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

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Abstract

This paper investigates how exchange rate policies impact migration and residential decisions, and their consequences on the labour and housing markets in the Swiss and Eurozone transnational economy. We construct an extensive dataset comprehending Switzerland, Italy and Germany and we use as a case study the 2015 Swiss Franc appreciation, which caused an increase in the purchasing power of a Swiss salary spent in the Eurozone. Using a dynamic difference in difference regression, we show that after the shock, Swiss border areas experienced an outflow of residents and an inflow of cross-border workers but no change in employment. We explain this pattern through residential relocation of Eurozone residents precedently living and working in Switzerland, that now turn into cross border workers. The relocation caused a reduction in housing demand in Swiss border municipalities which translated into lower housing prices. We find heterogeneous responses at the regional level: in Italian and French-speaking municipalities the relocation prevails, while in German-speaking ones there has been a labor-leisure time effect. The results on the other side of the border are coherent with our effects in Switzerland. Our findings suggest that, economic incentives in the origin country within a transnational economy impact migration and residential decisions with important implication on the employment structure and housing prices.

JEL Classification: R23, J61, R30, F31

Keywords: residential relocation, cross-border employment, housing prices, exchange rate

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1 Introduction

Transnational macro-economies are regions that span across national borders, where economic activities are integrated between neighboring countries, creating unique opportunities for employment and residential patterns.[1] Within these regions, border economies are especially relevant. Located near international borders, these areas leverage proximity to foster a dynamic, interdependent system of economic and social exchange with their neighboring countries. A significant feature of border economies is cross-border employment. Unlike long-term migration, it represents a form of temporary migration involving workers living in one country and commuting to work in a neighboring country (Kondoh, 1999; Tassinopoulos and Werner, 1999). Cross-border work also differs from standard commuting as crossing national boundaries adds a unique legal and logistical dimension.[2] This phenomenon is prevalent in regions like the US-Mexico border (Gerber, 2024) and between Switzerland and neighboring Eurozone countries. For example, in the fourth quarter of 2022 in Switzerland, there were 380'000 cross-border workers (roughly 7.5% of the workforce) of whom 56.3% resided in France, 23.5% in Italy, and 17.1% in Germany. Despite the growing political and economic significance of cross-border employment, its implications for residential choices remain largely understudied.

Often, countries within a transnational macro-economy do not share the same currency. Thus, exchange rate shocks can reshape the economic dynamics between these regions. In particular, an exchange rate shock influences one country's imports, exports and hence employment. Further, it also affects wages relative to those of its neighbors, affecting labor migration patterns (Dustmann et al., 2023; Nekoei, 2013). While the effects of a currency change on prices, wages and trade have been thoroughly investigated, little is known about how currency shocks, by changing relative wages, impact cross-border work, migration and consequently the real estate markets.

This paper examines how currency shocks, by affecting relative wages, impact relocation across borders, and its implication for cross border commuting and housing. As a case study, we exploit the Swiss National Bank's (SNB) removal of the Euro/Swiss franc exchange rate floor in January 2015, which triggered a sharp Swiss franc appreciation, increasing Swiss wages relative to those in the Eurozone. To explore these effects, we construct an innovative dataset that integrates data from Switzerland, Italy, and Germany analyzing areas within 20 km of the Swiss border, where cross-border employment is feasible, and using more distant areas as our control group. We find that this economic incentive impacted relocation as Eurozone residents sought to capitalize on higher Swiss wages by living in more affordable neighboring countries and working across the border, with important implications for housing prices, and the employment structure.

We construct a new dataset containing information on Switzerland, Italy and Germany over the period 2012–2019. We gather Swiss data on cross-border workers, employment, and population by nationality at the municipality level and merge them with house prices and characteristics at the individual level. We then collect migration flows between Switzerland and Italy, population and house prices at the municipality level for Italy. Finally, we complement these data with house prices in German municipalities. We then geolocalize each Swiss border post and create a treatment indicator using Euclidean distances from each municipality and the nearest border post and classify municipalities as border and non-border, identifying the transnational economy between Switzerland,

[1] See section D.1 of the Appendix for a full list of the European transnational areas.

