the border).[2]

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 shows to be a major factor 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 (e.g., Bahar and Rapoport, 2018; Bahar et al., 2022). 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 the existence of a causal link between the quality of inputs and the quality

[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., 2021); the years before the great trade collapse; using alternative clustering for standard errors; controlling for product-destination shocks; controlling for the size or export propensity of each postal code; and when checking the quality of the variation by using a placebo test.

of exported products, I test whether, following the implementation of the AFMP, growth in intermediate input prices arriving from border countries affected price and quality growth of a particular product-destination export pair differently for treated and control postal codes. This difference-in-differences strategy gets rid of all the time-invariant endogeneity issues, and to the extent that any unobserved time-variant shock is not correlated with the time and regional implementation of the AFMP, it also delivers sensitive coefficients. Using this strategy, I find that the increase in prices of foreign workers' origin-country inputs is positively and significantly related to export price and quality growth only for the highly treated postal codes. While it could be unsurprising that growth in imported inputs prices is related to growth in exported prices and quality, I show that this relation increased more for highly treated postal codes than for those in the control group following the AFMP. Moreover, adding to the same specification also the prices of inputs from other countries, I find that their growth is not differentially affecting price and quality of exported products.

These results suggest that input quality upgrading can be considered as a driving force underneath export growth, and information frictions decreased upstream thanks to the knowledge of foreign workers arriving from border countries.[3] Importantly, I do 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. Moreover, when controlling for these alternative mechanisms my results do not change. It is therefore hard to argue that my empirical results can be rationalized exclusively 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

[3]This mechanisms need not to work only within the same firm because the better input can also be purchased by a firm in the same postal code, and then sold to the exporter that uses it for producing the export product. In other words, thanks to the use of data at the postal code level my estimates can account for both the within-firm and across-firm positive effect of better inputs. This also means that my coefficients provide a lower bound of the importance of this mechanisms because I cannot capture the same positive effect if the input is imported by a firm in a postal code and then sold to an exporter which is in a different one.

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.

The positive role of migrants on trade has been extensively analyzed by various papers (e.g., Head and Ries, 1998; Rauch, 1999, 2001; Rauch and Trindade, 2002; Felbermayr and Toubal, 2012). While most of the earlier contributions fail to convincingly assess a causal relation due to endogeneity issues and poor data quality (Felbermayr et al., 2015), recent papers use instrumental variable strategies (Peri and Raquena-Silvente, 2010; Ottaviano et al., 2018; Cardoso and Ramanarayanan, 2019; Marchal and Nedoncelle, 2019; Orefice et al., 2021) or natural experiments (Parsons and Vézina, 2018; Bahar et al., 2022; Olney and Pozzoli, 2021) to assess causality. However, these papers either do not allow to distinguish the skill of the migrant or embed almost exclusively low skilled migrant flows (mostly from developing countries), and we know little about the mechanisms by which foreign workers foster trade. Bahar and Rapoport (2018), Orefice et al. (2021), and Bahar et al. (2022) argue that migrants can affect trade by bringing information on their origin country (network effect), by bringing new skills and general knowledge for production (knowledge diffusion effect), or by optimizing the diversity at the firm or country level (diversity effect). My paper makes two main contributions to this literature. First, I analyze a new and unexplored setting in which a developed country receives a large number of high-skilled workers from other developed countries. Second, the Swiss data and the unique features of the AFMP implementation make it possible to open the black box of the knowledge diffusion effect and to identify a new mechanism by which foreign workers can foster trade.

Several studies show 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; Malgouyres et al., 2019), and telephone call rates (Fink et al., 2005; Portes and Rey, 2005) have fostered trade by lowering the burden of communication. My results contribute to this literature by showing that also international labor mobility can soften information frictions. More specifically, foreign workers bring origin-specific

knowledge that is instrumental to improve the quality of inputs (e.g., Bernard et al., 2019), and, in turns, input quality affects export quality (e.g., Kugler and Verhoogen, 2012; Manova and Zhang, 2012; Bastos et al., 2018) and export growth, especially in distant destinations (e.g., Hummels and Skiba, 2004; Baldwin and Harrigan, 2011; Martin and Mayneris, 2015). Other related contributions (e.g., Balsvik, 2011; Mion and Opromolla, 2014; Parrotta et al., 2014; Mion et al., 2016; Parrotta et al., 2016; Bernard et al., 2019) analyze more generally the role of workers' experience for export performance and firm productivity. My paper quantifies the specific role of foreign workers' knowledge and identifies the mechanism by which they foster trade.

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 their efficacy. 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 the quality of inputs and output.

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 (Kugler and Rapoport, 2007; Javorcik et al., 2011; 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 (Cristelli and Lissoni, 2020; Gray et al., 2020). My analysis provides another dimension in which foreign workers are beneficial to the economy. Moreover, it 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 driven by exports growth and by an increase in input quality led by the origin-specific knowledge of new foreign workers.

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.

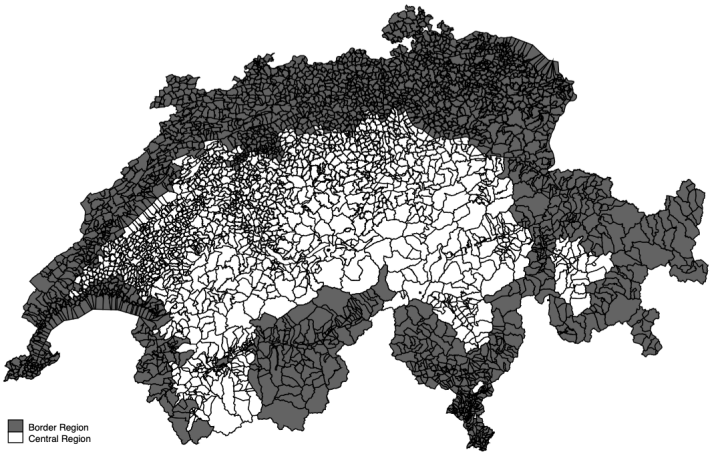
2 The Swiss-EU Agreement on the Free Movement of Persons

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 agriculture, air transport, international trade, mutual recognition of conformity assessment, government procurement and scientific and technological cooperation.[4] 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, RI were subject to national quotas set by the Swiss federal government, and together with CBW 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. This represented a major impediment to hire foreign workers since it involved a complicated bureaucratic process, it increased considerably the length of the hiring process, and the uncertainty about the outcome. Additionally, CBW had to return to their residence every day after work, they could not work in the central region of Switzerland, the duration of the permit was tied to the contract length and they had to provide evidence that they were living in one of the municipalities close to the border of one of the four neighboring countries for at least 6 months before the permit request. 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.

[4] 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).

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 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. Foreign residence requirement was relaxed and CBW were allowed 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 impediment was the crucial aspect of the AFMP both for CBW (in 2004 for BR and 2007 for CR) and RI (in 2007) for two reasons. First, because quotas were never attained before the agreement: their utilization rate was around 70% in the period before the AFMP (Secretariat d'Etat, 2017). Second, 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.[5]

[5]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.

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	National priority requirement	National priority requirement	Free	Free
	BR	Daily return to foreign domicile	Weekly return to foreign domicile	Free	Free
	BR	Permit duration related to contract lenght	5 years permits	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).

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 (HS-6) in the 2002 version, the destination or origin country, the quantities, the value and the year. The presence of both values and quantities is a great value added because they allow me to compute unit values that will be instrumental to understand the mechanisms at play.[6] 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. The resulting data comprises 6.8 million postal code-product-destination-year export flows and 16.3 million postal code-product-origin-year import flows (Table A-1 in Appendix A). While the unit of observation is at the postal code-product-country-year, the fact that the median product-destination is usually exported by only one firm makes the EDEC data representing mostly firm-product-destination flows.

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

[6]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).

of the workers and on the workplace at the MS region level.[7] 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 these 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 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).

To construct the distance from the border of each postal code in Switzerland, I use information on the location of each border crossing from Henneberger and Ziegler (2011) and compute the travel distance by car in minutes from each postal code to the closest border crossing.[8] For the postal codes in which the algorithm was not able to compute the time distance or was computing implausible driving times, I take the value from Beerli et al. (2021).[9] Finally, I take information on whether a postal code belongs to the border or central region of Switzerland from Beerli et al. (2021).

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.

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

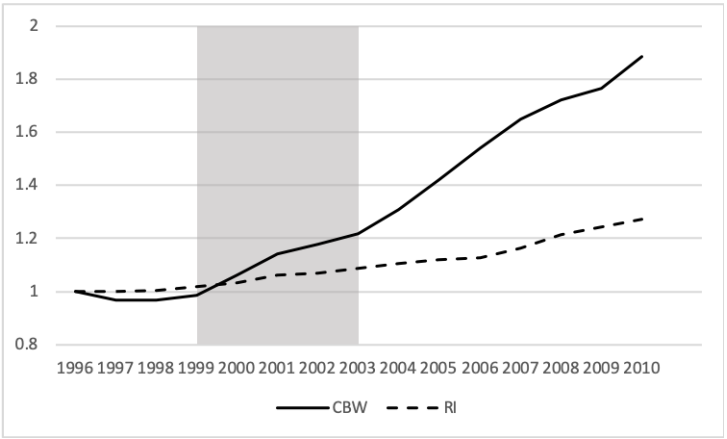
[8] I used the API algorithm provided by HERE Developer.

[9] Please, note that Beerli et al. (2021) computed the driving time only for a subset of postal codes in Switzerland. Therefore, I cannot use their measure in my analysis because it does not cover some of the postal codes in which I observe import or export flows. In any case, my driving time measure and that of Beerli et al. (2021) are highly correlated.

- ***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.

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.

