# The Residential Integration of Transnational Regional Economies: Evidence from the 2015 Swiss Franc Appreciation*

Mattia Albertini† Lorenzo Barisone†‡

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**Abstract**

This paper examines how currency shocks, by affecting relative wages, influence cross-border relocation, commuting, and the housing markets in a transnational economy. We leverage the 2015 Swiss franc appreciation as a natural experiment, which affected the Swiss wages relative to those of its neighbors. Using municipal-level data from Switzerland, Italy, and Germany, we estimate a dynamic difference-in-differences regression between border and non-border areas. The results indicate that, after the currency shock, Swiss residents with an European nationality relocated to neighboring countries but maintained employment in Switzerland, turning into cross-border workers. As a result, housing prices in Swiss border areas dropped, while increased in adjacent Italian regions abroad. The results reveal heterogeneity in relocation patterns by the neighboring country, emphasizing the role of each country's conditions in shaping relocation choices, and display a distance gradient. The evidence suggests that shocks in international wages affect migration and housing demand in strategic locations, which in turn affects housing affordability for local residents. Stricter cross-border work regulations could encourage long-term migration, and mitigate housing markets distortions.

*JEL Classification*: R23, J61, R30, F31

*Keywords*: residential relocation, cross-border employment, housing prices

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†Institute of Economics (IdEP), Faculty of Economics, Università della Svizzera italiana (USI), 6900 Lugano, Switzerland. (mattia.albertini@usi.ch; lorenzo.barisone@usi.ch).

‡Office of Urban Statistics, City of Lugano, 6900 Lugano, Switzerland. (lorenzo.barisone@lugano.ch).

# 1 Introduction

Transnational economies are regions that span national borders, where economic activities are deeply integrated between neighboring countries.[1] In these areas, geographic proximity, international cooperation and regulation alignment facilitate migration and cross-border commuting, leading to a greater labor market integration. However, unlike national economies, these regions involve neighboring countries with often very different wage structures, tax systems, and especially currencies. As a result, exchange rate fluctuations alter the relative wages between neighboring countries in a closely connected labor market, shaping cross-border migration patterns (Dustmann et al., 2023; Nekoei, 2013).

This is the case of Switzerland, which is part of the Alpine transnational area alongside its neighboring Eurozone (EZ) economies, yet maintains its own currency, the Swiss franc. A set of bilateral agreements between Switzerland and its neighboring Eurozone countries ensures stable labor migration flows within the transnational area, especially by allowing cross-border work; that is, the permission to work in Switzerland without the requirement of residence. As a consequence, an integrated labor market without a common currency leads to substantial wage arbitrage possibilities for cross-border workers: following an appreciation of the Swiss franc against the euro, cross-border workers receive a wage premium as their earnings in Swiss francs are spent in Euros in their home countries. This creates an incentive for workers in the transnational area to pursue cross-border work rather than settle in Switzerland.

It is well established that exchange rate shocks influence migration flows and migrant employment by affecting the immigrant's labor supply (Nekoei, 2013) and by reducing immigrants' reservation wages (Dustmann et al., 2023). Similarly, Bello (2019) shows that cross-border workers respond to changes in the exchange rate by crossing more often the Swiss-Italian border when the exchange rate is favorable. While most of this literature focuses on the relationship between exchange rate and labor market outcomes of migrant workers, relatively less attention has been devoted to the residential choices of these migrants and the role of housing markets in absorbing exchange rate shocks within transnational economies, especially in border regions. If a depreciation of the Swiss franc reduces the real wage premium for cross-border workers, it may dampen housing demand in strategic neighboring Eurozone regions. Conversely, an appreciation of the Swiss franc can intensify the pressure on housing demand, potentially leading to price surges in border municipalities. Understanding these interactions is crucial to foresee affordability concerns, and plan urban development strategies in border areas.

This paper examines how currency shocks, by affecting relative wages, influence cross-border relocation, and its implication on international commuting and housing. As a case study, we exploit the Swiss National Bank's (SNB) unexpected removal of the Euro/Swiss franc (EUR/CHF) exchange rate floor in January 2015, which triggered a sharp appreciation of the Swiss franc, effectively increasing Swiss wages relative to those in the Eurozone. Using detailed data on migration flows, employment, and real estate prices from Switzerland, Italy, and Germany we leverage distance from the Swiss border to investigate the relocation decision of long-term migrants in Switzerland. Our findings indicate that this economic shock significantly affected the residential patterns of long-term migrants coming from the Eurozone (EZ residents), who sought to capitalize on higher Swiss wages while benefiting from lower living costs in neighboring countries. Instead of residing in Switzerland, migrants opted to relocate across the border while maintaining employment in Switzerland, leading to an increase in cross-border work, a decrease in housing prices in Switzerland, and an increase in adjacent Eurozone municipalities.

[1] International cooperation programs, such as the European Cross-Border cooperation, known as Interreg A program, play a fundamental role in the identification and development of European transnational areas by promoting cross-border integration in key sectors such as innovation, healthcare, education, and employment. The official definition includes 12 areas in Europe: Alpine area, North Sea area, North West Europe area, Northern Periphery area, Baltic Sea area, Atlantic area, Danube area, Central Europe area, Adriatic-Ionian area, Balkan-Mediterranean, South West Europe area, and the Mediterranean area. See Table A.1 to see the full member countries' list.

In more detail, using a dynamic difference-in-differences approach, we analyze the impact of the 2015 Swiss franc appreciation on employment, cross-border work, migration flows, and housing prices between areas within 20 km from the Swiss border and those further away. Swiss municipalities within 20 km saw a significant increase in cross-border workers of about 5% while total employment did not change. In these border areas, we also observed a 1.5% decrease in foreign working-age residents and a 1.7% reduction in housing prices per square meter, consistent with the residential relocation of these workers to the Eurozone, maintaining their jobs on the Swiss side. This trend is particularly pronounced at the Swiss-Italian and Swiss-French border, where the substitution between cross-border workers and residents and the decrease in housing prices were more significant. By contrast, the municipalities at the Swiss-German border do not show evidence of relocation and display a reverse pattern. To validate these different spatial results we estimate the impact of the policy in Italy and Germany. On one hand, Italian municipalities within 20 km from the Swiss border experienced an increase in immigration from Switzerland of more than 5% and a 3% increase in housing prices. On the other hand, Germany witnessed 1.1% lower migrations from Switzerland, and the German real estate market remains unaffected. The results on migration and housing prices suggest that residential relocation is in place only at the Swiss-Italian border. We complete the analysis evaluating the spatial gradient in the house prices and migration patterns by distance from the border at the Italian and the Swiss border. The results show that the effect on housing prices and migrations are magnified the closer to the border in both Switzerland and Italy, with more pronounced effects within 5 km from the border.[2]

This study contributes to the literature on the determinants of workers' migration such as wage differentials (Dustmann, 2003; Todaro, 1969), exchange rates (Bello, 2019; Dustmann et al., 2023; Nekoei, 2013; Nguyen and Duncan, 2017) and migratory restrictions (Beerli et al., 2021; Dustmann et al., 2017). A study relevant to our analysis is provided by Beerli et al. (2021), that also inspired our estimation strategy. The authors find that the abolition of migratory restrictions on cross-border work in Switzerland led to an increase in cross-border workers and an expansion of the Swiss labor market. Our study of the 2015 Swiss franc appreciation build on this result and investigates the role of residential choice for cross-border workers. Further, we extend our analysis by identifying the neighboring nation as a key source of heterogeneity, as incentives for cross-border work are dependent on the labor market and fiscal conditions of the neighboring nation. We also build on a smaller yet growing strand of this migration literature that explores how exchange rate volatility shapes migration decisions (Bello, 2019; Nekoei, 2013; Nguyen and Duncan, 2017). For example, Bello (2019) finds that Swiss franc appreciations increase cross-border employment at the Swiss-Italian border and interprets it as an increase in labor supply. By providing evidence on relocation, our analysis shows that changes in cross-border workers do not necessarily reflect changes in the labor supply but only changes in the residence permits.

We also contribute to the literature investigating the economic effects of the Swiss franc exchange rate shock in 2015, by highlighting the impacts on residential relocation and the real estate markets. Much of the existing research focuses on the effects of currency fluctuations on labor demand and tradable goods (Auer et al., 2019; 2021; Cavallo et al., 2021; Colella, 2022; Kaufmann and Renkin, 2017), less attention has been given to cross-border relocation, and therefore employment composition, and housing markets reactions. For example, Auer et al. (2019) and Auer et al. (2021) document that the 2015 Swiss franc appreciation led to partial pass-through effects on prices of tradable goods, resulting in a real price shock in Switzerland. However, the consequences for relocation and hence house prices are still unclear. Our study fills this gap by showing how stronger Swiss wages, following the Swiss franc appreciation, affected relocation, which led to changes in housing demand and prices in border municipalities. Unlike previous research on the 2015 Euro/Swiss franc shock, such as Kaufmann and Renkin (2017) who identified a negative impact on employment due

[2] This paper focuses on the effects of currency shocks on individual migration and housing markets rather than firm-level responses. While firms also react to exchange rate fluctuations through labor demand adjustments, production shifts, or outsourcing decisions, our study aims to isolate the direct effects of wage differentials on cross-border worker relocation. Firm-level adjustments are beyond the scope of this analysis.

to shifts in labor demand in manufacturing, and Colella (2022), who found a change in skill requirements in high substitutability jobs, our estimation strategy allows us to control for the labor demand effect and to explore its spatial dimension, the residential composition of the workforce, and the real estate impact. We find that the Swiss franc appreciation had no differential effect on employment between border and non-border municipalities, even when comparing the manufacturing sector or import/export concentrated industries. This suggests that firms in border municipalities are not better able to hedge labor demand shocks by exploiting the availability of a larger cross-border labor force. We identify instead that in the absence of labor demand effects, the changes in cross-border employment are compatible with residents' relocation, as stronger Swiss wages are now more attractive when spent in the Eurozone. We then assess these implications for the Swiss, Italian and German housing prices.

Finally, this research contributes to the existing literature on the economic effects of migration on housing markets. Previous studies primarily examine how migration affects house prices in the host country. For example, in the United States, Saiz (2007) finds that a one percent increase in a city's population due to immigration corresponds to approximately a one percent rise in both average rents and housing values. Similarly, Degen and Fischer (2017) observes in Switzerland that a one percent increase in immigration leads to a 2.7% increase in the prices of single-family homes. In Spain, Sanchis-Guarner (2023) demonstrates that a one percent rise in immigration rates leads to about 3.2% increase in house prices. Our research extends this perspective by examining how migration shocks affect the housing markets not only in the host country but also in the home country.

The remainder of the paper proceeds as follows. The first section presents background information on the removal of the 2015 Euro/Swiss franc cap. The second section introduces the data and the research design. The third section presents the main results of the paper and the conclusions.

# 2 Background

## 2.1 The SNB Policy

On January 15, 2015, the Swiss National Bank (SNB) unexpectedly abandoned the Euro/Swiss franc exchange rate's floor (Mirkov et al., 2016) previously fixed at 1.20, transitioning to a fully flexible regime. This abrupt shift in monetary policy caused a sharp appreciation of the Swiss franc.

In the aftermath of the 2008 financial crisis, the Swiss franc experienced significant appreciation against both the euro and the US dollar. To mitigate this appreciation, on September 6, 2011, the SNB set a floor for the Euro/Swiss franc exchange rate at 1.20 and pledged to purchase unlimited foreign currency to maintain this level. Between 2012 and 2015, this intervention stabilized the exchange rate within the 1.20 to 1.24 window, often binding at 1.20. After four years of relative stability, the SNB lifted the floor, announcing that it would no longer artificially keep the Swiss franc low. Overnight, the Euro/Swiss franc exchange rate plunged from 1.20 to 0.98, and fluctuated between 1.05 and 1.15 until 2019.

Figure 1 shows the daily evolution of the Euro/Swiss franc exchange rate and its 3-month forecast, highlighting a significant deviation between predicted and expected values at the start of 2015.[3] The expectations deviate substantially from the actual value at the beginning of 2015, and swiftly adjusting after the shock. The forecast error, shown in Figure A.1 in the Appendix, was minimal before and after the policy shift, but spiked to overestimate the Franc's value by 20% immediately after the shock. Another supporting evidence on the unexpectedness of the policy comes from the KOF Consensus Forecast, which surveys a panel of 20 economists quarterly, asking them to forecast the Euro/Swiss franc exchange rate for the following year. One month before the shock, the average prediction of the economists surveyed was 1.2 Swiss francs per Euro for the following 12 months. These examples illustrate the unexpected nature of the SNB's decision, with markets quickly adjusting to the new reality, as seen in Figure A.2 from Kaufmann and Renkin (2019).

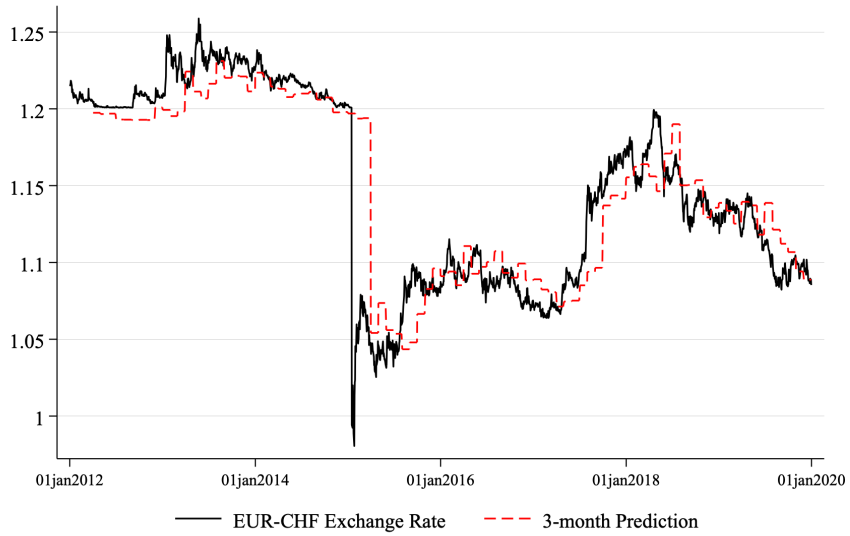
The long-term impact of the SNB's policy is evident from Figure A.3a of the Appendix, which shows the average annual change in the Euro/Swiss franc rate compared to 2014. Following the policy change, the rate remained persistently lower: 12.02% lower in 2015, 10.25% in 2016, 8.5% in 2017, 4.9% in 2018, and 8.4% in 2019. This consistency indicates that markets viewed the SNB's policy as a lasting shift.

The Swiss franc's rapid appreciation made imports cheaper and exports more costly, directly increasing the purchasing power of Swiss salaries. The increase in purchasing power in the nominal average Swiss wage in comparison to 2014 is represented in Figure A.3b of the Appendix. On average, Swiss salaries have gained 15% in purchasing power when spent in the Eurozone. This currency appreciation played a key role in influencing the labor market, particularly by incentivizing cross-border workers, who could benefit from higher Swiss wages while living in lower-cost neighboring countries.

In conclusion, the 2015 Euro/Swiss franc shock has become increasingly popular among scholars as a source of exogenous variation to study a variety of economic outcomes. Indeed, being unexpected and perceived as persistent, the SNB intervention represents an ideal framework to conduct a natural experiment.

[3] We estimate the forecast with an AR(1) regressing the Exchange rate between Swiss franc and Euro on the rate 3-month prior, controlling for time-fixed effects.

Figure 1: Euro/Swiss franc Exchange Rate and 3-month Prediction




*Notes:* The Figure shows the evolution of the actual Euro/Swiss franc exchange rate and its 3-month prediction. The 3-month forecast is computed with a distributed lag model, where the closing value of the Euro/Swiss franc exchange rate is regressed against itself three months prior, along with month-fixed effects.

## 2.2 Implications of the Policy

The 2015 exchange rate shock led to an increase in the purchasing power of Swiss salaries when spent in the Eurozone (EZ) consumption market. This results in a reduction in consumer prices for Swiss residents when purchasing goods across the border, as documented by Auer et al. (2021).

The shock had multiple economic consequences, some of which were interdependent. For example, Auer et al. (2019) and Auer et al. (2021) analyzed the price effects on tradable goods, quantifying the real price impact in Switzerland. On the labor market, Kaufmann and Renkin (2017) identified a negative employment effect in the manufacturing sector, while Gatti (2023) report an increase in labor demand for import-oriented firms and a decline for export-dependent ones. Additionally, Colella (2022) identified a change in skill requirements in high substitutability jobs. Although some studies, such as Burstein et al. (2024), that explored the relationship between economically relevant outcomes (cross-border shopping), there is limited literature on the spatial implications of this shock, particularly in relation to residential relocation. This paper aims to examine the role of the shock in triggering cross-border work and its effects on real estate markets due to relocation in the Swiss-EZ transnational area.

Cross-border workers (CBWs) represent a form of temporary migration characterized by working in Switzerland while residing in an EZ country. With the Free Movement of Persons Agreement in 2002, CBWs were liberalized, and nowadays account for roughly the 7.5% of the Swiss labor force, reaching 30% in border municipalities. Following the 2015 shock, the number of CBWs in Switzerland increased by approximately 10%. This increase is consistent with the higher incentive for CBWs to take advantage of real wage gains following the policy. Consequently, residents are incentivized to relocate from Switzerland to the EZ while maintaining employment in Switzerland, thereby becoming cross-border workers. This reduces housing demand in Switzerland and increases it in the cheaper neighboring Eurozone countries. This shift in demand led to declining housing prices on the Swiss side of the border and rising prices in the Eurozone. We formalize the mechanism of relocation with a theoretical model presented in Section C.1 of the Appendix. The model predicts cross-border relocation flows in the presence of commuting costs and wage gains, and displays the implications for housing prices.