[2] In Switzerland, these workers are issued with a permit (permit G) that grants them the status of cross border worker. Notably, it does not allow residence but only the possibility to work.

Italy and Germany as all border municipalities within 20 km from the closest border post.

Using a dynamic difference-in-differences approach, we analyze the impact of the 2015 Swiss franc appreciation on employment, cross-border work, nationality structure, and housing prices between areas within 20 km from the Swiss border and those further away. Swiss municipalities within 20km 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 relocation of these workers to their home country, maintaining their jobs on the Swiss side. A lower-bound estimate for the direct impact of relocation on house prices, show that a 1% decrease in the share of EZ residents in Swiss border areas resulted in a 1.7 percentage point reduction in housing prices. This trend is particularly pronounced at the Swiss-Italian and Swiss-French border, where the CBW-resident substitution and the decrease in housing prices were more significant. By contrast, the municipalities at the Swiss-German border do not show evidence of relocation. 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. Roughly, we estimate that a 1% increase in immigration from Switzerland to Italy led to a 1.8 percentage point rise in housing prices. On the other hand, the German real estate market remains unaffected. These results suggest that at the Swiss-Italian and Swiss-French border, the adjustment in housing and labor markets following the Swiss franc appreciation is driven by residential relocation. Conversely, in German-speaking municipalities, we suggest a different mechanism in place, explainable mainly by the different taxation regime for German cross-border workers. We complete the analysis evaluating the spatial discontinuities in house prices between the Italian and Swiss border. The results show that housing prices per square meter vary with the distance to the border in both Switzerland and Italy, with more pronounced effect within 5 km from the border.

This study contributes to the literature on the determinants of workers' migration such as wage differentials (Dustmann, 2003; Todaro, 1969), exchange rates (Bello, 2020; 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 Beerli et al. (2021), that finds that the abolishment of migratory restrictions on cross-border work in Switzerland led to an increase in cross-border workers but did not affect employment due to an expansion of the market. Our analysis of the 2015 Swiss franc appreciation goes beyond this result by identifying relocation of workers in a neighboring country while maintaining their jobs as an explanation for the absence of general employment effects. Further, we extend this discourse by identifying the neighboring nation as a key heterogeneity analysis. Incentives for cross-border work and relocation 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, 2020; Nekoei, 2013; Nguyen and Duncan, 2017). For example, Bello (2020) 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 of the labor supply.

We also contribute to the literature on exchange rate shocks by highlighting the impacts for 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., 2020; 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, leading to 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 leading to a change 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 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 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, also 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 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, other studies on the currency shocks at the border, such as Burstein et al. (2022) that explores welfare effects from changes in the cross-border shopping dynamics, our study identifies that spatial differences that should inform structural economic models.

This research expands the existing body of literature on the economic effects of migration on housing markets by investigating the impact of relocation on house prices. Previous studies consistently identify a positive relationship between migration and housing prices. For example, in the United States, Saiz (2007) finds that a 1% increase in a city's population due to immigration corresponds to approximately a 1% rise in both average rents and housing values. Similarly, Degen and Fischer (2017) observe in Switzerland that a 1% increase in immigration leads to a 2.7% increase in the prices of single-family homes. In Spain, Sanchis-Guarner (2023) demonstrates that a 1% rise in immigration rates results in an increase of about 3.2% in house prices. Our study contributes to this literature by focusing on the effects of migration driven by the relocation.

Finally, we also contribute to the literature on place attachment, which refers to the behavioral relationship between individuals and places that can influence residential choices. Recent studies have highlighted the relation between an individual's social network and their residential mobility (Büchel et al., 2020), and between improvements in the urban environment and a heightened sense of place attachment (Bazrafshan et al., 2014; Benson, 2014; von Wirth et al., 2016). Moreover, place attachment is found to be an important component of re-migration in the home country (Chabé-Ferret et al., 2018). For example, (Nguyen et al., 2017) finds that improving living conditions in the place of origin increases the probability of returning home to rural areas. Our findings suggest that also in advanced economies improving conditions in the place of origin determines re-migration.