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, the evolution of RI shows only a mild discontinuity following the RI liberalization in 2007 (Figure 2). 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

Table 2: Foreign Workers Growth by Resident Permit and Nationality

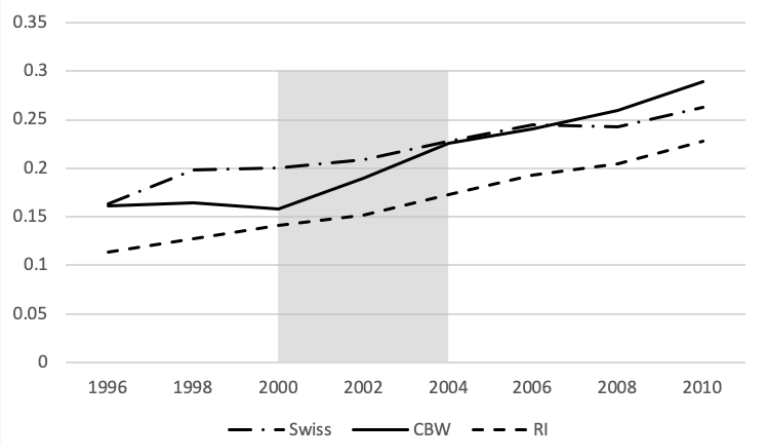
Panel a: Cross-Border Workers									
	Stocks						**Average Net Yearly Inflows**		
	1996	1999	2000	2003	2004	2010	1996–1999	2000–2003	2004–2010
Total	**146,985**	**144,779**	**155,953**	**178,817**	**192,222**	**276,856**	**-552**	**5,716**	**12,091**
Border	**145,823**	**143,241**	**154,142**	**175,776**	**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	**831**	**1,122**	**1,309**	**2,199**	**2,742**	**6,7909**	**73**	**223**	**576**
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.

phase. Importantly, the composition of incoming flows changed 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

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.

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 et al., 2022; Gray et al., 2020; Olney and Pozzoli, 2021).

The distribution of foreign workers across different industries represents another interesting feature that can be analyzed using the SESS data. Approximately 70% of 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. Finally, the great increase in the number of foreign workers into the services sector could be an important source of services export growth as well, however, these data are not available for Switzerland and in this paper I need to restrain to the analysis of trade in goods only.

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.

- ***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., 2021). Table 4 shows for the border region and the central region, the share of CBW and RI workers for the years 1996 (i.e., before the agreement) and 2010 (i.e., after the agreement) by the driving distance (in minutes) to the closest border crossing. Figure 4 represents the time-to-border distribution of postal codes across Switzerland distinguishing those that are within 15 minutes from the border in red, those between 15 and 30 minutes in orange, and those beyond 30 minutes in yellow.

It is evident from Table 4 that the share of CBW increased more heavily in the border region, while the central region remained practically unaffected. Moreover, the

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

		CBW		RI	
	Border-Time Distance	1996	2010	1996	2010
Border Region	■ ≤15 min	19.3%	23.5%	26.5%	26.0%
	■ >15≤30 min	5.2%	6.0%	26.8%	27.5%
	■ >30 min	1.0%	2.1%	25.2%	26.9%
Central Region	■ ≤15 min	-	-	-	-
	■ >15≤30 min	0.0%	1.1%	22.8%	24.9%
	■ >30 min	0.0%	0.0%	19.9%	21.5%

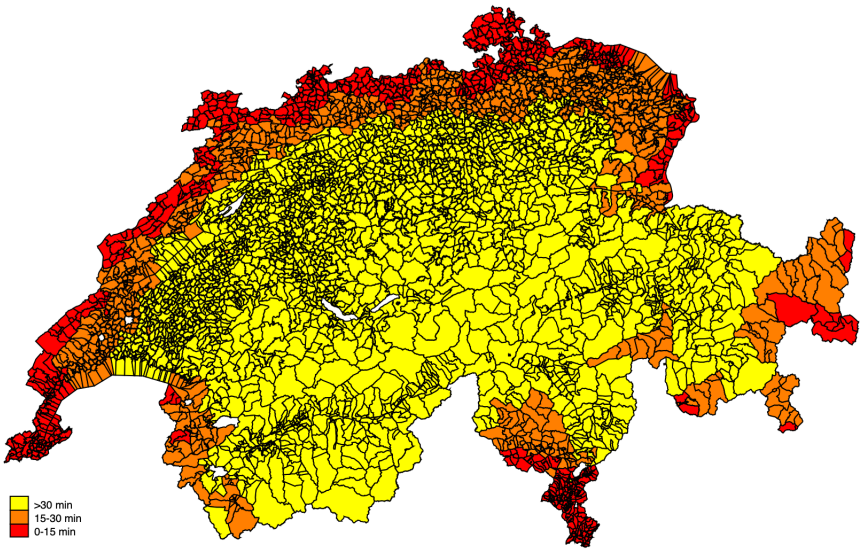
Note: This table shows the share of CBW and the share of resident immigrants (RI) in 1996 and 2010 with respect to total employment for MS regions within 15 minutes from the border, regions between 15 and 30 minutes and regions beyond 30 minutes in the border (BR) and central (CR) regions. Data source: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

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 more than four 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 roughly 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 the increase in the share of RI is not related to the border-time distance and it is smaller than for CBW. Therefore, the implementation of the AFMP is associated to an important increase in the share of CBW especially in the postal codes located in the border region within 15 minutes from the border crossing. Instead, the increase in the RI was smaller and more evenly spread over space.

- ***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 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

Figure 4: 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 5: Export Growth by Time Distance from the Border

	(1) Δ Log Exp_i	(2) Δ Log $\#\text{Dest}_i$	(3) Δ Log $\#\text{Prod}_i$	(4) Δ Log Int_i
D1_i	0.1874^b	-0.0510	-0.0372	0.2756^a
	(0.089)	(0.038)	(0.036)	(0.065)
D2_i	0.1234	-0.0165	0.0315	0.1084^c
	(0.093)	(0.040)	(0.036)	(0.063)
Observations	2,793	2,793	2,793	2,793
R^2	0.0016	0.0005	0.0009	0.0060

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 $\#\text{Dest}_i$, Δ Log $\#\text{Prod}_i$, Δ Log Int_i indicate the change between 1996 and 2010 in the log exports, number of destinations, number of products, and average exports per product and destination. Data Source: EDEC.

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. Decomposing the change in exports of locality i into the change in the number of destinations, Δ Log $\#\text{Dest}_i$, number of products, Δ Log $\#\text{Prod}_i$, and average exports per product and destination , Δ Log Int_i, I can better analyze the features of the increase in aggregate exports. Results in columns 2 to 4 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 in 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 localities 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 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 border and EU15 countries (Table 7). Moreover, localities within 30 minutes from 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

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.

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.

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

The previous section highlighted that following the implementation of the AFMP, a great number of high-skilled cross-border workers started working in the localities closer to the border and, at the same time, exports started to grow more in these localities. In this section, I implement an empirical strategy that exploits the discontinuity in the implementation time across regions and in the geographical presence of foreign workers to understand whether they are responsible for export growth. First, I provide an aggregate quantification of the policy and disentangle the effect into the different margins of trade. Second, I exploit the granularity of the data to focus on the main margin of interest. Third, I provide different robustness checks.

4.1 Postal-Code Level Analysis

The ideal setting to study the effect of international labor mobility on trade growth would be to regress changes in exports on changes in the number of foreign workers. Unfortunately, foreign workers' data is at a more aggregate level (MS region). This means that it is not possible to clearly define treatment and control since several MS regions contain both localities 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. For this reason, I use the exceptional features highlighted in the previous section that provide exogenous variation to quantify the effects of the AFMP.[10] In particular, I exploit 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.

Table 8 and Figure 5 provide a visualization of the difference-in-differences strategy: colors identify the distance from the border (red for postal codes within 15 minutes from the border, orange for those between 15 and 30 minutes and yellow for those beyond 30 minutes), and BR and CR indicate respectively postal codes in the border and central

[10]Even in the presence of data on the number of foreign workers at the appropriate level, 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., 2021). 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.

Table 8: Difference-in-Differences Strategy

	2004-2006	2007-2010
Treated	BR■ BR■	BR■ BR■ CR■
Control	CR■ BR■ CR■	BR■ CR■

Note: This table shows which postal codes are in the treated and control group for the periods 2004-2007 and 2007-2010. Colors refer to the time-distance from the border: red for postal codes within 15 minutes from the border, orange for those between 15 and 30 minutes and yellow for those beyond 30 minutes. Figure 4 provides a visual representation of the distance from the border of each postal code in Switzerland.

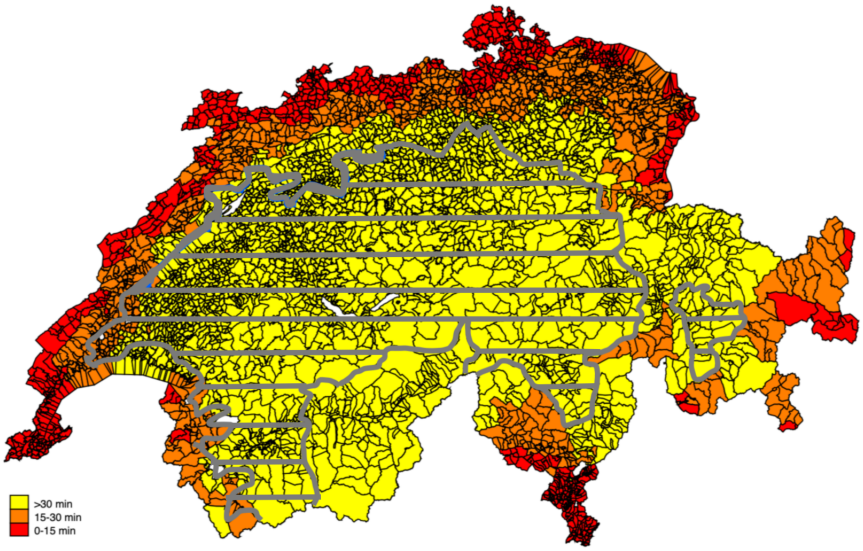
region and the latter is highlighted in grey in Figure 5. The years 2004 and 2007 are the key moments for the liberalization of the labor market in Switzerland because the main obstacle to hire foreign workers, i.e., the national priority requirement, was lifted (2004 the BR, 2007 in the CR). Accordingly, in the period 2004-2006 the highly treated group is represented by postal codes within 15 minutes from the border and the mildly treated group by postal codes 15 to 30 minutes from the border located in the BR. The control group includes all postal codes in the CR and the postal codes in the BR beyond 30 minutes from the border, which did not experience any inflow of CBW. In the period 2007-2010, also the CR is liberalized, thus, the postal codes between 15 and 30 minutes from the border that are in the CR become treated and the control group is represented by those postal codes that did not experience an inflow of CBW, i.e., those located beyond 30 minutes from the border both in the BR and CR.[11] This difference-in-differences strategy can be expressed analytically as:

$$Log\, Exp_{it} = \alpha_0 + \alpha_1 R_{it} + \alpha_2 R_{it} * D1_i + \alpha_3 R_{it} * D2_i + \lambda_i + \sigma_t + \epsilon_{it} \qquad (1)$$

where LogExp_{it} represents log exports of postal code i 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 to 2010 and from 2007 to 2010 for the localities in central region. $D1_i$ identifies localities within 15 minutes of the border, and $D2_i$ identifies localities 15 to 30 minutes from the border. λ_i and σ_t represent, respectively, postal code and year dummies. α_2 represents the differential effect of the AFMP on trade growth for highly treated postal codes located within 15 minutes from the border. α_3 the same differential effect for the postal codes which are located between 15 and 30 minutes from the border-crossing. A similar approach was implemented by Bigotta (2015) and Beerli et al. (2021) to understand,

[11] Please note that there are not postal codes within 15 minutes from the border in the CR.