Relocation effects are particularly pronounced among EZ-born citizens for at least two reasons. First, EZ-born residents form the largest group of foreign-born citizens in Switzerland, outnumbering all other foreign-born groups by a factor of ten. Second, EZ residents often share networks, language, and cultural ties with the bordering countries, which strengthens their attachment to their home country. Ceteris paribus, the utility of residing in one's home country is higher for EZ citizens than for other foreign-born groups. This phenomenon is known as place attachment or home bias (Benson, 2014; Büchel et al., 2020; Chabé-Ferret et al., 2018). This suggests that EZ-born residents are more likely to relocate across the border to their home country.

The incentive to relocate is also influenced by proximity to the border. The closer the residence and workplace are to the Swiss-EZ border, the lower the commuting costs, both in terms of time and financial expenditures. Hence, individuals living closer to the border are more likely to relocate and become cross-border workers, maximizing the benefits of the exchange rate shock.

This mechanism applies to countries that share a common border and have homogeneous economic and/or cultural backgrounds, i.e. in a transnational economy. The Swiss-EZ region provides an ideal case study: residents on both sides of the border speak the same language, possess similar educational and professional skills, and share a common culture.

# 3 Data

We create a dataset containing information on migration flows, employment and real estate prices for Switzerland, Italy, and Germany between 2012 and 2019. We exclude years prior to 2012 due to Switzerland's adherence to a flexible exchange rate regime and avoid post-2019 data to eliminate the confounding effects of the COVID-19 crisis.

Our dataset is composed of six distinct sources. First, for Switzerland we collect yearly data at the municipality level on the number of total FTE employees (Federal Statistical Office, 2012–2019a), full-time equivalent (FTE) cross-border workers and the number of residents by nationality and age group from (Federal Statistical Office, 2012–2019b). The latter allow us to identify Swiss residents with a Eurozone nationality. Second, we incorporate geolocalized data on house postings' sales prices along with a wide range of observable characteristics for Switzerland from Meta-Sys AG (2012–2019). Third, we access municipal-level data at yearly level for Italy on the total number of residents in Italy and total number of immigrants from all Switzerland to Italy from the Italian National Institute of Statistics (2012–2019). Fourth, Italian house prices and characteristics are provided by the Italian Revenue Agency (2012–2019). The unit of observation for Italy is the OMI district, a sub-area within municipalities characterized by a homogenous real estate market. Prices for OMI areas are constructed from real estate postings. Finally, we obtain municipal-level data on the number of residents in Germany and number of immigrants from Switzerland to Germany by year from Federal Statistical Office Germany (2012–2019) and housing prices by year from 21st Real Estate (2012–2019). Table 1 displays the summary statistics for each of the different datasets used.[4]

Panel A presents the employment and demographic data at the municipal level for Switzerland. This includes the total number of full-time equivalent (FTE) workers, FTEs cross-border workers, FTE cross-borders workers as share of total FTE workers and the population of working-age (aged 20 to 64) Eurozone residents, and working-age European residents not from the Eurozone (Other European). Panel B shows the real estate dataset for Switzerland. For each housing posting, we observe the sales price (in Swiss franc), living area (square meters), number of rooms, floor level, and other structural attributes such as heating system, balcony, garden, winter garden, elevator, and wheel chair ramp, laundry and private parking. The dataset also records whether the property adheres to the Minergie energy-efficiency standard and specifies the residence type (apartment, house), the housing category (villa, basement, etc.), and the year of construction.[5] To maximize the number of observations, missing housing characteristics are assumed to be absent. We acknowledge that posting prices may diverge from final transaction prices. While this limitation remains untestable, in our framework we only need to plausibly assume that bargaining power differences are constant between treatment and control group.

Panel C displays summary statistics for the Italian dataset at the municipal level. For each Italian municipality, we gather data on the number of residents, the number of immigrants from Switzerland. Panel D presents the Italian real estate data at the OMI district level. For each district, we observe the average house price per square meter (in Euros), the housing category (economic, civil, luxury, villas, and typical houses), and its condition (excellent, good, bad, very bad).

Panel E presents data on housing prices in German municipalities, including the average price per square meter (in euros), the degree of urbanization, and migration from Switzerland to Germany, both in absolute terms and relative to the population. Note that from 2018 onward, migration data contain missing values for municipality-year observations where fewer than three people migrated from Switzerland to Germany.

[4] We also collect cadastral land prices from Direction Interministérielle du Numérique. However, these data are available only from 2014 onward, preventing assessment of pre-trends. In Figure B.1 we still show that prices in France increased closer to the border.

[5] The Minergie is a standard Swiss certification provided to ecological housing.

Table 1: Summary Statistics

| | Observations | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| ***Panel A: Swiss Data by Municipality*** | | | | | |
| Workers | 16'992 | 2'391.57 | 13'435.56 | 6 | 499'346 |
| Total full-time equivalents | 16'992 | 1'860.26 | 10'390.88 | 4.62 | 382'731.2 |
| Cross-border workers share | 16'992 | 0.056 | 0.108 | 0 | 0.835 |
| Population | 16'992 | 3'893.33 | 12'526.89 | 30 | 420'217 |
| Eurozone working-age population (20-64 y.o.) | 16'992 | 440.7 | 2'085.4 | 0 | 72'985 |
| Eurozone working-age population share | 16'992 | 0.084 | 0.0456 | 0 | 0.388 |
| Other European working-age population (20-64 y.o.) | 16'992 | 1.35 | 10.051 | 0 | 437 |
| Other European working-age share | 16'992 | 0.0002 | 0.0005 | 0 | 0.013 |
| Degree of Urbanization | 16'992 | 2.29 | 0.8079 | 1 | 3 |
| Altitude (m.a.s.l.) | 16'992 | 799.31 | 403.47 | 197 | 3'434.8 |
| Distance to Border | 16'992 | 25.05 | 17.7 | 0.268 | 76.7 |
| ***Panel B: Swiss Data by Housing Posting*** | | | | | |
| Sales house prices (CHF) | 501'025 | 965'901.7 | 690'445.4 | 105'000 | 2.00e$^7$ |
| Sales house prices per squared meter (CHF) | 501'025 | 6'639.74 | 2'709.38 | 302.85 | 15'000 |
| Living surface (m$^2$) | 501'025 | 145.51 | 76.108 | 12 | 5'600 |
| Rooms | 501'025 | 5 | 1.884 | 0.5 | 30 |
| Floor | 501'025 | 0.596 | 1.193 | 0 | 16 |
| View | 501'025 | 0.392 | 0.488 | 0 | 1 |
| Heating system | 501'025 | 0.248 | 0.432 | 0 | 1 |
| Balcony | 501'025 | 0.688 | 0.463 | 0 | 1 |
| Garden | 501'025 | 0.159 | 0.366 | 0 | 1 |
| Winter-garden | 501'025 | 0.038 | 0.191 | 0 | 1 |
| Elevator | 501'025 | 0.299 | 0.458 | 0 | 1 |
| Wheelchair ramp | 501'025 | 0.098 | 0.297 | 0 | 1 |
| Laundry | 501,025 | 0.050 | 0.218 | 0 | 1 |
| Standard Minergie | 501'025 | 0.067 | 0.251 | 0 | 1 |
| Private parking | 501'025 | 0.491 | 0.499 | 0 | 1 |
| Residence type | 501'025 | 0.54 | 0.498 | 0 | 1 |
| Housing category | 501'025 | 9.8 | 6.415 | 1 | 24 |
| Posting quality | 501'025 | 17.899 | 40.74 | 0 | 310 |
| ***Panel C: Italian Data by Municipality*** | | | | | |
| Population | 9'790 | 6'879.53 | 39'848.56 | 31 | 1.3e$^5$ |
| Migration from Switzerland | 9'790 | 0.878 | 6.439 | 0 | 296 |
| Share of migrants from Switzerland | 9'790 | 0.0002 | 0.0008 | 0 | 0.032 |
| Distance to Border | 9'790 | 39.92 | 21.02 | 0.652 | 74.9 |
| ***Panel D: Italian Data by OMI Districts*** | | | | | |
| House prices per squared meter (EUR) | 140'196 | 1'288.9 | 680.02 | 207.5 | 13'000 |
| House category | 140'196 | 3.346 | 1.226 | 1 | 5 |
| Housing condition | 140'196 | 2.182 | 0.484 | 1 | 3 |
| ***Panel E: German Data by Municipality*** | | | | | |
| House prices per squared meter (EUR) | 14'560 | 2'103.6 | 671.88 | 827.9 | 5'090.5 |
| Migrations from Switzerland | 12'864 | 9.853 | 29.394 | 0 | 346 |
| Share of migrants from Switzerland | 12'864 | 0.001 | 0.003 | 0 | 0.043 |
| Degree of Urbanization | 14'560 | 2.617 | 0.521 | 1 | 3 |
| Distance to Border | 14'560 | 40.25 | 20.76 | 0.979 | 74.9 |

*Notes:* Source: 21st Real Estate (2012–2019); Federal Statistical Office (2012–2019a;-); Italian National Institute of Statistics (2012–2019); Italian Revenue Agency (2012–2019); Meta-Sys AG (2012–2019)

# 4 Research Design

To analyze residential relocation patterns between Switzerland and its neighboring countries, we employ a dynamic difference-in-differences (DiD) regression framework. In this approach, we estimate the effect of the 2015 policy shock by interacting pre- and post-shock year indicators with a treatment identifier, while controlling for individual fixed effects and time-varying covariates. The treatment group consists of municipalities located within a 0–20 km radius from the national border (referred to as *border municipalities*), whereas the control group includes municipalities located 20–75 km from the border (*non-border* or *inner municipalities*). Additional details on the selection of distance bandwidths are provided in Section 4.1.

This structure allows us to capture differential effects on border municipalities relative to inner municipalities, thereby isolating the impact of the 2015 shock on employment, cross-border, residential mobility, and housing prices, for Switzerland, Italy, and Germany. We conduct multiple robustness checks to rule out alternative explanations for our mechanism. Notably, we introduce a variation in our treatment group within the 0–5 km bandwidth to assess the effect of proximity.

## 4.1 Treatment Selection

In Switzerland, we define the treatment group as municipalities located within 20 km of a customs border post (*border municipalities*), while the control group comprises municipalities located between 20 km and 75 km from the nearest border post (*non-border municipalities*). This distance is measured over a straight line (Euclidean distance). The 20 km threshold is based on the 2002 bilateral Agreement on the Free Movement of Persons, which defines the border areas where cross-border workers can reside as those within 20 km of the Swiss border. We apply this definition of border areas to our entire sample. [6]

We calculate the Euclidean distance from the center of each municipality to the nearest border post (refer to Figure A.4 in Appendix). Municipalities located within the 0–20 km range are classified as *border*, representing 45.6% of the 2,133 municipalities in our dataset. Figure 2 depicts the results of our selection criterion in Switzerland. Although alternative distance measures, such as commuting distance, could be used, the definition of border municipalities based on Euclidean distance is highly consistent with the selection obtained using commuting distances, as in Beerli et al. (2021).

In Italy, we apply the same treatment selection method to classify border and non-border municipalities, focusing on the provinces of Piedmont and Lombardy, which border the Swiss Cantons of Ticino and Valais. The 20 km bandwidth for defining border municipalities in Italy is supported by national law. According to the Italian Revenue Agency's Resolution No. 38/E of 2017, Italian municipalities within 20 km of the border with Canton Ticino or Valais are designated as border regions.[7]

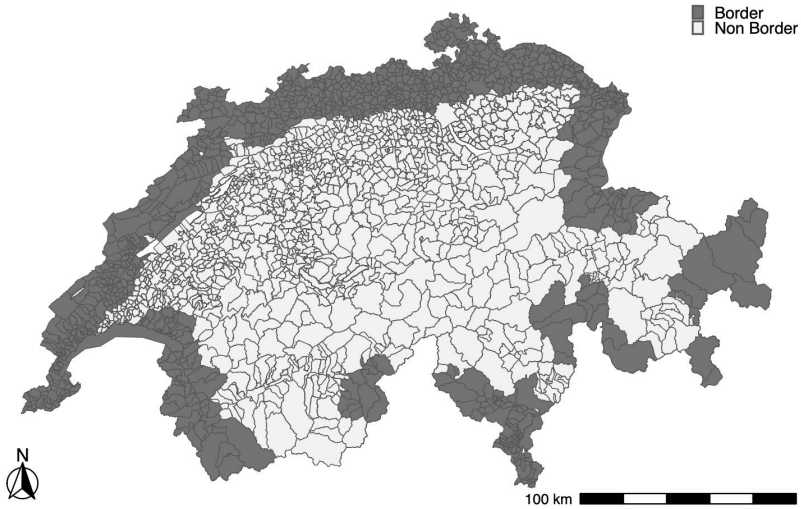
For consistency with the Swiss selection criteria, where non-border municipalities are located 20–75 km from the nearest border, we apply the same rule in Italy. This classification results in approximately 27.3% of the 1,244 Italian municipalities in our sample being designated as treated. The geographical distribution of treated and control municipalities in Italy is illustrated in Figure A.5 of the Appendix.

A similar treatment selection is applied in Germany to maintain coherence with the Swiss and Italian frameworks. In Germany, 20.2% of the 455 municipalities in our sample are classified as treated. The selection of treated municipalities in Germany is shown in Figure A.6 of the Appendix. The upper threshold of 75 km is used also for Germany to ensure consistency with the Swiss framework, where 75 km represents the maximum distance for non-border municipalities.

[6] Cross-border workers are eligible for fiscal privileges, including the taxation of wages and other income exclusively in Switzerland, one of the OECD countries with the lowest tax rates. In 2023, the average single worker in Switzerland faced a net tax rate of 18.6%, compared to the OECD average of 24.9%.

[7] The resolution states that Swiss cross-border workers are those who reside in a municipality whose territory is fully or partially within 20 km of the border with the Cantons of Ticino, Grisons, or Valais, and commute to Switzerland for employment.

Figure 2: Treatment Municipalities in Switzerland




*Notes:* The Figure shows the treatment selection of *border* and *non-border*. The sample consists of 45.6% *border* municipalities out of 2,133 in sample.

## 4.2 The estimating equation

To estimate the causal effect of the Swiss franc appreciation on labor market, migration, and real estate outcomes across borders, we employ a dynamic difference-in-differences (DiD) framework, incorporating location and time-fixed effects. Specifically, we estimate the following equation:

$$Y_{it} = \theta_i + \theta_t + \sum_k \gamma^k B_i^c \cdot \tau_i^k + \delta X_{it} + \varepsilon_{it} \tag{1}$$

The outcome $Y_{it}$ represents the labor market, migration, or real estate outcomes for location $i$ at time $t$. The variable $B_i^c$ is an indicator for location $i$ being within the 20 kilometers or in the 20–75 kilometers from the border in country $c \in \{Switzerland, Italy, Germany\}$, while $\tau_i^k$ is a year indicator with $k \in \{2012, \ldots, 2019\}$ and $k \neq 2014$. The coefficients of interest, $\gamma^k$, capture the interaction between the border indicator and the time dummies, which represents the differential effect of proximity to the border on outcomes across years relative to 2014. Equation (1) also includes location fixed effects $\theta_i$, and time fixed effects $\theta_t$, as well as other time-varying characteristics $X_{it}$ (the variables in table 1). Standard errors are clustered at the location level to account for potential autocorrelation over time within locations. To explore heterogeneity in effects, we also implement static DiD regressions by pooling pre- and post-treatment periods.

Testing the effects of residential relocation presents significant methodological challenges. A key issue is that the exchange rate shock impacts all locations uniformly, leaving no natural variation to exploit for causal identification. In the literature on exchange rate shocks, a common approach is the construction of exogenous exposure indexes, which typically rely on firm-level exposure to trade activities, such as exports and imports intensity (Dominguez and Tesar, 2006; Gatti, 2023). However, this methodology is less applicable in the context of housing markets and residential relocation, where such trade-related variables are not available or meaningful. Instead, we adopt an alternative strategy that leverages the quasi-exogenous nature of geographical distance from the national border as a key identification mechanism. This approach is based on the assumption that distance from the border, is exogenous to other economic factors affecting housing prices or migration flows in the pre-shock comparison with 2014. Our approach draws from the work of Beerli et al. (2021), who use commuting time to define the border indicator. We prefer distance over commuting time because it is less

likely to be influenced by local economic conditions, making it a more reliable exogenous measure. To address potential limitations of this distance-based approach, we conduct a comprehensive set of regressions to test for alternative explanations and mechanisms, ensuring the robustness of our findings. This methodology allows us to isolate the effect of the exchange rate shock on residential relocation while mitigating the challenge of limited location-specific variation in shock exposure.

The validity of the difference-in-differences approach generally relies on two core assumptions: (i) Parallel trends; (ii) No anticipation effect (Angrist and Krueger, 1991; Ashenfelter and Card, 1985; Bertrand et al., 2004; Card and Krueger, 2000). In the context of our study, these assumptions imply that, in the absence of the Swiss franc appreciation, the treated and control units would have followed similar trajectories, and that the Swiss National Bank (SNB) intervention was unforeseen by the markets. On one hand, although it is challenging to fully validate the parallel trends assumption, we employ a dynamic DiD approach to provide statistical supporting its validity. Specifically, we examine the $\gamma^k$ coefficients in the pre-treatment period to assess whether treated and control municipalities displayed comparable trends prior to the 2015 shock. On the other hand, we discussed the satisfaction of the no-anticipation assumption in Section 2.