The remainder of the paper proceeds as follows. The first section presents background information on the 2015 EUR/CHF cap's removal. 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 EUR/CHF 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 (EUR) and the US dollar. To mitigate this appreciation, on September 6, 2011, the SNB set a floor for the EUR/CHF 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 in the 1.20 and 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 EUR/CHF exchange rate plunged from 1.20 to 0.98, and fluctuated between 1.05 and 1.15 until 2019.

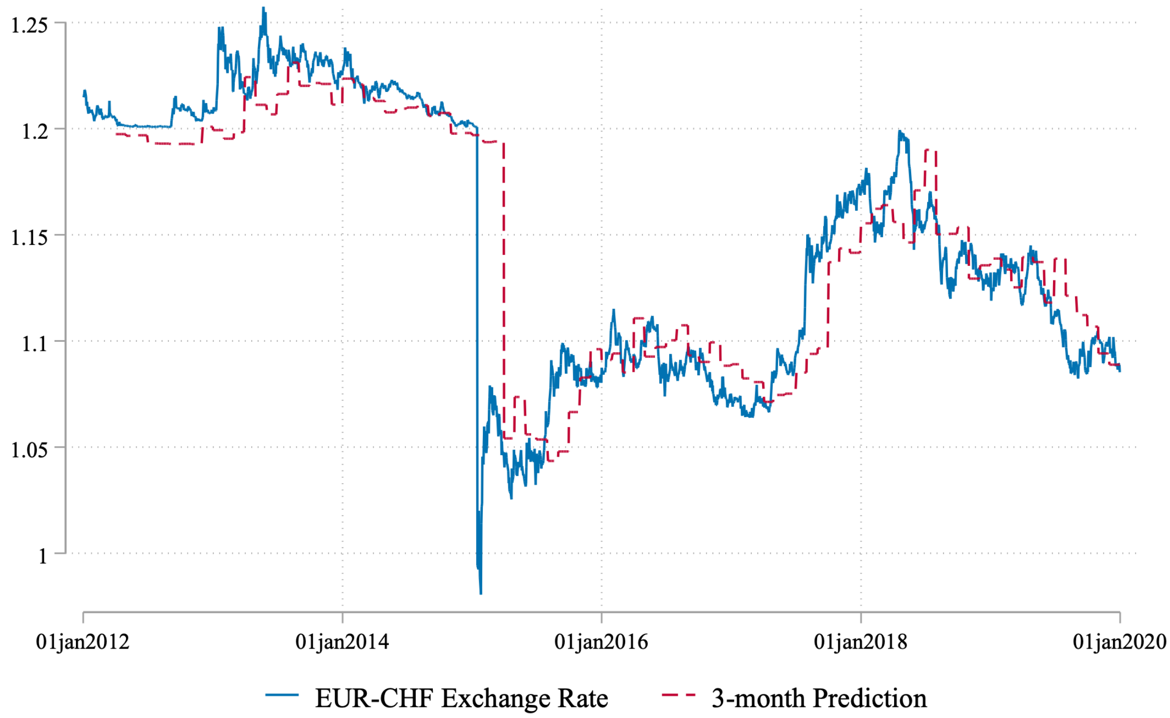
Figure 1 shows the daily evolution of the EUR/CHF exchange rate and its 3-month forecast, highlighting a significant deviation between predicted and expected values at the start of 2015 (details on the forecast in Section D.1 of the Appendix). The expectations deviate substantially from the actual value at the beginning of 2015, and swiftly adjusted after the shock. The forecast error, shown in Figure B.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 to forecast the EUR/CHF exchange rate for the following year. One month before the shock, the average prediction of the interviewed economists 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 B.2 from Kaufmann and Renkin (2019).