Figure 5: Postal Code Distance from the Border, and Central and Border Regions



Note: This figure represents the distance from the border for each postal code in Switzerland and the border and central regions (with the latter highlighted in horizontal grey lines). 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.

respectively, the effect of the same agreement on labor market outcomes and on the size and productivity of firms.[12] A key element of these papers 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. Furthermore, Table A-2 in the appendix shows that also in my setting treated and control postal codes are very similar in terms of export and import values, number of products, number of destinations, and exports or imports per product-destination before the implementation of the AFMP. Finally, standard errors are clustered at the same level as the treatment, i.e., at the postal code-time level, but I provide evidence that the results are robust to different clustering strategies.

Results in Table 9 show that there is indeed a positive and significant differential effect on total exports for both the postal codes within 15 minutes from the border and those between 15 to 30 minutes. Disentangling this into the different margin, most of the effect is accounted by the intensive margin, i.e., the average exports per product-destination. For the postal codes 15 to 30 minutes from the border there is also a

[12]The main difference with respect to Beerli et al. (2021) is that I make use of the variation arising from the staggered implementation across border and central postal codes, while they only use the variation within the border region. The reason for keeping the postal codes in the central region is that I can have a counterfactual for all the products exported by the treated region, while if I restrain the analysis only to the border region postal code the set of products that can be used in the regression shrinks. Nevertheless, I show in the next subsection that my results hold also when excluding the central region postal codes.

Table 9: Effect of the AFMP on Exports

	(1) Log Exp_{it}	(2) Log $\#Pdt_{it}$	(3) Log $\#Dest_{it}$	(4) Log $AvgExp_{it}$
R_{it}	-0.1028^a	-0.0376^b	-0.0208	-0.0444^c
	(0.036)	(0.016)	(0.013)	(0.026)
R_{it}*$D1_i$	0.1742^a	0.0031	0.0157	0.1554^a
	(0.048)	(0.021)	(0.019)	(0.033)
R_{it}*$D2_i$	0.1777^a	0.0324	0.0460^b	0.0993^a
	(0.051)	(0.021)	(0.019)	(0.033)
Obs.	47,193	47,193	47,193	47,193
R^2	0.9000	0.9274	0.9153	0.5176
R_{it}+R_{it}*$D1_i$	0.0714	-0.0345	-0.0051	0.1110^a
R_{it}+R_{it}*$D2_i$	0.0749	-0.0052	0.0252	0.0549

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 level in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

small but significant effect for the number of destinations. These results confirm the stylized facts of the previous section. The increasing availability of foreign workers is associated to increased exports, mainly thanks to an increase in the average exports per product and destination, while we observe small or negligible figures for the number of products and destinations. Under the assumption that the coefficient of R_{it} is correctly estimated, I can get the aggregate effect of the agreement 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}*$D2_i$. The results at the bottom of Table 9 indicate that the only margin for which there is a statistically significant effect is the intensive margin and only for the postal codes within 15 minutes from the border. Therefore, this is the key margin for export growth following the AFMP implementation.

The results of this subsection reveal that the implementation of the AFMP is associated to an increase in exports that is mostly channeled by the average exports per product-destination, while there are not meaningful increases attributable to the extensive margins. One limit for interpreting these results as causal is represented by the fact that there could be a different product and destination specialization across treated and control localities. In other words, my results could be capturing compositional differences in terms of products and destinations that could lead to differential trade growth across postal codes. For this reason, in the rest of the paper I exploit the granularity of my data to make a sensitive comparison. More specifically, I focus only on

the intensive margin and compare exports of the same product and destination across treated and control postal codes. This reduces the sample of analysis of around 20% (i.e., from 6.6 million postal code-product-destination-year to 5.1 million). However, this is not an important loss of information for two reasons. First, continuing postal code-destination-product flows account for more than 90% of exports. Second, this is the key margin of adjustment that this subsection is suggesting to be relevant to understand the effect of the AFMP. Considering that in the EDEC data there are 3,500 postal codes, 217 destinations, 5,300 products, and 15 years, by filling the matrix we would have over 60 billion observations. Thus, 5.1 million active observations correspond to 0,00009% of all the possible postal code-product-destination-year combinations.

4.2 Intensive Margin Analysis

Following the findings of the previous subsection, I restrict the analysis to the intensive margin, i.e., the exports of postal code i to destination c of product p at time t, and use the same empirical strategy to understand the effect of the AFMP. The main advantage of comparing the exports of the same product to the same destination across treated and control postal codes is that the results are not driven by an apple and orange comparison. In other words, the results do not depend on differences in terms of products and destinations between treatment and control. Moreover, since most export growth is actually due to the intensive margin and this accounts for the bulk of total exports, I am sure I am not ignoring other important channels of adjustment.

Column 1 of Table 10 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,[13] 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}*$D2_i$ at the bottom of Table 10. 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

[13]The negative coefficient for R_{it} is due to the fact that it takes value 1 also for the central region starting in 2007. In other words, the regression considers as treated postal codes which did not receive foreign cross-border workers and did not experience trade growth. Indeed, when running the same regression without the interactions with the time-to-border dummies the same coefficient turns positive, meaning that most of the positive effect is driven by treated postal codes.

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 contrast, 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 indirect effects should be unlikely because Switzerland is a small open economy and the robustness checks provide evidence that direct effects should not be an issue, given the difference-in-differences setting, I cannot entirely rule out the existence of general-equilibrium forces that can potentially affect the control postal codes. Under milder assumptions, I quantify that the difference in export growth in the period 1996-2010 between the border and central localities would have been almost half of the observed, i.e., 8 instead of 18 percentage points[14] without the implementation of the AFMP.

Table 10: 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
R_{it}+R_{it}*$D1_i$	0.0548^{a}		
R_{it}+R_{it}*$D2_i$	-0.0004		

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.

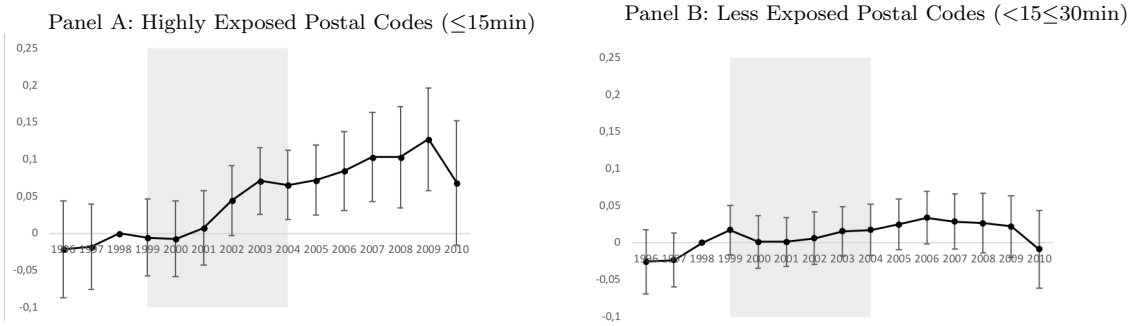
[14]This is given by the difference between the growth of the border region postal codes, 97%, and that of the central postal codes, 79%

This empirical specification provides lower-bound estimates of the AFMP for two reasons. First, it does not account for possible anticipatory effects between 1999 and 2004. Second, it considers as treated from 2007 onwards the postal codes located in the CR between 15 and 30 minutes from the border, which experienced increases in the share of CBW that are close to zero. To assess the importance of these factors, in column 2 of Table 10 I restrict the analysis to the border region and the years before 2007, and in column 3 I add the interaction between a dummy that identifies the years 1999 to 2003, A_t, with the time-to-border dummies.[15] As expected, the coeffients increase in magnitude, suggesting that my results are not driven by any unobserved shock that had differential effects on the treated and control postal codes depending on the distance from the border (such as the Great Trade Collapse). Moreover, they further confirm 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. This does not mean that RI cannot have a positive effect on exports in general. In the context of the AFMP, most of the variation arises from CBW. For them, the Swiss labor market liberalized before, and following the opening, their skill composition became more skilled and their presence increased disproportionally more close to the border. Instead RI were liberalized after, their increase was more modest, their presence was more geographically spread across the country and their skill composition did not change following the implementation of the AFMP. For these reason, I am unable to identify a sizeable effect for RI workers. Replicating the same specification clustering standard errors at the postal-code level (Table A-3 in the appendix), the coefficients' statistical significance is only marginally different.

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. (2021) 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 10 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., 2021), which is equal to 0.0023. In other words, an increase of one percentage point in the number of foreign workers, which corresponds

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

Figure 6: 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.

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.

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-4 and A-5 in the appendix present the results. Panel A of Figure 6 provides their visual representation for the localities within 15 minutes of the border, 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 2003, 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 observed in 2003 (with respect to full implementation in 2004) is reasonably due to the less stringent handling of the application process highlighted in section 2 (Beerli and Peri, 2017).