# 5 Results

This section presents the results of the impact of the Swiss franc appreciation in 2015 on labor markets, migration, and housing outcomes across Switzerland, Italy, and Germany. We begin by analyzing how the appreciation affected the Swiss labor market, with a focus on cross-border workers (CBWs). Our findings suggest that, following the shock, Swiss border municipalities experienced a greater increase in the number of CBWs, while total employment levels remained largely unchanged. This pattern suggests that residential relocation was a likely driver of the increase in CBWs. Next, we explore the potential effects of the shock on residential mobility within Switzerland by examining changes in the working-age population of Eurozone nationals and variations in house prices per square meter.

We further investigate the heterogeneity of all these effects across Switzerland's language regions, comparing outcomes particularly in the Italian-speaking and German-speaking regions. Following this, we assess the coherence between the economic impacts observed in Switzerland and in the corresponding neighboring countries, Italy and Germany. In particular, we study the migration flows from Switzerland to Italy, and the housing prices per square meter in Italy and Germany.

Lastly, we investigate how the impact of the shock varies with distance from the border, conducting a gradient analysis to capture the spatial dimension of the effects.

## 5.1 Labor Market Outcomes

Following the exchange rate shock of 2015, Swiss wages expressed in euros increased by approximately 15% relative to 2014 levels. This wage appreciation provided a strong incentive to seek employment as cross-border workers (CBWs), who typically spend their earnings outside of Switzerland, thereby increasing their purchasing power. As a consequence, a higher number of cross-border worker may lead to an increase in the labor supply in border regions. Additionally, the higher Swiss wages may also encouraged Swiss citizens to relocate abroad, a mechanism that primarily affects residential patterns rather than labor supply.

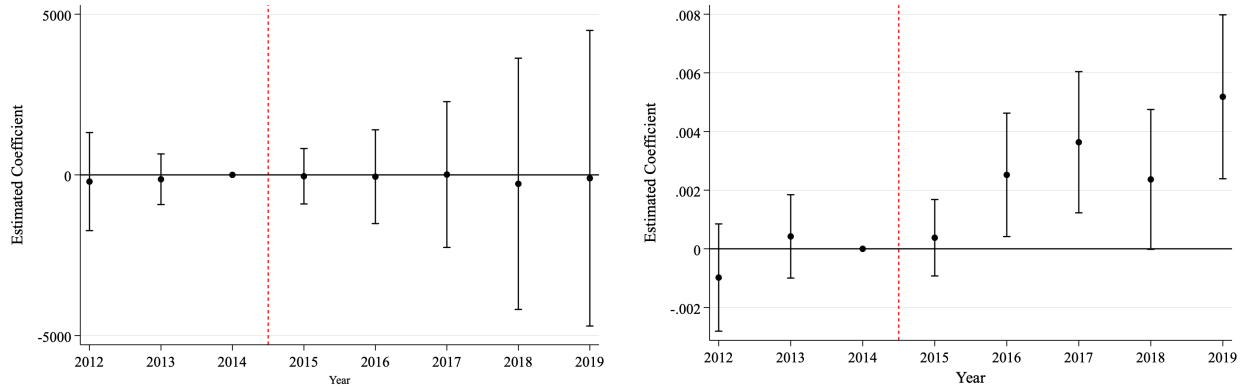
In Figure 3a we analyze the difference in total employment, measured as the number of employees at the municipal level, between border and non-border municipalities. The results show no statistically significant effect of the exchange rate shock on employment in border municipalities. Figure B.2 reports the time trends for both border and non-border municipalities, showing parallel trajectories across groups before the shock.

Manufacturing export-intensive and import-intensive firms experienced, respectively, a decrease and an increase in employment (Gatti, 2023). We check that a different import-export composition between border and non-border areas does not threatens our identification in Figure B.4 of the Appendix. It shows that employment in the import and export sectors did not differ significantly between the treatment and control groups, strengthening the validity of our treatment selection.

Figure 3a captures employment in equilibrium but does not disentangle the effects of labor supply and demand. On the labor demand side, Kaufmann and Renkin (2017) found that labor demand in the manufacturing sector declined following the currency appreciation, leading to a contraction in employment in Switzerland. Consistent with Kaufmann and Renkin (2017), Figure B.3 in the Appendix shows a decline of approximately 10% in manufacturing sector employment. However, there is no statistically significant difference in the effect between border and non-border municipalities. This suggests that while shifts in labor demand may have occurred at the national level, the relative comparison between border and non-border municipalities, the focus of our analysis, remains unaffected by these sectoral shifts.

On the labor supply side, assuming the same labor demand effect between border and non-border municipalities as shown in Figure B.3, an increase in labor supply at the border due to new cross-border workers would have resulted in positive coefficients after 2015 in Figure 3a. Therefore, the evidence suggests that there was no labor supply effect following 2015.

Figure 3: The Labour Market Effects




(a) Total Employment

(b) Cross-border workers

*Notes:* For each year, the Figure displays the estimate of the $\gamma^k$ coefficients reported in equation (1). Specifically, it illustrates the estimated difference in the (a) population weighted number of workers ($N = 17'032$) (b) share of cross-border workers per full time equivalent worker ($N = 16'992$) between border and non-border Swiss municipalities at the shock. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

The findings in Figure 3a suggests that there was no increase in the labor supply in border areas. However, Figure 3b illustrates that the share of cross-border workers in full-time equivalent positions as a percentage of total full-time employment increased. In particular, we observe a gradual an expansion in the cross-border labor market in border municipalities following the 2015 appreciation of the Swiss franc. On average, the share of cross-border workers increased by approximately 6% after 2015, double the annual growth rate observed in the pre-2015 period. Figure B.5 in the Appendix shows the effect separately for treatment and control municipalities to visualize the parallel trends. We also validate this result in Figure B.6 in the Appendix, by showing a corresponding increase in average daily traffic at border crossings during working days. These findings align with Bello (2019), who shows that similar exchange rate shocks have historically led to a surge in an increase of traffic driven by cross-border workers along the Swiss border.

Having excluded labour supply effects between border and non-border municipalities after the appreciation in 2015, the results from Figure 3 suggest a composition effect of the resident and cross-border worker labor force in border regions. Specifically, cross-border workers, who typically have lower reservation wages, have gradually replaced the resident labor force. This is in line with Gatti (2023), which finds that after 2015 unemployment increased among foreign residents in Switzerland, while increased among cross-border workers in border regions.

These findings offer a new perspective on the study of cross-border worker (CBW) labor supply. After 2015, the economic incentives for residing in Switzerland changed significantly. Becoming a CBW became more advantageous than participating in the Swiss labor market as a resident. We suggest that the shift observed in Figure 3 is due to fewer individuals choosing to join the labor force as residents, while a growing proportion opted for the CBW status. We term this phenomenon *residential relocation*, which represents a shift in residence location, and hence in residential status in Switzerland. Individuals who might have previously settled as Swiss residents now prefer the CBW status, attracted by the increased economic benefits of international commuting. Importantly, CBWs tend to cluster near the Swiss border, as shown in Figure A.7 in the Appendix. Therefore, residential relocation is concentrated in border regions, as commuting from farther areas becomes prohibitively costly, making cross-border work less feasible.

## 5.2 Residential Outcomes

As discussed earlier, the 2015 appreciation of the Swiss franc led to an increase in cross-border workers (CBWs) in border municipalities, resulting in a composition effect on the labor force. In this section, we analyze the residential relocation caused by the economic shock by comparing the residential outcomes in border and non-border municipalities across Switzerland, Italy, and Germany.

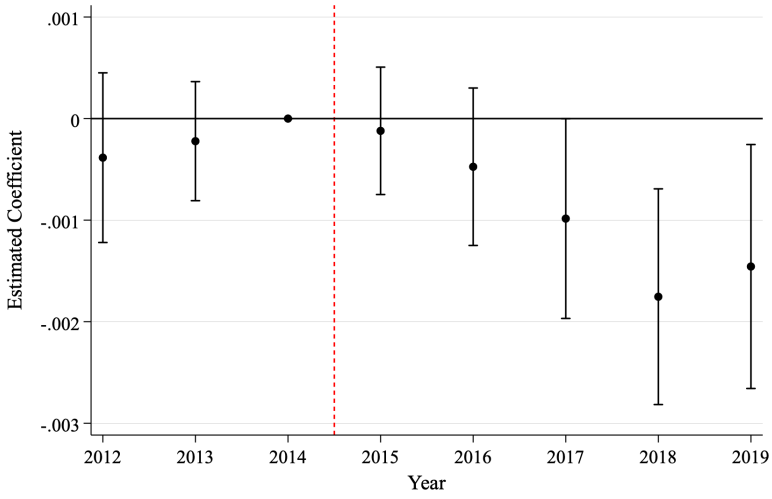
### 5.2.1 Switzerland

The 2015 Swiss franc appreciation had significant impacts on the residential relocation of Swiss residents, particularly among Eurozone (EZ) migrants living in Switzerland. This group was the most likely to shift residence for several reasons. First, relocating to neighboring EU countries entails lower legal and administrative costs for Eurozone nationals. Additionally, EZ migrants in Switzerland often possess social and professional networks across the border, which facilitate their integration in the Eurozone. These factors make Eurozone migrants the most responsive residents, facilitating their transition to the cross-border worker (CBW) status.

Figure 4 illustrates the effect of the 2015 shock on the share of working-age EZ residents as a share of the population in border and non-border municipalities. The Figure shows that municipalities within 20 km of the Swiss border experienced a significant decline in the share of EZ migrants compared to non-border municipalities, a trend that persisted over several years. On average, this decline corresponds to a 1.5% reduction in the share of EZ migrants relative to pre-shock levels. Figure B.7 in the Appendix shows the parallel trends prior to 2015 and demonstrates the general slowdown in the growth of EZ residents, more pronounced in border municipalities. As a robustness check, in Figure B.8 in the Appendix we show a concurrent increase in the share of migrants relocating from Swiss border regions to European countries, supporting the evidence that residential relocation occurred from Switzerland to the neighboring Eurozone countries. Also, in Figure B.9 in Appendix we show that non-Eurozone foreigners were unaffected.

Figures B.10a and B.10b in the Appendix reveal that the decrease in Eurozone residents was not offset by an increase in other nationalities, including Swiss natives. This implies that the reduction in EZ does not represent a compositional effect but a real drop in demand for residence in border municipalities.

Figure 4: Eurozone residents in Switzerland




*Notes:* For each year, the Figure displays the estimate of the $\gamma^k$ coefficients reported in equation (1), namely the estimated difference in Eurozone working-age citizens' share between border and non-border Swiss municipalities at the shock. The total number of observations is 17′064. We control for municipality and year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

The findings in Figure 4 suggest a drop in the housing demand in border region. In Figure 5 we show the impact of the 2015 Swiss franc appreciation on house prices per square meter in the Swiss border municipalities. The shock triggered a sharp and persistent decrease in house prices of approximately 1.7%, translating to an average reduction of 15'000 Swiss francs for the average house in our sample. The trends for house prices are shown in Figure B.11, which displays parallel trends before the shock.

To ensure that the observed price reduction is not driven by an increase in the housing supply, we analyzed whether the housing stock in border municipalities expanded after 2015. As shown in Table B.2, the effect on the total square meters of properties for sale is zero, ruling out supply-side factors as the primary driver of the price decline.

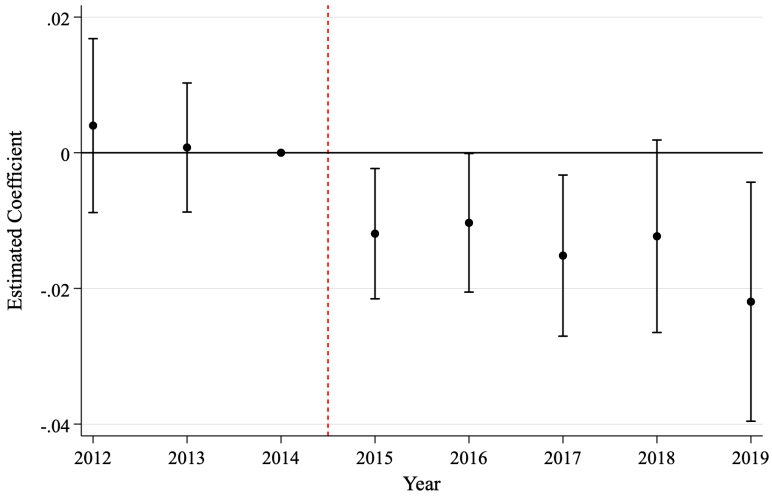
Lower foreign investment in housing at the border as a driver of the post-2015 housing price changes is unlikely in the Swiss context. First, the Federal Act on the Acquisition of Immovable Property by Foreigners (Lex Koller) restricts non-resident foreigners from purchasing residential properties or estate shares in Switzerland. Second, it is challenging to foresee why real estate investments are correlated with distance to the border.

Therefore, we attribute the drop in house prices to the residential relocation of Eurozone residents. In Table B.1 in the Appendix, we also provide an estimate for the direct impact of the Eurozone migrants on Swiss house prices. Specifically, a 1% decrease in the share of EZ residents in Swiss border areas resulted in a 1.8 percentage point reduction in housing prices at the border.

We suggest that the sharp drop in house prices in 2015 was driven by favorable conditions for selling properties following the shock. Due to the Swiss franc appreciation, homeowners could sell their properties for up to 20% less in Swiss francs without incurring financial losses in Euros. This effect was particularly pronounced in border regions, where the feasibility of cross-border work made relocation more attractive. However, the decline in house prices is also consistent with downward adjustments in real estate price expectations by real estate intermediaries, which may anticipate the housing demand drop (Braun et al., 2024).

At the same time, the administrative procedures for residential relocation, such as vacating properties and changing residence permits, delayed the formal exit from Switzerland after selling a home. This explains the discrepancy between the rapid decline in house prices shown in Figure 5 and the gradual reduction in the share of Eurozone residents illustrated in Figure 4.

Figure 5: Swiss House Prices per $m^2$




*Notes:* For each year, the Figure displays the estimate of the $\gamma^k$ coefficients reported in equation (1), namely the estimated difference in the log of housing prices per meter squared between border and non-border Swiss municipalities at the shock. The total number of observations is 503′743. We control for municipality, year-fixed effects, and housing characteristics. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Meta-Sys AG data.

We find that, following the real wage shock induced by the 2015 Swiss franc appreciation, there was no labor supply effect, but there was an increase in cross-border workers, a decline in Eurozone residents, and a decrease in house prices. We reconcile these findings through the concept of residential relocation. However, factors such as average salaries, economic activity, housing prices, and the general cost of living in border areas of neighboring Eurozone countries may lead to heterogeneous relocation decisions depending on the specific country.

To explore the heterogeneity in relocation incentives, we examine the effects on Swiss border municipalities, conditional on their neighboring country. Specifically, we focus on the three main nations bordering Switzerland: Germany, France, and Italy. Panel A of Table 2 shows the DiD coefficients for changes in employment. Our findings indicate no significant employment effect, regardless of the bordering nation. Panel B reports the effects on the share of cross-border workers (CBWs). After the 2015 Swiss franc appreciation, CBWs increased at the borders with Italy and France, by 14% and 9%, respectively. In contrast, the CBW share at the German border declined by 6%. Panel C shows that the share of Eurozone residents (EZ) declined in municipalities bordering Italy and France, consistent with the observed CBW changes. At the German border, however, EZ residents increased by approximately 2%, aligning with the opposite CBW trend observed there. Panel D presents changes in house prices per square meter. Municipalities along the French and Italian borders experienced a relative decline in house prices of 4.3% and 4.2%, respectively. In contrast, house prices in municipalities along the German border rose by 3.8%.

Table 2 suggests that relocation occurs on the Swiss-Italian and Swiss-French sides of Switzerland, while on the German side, we observe the reverse effect. We propose three key explanations for these findings. First, the observed relocation patterns align with the tax regimes established in Switzerland's bilateral agreements with neighboring countries. During the study period, agreements with France and Italy allowed cross-border workers to be taxed in Switzerland, benefiting from Switzerland's exceptionally low tax rates.[8] In contrast, German cross-border workers are taxed in their country of residence (European Parliament, 1997). Therefore, the shock could lead to significantly higher tax rates on Swiss wages, dampening their appeal and potentially creating a disincentive to relocate. Second, the neighboring German region of Switzerland is Baden-Württemberg, which is one of the most productive regions of Germany, displaying smaller wage differentials with Switzerland compared to the Swiss-French and Swiss-Italian regions, as is shown in Figure A.8. We suggest that smaller wage gaps likely diminish the incentive to relocate across the Swiss-German border. Lastly, we propose a role for cross-border shopping, which became more convenient after 2015. Cross-border shopping is notably prevalent along the German-speaking border, facilitated by the proximity of German stores and short travel distances.[9] As shown by Burstein et al. (2024), cross-border shopping post-2015 provided welfare benefits for border areas, potentially enhancing the value of residing in Swiss-German border regions.

Overall, the results in Table 2 show that the direction of each individual outcome is coherent with the residential relocation. In the following section, we will validate these effects by examining migration and real estate patterns in the border regions of Italy and Germany. In particular, we find an increase in migrations from Switzerland to Italy and a contextual increase of housing prices. In Germany instead we find no effect on housing prices. For completeness, in Figure B.1, we also run our specification on French data. Despite the data being noisier and the inability to assess pre-trends, we observe that land prices in France increased closer to the border, displaying a distance gradient coherent with residential relocation.

[8] The average tax wedge on labor income in Switzerland is 23.4% while the average of Germany, France, and Italy is more than 45%. For more information visit OECD (2024)

[9] See Figure A.9 in the Appendix and Kluser (2024), Figure 1.