The long-term impact of the SNB's policy is evident from Figure B.3a of the Appendix, which shows the average annual change in the EUR/CHF 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 B.3b of the Appendix. On average, the Swiss salary has earned 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 EUR/CHF shock has become growingly popular amongst scholars as a source of exogenous variation to study a variety of economic results. Indeed, being unexpected and perceived as persistent, the SNB intervention represents an ideal framework to conduct a natural experiment.

Figure 1: EUR/CHF Exchange Rate and 3-month Prediction



Notes: The Figure shows the evolution of the actual EUR/CHF exchange rate and its 3-month prediction. The 3-month forecast is computed with a distributed lag model, where the closing value of the EUR/CHF 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 corresponds to a reduction in consumption 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 effects in manufacturing, while Gatti (2023) reports 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. (2022), that explored the relationship between economic relevant outcomes (cross-border shopping), there is limited literature on the spatial implications of this shock, particularly regarding 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 the working in CH and residing in an EZ country. With the Free Movement of Persons Agreement in 2002, CBWs have been liberalized, and nowadays accounted for an important share of the Swiss labour force, roughly 7.5% of the Swiss labor force, reaching 30% in border municipalities. Following the 2015 shock, the number of CBWs increased by approximately 10% across Switzerland. 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, reducing housing demand in Switzerland and increasing it in the neighboring Eurozone. This shift in demand has led to decreasing housing prices on the Swiss side of the border and rising prices in the Eurozone.

Relocation effects are particularly pronounced among EZ-born citizens for at least two reasons. First, EZ residents form the largest group of foreign-born citizens in Switzerland, outnumbering all other foreign-born individuals 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 place of origin. In economic terms, ceteris paribus, the utility of residing in one's home country is higher for EZ citizens than for other foreign-born groups, this is known as place attachment (Bazrafshan et al., 2014; Benson, 2014; Büchel et al., 2020; Chabé-Ferret et al., 2018; Nguyen et al., 2017; von Wirth et al., 2016). 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 sharing a common border and with 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, have homogeneous education and working skills, and share similar cultures.

3 Data

In this study, we collect data from Switzerland, Italy, and Germany between the period from 2012 to 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 five distinct sources. First, we observe yearly data on the number of full-time equivalent (FTE) cross border worker from the Federal Statistical Office (2012–2019a), alongside information on total FTE employees and demographic data from the Federal Statistical Office (2012–2019b), aggregated at the municipal level in Switzerland. The demographic data includes a complete set of native and foreign-born citizens by age and by continent of origin.[3] Second, we incorporate geolocalized data of sales' housing prices and characteristics in Switzerland from Meta-Sys AG (2012–2019). Third, we access municipal-level data for Italy on the number of residents in Italy and number of immigrants from Switzerland to Italy by year from the Italian National Institute of Statistics (2012–2019). Fourth, Italian housing price data 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 housing price by year from 21st Real Estate (2012–2019). Table 1 displays summary statistics of the different data used.[4]

Panel A presents the employment and demographic data at the municipal level for Switzerland. This includes the total number of workers, FTEs, cross-border workers, and the population of working-age Eurozone/Non-Eurozone residents (defined as individuals aged 20 to 64). Panel B shows the real estate dataset for Switzerland. For each housing posting, we observe the sales price (in CHF), 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...) and the year of construction.[5] To maximize the number of observations, missing housing characteristics are assumed as absent. The geolocation of each house is available, enabling the matching of property posting to municipalities. Posting prices may diverge from final transaction prices due to individual bargaining, thus we need to assume that bargaining power differences over house prices remain constant across time and regions, thereby not introducing systematic bias. However, we acknowledge the potential for bias, a limitation that remains untestable within the scope of this study.

Panels C displays summary statistics for the Italian dataset at the municipal level. For each Italian municipality, we gather data on population size and 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, civils, luxury, villas, and typical houses) and condition (excellent, good, bad, very bad).

Panel E provides data on housing prices for German municipalities, including the average price per square meter (in Euros) and the municipality's degree of urbanization.

[3] In case of EU we also observe whether the foreign born is from an Eurozone country or not.