Other potential threats to identification include the implementation of other concurrent agreements together with the AFMP, the existence of heterogeneous supply or demand shocks, and the relocation of firms from control to treated areas. In Appendix B, I show that removing from the estimation sample all the products included in these agreements, and including controls for demand and supply shocks results remain unchanged. Moreover, always in Appendix B, I provide evidence that the extent of heterogeneous supply or demand shocks is very limited, and the relocation of firms did not take place. Finally, I use a placebo exercise to show that the results do not derive from random noise, and I test their robustness to alternative clustering strategies for the standard errors, to weighting observations by population size, and to controlling for the export propensity of each postal code.

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?

Bahar and Rapoport (2018) and Orefice et al. (2021) argue that there are two main channels for migrants to promote exports.[16] The first is called *"network effect"* and it is related to the origin-specific information that migrants bring in terms of language, tastes, culture, and institutions that can affect the ability to reach foreign consumers (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) and $OtherEU25_c$ for EU25 countries which are not border countries.[17] The reference category is, in both cases, extra-EU25 destinations, which

[16] I consider the diversity channel highlighted in Orefice et al. (2021) to have an effect only in the long run and thus not playing a role in my setting.

[17] Please, note that the regressions are fully saturated with all the possible interactions.

means that when using the interaction with Border$_c$, I exclude from the estimation Other EU25$_c$ countries, and the opposite when using the interaction with Other EU25$_c$. Table 11 shows that all these interactions are negative or non-significant. This means that exports grew less or at the same pace with respect to destinations from which foreign workers came than for extra-EU25 destinations. In other words, the differential increase in exports of localities close to the border did not direct more toward the countries from which the foreign workers came.[18] 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 that this does not mean that exports toward border or other EU25 destinations decreased. The sums of the relevant coefficients at the bottom of Table 11 are always positive with respect to border destinations and positive or not statistically different from zero with respect to other EU25 destinations. These results suggest that the AFMP had an overall positive effect also for border and other EU25 countries, but smaller than for extra-EU25 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., 2022; Olney and Pozzoli, 2021).

The second mechanism is called *"knowledge diffusion"* and relates higher exports to the fact that immigrants bring new skills and knowledge that can improve productivity of firms and boost exports worldwide (Bahar and Rapoport, 2018; Orefice et al., 2021; Bahar et al., 2022). Since the AFMP led to a sharp increase in the stock of foreign skilled workers in Switzerland, this might be the relevant channel. Indeed, Beerli et al. (2021) using a similar setting as this paper, find that the productivity of firms affected by the foreign workers inflow increased more than that of unaffected firms. However, Table 11 indicates that the increase in exports was especially directed to distant destinations and Hummels and Skiba (2004), Baldwin and Harrigan (2011), Martin and Mayneris (2015) argue that product quality is a crucial factor for reaching distant destinations. Therefore, in my setting the knowledge brought by the foreign workers could have increased the quality of exported products and helped them reach distant destinations. If this is the case, the positive effect in export values observed in Table 10 should be driven both by quantities and by prices. By decomposing the increase in export

[18]Table A-6 in the appendix shows that the results are similar when standard errors are clustered at the postal-code level.

Table 11: Effect of the AFMP on Exports by Destination Country

		(1)		(2)
Dep. Var.		Log Exp_{ipct}		Log Exp_{ipct}
R_{it}		0.0408^a		-0.0123
		(0.011)		(0.010)
R_{it}*$D1_i$		0.1043^a		0.0826^a
		(0.024)		(0.016)
R_{it}*$D2_i$		0.0201		0.0271^a
		(0.014)		(0.010)
R_{it}*$D1_i$	*$Border_c$	-0.0480^b	*$OtherEU25_c$	-0.0292^b
		(0.020)		(0.013)
R_{it}*$D2_i$	*$Border_c$	0.0187	*$OtherEU25_c$	-0.0266^b
		(0.014)		(0.012)
Observations		3,854,650		5,136,193
R^2		0.7590		0.7591
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$	*$Border_c$	0.0971^a	*Other $EU25_c$	0.0411^a
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$	*$Border_c$	0.0796^a	*Other $EU25_c$	-0.0118

Notes: Even if coefficients are not shown to save space, regressions are fully saturated with all the relevant interactions that are not captured by the locality-product-destination 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. $Border_c$ indicates border countries, Other $EU25_c$ identifies EU25 countries which are not border countries. In the first column other EU25 countries are excluded, in the second column border countries are excluded. 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.

values into quantities and prices (columns 2 and 3 of Table 12), 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,[19] the residual from the OLS estimation of the following demand equation (divided by $\sigma - 1$) using the Swiss data measures the increased amount that localities sell, conditional on prices and demand:

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

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. It is important to highlight that this measure captures much more than just physical quality. It embeds

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

Table 12: 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: Even if coefficients are not shown to save space, regressions are fully saturated with all the relevant interactions that are not captured by the locality-product-destination and year 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 and BACI.

more generally the effectiveness of a postal code to sell a particular product in a certain destination, such as the capacity to reach customers or the capability to meet clients' taste. Therefore, it should be interpreted as a broad measure of quality. Column 4 of Table 12 shows that Swiss products produced in these localities were more appealing after the implementation of the Swiss-EU agreement.[20] Therefore, quality upgrading is a key mechanism by which foreign workers made exports grow.

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. While

[20]Table A-7 in the appendix shows that the results are similar when clustering standard errors at the postal code level.

Cristelli and Lissoni (2020) find an increase in R&D personnel and in the patent activity following the AFMP, 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.[21] Column 5 of Table 12 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.[22] I run the same specification as in Table 10 with import values, quantities and prices as dependent variables. Columns 1–3 of Table 13 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, meaning that there is evidence of a differential increase in the quality of imported inputs. Instead, for localities lowly treated, i.e., 15 to 30 minutes from the border, the coefficient on prices is negative and significant, meaning that the average quality of imported inputs decreased with respect of those of the control group. The sums of the coefficients of R_{it} with either $D1_i$ or $D2_i$ at the bottom of Table 13 imply that the AFMP led to an increase in imports for treated

[21] Using BACI data from CEPII for 1995, I follow Balassa (1965) and construct the revealed comparative advantage (RCA) index as the ratio between the share of exports of product p for country c divided by the world's ratio of exports of the same product: $\left(Exp_{cp}/\sum_p Exp_{cp}\right) / \left(\sum_c Exp_{cp}/\sum_c\sum_p Exp_{cp}\right)$. CA_p^{Bord} takes value one if the RCA index takes a value higher than one for product p for one of the Switzerland border countries.

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

postal codes, however, it is mostly driven by an increase in prices (i.e., quality) for the localities within 15 minutes from the border, while it is driven by quantities for those between 15 and 30 minutes from the border, and accordingly, prices fall.

To understand which products and countries are driving the increase in prices, I interact R_{it}*$D1_i$ and R_{it}*$D2_i$ with a dummy identifying intermediates products arriving from border countries.[23][24] Results in column (4) of Table 13 show that this interaction is positive, meaning that intermediate products arriving from border countries are those that contributed the most in the increase in input prices. Restricting further the intermediate products to those that are used in the production of exported products increases marginally the magnitude of the coefficient in column (5) of Table 13.[25] These results suggest that most of the increase in the quality of inputs (measured as unit prices) for the postal codes located within 15 minutes from the border arose from intermediate products arriving from border countries. While the interactions are also positive for the postal codes 15 to 30 minuets from the border, when summing the appropriate coefficients at the bottom of Table 13, it is clear that the AFMP increased significantly prices only for the highly treated postal codes. Finally, to show that the origin of the intermediates is crucial, I check whether inputs arriving from EU25 countries (excluding the border ones) show the same patterns. Results in column (6) of Table 13 reveal that intermediate inputs arriving from other EU25 countries did not contribute to the increase in the price of intermediate inputs for the highly treated postal codes. Therefore, 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. Instead, intermediate inputs arriving from different origins did not play a role for the highly treated postal codes. Clustering standard errors at the postal-code level (Table A-8 in the appendix) does not change the results.

The crucial point after observing that input prices increased especially for the postal codes in which export values and quality increased, is to understand whether there is a causal link that goes from the quality of inputs to the quality of exports. The issue that I

[23]The definition of intermediate products follows the EU classification based on the European Commission Regulation No 586/2001 (March 26, 2001). This distinguishes products into intermediate, capital, consumer durable, consumer non-durable, and energy.

[24]I prefer keeping the border countries together and not present the results dividing them in order to avoid possible misinterpretations or misuse of significant or non-significant coefficients due to the salience of the migration issue in the Swiss context.

[25]To identify those intermediate products that are used in the production of exported products, I use information on the IO table for Switzerland in 2000 (the first available). Since IO tables are quite aggregated and account for only 22 products, the difference between all imported inputs (column 4 of Table 13) and those that are actually used for the exported products is small (column 5 of Table 13).