Table 2: Heterogeneity by Bordering Country

| | Germany | France | Italy |
|---|---|---|---|
| ***Panel A: Employment*** | | | |
| Treat × Post | -262.11 | 429.71 | -271.35 |
| | (1688.16) | (1889.25) | (1681.61) |
| R-Squared | 0.999 | 0.999 | 0.999 |
| N | 12'152 | 12'608 | 10'280 |
| Municipality FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| ***Panel B: CBWs' Share*** | | | |
| Treat × Post | -0.002* | 0.005*** | 0.015*** |
| | (0.002) | (0.002) | (0.004) |
| Relative Effect | -6.34% | 9.19% | 14.11% |
| R-Squared | 0.943 | 0.961 | 0.973 |
| N | 12'184 | 12'648 | 10'328 |
| Municipality FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| ***Panel C: EZ Residents' Share*** | | | |
| Treat × Post | 0.0015*** | -0.0022*** | -0.0025** |
| | (0.0006) | (0.0006) | (0.0012) |
| Relative Effect | 1.8% | -2.7% | -2.6% |
| R-Squared | 0.975 | 0.968 | 0.971 |
| N | 12'200 | 12'680 | 10'328 |
| Municipality FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| ***Panel D: Log House Prices ($m^2$)*** | | | |
| Treat × Post | 0.0381*** | -0.0438*** | -0.0427*** |
| | (0.0054) | (0.0064) | (0.0087) |
| R-Squared | 0.512 | 0.561 | 0.495 |
| N | 313'313 | 367'912 | 308'101 |
| Municipality FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| House Characteristics | Yes | Yes | Yes |

*Notes:* Panel A of the Table displays the DiD effect for municipalities bordering Germany, France, and Italy after the 2015 Swiss franc appreciation. Panel A displays the effect on the total number of employees weighted by municipality population. Panel B reports the effect on the share of full time equivalent CBW on total full time employees. Panel C displays the estimated difference in the share of EZ workers. Panel D reports the logarithm of house prices. Standard errors are clustered at the municipality level. Significance levels: *** $p < .01$, ** $.01 \leq p < .05$, * $.05 \leq p < .10$. Source: Our elaboration on Swiss Federal Office of Statistics and Meta-Sys AG data.

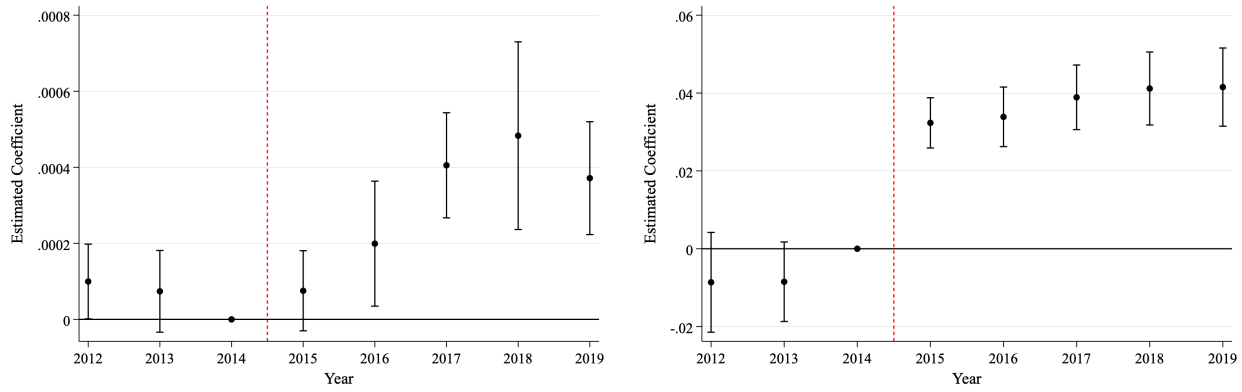
### 5.2.2 Italy

In Switzerland, municipalities bordering Italy have witnessed a 2.6% decline in the number of Eurozone (EZ) migrants, alongside a 14.11% increase in cross-border workers (CBWs). Moreover, at the Swiss-Italian border house prices decreased by about 4% as shown in Table 2. In Figure 6a we display the effect of the 2015 appreciation of the Swiss franc on immigration from Switzerland to Italy. After 2015, Italian border municipalities saw an increase in immigration from Switzerland. This shift represents an approximate 5% increase in return migration relative to the pre-shock average in the treated municipalities.

Figure 6a reports data on return migration from the entire Switzerland to each Italian municipality, therefore does not allow us to isolate migration patterns from border or non-border areas. However, if return migration was driven by residential relocation from Swiss non-border to Italian border areas, we would expect to observe an effect on labor force participation, but in figure 3a we find no employment effect.

Thus, we observed a decline in Eurozone residents in Switzerland (Figure 4) and a contextual increase in return migration to Italy (Figure 6a). Further, the timing of the inflow to Italy closely mirrored the outflow of Eurozone residents from the border Swiss municipalities. This evidence reinforces the hypothesis that the economic incentives following the 2015 Swiss franc appreciation played a crucial role in shaping the mobility patterns across borders of the transnational economy.

Figure 6: The Residential Effects in Italy




(a) Migration from Switzerland to Italy

(b) Italian House Prices per $m^2$

*Notes:* For each year, the Figure displays the estimate of the $\gamma^k$ coefficients reported in equation (1). Specifically, it illustrates the estimated difference in the (a) share of immigrants from Switzerland ($N = 9'788$) (b) log of housing prices per square meter ($N = 140'171$) between border and non-border Italian municipalities at the shock. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on ISTAT data and Italian Revenue Agency data.

In Figure 6b we present the effect on the log house prices per square meter at the district level (OMI) in the Italian border municipalities. The figure indicates a sharp and persistent increase of about 3% to 4% in house prices in border areas after 2015.

To ensure that the price increase in Italian border municipalities does not stem from an increased demand for housing by Italian residents relocating from control municipalities, we show in Figure B.12 in the Appendix that there was no significant migration to the Italian border areas either from the non-border areas or the other remaining municipal regions of Italy.

It is unlikely that the observed difference is due to an increase in Swiss investments in Italian real estate at the border. Article 16 of the preliminary norms of the Italian Civil Code, the 'principle of reciprocity,'

significantly restricts housing purchases by non-resident Swiss citizens and companies not based in Italy.[10] Further, distance from the border is unlikely to be a significant factor in determining real estate investments.

Therefore, we attribute the spike in house prices in 2015 to the residential relocation from Switzerland to Italy. In Table B.3 we also provide an estimate for the effect of relocation in Italy from Switzerland. In particular, a 1% increase in immigration from Switzerland to Italy led to a 1.8 percentage point increase in housing prices.

The timing of the effect observed in Figure 6b mirrors the effects observed in Switzerland shown in Figure 5. As mentioned earlier, the timing can be explained by the favorable conditions for purchasing properties in euros during this period and/or by upward adjustments in real estate price expectations among real estate intermediaries. However, the actual process of residential relocation is delayed due to the administrative procedures required in both Switzerland and Italy.

In summary, the observed return migration and housing prices in Italy provide robust evidence of residential relocation driven by the economic integration between Switzerland and Italy. These results suggest that, in an integrated transnational labor market, exchange rate shocks have a broader pass-through effect, not only influencing retail prices (Auer et al., 2019; 2021) but also indirectly affecting housing markets through labor migration in strategic border areas. A key implication of this finding is that, exporting housing demand in cheaper border location may create affordability challenges for local Italian resident workers, whose purchasing power is significantly lower than that of cross-border workers. Implementing mechanisms to regulate cross-border labor flows during currency shocks could help mitigate unintended housing market distortions.

### 5.2.3 Germany

Municipalities along the Swiss-German border have experienced, on average, a 1.8% increase in Eurozone (EZ) residents, a 14.11% rise in cross-border workers (CBWs), and a 3% increase in house prices. These effects are the smallest compared with the observed changes along the Italian and French borders.

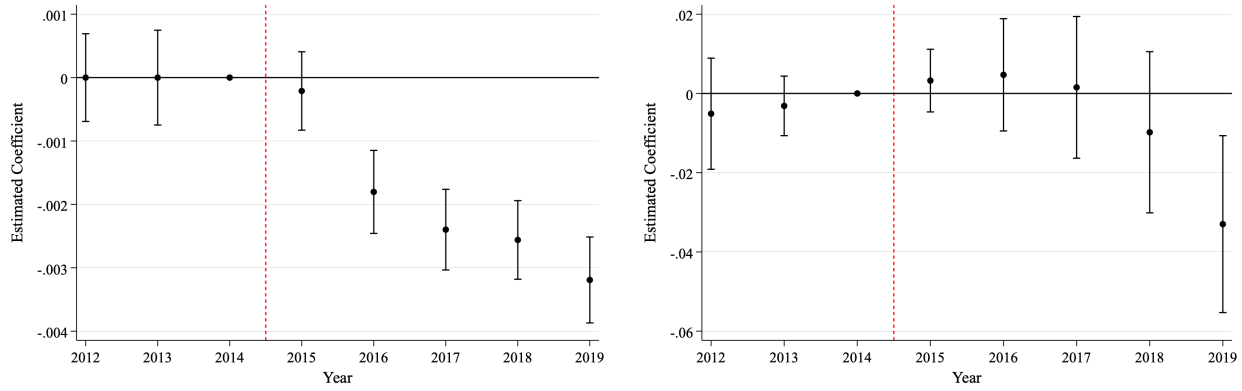
Figure 7a illustrates the impact of the 2015 Swiss franc appreciation on migration from Switzerland to Germany. Following the appreciation, German-border municipalities experienced an increase in immigration from Switzerland. However, this shift corresponds to only a 1.1% decrease in return migration compared to the pre-shock average in the treated municipalities.

Thus, the small increase in Eurozone residents at the Swiss-German border is accompanied by a decrease in migration flows into Germany after 2015. While the observed migration flows between Switzerland and Germany appear to be balanced, they do not align with the residential relocation observed at the Italian border.

Figure 7b presents the effect on the logarithm of German house prices per square meter, showing no significant price changes at the border after 2015. If anything, a slight decline is observed in later years. Overall, the effects on migration and housing prices suggest that, unlike at the Swiss-Italian and Swiss-French borders, there was no substantial residential relocation at the Swiss-German border.

[10] Although exceptions are made for secondary holiday homes under 200 square meters, such purchases are subject to longer waiting periods and stricter loan conditions, including higher down payments and lower loan-to-value ratios, limiting their impact on the overall market.

Figure 7: The Residential Effects in Germany




(a) Migration from Switzerland to Germany

(b) German House Prices per $m^2$

*Notes:* For each year, the Figure displays the estimate of the $\gamma^k$ coefficients reported in equation (1). Specifically, it illustrates the estimated difference in the (a) share of immigrants from Switzerland ($N = 12'864$) (b) log of housing prices per square meter ($N = 14'560$) between border and non-border German municipalities at the shock. Effects are linearly detrendend by the pre period increase in house prices and immigration at the border. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on the Statistical Office of Baden-Württemberg and 21st Real Estate data and on the

The result in Figure B.10 suggests that the effects for the German border displayed in Table 2 of Section 5.2.1 are not linked with relocation from Switzerland to Germany. In particular, we have shown that Euro-zone residents increased at the Swiss-German border, cross-border workers decreased, and return migration to German border areas were reduced.

One potential explanation for the different migration patterns between the Italian and German sides is the different taxation regime in the bilateral agreements with Switzerland. While Italian cross-border workers are taxed in Switzerland, German cross-border workers' wages are taxed in the place of residence (European Parliament, 1997), therefore, the real wage increase may reduce the incentive to do cross-border work due to a mechanical increase in the tax rate in Germany. Eluding the erosion of purchasing power due to the higher tax rate may have determined the observed reduction in return migration, or increase in migrants, from Germany and an overall reduction in cross-border work. In fact, living at the Swiss-German border is still convenient as higher purchasing power can be exploited in the form of cross-border shopping (Burstein et al., 2024). [11] If the advantages of cross-border shopping dominate the relocation incentive, it implies that following the shock on the German side, there was long-term migration rather than relocation. We provide suggestive evidence that at the Swiss-German border, the higher wages were capitalized by cross-border shopping, as shown in Table B.4 in the Appendix. It shows that traffic on the weekend increased more at the Swiss-German border than at the Italian or French borders. While it does not reflect the extent of cross-border shopping, we believe that crossing the border on the weekend and engaging in cross-border shopping are strongly correlated.

At the same time, house prices at the Swiss-German border increased, while we found no effect in the German market. One potential explanation for the effects in Germany may be the different home-ownership rates across different nationalities (as shown in Figure A.10) with Germans being less likely to be homeowners. This may explain the dynamic on the German side, while on the Swiss border, house prices may discount the welfare gains deriving from cross-border shopping (Burstein et al., 2024).

[11] Figure A.9 of the Appendix we shows the fraction of vehicles entering and leaving Switzerland by purpose of travel: the percentage of Swiss vehicles moving across the German border for cross-border shopping is the highest, while the percentage of foreign vehicles for commuting is the lowest, suggesting that cross-border shopping is relatively more important than cross-border work in Germany.

In conclusion, without evidence of relocation, there are potentially many explanations for the effects observed at the Swiss-German border and in Germany. For example, Kloiber et al. (2025) suggests that on the Swiss-German side, cross-border workers may have capitalized on the higher Swiss salary after 2015 by reducing labor time. We suggest that an important channel is cross-border shopping and the German taxation scheme, as it is the only one that can coherently reconcile the effects on both sides of the German border.

### 5.3 The Gradient of Relocation

An important implication of residential relocation is that it is more convenient when both the residence and workplace are close to the border. First, proximity reduces transaction and relocation costs, simplifying the transition from one country to the other. Second, workers relocating across borders have an incentive to minimize their commuting distance between their new residence and their workplace in Switzerland, which reduces overall commuting costs. Therefore, residential relocation displays a gradient in the effect based on distance from the border.

The residential relocation mechanism becomes clearer when we compare the trajectories of the outcomes in Switzerland and Italy by distance from the border in Figure 8.[12] The Figure shows that the effects on house prices and migration are stronger the closer to the national border. Specifically, house prices in Switzerland at a 5 km distance decrease by at least 1.4 percentage points more than at 20 km, corresponding to a 3.3% drop in house prices. In the 5 km bandwidth the effect on Eurozone residents is about 60% larger than the effect within 20 km. On the Italian side, we observe a similar pattern, with a drop in Italian house prices of about 7% and an increase in migration flows twice as large as in the model within 20 km. Finally, observations within 10 km fall between the 5 km and 20 km effects, highlighting the gradient in the effect.

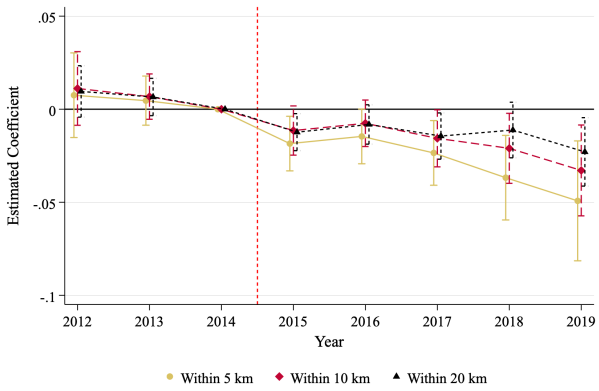
In Figure B.1 of the Appendix we show that prices in France display a gradient closer to the border. In Figure B.14 in the Appendix we show the spatial discontinuity in the prices changes in municipalities at 5 km from the border during the pre-post period (top panel), while between 2013 and 2014, there were no sharp differences (bottom panel).[13]

These findings highlight the role of spatial proximity in cross-border relocation. The presence of a clear relocation gradient suggests that individuals are highly responsive to changes in commuting costs, leading to stronger effects on migration and housing prices closer to the border. These insights contribute to a broader understanding of how labor mobility and housing markets interact in border regions, offering new perspectives on the role of economic shocks in shaping cross-border migration and residential choices.

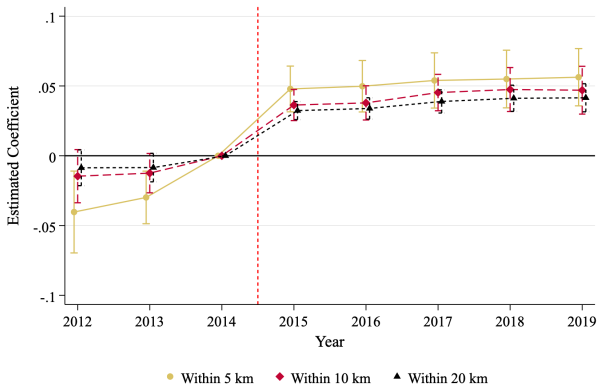
[12] For the sample selection within 5 km, see Figure A.11 in the Appendix.

[13] We compute a polynomial curve for the average house price at each unit of distance from the border for the Swiss municipalities bordering Italy, namely, Canton Ticino in Switzerland and the municipalities of Lombardy and Piedmont in Italy (converting values to Swiss francs using the average exchange rate in 2014) for the pre- (2013–2014) and post-treatment (2015–2019) periods (shown in Figure B.13 in the Appendix). Finally, we compute the percentage change at each unit of distance in the polynomial values between the pre-treatment (2012–2014) and post-treatment (2015–2019) periods.

Figure 8: Distance gradient in Switzerland and Italy

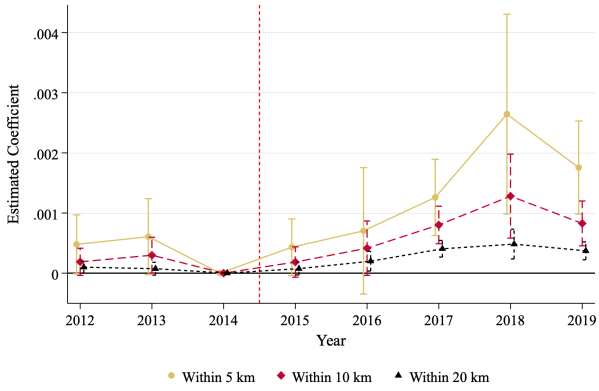



(a) House prices per $m^2$ in Switzerland




(b) House prices per $m^2$ in Italy


(c) Eurozone residents in Switzerland




(d) Migration from Switzerland to Italy

*Notes:* For each year, the Figure displays the estimate of the $\gamma^k$ coefficients reported in equation 1 within 5 km, 10 km and 20 km. We show the result for the following outcomes: a) log of housing prices per meter squared in Switzerland ($N = 503'743$), b) log of housing prices per meter squared in Italy ($N$ =140'171), c) Share of Eurozone residents ($N = 17'064$), and d) Share of Immigrations from Switzerland to Italy ($N$ =9'788) between border and non-border municipalities in Switzerland and in Italy at the shock. We report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Meta-Sys AG, Swiss Federal Office of Statistics, ISTAT and Italian Revenue Agency data.

# 6 Conclusions

In this paper, we investigate how currency shocks, by affecting relative wages, influence cross-border relocation, and its implication on international commuting and housing. As a case study, we exploit the Swiss National Bank's (SNB) unexpected removal of the Euro/Swiss franc (EUR/CHF) exchange rate floor in January 2015, which triggered a sharp appreciation of the Swiss franc, effectively increasing Swiss wages relative to those in the Eurozone. Our findings indicate that this economic shock significantly affected the residential patterns of long-term migrants coming from the Eurozone (EZ residents), who sought to capitalize on higher Swiss wages while benefiting from lower living costs in neighboring countries. Instead of residing in Switzerland, migrants opted to relocate across the border while maintaining employment in Switzerland, leading to an increase in cross-border work, a decrease in housing prices in Switzerland, and an increase in adjacent Eurozone municipalities.

Using a dynamic difference-in-differences approach, comparing Swiss municipalities within 20 km with those further away, we estimate a significant increase in cross-border workers of about 5% while we find no effect on total employment. In these border areas, we also observed a 1.5% decrease in foreign working-age residents and a 1.7% reduction in housing prices per square meter, consistent with the relocation of these workers to their home country, maintaining their jobs on the Swiss side. This trend is particularly pronounced at the Swiss-Italian and Swiss-French border, where the substitution between cross-border workers and residents and the decrease in housing prices were more significant. By contrast, the municipalities at the Swiss-German border do not show evidence of relocation sand display a reverse pattern. To validate these different spatial results we estimate the impact of the policy in Italy and Germany. On one hand, Italian municipalities within 20 km from the Swiss border experienced an increase in immigration from Switzerland of more than 5% and a 3% increase in housing prices. On the other hand, Germany witnessed 1.1% lower migrations from Switzerland, and the German real estate market remains unaffected. The results on migration and housing prices suggest that residential relocation is in place only at the Swiss-Italian border. We complete the analysis evaluating the spatial gradient in the house prices by distance from the border at the Italian and the Swiss border. The results show that the effect on housing prices and migrations are magnified the closer to the border in both Switzerland and Italy, with more pronounced effects within 5 km from the border.

In conclusion, these results contribute to a broader understanding of how labor mobility and housing markets interact in border regions, offering new perspectives on the role of economic shocks in shaping cross-border migration and residential choices. Specifically, we show that in an integrated transnational labor market, exchange rate shocks have a broader pass-through effect, not only influencing retail prices but also indirectly affecting housing markets through labor migration in strategic border areas. A key implication of this finding is that, exporting housing demand in cheaper border location may create affordability challenges for local resident workers, whose purchasing power is significantly lower than that of cross-border workers. Implementing mechanisms to regulate cross-border labor flows during currency shocks could help mitigate unintended housing market distortions.

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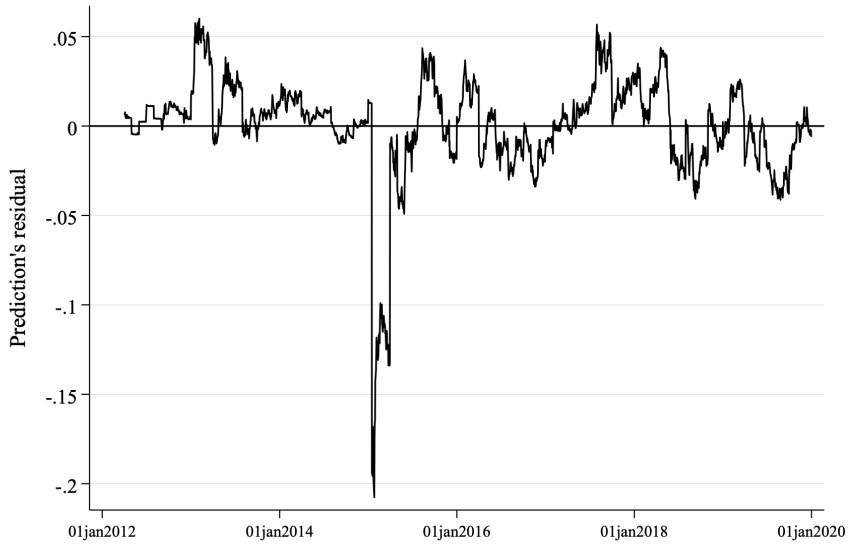
# A Appendix: Additional Figures and Tables

Table A.1: European Transnational Areas

| | |
|---|---|
| **Alpine area** | Switzerland, southern Germany, northern Italy, eastern France, Austria, Liechtenstein and Slovenia |
| **North Sea area** | Norway, western Sweden, eastern United Kingdom, Denmark, Netherlands, northern Belgium, and northern Germany |
| **North West Europe area** | Ireland, United Kingdom, northern France, Belgium, Netherlands, western Germany, Luxembourg, and Switzerland |
| **Northern Periphery area** | Iceland, Norway, northern Sweden, northern Finland, northern United Kingdom, and northern Ireland |
| **Baltic Sea area** | Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Belarus, western Russia, Poland, Denmark, and northeast Germany |
| **Atlantic area** | Ireland, western United Kingdom, western France, northern and western Spain, and Portugal |
| **Danube area** | Southern Germany, Czech Republic, Austria, Slovakia, Slovenia, Hungary, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Bulgaria, Romania, Moldova, and southern Ukraine |
| **Central Europe area** | Eastern Germany, Poland, Czech Republic, Slovakia, Hungary, Austria, Slovenia, northern Italy, Croatia |
| **Adriatic-Ionian area** | Eastern and southern Italy, Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Albania, and Greece |
| **Balkan-Mediterranean** | Albania, Macedonia, Bulgaria, Greece, and Cyprus |
| **South West Europe area** | Portugal, Spain, and south-west France |
| **Mediterranean area** | Southern Portugal, southern Spain, southern France, Italy, Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Albania, and Greece |

*Notes:* Source: European Environment Agency (2020).

Figure A.1: Difference between Euro/Swiss franc Exchange Rate and 3-month Prediction




*Notes:* The Figure shows the difference between the actual exchange rate and the 3-month prediction for each day. The 3-month forecast is computed with a distributed lag model, where the closing value of the Euro/Swiss franc exchange rate is regressed against itself three months prior, along with month-fixed effects.

Figure A.2: Swiss franc/Euro expectations, KOF Consensus Forecast

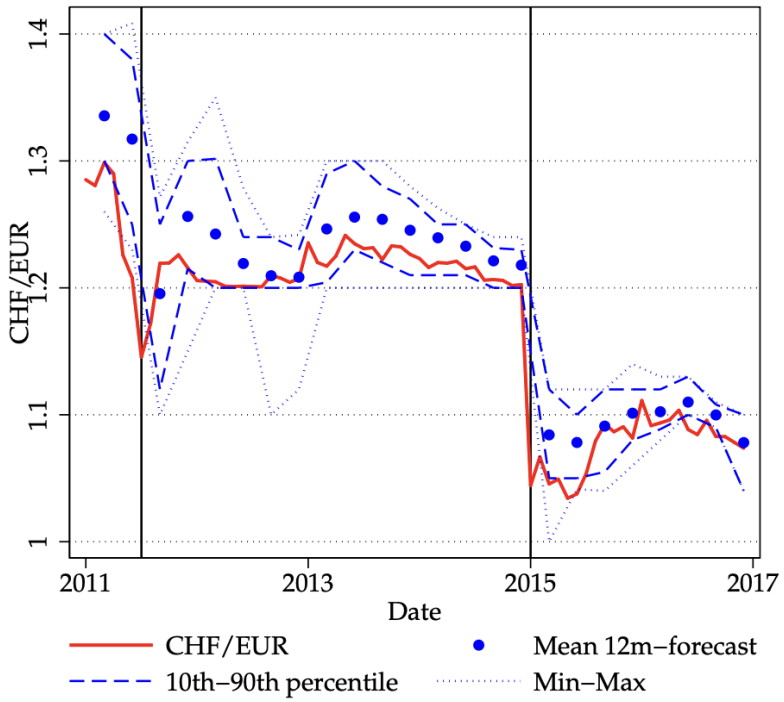
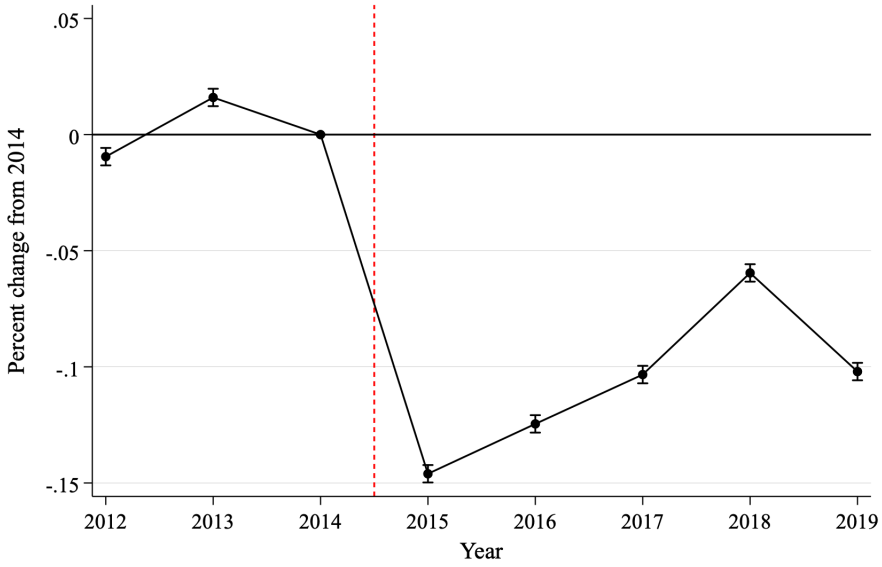


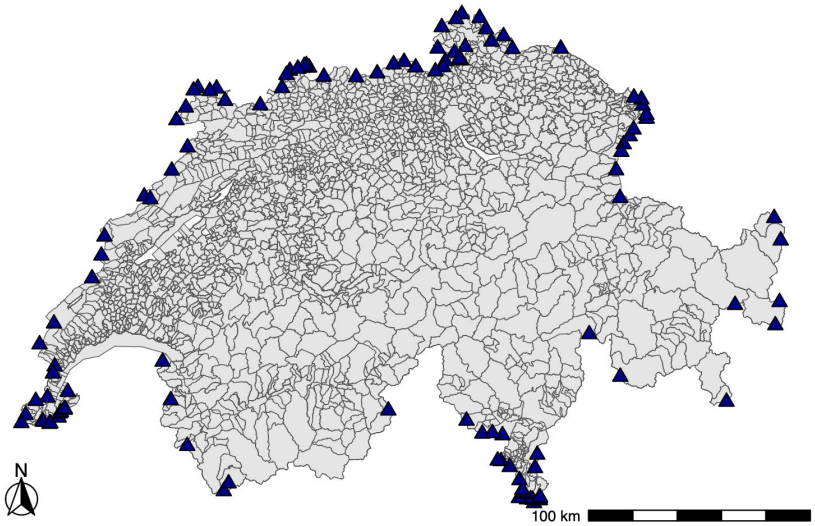
Figure A.3: Yearly Average Euro/Swiss franc Exchange Rate and Nominal Wage (Euros) in Switzerland




(a) Euro/Swiss franc Exchange Rate


(b) Nominal Swiss Wage

Figure A.4: Border Posts




*Notes:* The map displays the location of Swiss border posts. Gaps along the Swiss borders are due to the presence of water basins or mountains.

Figure A.5: Treatment Municipalities in Italy

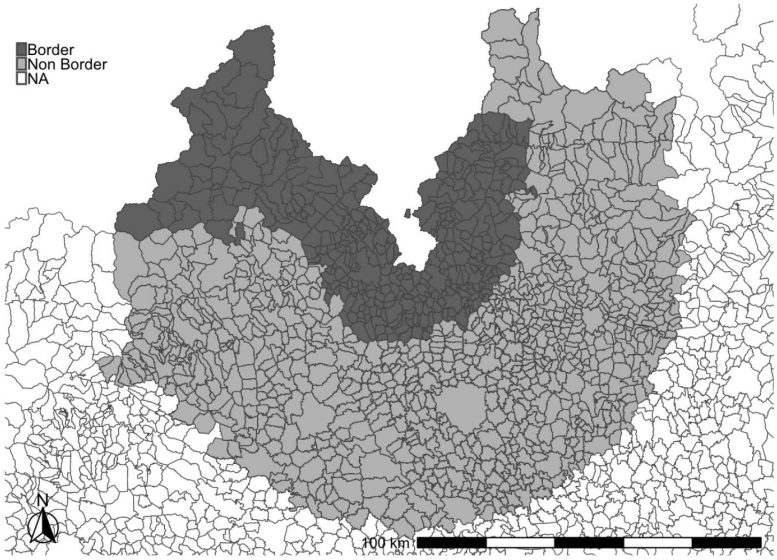


Figure A.6: Treatment Municipalities in Germany

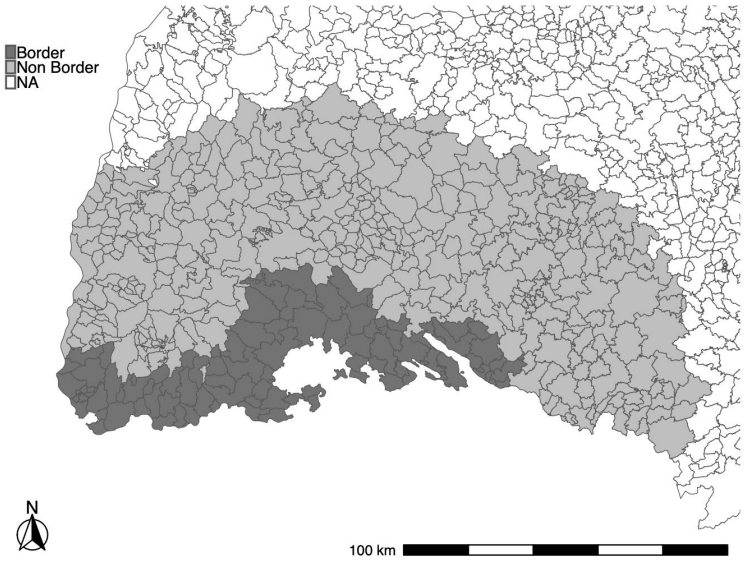
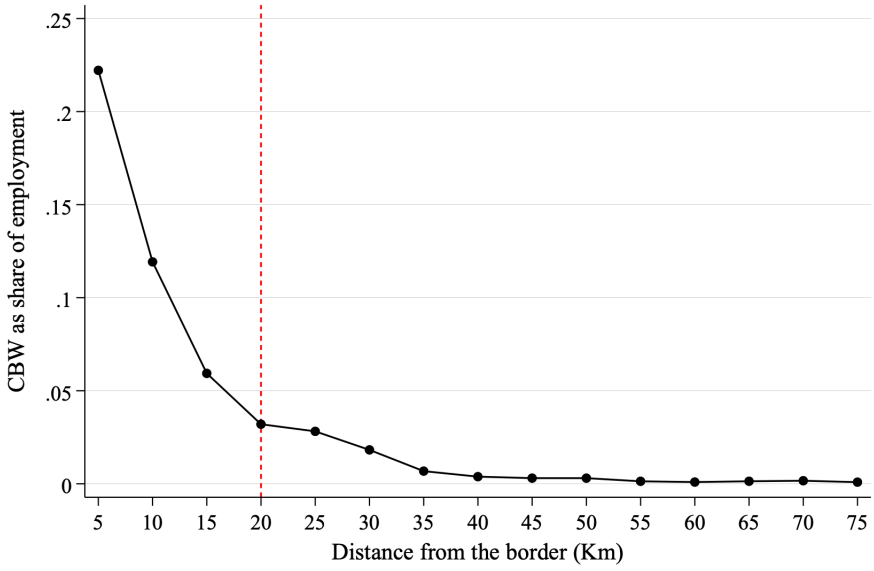
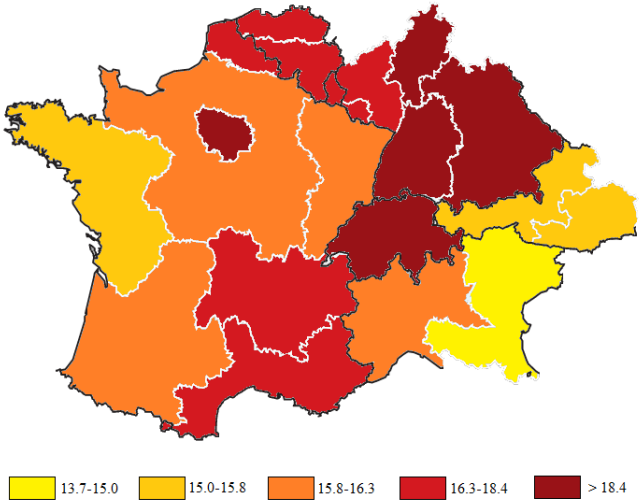



Figure A.7: Cross-Border Workers by Distance



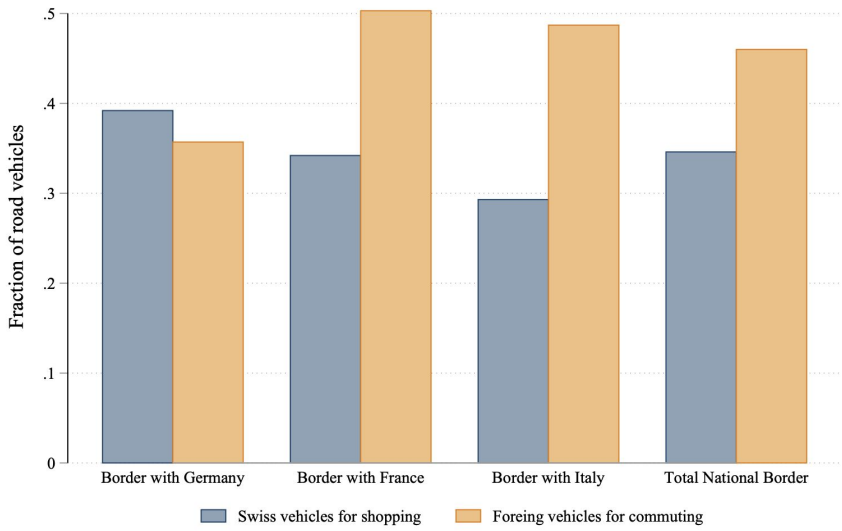

*Notes:* The Figure shows the share of FTE crossborder workers over total FTE employment by 5 km distance bin from the national border. The red vertical line identifies treatment and control areas. Source: our elaboration on Swiss Federal Office of Statistics data.