Table 13: 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}
R_{it}	-0.0279^a	-0.0350^a	0.0071^a	-0.0202^a	-0.0200^a	0.0018
	(0.005)	(0.005)	(0.002)	(0.003)	(0.003)	(0.002)
R_{it}*$D1_i$	0.0468^a	0.0315^a	0.0153^a	0.0088^b	0.0086^b	0.0165^a
	(0.007)	(0.008)	(0.003)	(0.004)	(0.004)	(0.003)
R_{it}*$D2_i$	0.0415^a	0.0525^a	-0.0110^a	-0.0275^a	-0.0275^a	-0.0124^a
	(0.006)	(0.007)	(0.003)	(0.004)	(0.004)	(0.003)
R_{it}*$D1_i$*Interm&$Border_{pc}$				0.0193^a		
				(0.005)		
R_{it}*$D2_i$*Interm&$Border_{pc}$				0.0276^a		
				(0.005)		
R_{it}*$D1_i$*IntermExp&$Border_{pc}$					0.0197^a	
					(0.005)	
R_{it}*$D2_i$*IntermExp&$Border_{pc}$					0.0278^a	
					(0.005)	
R_{it}*$D1_i$*IntermExp&$OtherEU25_{pc}$						-0.0048
						(0.008)
R_{it}*$D2_i$*IntermExp&$OtherEU25_{pc}$						0.0195^a
						(0.008)
Obs.	13,466,440	13,466,440	13,466,440	8,174,392	8,174,392	9,908,975
R^2	0.7001	0.8253	0.8892	0.8770	0.8770	0.8808
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&$Border_{pc}$				0.0078^a		
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*Interm&$Border_{pc}$				-0.0201^a		
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$*IntermExp&$Border_{pc}$					0.0083^a	
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*IntermExp&$Border_{pc}$					-0.0197^a	
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$*IntermExp&$OtherEU25_{pc}$						0.0135^a
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*IntermExp&$OtherEU25_{pc}$						0.0089^a

Notes: All regressions are fully saturated with all the relevant interactions that are not captured by the locality-product-destination 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. Interm&$Border_{pc}$ identifies intermediate products imported from border countries, IntermExp&$Border_{pct}$ indicates intermediate products imported from border countries used in the production of exported products and IntermExp&$OtherEU25_{pc}$ the same but for EU25 countries which do not share a border with Switzerland. 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.

need to tackle for providing causal estimates, is related to the endogeneity between input and output prices. My strategy is to test whether growth in the price of the intermediate inputs used for the production of a specific exported product is differentially related to export price and quality growth of that product across treated and control postal codes. If the omitted variable (or the simultaneity) driving both import and export prices affects symmetrically both the treated and the control localities (i.e., it is orthogonal to the shock), the endogeneity issue is actually solved. Since I am comparing exactly the same intermediate inputs and exported products (also in terms of destination or origin country) across treated and control postal codes, the likelihood that my results are capturing shocks which vary within Switzerland and are correlated with the distance from the border and the time implementation of the AFMP should be rather low.

This empirical strategy is implemented using the same the difference-in-difference specification of Table 10 adding the interaction of R_{it}*$D1_i$ and R_{it}*$D2_i$ with the weighted average prices of inputs used in the production of the exported product coming from

border countries, P_{it}^{ior}. The coefficient of R_{it}*$D1_i$*P_{it}^{ior} tells whether, following the implementation of the AFMP, the price (and quality) of the exported product increased due to the quality improvement of inputs coming from border countries for the postal codes within 15 minutes of the border more than for postal codes in the control group. In other words, whether the inputs coming from the border countries are responsible for the increase in the quality of exported products. Instead, R_{it}*$D2_i$*P_{it}^{ior} checks whether the same applies for the postal codes located 15 to 30 minutes from the border. Indeed, columns (1) and (3) of Table 14 indicate that intermediate inputs quality growth from border countries is related to a differential increase in the unit values and perceived quality of exported products for the highly treated postal codes.

To check whether the estimation is contaminated by the fact that there are inputs which come from different origin countries that are not included in the regressions, I add in columns (2) and (4) of Table 14 another interaction of R_{it}*$D1_i$ and R_{it}*$D2_i$ with the weighted average prices of inputs coming from origins different from border countries, P_{it}^{iot}. Results clearly show that only the increase in price of intermediates that come from origin countries are positively related to increases in prices and quality of products exported from the localities within 15 minutes from the border.[26] While the estimated differential effects are small, this exercise provides evidence that higher-quality inputs are related to the increase in the quality of exported products. This is an important result because it suggests that the increase in the quality of inputs fostered by foreign workers had an impact on the quality of exports. The sums of the relevant coefficients at the bottom of Table 14 confirm this interpretation and 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 broad measure of quality in columns (3) and (4), the same interaction remains positive and significant, meaning that other channels can be at play.

A possible issue with these results is that they might be driven by the low disaggregation of the product classification present in the IO table for Switzerland used to connect imported inputs to exported products. In other words, I might be considering as inputs products which are not, thus polluting my estimations. In order to better match input with outputs, I use the US IO tables made available by the Bureau of Economic Analysis. These account for more than 400 products and allow me to refine the analysis. Results in Table A-9 in the Appendix are very similar to those of Table

[26] Clustering standard errors at the postal-code level does not change the results (Table A-10).

Table 14: 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

Notes: All regressions include locality-product-destination and time fixed effects and all the interactions of D1, D2, and R_{it} 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.

14: prices of inputs used for the production of exported products coming from border countries are positively related to higher prices and perceived quality of exported products, while those coming from other countries are not. Therefore, my findings are consistent with a story in which 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.

These results provide evidence of a new mechanism by which foreign workers can affect trade. Since Gould (1994) researchers have concentrated on three possible mechanisms: the information or network channel, the knowledge diffusion channel, and the taste channel. The first is related to trade-relevant information that foreigners provide 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, 2021; Parsons and Vézina, 2018; Bahar et al., 2022), but my results show that it is less relevant in a setting where trade occurs mostly among developed countries. The second highlights the importance of the skills and production knowledge that immigrants can use to boost productivity and then exports. The third focuses on 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.[27] Better intermediate inputs improve the quality of the resulting output (as also demonstrated in different settings by Kugler and Verhoogen, 2012; Manova and Zhang, 2012; Bastos et al., 2018), making these products more appealing for international markets, and increasing exports especially in distant destinations.[28] 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), and the diffusion of broadband internet analyzed by Malgouyres et al. (2019). At the same time, my results permit to understand further the knowledge diffusion and taste mechanisms, in that they show that part of the bias toward home-country products is due to better information about better-quality intermediates and that the knowledge that they provide to improve productivity and exported products can also be related to their origin country. Finally, it is important to highlight that the mechanism that I find is not related to be within the same firm only. My analysis also captures more generally the positive effect of having access to higher quality inputs imported by other firms within the same postal code and then re-sold to exporters that use them to produce exported products. This means that my estimates provide a lower bound of the positive effect of foreign workers, because my setting does not allow to capture the same mechanism when the importer and the exporter are in different postal codes.

Using the implementation of the AFMP, Beerli et al. (2021) find that foreign workers increased the sales and productivity of Swiss firms. The results of this paper help understanding further these dynamics by showing that part of the increase in sales is due to higher exports, and part of the increase in productivity could be attributable to better intermediate inputs. Finally, my findings 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.

[27] Bernard et al. (2019) show that also domestic workers' mobility can be instrumental to finding better intermediate inputs.

[28] See Hummels and Skiba (2004); Baldwin and Harrigan (2011); Martin and Mayneris (2015) for an explanation of why quality helps selling to distant destinations.

5.3 Discussion

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

- *Constrained firms*

Suppose that due to immigration restrictions, Swiss firms were not able to hire enough workers and thus operated at an inefficient scale before the agreement with the EU. 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. Moreover, if a minimum scale is required for producing higher-quality goods, this could also explain both the input and output quality growth. Indeed, the findings of Beerli et al. (2021) show that the AFMP led to increased productivity for firms which reported to have difficulties to recruit skilled workers. However, firms had margins to hire more since quotas were never attained (Secretariat d'Etat, 2017), and 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. This does not mean that this mechanism did not play a role in the context of the AFMP; my findings just suggest that this is not likely to be the main channel for trade growth.

To dispel this potential threat, I run the same regressions as in Table 14 excluding either all the postal codes in which there is at least one firm that declared to have difficulties in hiring high-skilled workers or the industries in which the share of firms declaring to have difficulties in hiring high-skilled workers is higher than the median, i.e., 10%. This information was kindly provided by Beerli et al. (2021) and is based on the Swiss Innovation Surveys of 1996 and 1999. Table A-12 in the Appendix shows that the interaction R_{it}*$D1_i$*P_{it}^{ior} is positive and significant both for prices and the perceived quality, while R_{it}*$D1_i$*P_{it}^{iot} is never significant. Therefore, despite the huge loss in the number of observations, my results hold excluding from the analysis either the postal codes with skilled constrained firms or the sectors in which at least 10% of firms declared to have issues in hiring high-skilled workers in the years 1996 and 1999. In other words, the increase in export prices and perceived quality does not seem to be driven by postal codes or sectors with constrained firms.

- *Wage Differences*

One could argue that wage differences between Switzerland and the border countries could be driving the increased number of high-skilled CBW, and thus, the increase in exports due to a selection effect in which the best foreign minds helped improving products and boosted exports. This is entirely in line with my results, however, wages remained relatively stable for foreign workers during the period of analysis (Beerli et al., 2021), thus it is the AFMP which was instrumental to the increase in their presence. Moreover, my paper does not aim to explain why these foreign workers arrived, but rather to understand the consequences of their arrival. In this respect, the merit of my analysis is to show how these foreign workers helped improving products, and explain the mechanisms of the increase in trade.

- *Economic geography forces*

Labor market pooling, the presence of intermediate input suppliers and knowledge spillovers stimulated by the implementation of the AFMP can potentially generate agglomeration economies inducing firms to increase output quality, boost export growth and import higher quality inputs. While these mechanisms do not explain why the higher quality of inputs comes from the origin country of the new foreign workers, I still provide evidence that they are not an issue in my case, by adding to the specification of Table 14 labor-market area trends that should capture the economic geography forces, together with any labor market-wide demand and supply shocks.[29] Results in Table A-13 in the Appendix are very similar to those in the main specification. Only the growth in the price of inputs coming from border countries are positively related to export prices growth. Therefore, while economic geography forces might have played a role following the implementation of the AFMP, they do not look like they represent the main force behind the increase in export quality.

- *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

[29]The labor market areas are the MS regions defined by the Swiss Federal Statistical Office.

quantities of exports. Therefore, my result cannot be driven by an increase of wages in border countries.

- *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-11 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 and the number of Swiss CBW residing in Switzerland and working in one of the border countries is rarely bigger than 10 people. 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.

- *Multi-Establishment Firms*

One intriguing aspect of my results is that the flow of information seem not to have reached the postal codes in the central regions in the years after the full implementation

of the AFMP. This is particularly puzzling taking into account that some firms have multiple-establishments within Switzerland, and thus information should be able to frictionlessly flow at least within the same firm across different postal codes. The reason why this did not happen is that multi-establishment firms that have subsidiaries both in treated and control postal codes are few, less than 1% of firms in Switzerland, and even if they are big (they employ about 25% of full time workers), 95% of them are in services sectors such as finance, insurance and retail. Thus, they have little to do with importing and exporting goods, and that is why we do not observe the manufacturing-specific information flowing from the border to the central region. Instead, these type of dynamics should be probably present for trade in services. However, the analysis is not possible because disaggregated data is not accessible to researchers outside the Swiss National Bank.