Figure A.8: 2014 Gross Hourly Wages in Euros



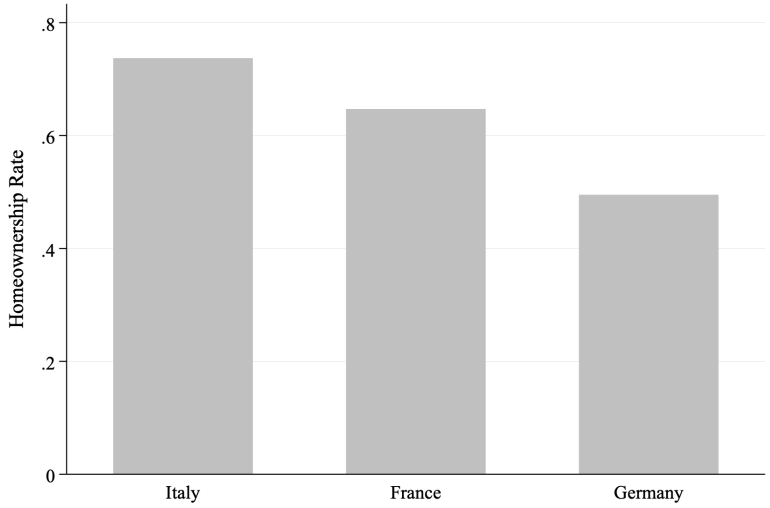

*Notes:* The Figure displays the 2014 hourly wages in Euros by selected regions of the Transnational area of Italy, France, Germany, and Switzerland. Source: Our elaboration on Eurostat Data.

Figure A.9: Fraction of Vehicles Entering and Leaving CH by Purpose of Travel



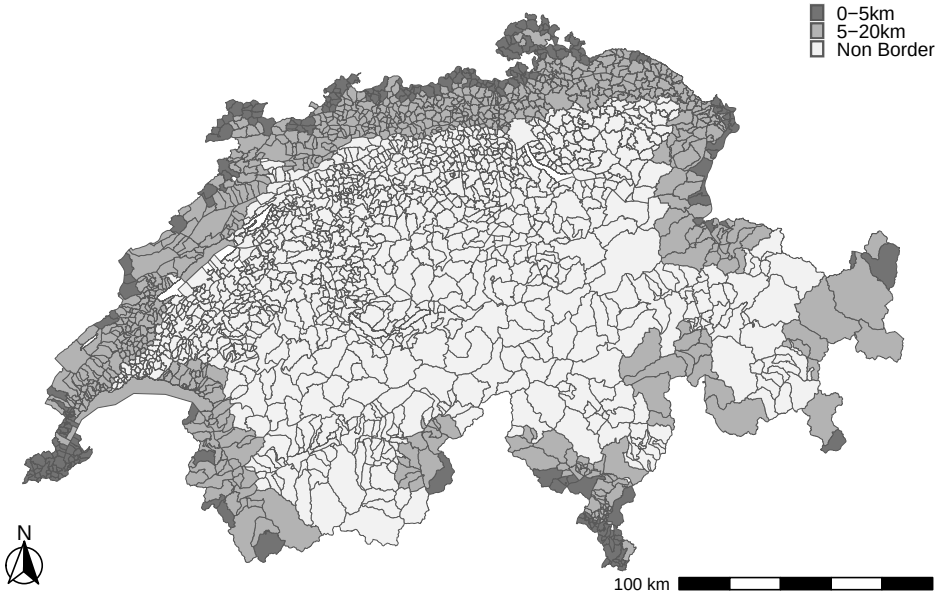

*Notes:* The Figure displays the fraction of vehicles entering and leaving CH by purpose of travel. Source: Our elaboration on Transalpine and cross-border passenger transport data (FSO).

Figure A.10: Homeownership Rates



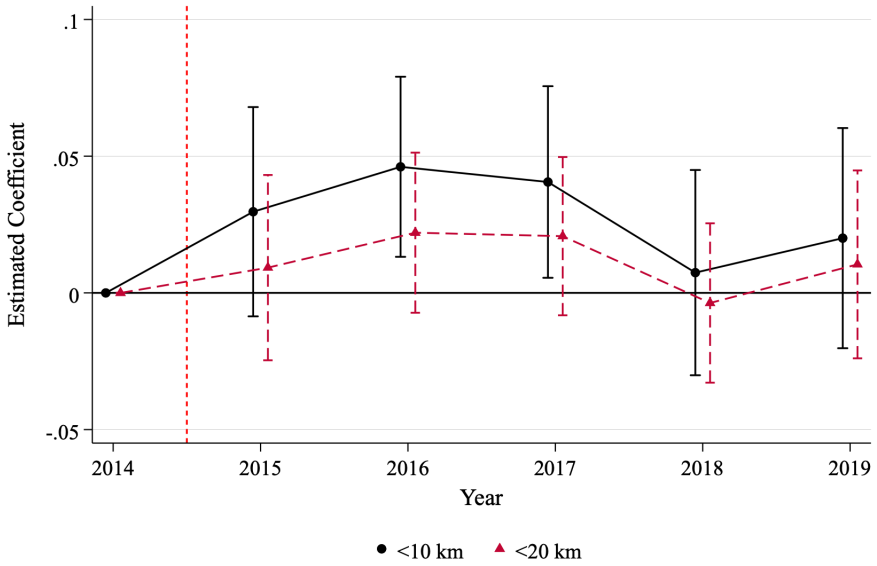

*Notes:* The Figure displays the homeownership Rates of Italy, France and Germany. Source: Our elaboration on Various National Statistics.

Figure A.11: Treatment Selection: Proximity to the border



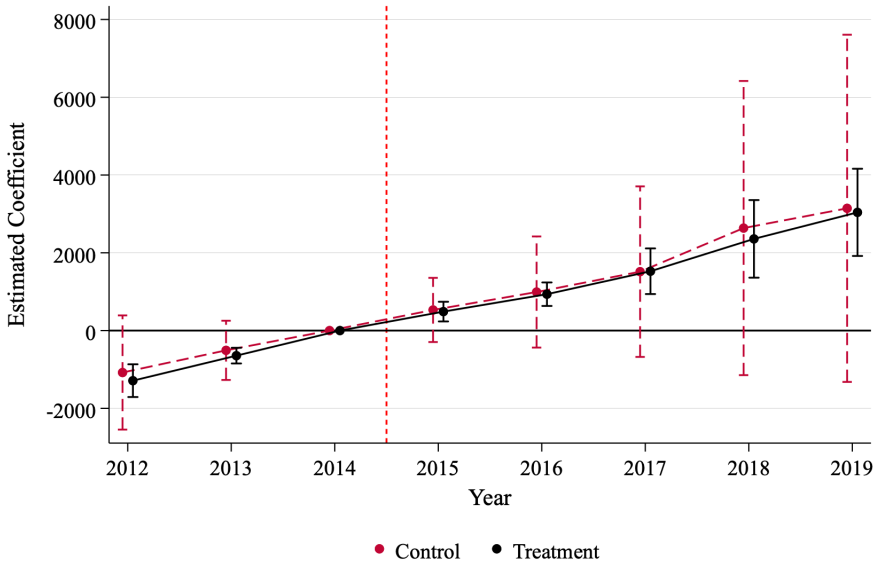
# B Appendix: Heterogeneities and Robustness Checks

Figure B.1: French Land Prices per $m^2$



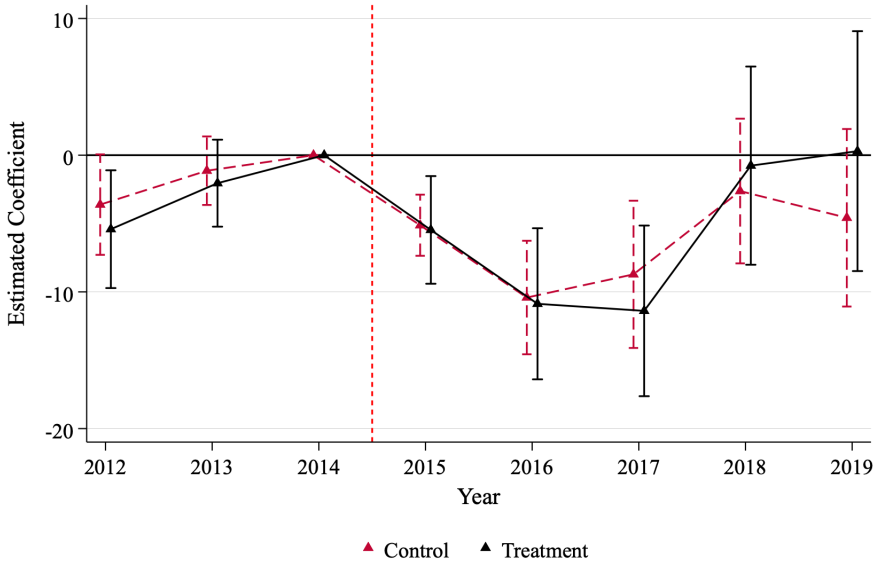

*Notes:* For each year, the Figure displays the estimate of the $\gamma_k$ coefficients reported in equation (1), namely the estimated difference in the log of housing prices per meter squared between border and non-border French municipalities at the shock. The total number of observations is 75'078. We control for municipality, year-fixed effects, and land characteristics. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Direction Interministérielle du Numérique data

Figure B.2: Total Employment by treatment group



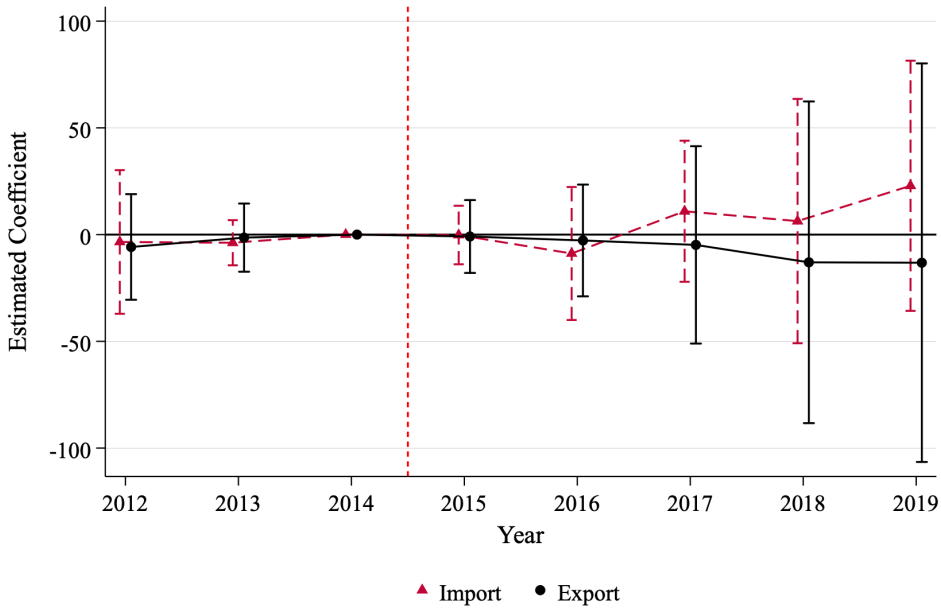

*Notes:* For each year, the Figure displays the estimate the estimated year dummies for overall FTE employment for border and non-border municipalities at the shock separatedly. The total number of observations is 16'992. We control for municipality fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure B.3: Employment in the manufacturing Sector



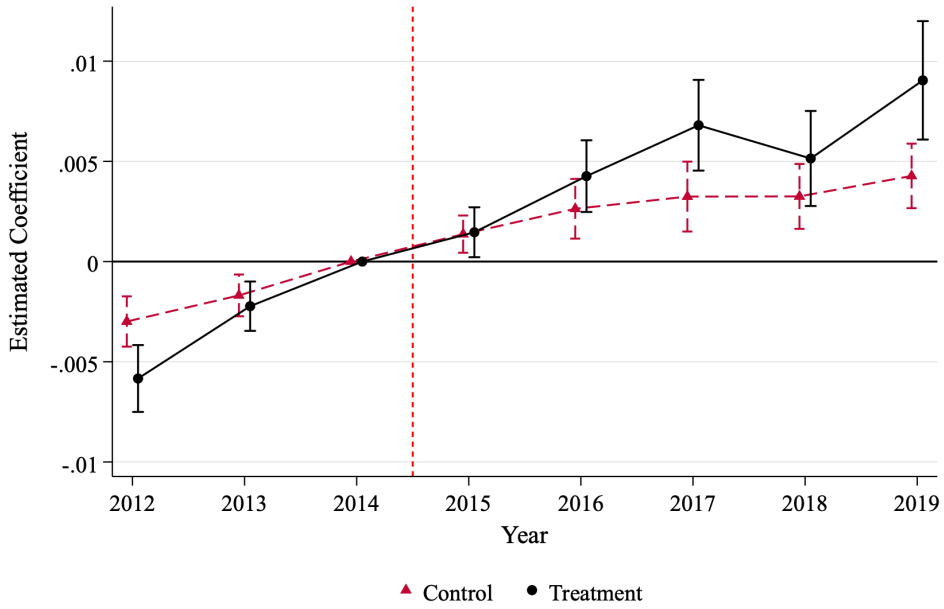

*Notes:* For each year, the Figure displays the estimate the estimated year dummies for FTE employment in the secondary sector for border and non-border municipalities at the shock separatedly. The average number of employees in the secondary sector by municipality in our sample is 50. The total number of observations is 15′756. We control for municipality fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure B.4: Import and Exports intensive municipalities



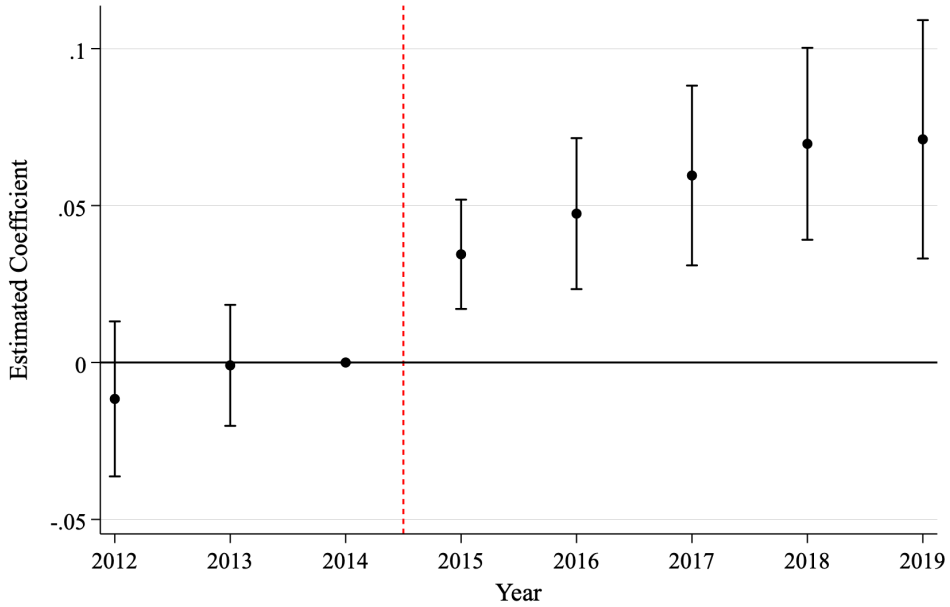

*Notes:* For each year, the Figure displays the estimate of the $\gamma^k$ coefficients reported in equation (1), namely the estimated difference in employment in import and export sectors between border and non-border municipalities at the shock. The total number of observations is 4′431′104. We control for municipality, year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure B.5: Cross-border workers by Treatment