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.[30] 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 15 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 15 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,

[30] CN_j takes value zero if the firm is French.

Table 15: Chinese and French Export Unit Values to Switzerland

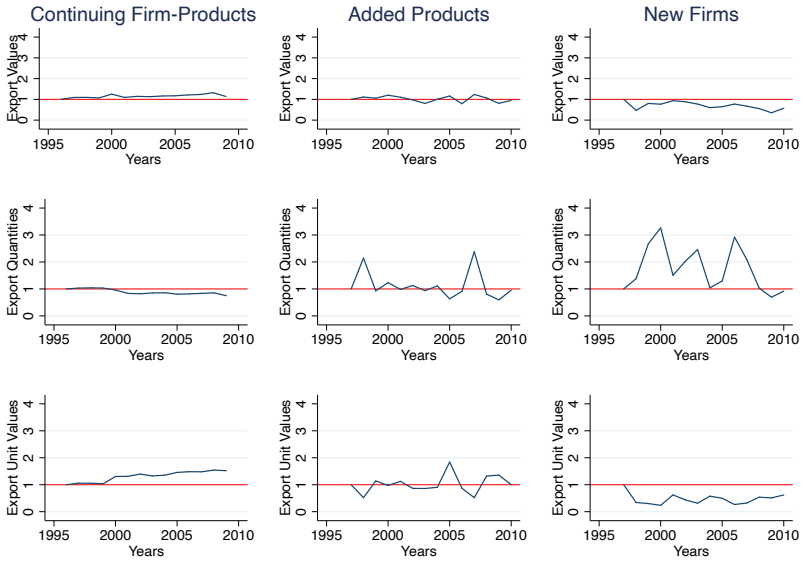
	(1) Log P_{jpt}	(2) Log P_{jpt}
T_{pt}*CN_j	-0.3010^a	
	(0.049)	
$T2_{pt}$*CN_j		-0.2830^a
		(0.047)
Observations	1,106,732	1,106,732
R^2	0.881	0.881

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.

Figure 7 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.[31] The first row of Figure 7 shows that French exports of intermediate products to Switzerland increased only modestly during the period of 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-1 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 15 might thus be explained by the fact that continuing firm-products

[31] 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.

Figure 7: 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.

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 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

Table 16: Chinese and French Imports from Switzerland

	(1) Log Imp_{jpt}	(2) Log Q^{Imp}_{jpt}	(3) 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.

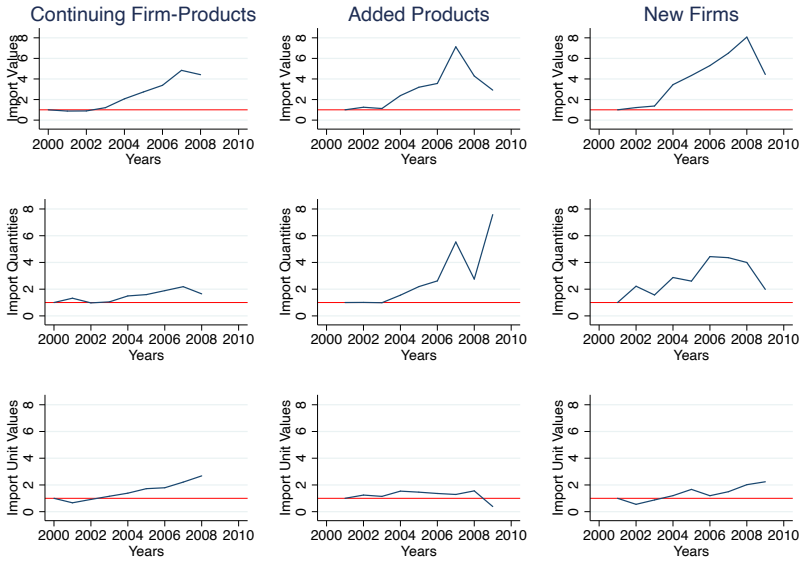
products or to an increase within the same customer-product pairs. To find evidence of the differential trend, I regress the log import values, quantities or unit values from Switzerland of firm j, product p and year t, Log Y_{jpt}, on the interaction between a dummy that identifies years from 2004, 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 16 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.

To disentangle aggregate imports growth of Chinese firms from Switzerland, I divide them into: new products, new firms and continuing firm-products. Figure 8 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 imports from established buyer-

Figure 8: 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.

seller relations and from new Chinese customers.[32] 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-2 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 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

[32]While Chinese imports show an increase also on the extensive margins, the results in the previous sections highlight that these margins did not show a differential role between treated and control localities. This means that they should not be attributable to the implementation of the AFMP.

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 localities find higher-quality intermediate inputs from their origin countries by intensifying their relation with existing foreign suppliers. Better intermediates are associated to increased appealing of Swiss products and 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, A., Ozg uzel, C., and Rapoport, H. (2022). Migration and Knowledge Diffusion: The Effect of Returning Refugees on Export Performance in the Former Yugoslavia. *The Review of Economics and Statistics*, pages 1–50.

Bahar, D. and Rapoport, H. (2018). Migration, Knowledge Diffusion and the Comparative Advantage of Nations. *Economic Journal*, 128(612):273–305.

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

Baldwin, R. and Harrigan, J. (2011). Zeros, Quality, and Space: Trade Theory and Trade Evidence. *American Economic Journal: Microeconomics*, 3(2):60–88.

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.

Bastos, P., Silva, J., and Verhoogen, E. (2018). Export Destinations and Input Prices. *American Economic Review*, 108(2):353–392.

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. (2021). The Abolition of Immigration Restrictions and the Performance of Firms and Workers: Evidence from Switzerland. *American Economic Review*, 111(3):976–1012.

Bernard, A. B., Moxnes, A., and Saito, Y. U. (2019). Production Networks, Geography, and Firm Performance. *Journal of Political Economy*, 127(2):639–688.

Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How Much Should We Trust Differences-In-Differences Estimates? *The Quarterly Journal of Economics*, 119(1):249–275.

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.

Cardoso, M. and Ramanarayanan, A. (2019). Immigrants and Exports: Firm-level Evidence from Canada. Technical report.

Cristelli, G. and Lissoni, F. (2020). Free Movement of Inventors: Open-Border Policy and Innovation in Switzerland. Paper 104120, MPRA.

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

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.

Henneberger, F. and Ziegler, A. (2011). Empirische Uberpr ufung des Auftretens von Lohndruck aufgrund des Immigrationsdrucks aus den EU17/EFTA-Mitgliedstaaten. Diskussionspapiere des Forschungsinstituts fur Arbeit und Arbeitsrecht an der Universit at St. Gallen 125, University of St. Gallen.

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

Hummels, D. and Skiba, A. (2004). Shipping the Good Apples Out? An Empirical Confirmation of the Alchian-Allen Conjecture. *Journal of Political Economy*, 112(6):1384–1402.

Javorcik, B. S., Özden, Ç., Spatareanu, M., and Neagu, C. (2011). Migrant Networks and Foreign Direct Investment. *Journal of Development Economics*, 94(2):231–241.

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.

Kugler, M. and Rapoport, H. (2007). International Labor and Capital Flows: Complements or Substitutes? *Economics Letters*, 94(2):155–162.

Kugler, M. and Verhoogen, E. (2012). Prices, Plant Size, and Product Quality. *Review of Economic Studies*, 79(1):307–339.

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.

Malgouyres, C., Mayer, T., and Mazet, C. (2019). Technology-induced Trade Shocks? Evidence from Broadband Expansion in France. CEPR Discussion Papers 13847, C.E.P.R. Discussion Papers.

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. (2021). The Impact of Immigration on Firm Level Offshoring. *The Review of Economics and Statistics*, 103(1):77–195.

Orefice, G., Rapoport, H., and Santoni, G. (2021). How Do Immigrants Promote Exports? Working papers 2021-06, CEPII research center.

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.

Peri, G. and Raquena-Silvente, F. (2010). The Trade Creation Effect of Immigrants: Evidence from the Remarkable case of Spain. *Canadian Journal of Economics*, 43(4):1433–1459.

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.

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

Table A-1: Descriptive Statistics

	Obs	Mean	Std. Dev.	Min	Max
Kg Imports	16,378,801	38,904	2,903,457	0.001	2.42e+09
Value Imports (CHF)	16,378,801	124,403	3,673,972	1,000	3.17e+09
Kg Exports	6,855,255	29,787	810,023	0.001	5.59e+08
Value Exports (CHF)	6,855,255	313,187	5,869,346	1,000	2.13e+09

Notes: This table presents descriptive statistics of EDEC data used for the analysis. Data Source: EDEC.

Table A-2: Imports and Exports by Region Prior to the AFMP

	Border Region			Central
	<15min	15-30min	>30min	Region
Exports	13.91	13.84	13.93	12.80
	(3.18)	(3.29)	(3.37)	(3.30)
Number of Products	2.89	2.83	2.85	2.19
	(1.65)	(1.69)	(1.75)	(1.66)
Number of Destinations	2.19	2.22	2.26	1.76
	(1.37)	(1.38)	(1.40)	(1.37)
Exports per Product-Destination	8.83	8.79	8.82	8.84
	(1.12)	(1.10)	(1.23)	(1.21)
Observations	2,765	2,488	2,625	4,306
	Border Region			Central
	<15min	15-30min	>30min	Region
Imports	14.79	14.64	14.39	13.73
	(2.54)	(2.66)	(2.94)	(2.63)
Number of Products	4.43	4.26	4.05	3.61
	(1.51)	(1.61)	(1.80)	(1.64)
Number of Destinations	2.32	2.33	2.27	2.03
	(0.98)	(0.96)	(1.07)	(0.95)
Imports per Product-Destination	8.04	8.05	8.06	8.08
	(0.79)	(0.78)	(0.89)	(0.83)
Observations	2,905	2,669	3,058	5,046

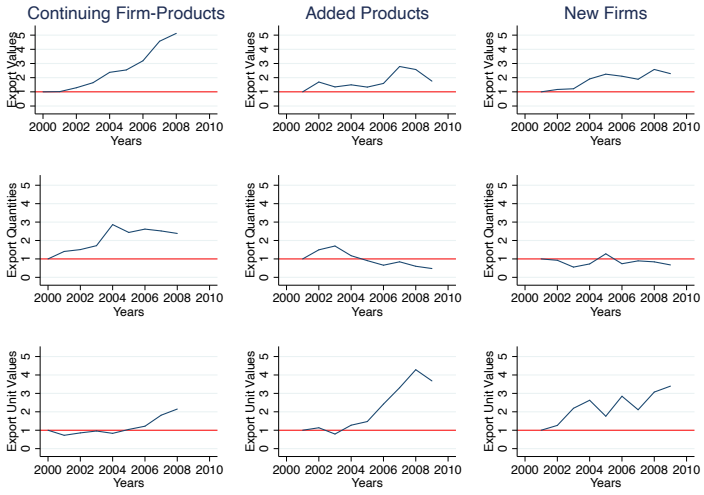
Notes: This table presents the average and standard deviation (in parentheses) for log exports and imports, number of products, number of destinations and average exports per postal code by distance from the border and distinguishing across border and central region of Switzerland for the period 1996-2000. Data Source: EDEC.

Table A-3: Effect of the AFMP on Exports, Standard Errors Clustered at the Postal Code Level

	(1) Log Exp_{ipct}	(2) Log Exp_{ipct}	(3) Log Exp_{ipct}
R_{it}	-0.0185		
	(0.012)		
R_{it}*$D1_i$	0.0733^b	0.0798^a	0.1098^b
	(0.037)	(0.037)	(0.049)
R_{it}*$D2_i$	0.0181	0.0212	0.0430^c
	(0.018)	(0.020)	(0.027)
A_t*$D1_i$			0.0419^c
			(0.024)
A_t*$D2_i$			0.0304^c
			(0.017)
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 level in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

Figure A-1: 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.

Table A-4: 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)
$D1_i * I_t^{1998}$	-	-	-	-
	-	-	-	-
$D1_i * I_t^{1999}$	0.0057	-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 6. 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.

Figure A-2: 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 distin-

Table A-5: 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 6. 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-6: Effect of the AFMP on Exports by Destination Country, Standard Errors Clustered at the Postal Code Level

		(1)		(2)
Dep. Var.		Log Exp_{ipct}		Log Exp_{ipct}
R_{it}		0.0408^{b}		-0.0123
		(0.016)		(0.012)
R_{it}*$D1_i$		0.1043^{c}		0.0826^{b}
		(0.059)		(0.039)
R_{it}*$D2_i$		0.0201		0.0271^{a}
		(0.028)		(0.019)
R_{it}*$D1_i$	*$Border_c$	-0.0480	*$OtherEU25_c$	-0.0292
		(0.046)		(0.022)
R_{it}*$D2_i$	*$Border_c$	0.0187	*$OtherEU25_c$	-0.0266^{b}
		(0.026)		(0.021)
Observations		3,854,650		5,136,193
R^2		0.7590		0.7591

Notes: All regressions are fully saturated with all the relevant interactions that are not captured by the locality-product-destination 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. $Border_c$ indicates border countries, Other $EU25_c$ identifies EU25 countries which are not border countries. In the first column other EU25 countries are excluded, in the second column border countries are excluded. Standard errors clustered at the postal code level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

Table A-7: Decomposition of the Effect of the AFMP on Exports, Standard Errors Clustered at the Postal Code Level

	(1)	(2)	(3)	(4)	(5)
	Log Exp_{ipct}	Log Q_{ipct}	Log P_{ipct}	$\hat{\eta}_{ipct}$	Log Exp_{ipct}
R_{it}	-0.0185	-0.0198	0.0013	-0.0038	-0.0207
	(0.012)	(0.013)	(0.006)	(0.007)	(0.016)
R_{it}*$D1_i$	0.0733^{b}	0.0631^{b}	0.0102	0.0276^{c}	0.129^{a}
	(0.037)	(0.033)	(0.010)	(0.015)	(0.040)
R_{it}*$D2_i$	0.0181	0.0262	-0.0081	0.0006	0.0195
	(0.018)	(0.020)	(0.010)	(0.011)	(0.024)
R_{it}*$D1_i$*CA_p^{Bord}					-0.0949^{a}
					(0.031)
R_{it}*$D2_i$*CA_p^{Bord}					0.0002
					(0.025)
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

Notes: All regressions are fully saturated with all the relevant interactions that are not captured by the locality-product-destination and year fixed effects. Standard errors are robust to hereroskedasticity and clustered at the postal code 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 and BACI.

Table A-8: Effect of the AFMP on Imports, Standard Errors Clustered at the Postal Code Level

	(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}
R_{it}	-0.0279^a	-0.0350^a	0.0071^b	-0.0202^a	-0.0200^a	0.0018
	(0.007)	(0.008)	(0.003)	(0.004)	(0.004)	(0.003)
R_{it}*$D1_i$	0.0468^a	0.0315^c	0.0153^a	0.0088^c	0.0086^c	0.0165^a
	(0.007)	(0.017)	(0.006)	(0.005)	(0.005)	(0.006)
R_{it}*$D2_i$	0.0415^a	0.0525^a	-0.0110^c	-0.0275^a	-0.0275^a	-0.0124^c
	(0.013)	(0.015)	(0.006)	(0.009)	(0.009)	(0.007)
R_{it}*$D1_i$*Interm&$Border_{pc}$				0.0193^b		
				(0.009)		
R_{it}*$D2_i$*Interm&$Border_{pc}$				0.0276^a		
				(0.009)		
R_{it}*$D1_i$*IntermExp&$Border_{pc}$					0.0197^b	
					(0.009)	
R_{it}*$D2_i$*IntermExp&$Border_{pc}$					0.0278^a	
					(0.009)	
R_{it}*$D1_i$*IntermExp&$OtherEU25_{pc}$						-0.0048
						(0.013)
R_{it}*$D2_i$*IntermExp&$OtherEU25_{pc}$						0.0195
						(0.035)
Obs.	13,466,440	13,466,440	13,466,440	8,174,392	8,174,392	9,908,975
R^2	0.7001	0.8253	0.8892	0.8770	0.8770	0.8808

Notes: All regressions are fully saturated with all the relevant interactions that are not captured by the locality-product-destination 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. Interm&$Border_{pc}$ identifies intermediate products imported from border countries, IntermExp&$Border_{pct}$ indicates intermediate products imported from border countries used in the production of exported products and IntermExp&$OtherEU25_{pc}$ the same but for EU25 countries which do not share a border with Switzerland. Standard errors clustered at the postal code level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

Table A-9: 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}	0.0005	-0.0008	-0.0070	-0.0077
	(0.005)	(0.005)	(0.006)	(0.006)
R_{it}*$D1_i$	0.0058	0.0041	0.0267^a	0.0272^a
	(0.006)	(0.006)	(0.008)	(0.008)
R_{it}*$D2_i$	-0.0099^b	-0.0077	0.0014	0.0028
	(0.005)	(0.005)	(0.006)	(0.006)
R_{it}*$D1_i$*P^{ior}_{it}	0.0012^a	0.0011^a	0.0016^a	0.0017^a
	(0.000)	(0.000)	(0.001)	(0.001)
R_{it}*$D2_i$*P^{ior}_{it}	0.0012^c	0.0014^b	0.0004	0.0005
	(0.000)	(0.000)	(0.001)	(0.001)
R_{it}*$D1_i$*P^{iot}_{it}		-0.0016		-0.0023^b
		(0.001)		(0.001)
R_{it}*$D2_i$*P^{iot}_{it}		-0.0038^a		-0.0026^a
		(0.001)		(0.001)
Observations	5,126,779	5,124,244	4,295,159	4,292,930
R^2	0.918	0.918	0.641	0.641
R_{it}+R_{it}*$D1_i$+R_{it}*$D1_i$*P^{ior}_{it}	0.0074^a	0.0024^a	0.0213^a	0.0197^a
R_{it}+R_{it}*$D2_i$+R_{it}*$D2_i$*P^{ior}_{it}	-0.0089	-0.0084	-0.0036	-0.0038

Notes: All regressions include locality-product-destination and time fixed effects and all the interactions of D1, D2, and R_{it} with the dummy indicating the intermediate inputs and P^{ior}_{it} or P^{iot}_{it} 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^{ior}_{it} and P^{iot}_{it} 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^{ior}_{it} are the average prices of intermediates used in the production of exported products imported from border regions and P^{iot}_{it} 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.

Table A-10: Effect of Input Prices on Export Prices and Quality, Standard Errors Clustered at the Postal Code Level

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
	(0.007)	(0.007)	(0.010)	(0.010)
R_{it}*$D1_i$	0.0068	0.0033	0.0250[a]	0.0253[a]
	(0.010)	(0.010)	(0.012)	(0.012)
R_{it}*$D2_i$	-0.0100	-0.0074	0.0002	0.0018
	(0.008)	(0.008)	(0.010)	(0.0010)
R_{it}*$D1_i$*P_{it}^{ior}	0.0016[b]	0.0015[b]	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
	(0.001)	(0.001)	(0.001)	(0.001)
R_{it}*$D1_i$*P_{it}^{iot}		-0.0022		-0.0036[b]
		(0.002)		(0.002)
R_{it}*$D2_i$*P_{it}^{iot}		0.0001		0.0004
		(0.004)		(0.004)
Observations	5,134,111	5,128,745	4,301,751	4,296,997
R^2	0.919	0.918	0.641	0.641

Notes: All regressions include locality-product-destination and time fixed effects and all the interactions of D1, D2, and R_{it} 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 level are in parentheses. [a] p<0.01, [b] p<0.05, [c] p<0.1. Data source: EDEC.

Table A-11: 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.