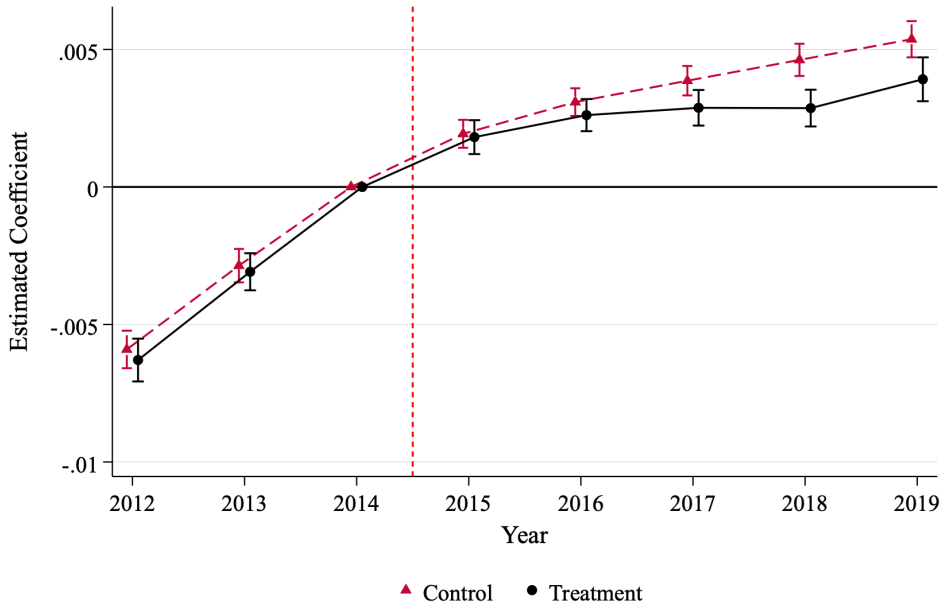

*Notes:* For each year, the Figure displays the estimated difference in CBW share at the shock for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is 16′992. We control for municipality and year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure B.6: Traffic at border posts



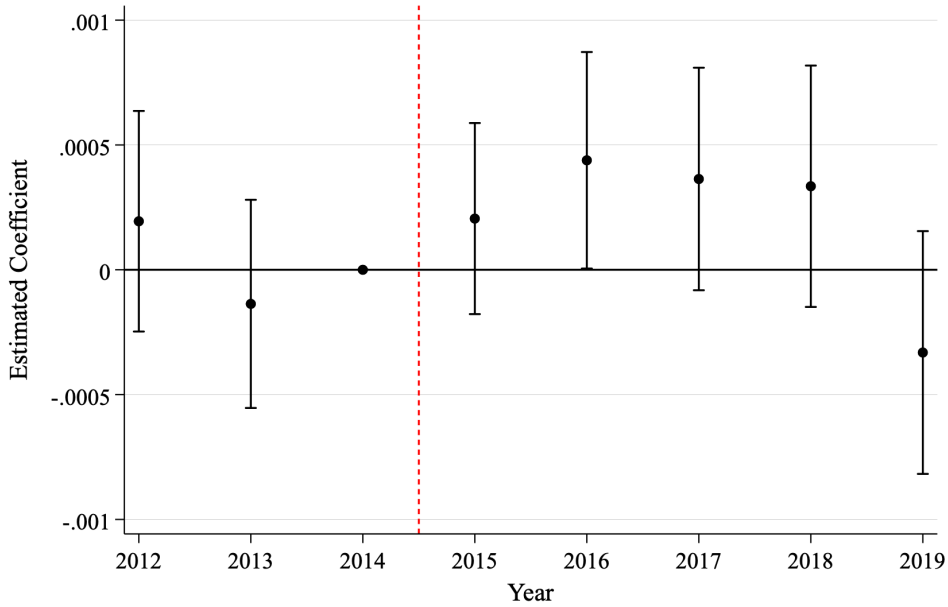

*Notes:* For each year, the Figure displays the estimated difference in traffic at the border posts between tuesday and thursday. The total number of observations is 358. We control for municipality and year-fixed effects and for identifiers for heavy commercial vehicles. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure B.7: Eurozone Working-age Residents' Share by Treatment



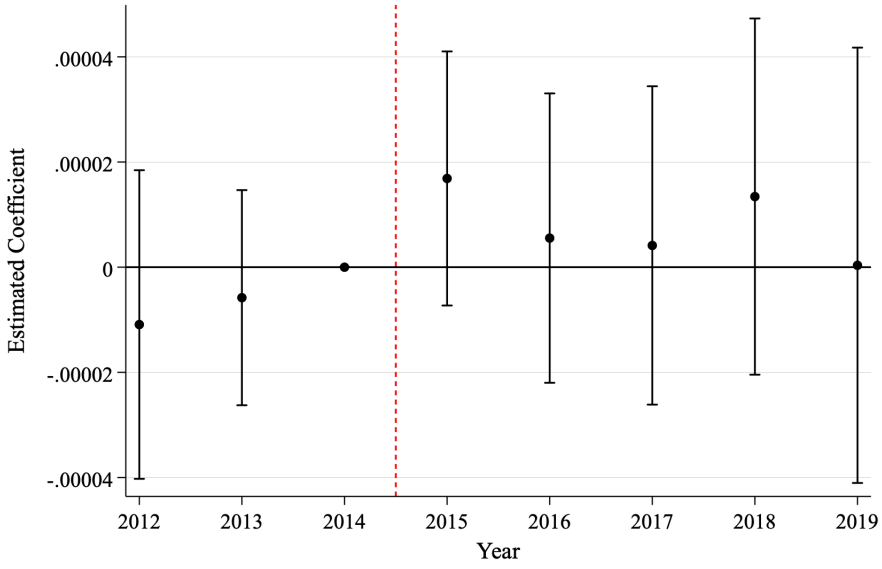

*Notes:* For each year, the Figure displays the estimated difference in Eurozone working-age citizens' share at the shock for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is 17′064. We control for municipality and year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure B.8: Emigrations from Switzerland to EU



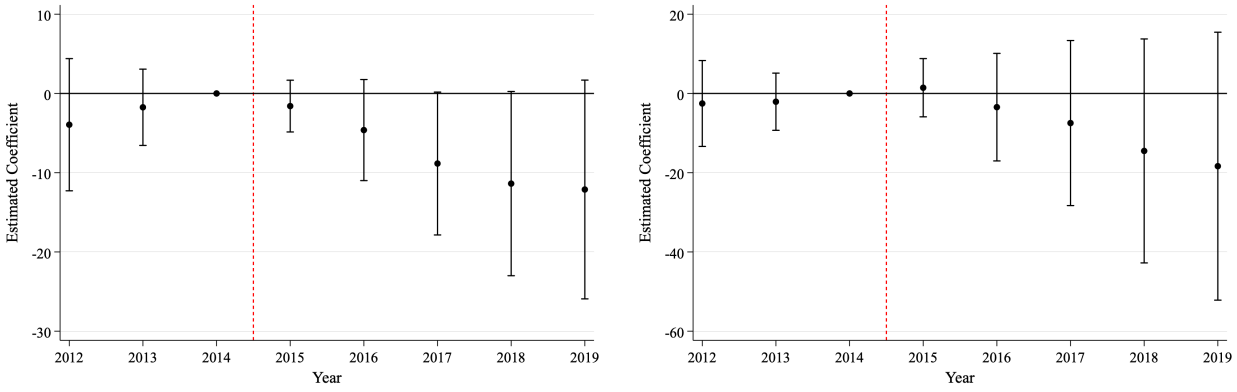

*Notes:* For each year, the Figure displays the estimated difference in the share of emigrations from CH to EU over total population for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is 17′064. We control for municipality and year-fixed effects and urbanization levels. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure B.9: Other European Working-age Residents' Share




*Notes:* For each year, the Figure displays the estimate of the $\gamma^k$ coefficients reported in equation (1), namely the estimated difference in other European working-age citizens' share between border and non-border Swiss municipalities at the shock. The total number of observations is 12′480. We control for municipality and year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure B.10: Absolute values of foreign residents

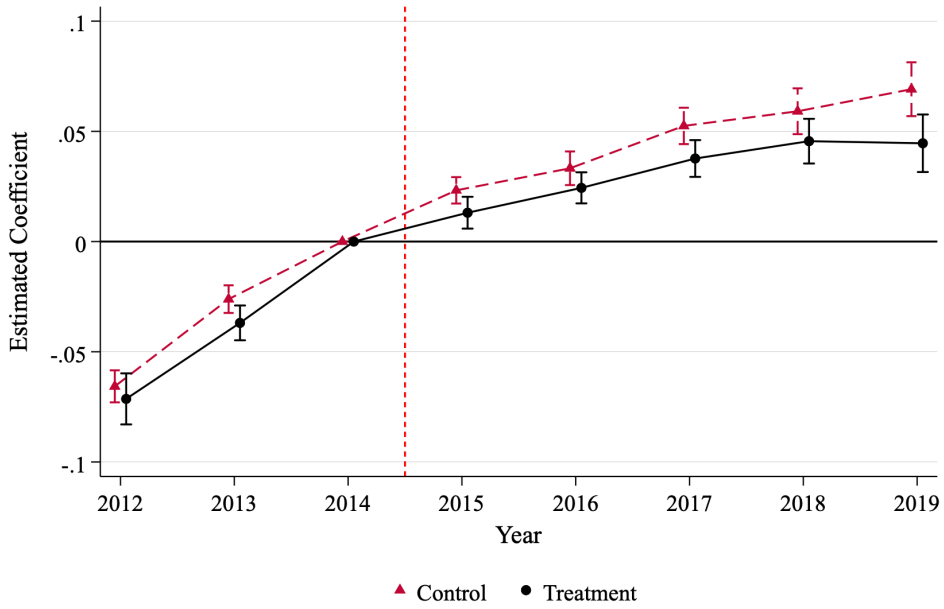



(a) Eurozone Residents

(b) Other foreign Residents

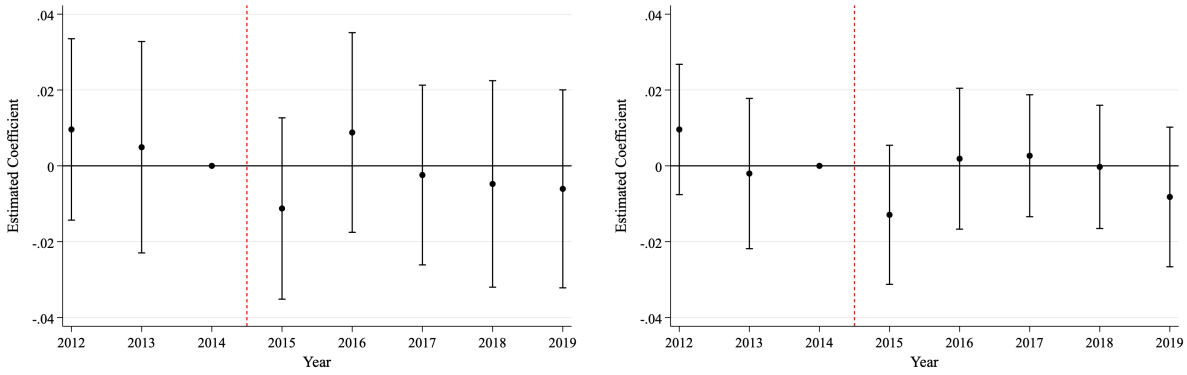
*Notes:* For each year, the Figure displays the estimate of the $\gamma^k$ coefficients reported in equation (1). Specifically, it illustrates the estimated difference in the (a) absolute value of Eurozone residents ($N$ = 17'064) (b) absolute value of other foreign (non-EZ) residents ($N$ =17'064) between border and non-border Swiss municipalities at the shock. Effects are linearly detrendend by the pre period increase in house prices and immigration at the border.We control for municipality and year-fixed effects and urbanization levels. Source: Our elaboration on the Swiss Federal Office of Statistics.

Figure B.11: Swiss House Prices per $m^2$ by Treatment




*Notes:* For each year, the Figure displays the estimated difference in the log of house prices per meter squared at the shock for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is 503′743. We control for municipality, year-fixed effects, and housing characteristics. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Meta-Sys AG data.

Figure B.12: Migration to Treatment Group in Italy

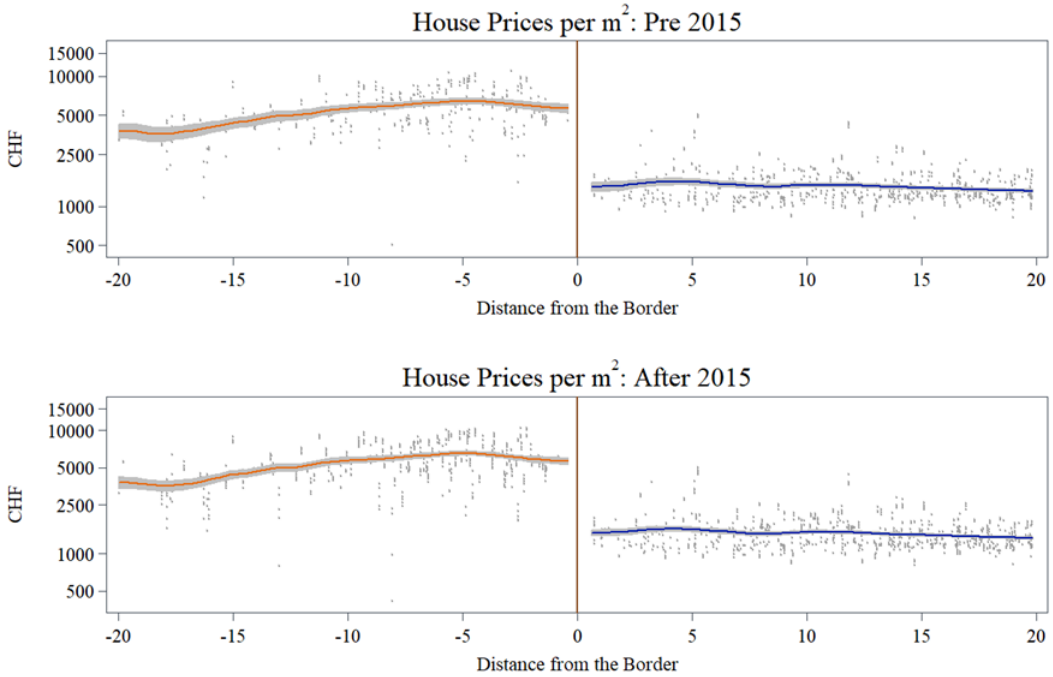



(a) Migration from Control to Treatment

(b) Migration from all Italy to Treatment

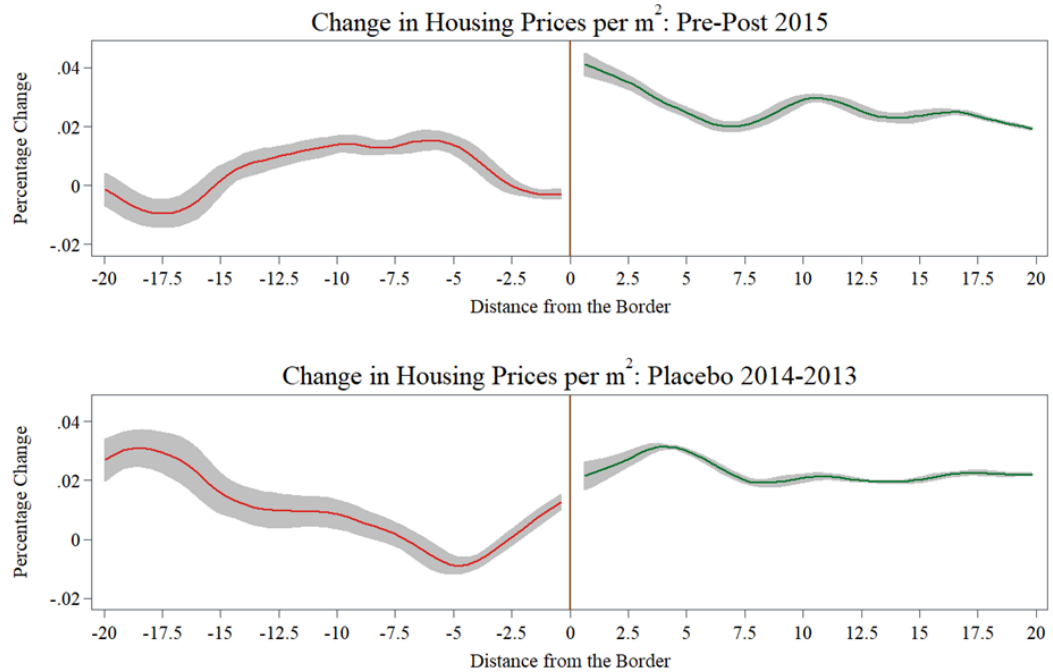
*Notes:* For each year, the Figure displays the estimated year fixed effect from 2014 of the logarithm of migrations in Italy, controlling for municipality fixed effects. We also report 95% level confidence intervals clustered at the municipality level. In sub-figure (a) we focus on migrations between the control group to the treatment group in Italy and the total number of observations is 27'860; in (b) we focus on migrations between the all Italy to the treatment group and the total number of observations is 79'230. Source: Our elaboration on ISTAT data.