Table A-12: Effect of Input Prices on Export Prices and Quality, Excluding Constrained Firms

	Excluding high-skilled constrained postal codes				Excluding high-skilled constrained industries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Log P_{ipct}	Log P_{ipct}	$\hat{\eta}_{ipct}$	$\hat{\eta}_{ipct}$	Log P_{ipct}	Log P_{ipct}	$\hat{\eta}_{ipct}$	$\hat{\eta}_{ipct}$
R_{it}	0.0180^a	0.0173^a	0.0060	0.0051	-0.0020	-0.0057	-0.0043	-0.0061
	(0.006)	(0.006)	(0.008)	(0.008)	(0.009)	(0.009)	(0.014)	(0.014)
R_{it}*$D1_i$	-0.0148^c	-0.0228^a	-0.0196^c	-0.0240^b	-0.0127	-0.0250^b	0.0109	0.00734
	(0.009)	(0.008)	(0.011)	(0.011)	(0.012)	(0.011)	(0.013)	(0.014)
R_{it}*$D2_i$	-0.0215^a	-0.0220^a	0.0002	-0.0004	-0.0349^a	-0.0286^a	-0.0135	-0.00838
	(0.007)	(0.007)	(0.009)	(0.009)	(0.011)	(0.010)	(0.013)	(0.014)
R_{it}*$D1_i$*P_{it}^{ior}	0.0045^a	0.0028^b	0.0031^c	0.0021	0.0012^b	0.0010^c	0.0023^b	0.0020^c
	(0.001)	(0.001)	(0.002)	(0.002)	(0.006)	(0.006)	(0.001)	(0.001)
R_{it}*$D2_i$*P_{it}^{ior}	0.0021^a	0.0013	0.0018^c	0.0009	0.0038^a	0.0031^a	-0.0010	-0.0009
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
R_{it}*$D1_i$*P_{it}^{iot}		-0.0000		0.0017		-0.0026		-0.0025
		(0.002)		(0.002)		(0.002)		(0.002)
R_{it}*$D2_i$*P_{it}^{iot}		0.0009		0.0032		-0.0011		-0.0036
		(0.004)		(0.004)		(0.003)		(0.005)
Observations	2,090,921	2,090,416	1,762,318	1,761,918	1,260,988	1,259,606	842,036	841,115
R^2	0.917	0.917	0.655	0.655	0.948	0.948	0.663	0.664

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.

Table A-13: Effect of Input Prices on Export Prices and Quality Controlling for Regional Trends

	(1)	(2)	(3)	(4)
VARIABLES	Log P_{ipct}	Log P_{ipct}	$\hat{\eta}_{ipct}$	$\hat{\eta}_{ipct}$
R_{it}	0.0052	0.0034	0.0032	0.0014
	(0.004)	(0.004)	(0.004)	(0.004)
R_{it}*$D1_i$	-0.0082	-0.0110^b	-0.0003	-0.0035
	(0.006)	(0.006)	(0.005)	(0.006)
R_{it}*$D2_i$	-0.0094^b	-0.0081^c	-0.0098^b	-0.0082^c
	(0.005)	(0.005)	(0.005)	(0.005)
R_{it}*$D1_i$*P_{it}^{ior}	0.0011^a	0.0010^a	0.0014^a	0.0013^a
	(0.000)	(0.000)	(0.000)	(0.001)
R_{it}*$D2_i$*P_{it}^{ior}	0.0018^b	0.0010	0.0019^a	0.0012
	(0.001)	(0.001)	(0.001)	(0.001)
R_{it}*$D1_i$*P_{it}^{iot}		-0.0014		-0.0017
		(0.001)		(0.001)
R_{it}*$D2_i$*P_{it}^{iot}		0.0018		0.0013
		(0.003)		(0.003)
Observations	5,134,111	5,128,745	5,134,111	5,128,745
R-squared	0.919	0.919	0.919	0.918

Notes: All regressions include locality-product-destination and time fixed effects, regional trends in the dependent variable 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 level are in parentheses. ^{a} p<0.01, ^{b} p<0.05, ^{c} p<0.1. Data source: EDEC.

B Robustness Checks

In this appendix section, I test the robustness of the results present in section 4 to a series of potential threats.

B.0.1 Concurrent Agreements

A potential threat to identification is represented by the concurrent implementation of other agreements together with the AFMP. These were signed on different matters: agriculture, international trade, air transport, road transport, mutual recognition of conformity assessment, government procurement, and scientific and technological co-operation. Most of them are not likely to have played a role for international trade, at least in the short term.[33] Instead, the agricultural, 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 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.[34] Column 1 of Table B-2 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.

B.0.2 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

[33]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 from 2002. The air transport agreement extended to Swiss airline companies the same rights of EU carriers. The road transport agreement allowed bigger trucks to circulate in Switzerland and was implemented only in 2008.

[34]The complete list appears in Table B-1.

Table B-1: Products Involved in Concurrent Agreements

HS 2-digit code	**Name**
1-21	Agricultural products
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 B-2: 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}	(8) Log Exp_{ipct}
R_{it}	-0.0047	-0.0236^{b}	-0.0197^{b}	-0.0157	-0.0157	-0.0157	-0.0265^{c}	-0.0167^{c}
	(0.014)	(0.009)	(0.009)	(0.012)	(0.010)	(0.011)	(0.014)	(0.010)
R_{it}*$D1_i$	0.0793^{a}	0.0565^{a}	0.0524^{a}	0.0729^{b}	0.0729^{a}	0.0729^{c}	0.0603^{b}	0.0769^{a}
	(0.023)	(0.013)	(0.012)	(0.037)	(0.020)	(0.040)	(0.024)	(0.016)
R_{it}*$D2_i$	0.0087	0.0342^{a}	0.0316^{a}	0.0199	0.0199	0.0199	0.0444^{a}	0.0215^{b}
	(0.014)	(0.010)	(0.010)	(0.018)	(0.013)	(0.013)	(0.016)	(0.010)
Obs.	2,623,422	4,488,926	4,488,926	5,136,193	5,136,193	5,136,193	5,136,193	5,128,191
R^2	0.7672	0.7950	0.7956	0.7589	0.7589	0.7589	0.7550	0.7588

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 is weighted by population size in 1990 and column 8 adds to the baseline specification the interaction between the export propensity (exports per capita in 1996) and time dummies. 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 and 7-8, 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.

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 have similar consequences for my estimates. To control for general demand shocks, I added to the main specification destination-product-year fixed effects. Results in column 2 of Table B-2 show that the results are very similar to the main specification, thus my results are not driven by demand shocks such as an exchange rate appreciation. The only 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. 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.[35] This exercise is 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 B-3 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.

Table B-3: 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.

In the second exercise, I added to the main specification industry-labor market area trends.[36] These 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

[35]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.

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

the border region) and boost exports. Column 3 of Table B-2 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.

B.0.3 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 (i.e., Bertrand et al., 2004). To control for this potential bias, I clustered standard errors at the postal code level (column 4 of Table B-2), at the regional-time level (column 5 of Table B-2), and at the regional level (column 6 of Table B-2). 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.

B.0.4 Weighting by Population or Controlling for the Export Propensity

To check whether results are driven by heterogeneity in the size of each postal code, I weight each postal code by the population of the municipality in 1990 using Census data. In this way, I can also control for the fact that some of the major cities are actually located in the border region. Results in column 7 of Table B-2 show that the results are actually quite similar, with the only difference that also for the postal codes between 15 and 30 minutes from the border the coefficient of R_{it}*$D2_i$ is positive and significant.

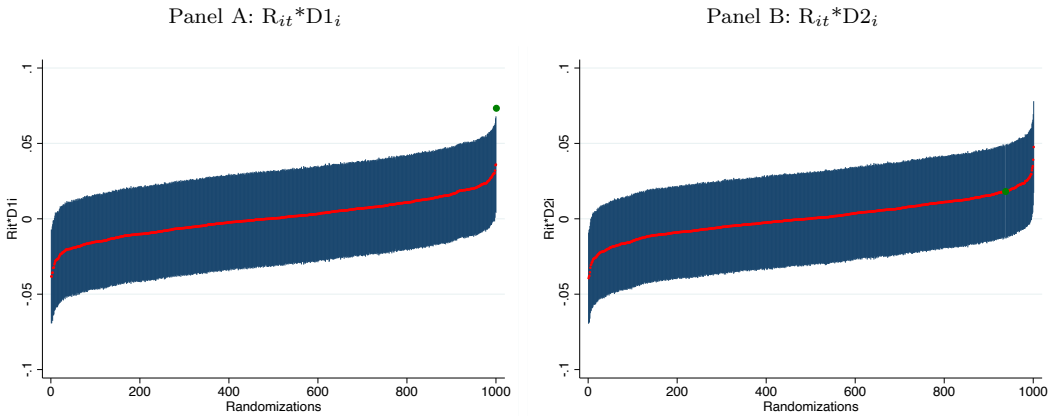
Another related concern is that border postal codes might be more export-oriented, and thus have benefited more from the liberalization for reasons not related to the implementation of the AFMP. Interacting the 1996 export per capita (using the 1990 Census population by municipality) with year dummies, I can control for this issue. Results in column 8 of Table B-2 confirm that R_{it}*$D1_i$ is positive and significant. Therefore, my results do not depend on the heterogeneous impact of the AFMP on postal codes depending on their initial export propensity.

B.0.5 Placebo

To dissipate doubts about the fact that random noise is driving the results, I perform 1000 randomizations of postal codes into treatment. Figure B-1 indicates that the randomization produces a wide range of coefficients, from -0.038 to 0.036 for R_{it}*$D1_i$

and from -0.039 to 0.047 for R_{it}*$D2_i$. The means are positive for both coefficients, but very small, i.e., respectively 0.0003 and 0.0005. Our benchmark coefficient for R_{it}*$D1_i$ in column 1 of Table 10, i.e., 0.0733 (denoted by a green mark), is significant at 99% level and it is out of the 99% confidence interval of the placebo estimates. Instead, the benchmark coefficient for R_{it}*$D1_i$ in column 1 of Table 10, i.e., 0.0181 (denoted by a green mark), is not significant at 99% level and it is inside the 99% confidence interval of the placebo estimates. Therefore, my results for the region within 15 minutes of the border crossing do not come from random noise present in the data but rather from the actual exogenous variation provided by the AFMP.

Figure B-1: Placebo Estimates



Note: Panel A plots the coefficient and confidence interval at 99% level for R_{it}*$D1_i$ for 1000 randomization of postal codes into treatment and panel B plots the same for R_{it}*$D2_i$.

B.0.6 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

Table B-4: 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.

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 B-4 shows indeed, that plant relocation did not differ between treated and control postal codes following the AFMP implementation.