Figure B.13: Transnational Bid-Rent Model Before and After 2015 Swiss franc Appreciation




*Notes:* The Figure displays the local linear estimation of the bid-rent curves between municipalities in Switzerland (Ticino, in red) and Italy (Piedmont and Lombardy, in blue) by distance in kilometers from the border. Source: Our elaboration on Metasys AG and Italian Revenue Agency data.

Figure B.14: Percentage Change in Transnational Bid-Rent Curves and Placebo Test




*Notes:* The Figure displays the percentage change in the transnational bid-rent curves between municipalities in Switzerland (Ticino, left-hand side) and Italy (Piedmont and Lombardy, right-hand side) by distance in kilometers from the border. We also report 95% confidence intervals. Source: Our elaboration on Metasys AG and Italian Revenue Agency data.

Table B.1: Migration on House Prices In Switzerland

| | Log House Prices $m^2$ |
|---|---|
| Treat × Post × EZ Share | 0.0178* |
| | (0.01069) |
| R-Squared | 0.539 |
| N | 493'511 |
| Municipality FE | Yes |
| Year FE | Yes |
| House Characteristics | Yes |

*Notes:* The Table displays the estimated triple difference in the effect of migration (EZ share) on the log of housing prices per square meter between border and non-border municipalities in Switzerland after the removal of the Euro/Swiss franc exchange rate floor in 2015. We control for municipality, year fixed-effects, and housing characteristics. Standard errors are clustered at the municipality level. Significance levels: *** $p < .01$, ** $.01 \leq p < .05$, * $.05 \leq p < .10$. Source: Our elaboration on Meta-Sys AG and Swiss Federal Office of Statistics data.

Table B.2: Housing Stock

| Log $m^2$ of new postings | House Prices |
|---|---|
| Treat × Post | 0.0035 |
| | (0.0201) |
| R-Squared | 0.825 |
| N | 14'599 |
| Municipality FE | Yes |
| Year FE | Yes |

*Notes:* The Table displays the estimated difference in the log squared meters of new postings of housing, between border and non-border observations after the removal of the Euro/Swiss franc exchange rate floor in 2015. We control for municipality and year fixed-effects. Standard errors are clustered at the municipality level. Significance levels: *** $p < .01$, ** $.01 \leq p < .05$, * $.05 \leq p < .10$. Source: Our elaboration on Meta-Sys AG data.

Table B.3: Migration on House Prices in Italy

| | Log House Prices $m^2$ |
|---|---|
| Treat × Post × Immigration Share | 0.0181* |
| | (0.00939) |
| R-Squared | 0.91 |
| N | 53'638 |
| OMI District FE | Yes |
| Year FE | Yes |
| House Characteristics | Yes |

*Notes:* The Table displays the estimated triple difference in the effect of migration from Switzerland to Italy on the log of housing prices per square meter between border and non-border municipalities in Italy after the removal of the Euro/Swiss franc exchange rate floor in 2015. We control for municipality, year fixed-effects, and housing characteristics. Standard errors are clustered at the municipality level. Significance levels: *** $p < .01$, ** $.01 \leq p < .05$, * $.05 \leq p < .10$. Source: Our elaboration on Italian Revenue Agency and ISTAT data.

Table B.4: Weekend Average Daily Traffic by Swiss-Border Country

| | Weekend Average Daily Traffic |
|---|---|
| Post | 0.086*** |
| | (0.0152) |
| Swiss-Italian × Post | -0.0288 |
| | (0.0271) |
| Swiss-French × Post | -0.0267 |
| | (0.0208) |
| R-Squared | 0.996 |
| N | 315 |
| Border Post FE | Yes |
| Year FE | Yes |

*Notes:* The Table displays the estimated difference in the log of Weekend Average Daily Traffic by Swiss-Border Country. The reference category is represented by the Swiss-German border. We control for border post and year fixed effects. Standard errors are clustered at the border post level. Significance levels: *** $p < .01$, ** $.01 \leq p < .05$, * $.05 \leq p < .10$. Source: Our elaboration on Swiss Federal Office of Statistics data.

# C Appendix: The Residential Location Model

## C.1 Set up

We now describe the residential location model that explains the mechanism of relocation after an exchange rate shock. Consider a transnational Regional Economy ($RE$) embedded within a wider economy. The Regional Economy consists of a set of discrete residential locations indexed by $r = 1,\ldots,s,\ldots R$. The $RE$ is populated by a fixed measure of $N$ workers, which earn an exogenous income level $y$ that is constant across workplaces $w$. We assume that within $RE$, there is an official border that divides it into two national sub-regions called $Ch$ and $Ez$,

$$Ch = \{1^{Ch},\ldots,s^{Ch},\ldots,R^{Ch}\}; \quad Ez = \{1^{Ez},\ldots,s^{Ez},\ldots,R^{Ez}\}$$

Thus, the discrete locations of the Regional Economy are derived from the union of the two sub-regions:

$$RE = Ch \cup Ez = \{1,\ldots,s,\ldots,R\}$$

The workplace is restricted to one sub-region, $Ch$. In other words, in $Ch$ the agents can both reside and work, while in $Ez$ can only reside. Agents face commuting costs $T_{rw}$, which are equal to the distance between residence and workplace $d$ times the transportation costs per kilometer $t$. The distance function, $d$, is differentiated on the two sides of the border; thus:

$$T_{rw} = \begin{cases} td_{rw} & \text{if } r,w \in Ch \\ t(d_{rb} + d_{wb}) & \text{if } r \in Ez \text{ and } w \in Ch \end{cases}$$

where $b$ is the nearest border post to the residence location.

Each location has a resident population stock $N_r$. The sum of all the households in the regional economy coming from the different locations gives us the resident population of the area:

$$N = \sum_r N_r$$

The discrete locations are characterized by an exogenous level of amenities $B_r$ and a location-specific idiosyncratic shock $z_{ir}$ that captures the idea that individual $i$ can have heterogeneous reasons to live in different parts of the Regional Economy; the idiosyncratic shock $z_{ir}$ also captures place attachment: individuals should have a weak preference to live in the place of origin. As it is standard in the literature, we assume that the idiosyncratic shock is Fréchet distributed. Individuals consume a basket of goods $c_r$ in the place of residence, a numéraire set of goods $c_w$ in the workplace, and they have an individual housing demand $h_r$. The housing prices are an implicit function of the distance from the border $d_{rb}$:

$$Q_r(d) = q_r(d_{rb}); \qquad r \in Ch \ \vee \ r \in Ez$$

The housing price decreases with the distance from the border in $Ez$ because, being the workplace restricted in $Ch$, the closer to the border the agent resides, the lower transportation costs are. Thus, the housing prices adjust to compensate for the higher transportation expenditures. On the other hand, in $Ch$ the housing costs can either increase or decrease with the distance.

We now describe agents' residence choices, deriving the residential choice probability equation; then we present the housing market equilibrium and the general equilibrium of the model. Finally, we explain how a currency appreciation, assimilated by a shock in consumption prices in one sub-region affects the equilibrium. In the section C.6 of the Appendix, we present a two-location model which specifically describes the mechanism in our empirical setting.

## C.2 Residence Choice Clearing Conditions

Individuals' preferences are described by a Cobb-Douglas utility function. The utility increase with amenities $B_r$, the idiosyncratic shock $z_{ir}$, the consumption of goods $c_r$ and $c_w$, and the consumption of housing $h_r$ in the chosen residential location $r$:

$$U_{irw} = B_r z_{ir} \left(\frac{c_r}{\alpha}\right)^{\alpha} \left(\frac{c_w}{\beta}\right)^{\beta} \left(\frac{h_r}{1-\alpha-\beta}\right)^{1-\alpha-\beta}$$

Each individual faces the following budget constraint, where the price of the workplace consumption is set as numéraire:

$$c_r p_r + c_w + h_r Q_r(d) + T_{rw} = y$$

We model the heterogeneity in the utility that workers derive from living in different parts of the city following McFadden (1974) and Eaton and Kortum (2002). For each agent $i$ and living in location $r$, there is an idiosyncratic component of utility $z_{ir}$, drawn from an independent Fréchet distribution:

$$F(z_{ir}) = e^{-A_r z_{ir}^{-\varepsilon}}; \qquad A_r > 0, \quad \varepsilon > 1$$

with $A_{or}$ being the average utility derived from living in location $r$, while $\varepsilon$ is the Fréchet shape parameter. We derive the individual demands for housing and consumption goods, obtaining the indirect utility of living in location $r$ and working in location $w$. Notice that the shock in consumption prices affects only the residence choice but not the workplace. Therefore, we can omit the subscript $w$, to make notation coincise:

$$V_{iwr} = \frac{B_r z_{ir}(y - T_{rw})}{p_r^{\alpha}[Q_r(d)]^{1-\alpha-\beta}} = \frac{B_r z_{ir}(y - T_r)}{p_r^{\alpha}[Q_r(d)]^{1-\alpha-\beta}} \tag{2}$$

Since the indirect utility is a monotonic function of the idiosyncratic shock $z_{ir}$, which has a Fréchet distribution, it immediately follows that the indirect utility also has a Fréchet distribution. After observing the realizations for idiosyncratic utility, each agent chooses her location of residence to maximize her utility, taking as given residential amenities, goods' prices, and the location decisions of other individuals.

Given that each individual can decide to live either in the Regional Economy or outside, in the wider economy, the expected utility of living in one of the locations of the Regional Economy must be equal to the reservation utility of living elsewhere in the wider economy $\bar{U}$:

$$\mathbb{E}[u] = \gamma\phi^{1/\varepsilon} = \gamma\left\{\sum_{r=1}^{R} A_r \left[p_r^{\alpha}[Q_r(d)]^{1-\alpha-\beta}\right]^{-\varepsilon} [B_r(y - T_r)]^{\varepsilon}\right\}^{1/\varepsilon} = \bar{U}$$

The probability that an individual decides to live in location $r$ out of all possible locations $s$, derived through the maximization process of the Fréchet distribution, and where the maximum of a Fréchet distribution is itself Fréchet distributed, is given by:

$$\pi_r = \frac{A_r \left(p_r^{\alpha}[Q_r(d)]^{1-\alpha-\beta}\right)^{-\varepsilon} [B_r(y - T_r)]^{\varepsilon}}{\sum_{s=1}^{R} A_s \left(p_s^{\alpha}[Q_s(d)]^{1-\alpha-\beta}\right)^{-\varepsilon} [B_s(y - T_s)]^{\varepsilon}} = \frac{\phi_r}{\phi}$$

The probability that an individual chooses to live in location $r$ positively depends on the location's amenities ($B_r$) and on the average utility derived from living in the residence $r$ ($A_r$), while it negatively depends on

the consumption price in the residence ($p_r$) and on the housing prices ($Q_r$). Equating the share of residents in location $r$ with the probability of living in location $r$ we obtain the residential location clearing condition:

$$\frac{N_r}{N} = \frac{\phi_r}{\phi} = \pi_r$$

## C.3 Housing Market Clearing Condition

The aggregated demand of housing in residence $r$ is given by the individual optimal housing demand (derived from the individuals' utility maximization) multiplied by the number of residents in location $r$:

$$H_r^D = h_r^* N_r \tag{3}$$

We model housing supply as a homogeneous good produced with constant returns to scale using non-land capital and land. Housing is supplied by land developers at increasing marginal cost and sold to atomistic landlords who then reside there. The total dwelling stock of sub-district $r$ is equal to:

$$H_r^S = \gamma [Q_r(d)]^{\eta_r^{S,Q}} \tag{4}$$

where $\eta_r^{S,Q}$ is the housing supply elasticity with respect to housing prices and $\gamma$ is a positive constant. Housing supply is allowed to vary across locations according to the tightness of topographical and administrative constraints on construction (Brulhart et al., 2025; Hilber and Vermeulen, 2016; Saiz, 2010). The housing market equilibrium is determined by the equality of $H_s^D$ and $H_s^S$.

## C.4 The General Equilibrium

In this section, we formalize the definition of equilibrium under the assumption of strictly positive, finite, and exogenous location characteristics: $B_r \in (0,\infty)$ and $A_r \in (0,\infty)$.

**Definition 1** *Given the parameters of the model* $\{\alpha,\beta,\varepsilon,\gamma,\eta\}$*, the reservation level of utility in the wider economy* $\bar{U}$*, an exogenous income level y, the exogenous locations' characteristics* $\{B_r, A_r\}$*, the general equilibrium is defined by the vector* $\{p, Q, N_r, \pi_r\}$ *if it satisfies:*

1. *The indifference condition,*

$$\gamma \left\{ \sum_{r=1}^{R} A_r \left( p_r^{\alpha} [Q_r(d)]^{1-\alpha-\beta} \right)^{-\varepsilon} [B_r (y - T_r)]^{\varepsilon} \right\}^{1/\varepsilon} = \bar{U} \tag{5}$$

2. *The residential choice probability equation,*

$$\pi_r = \frac{A_r \left( p_r^{\alpha} [Q_r(d)]^{1-\alpha-\beta} \right)^{-\varepsilon} [B_r (y - T_r)]^{\varepsilon}}{\sum_{s=1}^{R} A_s \left( p_s^{\alpha} [Q_s(d)]^{1-\alpha-\beta} \right)^{-\varepsilon} [B_s (y - T_s)]^{\varepsilon}} \tag{6}$$

*3. The housing market equilibrium equation,*

$$H_r^D = H_r^S, \qquad \forall r \in R \tag{7}$$

Thus, the general equilibrium result is given by the population composition of the residential location:

$$N_r = \pi_r N \tag{8}$$

## C.5 Comparative Statics

In this section, we explain the comparative statics on the main equilibrium parameters for a given change in consumption prices.[14] Log-differentiating the residential choice probability equation and the housing market equilibrium equation, we obtain a relation between the change rate of the population residing in $r$ with a change rate of the consumption goods' price in $r$:

$$\widehat{N}_r = -\frac{\varepsilon\alpha\left(1+\eta_r^{S,Q}\right)}{\varepsilon(1-\alpha-\beta)+1+\eta_r^{S,Q}} \cdot \widehat{p}_r = \vartheta_r \widehat{p}_r$$

Now, since $\vartheta_r < 0$, a negative shock in the consumption goods' price in $r$, $p_r$, will cause an increase of the population in $r$, $N_r$. In turn, from the log-differentiation of the housing market equilibrium equation, a positive shock in $N_r$ will cause an increase in $Q_r(d)$:

$$\widehat{Q}_r(d) = \frac{1}{1+\eta_r^{S,Q}} \cdot \widehat{N}_r = \xi_r \widehat{N}_r$$

where $\xi_r > 0$. Finally, by rearranging the equations of the equilibrium we obtain the model-based change in housing prices for a given change in consumption goods' price:

$$\widehat{Q}_r(d) = -\frac{\varepsilon\alpha}{\varepsilon(1-\alpha-\beta)+1+\eta_r^{S,Q}} \cdot \widehat{p}_r = \eta_r^{Q,p} \widehat{p}_r$$

Since $\eta_r^{Q,p} < 0$, a negative shock in $p_r$ will cause an increase of the housing price $Q_r(d)$.

## C.6 Two-locations Model

Assume that there are only two locations in the transnational Regional Economy, $R = 2$, one on each side of the border. In one of the two sides, *Ch*, residence and workplace coincide:

$$w = r = Ch$$

while on the other side, in *Ez*, being the workplace $w$ fixed in *Ch*, it is only possible to reside:

[14] Notice the following notation rule; for a generic variable $x_r$, we define $\widehat{x}_r$ as the change rate in $x_r$ after a given shock in the economy:

$$\widehat{x}_r = \frac{d\ln x_r}{x_r}$$

$$w = Ch; \qquad r = Ez$$

All the prices are expressed in the unit of account of *Ch*. Thus, an appreciation of the unit of account in *Ch*, which determines a reduction of the consumption goods price in $Ez$, will cause an increase in the population residing in $Ez$. Since the total population of the regional economy is fixed, the appreciation will cause a reduction of residents in *Ch*:

$$\widehat{p}_{Ez} < 0 \quad \Rightarrow \quad \widehat{N}_{Ez} > 0 \quad \wedge \quad \widehat{N}_{Ch} < 0$$

The shock in the population stock will be such that the housing prices decrease in *Ch* and increase in $Ez$:

$$\widehat{N}_{Ez} > 0 \quad \Rightarrow \quad \widehat{Q}_{Ez}(d) > 0; \qquad \widehat{N}_{Ch} < 0 \quad \Rightarrow \quad \widehat{Q}_{Ch}(d) < 0$$

The idiosyncratic shock $z_{i,Ch}$ ensures that only agents with specific heterogeneous preferences will move to $Ez$. In particular, this parameter captures heterogeneous reasons for the agents' residence choice such as the weak preference to reside in the place of origin (i.e. place attachment).

Notice that the change in housing prices in $Ez$ and *Ch* relative to the distance from the border between these two regions is such that:

$$\frac{\partial \widehat{Q}_{Ez}(d)}{\partial d} < 0 \qquad \frac{\partial \widehat{Q}_{Ch}(d)}{\partial d} > 0$$

The increase in housing prices diminishes with the distance to the border in $Ez$ because, being the workplace restricted in *Ch*, the closer to the border the agent resides, the lower transportation costs are. Thus, agents prefer to relocate to the other side (in $Ez$) in proximity to their workplace in *Ch*. On the contrary, the decrease in housing prices in *Ch* is higher (in absolute terms) nearer to the border since the probability of relocation is higher; this relates to the fact that the transaction costs (moving, legal, consulting costs, ...) are lower for municipalities in *Ch* nearer to $Ez$.

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