[4] The ideal dataset would also include data on France and Austria, the two other bordering countries of Switzerland. However, to our knowledge, for France and Austria there is no available data in our study period.

[5] Minergie is a 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	$1.3e^5$
Immigrations from Switzerland	9’790	0.878	6.439	0	296
Share of immigrants 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
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: The table shows summary statistics of our dataset. For Panel A, other European refers to Europeans countries not in the Eurozone; Cross borders share represent the share of FTE CBW over total FTE worker. In Panel B, unobserved housing characteristics are imputed as absent. In Panel C, share of immigrants is expressed as a total of the resident population in the pre period. In panel D, house condition identifies whether the house is in optimal, good, or bad conditions.

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 provide numerous robustness to rule out alternative explanations of our mechanism. Notably, we propose a variation of our treatment group in the $0-5$Km bandwidth to evaluate 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 selection of the 20 km threshold is grounded in the bilateral agreement between Switzerland and the European Union that use this distance to determine cross-border workers eligible for fiscal privileges. The fiscal privileges refer to wages and other income taxed exclusively in the country of employment (Switzerland), and beinf Switzerland among the top five OECD countries with the lowest tax rates, the incentive to respect the distance criterion are likely binding.[6]

We calculate the Euclidean distance between the center of each municipality and the nearest border post (refer to Figure B.5 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 a similar 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]

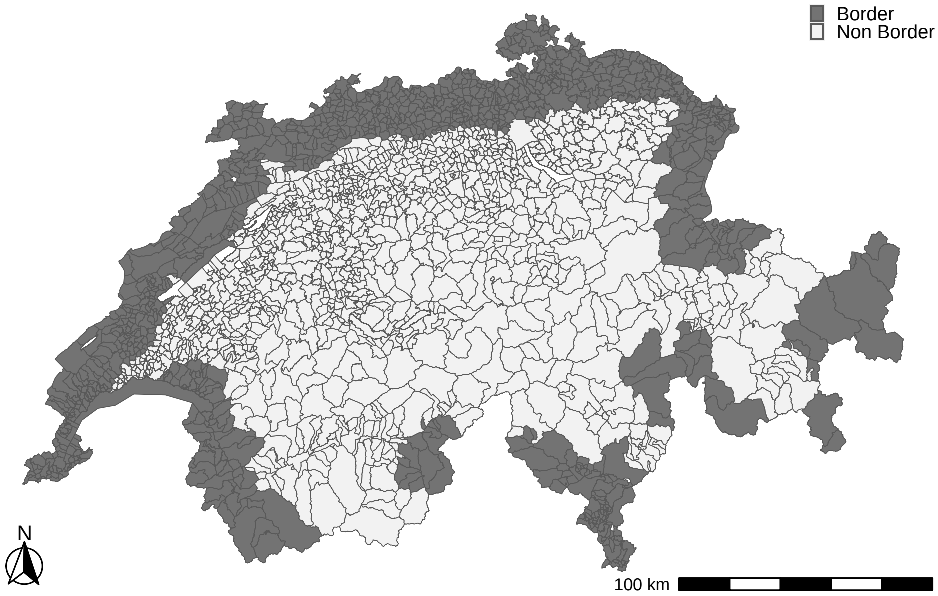
[6] In Section D.2 of the Appendix we also provide a simple calculation showing that 20km is the distance from the border which makes a resident indifferent by turning into a cross-border worker given the 2015 shock.

[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.

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 B.6 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 B.7 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.

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 τ_i^k is a year indicator with $k \in \{2012, \ldots, 2019\}$ and $k \neq 2014$. The coefficients of interest, γ^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 θ_i, and time fixed effects θ_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 employ an alternative strategy, leveraging the quasi-exogenous nature of geographical distance to the national border as a key identifier. 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 for difference-in-differences 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, 1994). 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, while it is challenging to perfectly validate the parallel trends assumption, we employ a dynamic DiD approach to provide statistical evidence. Specifically, we examine the γ^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, to address the no-anticipation assumption, we have provided evidence with Figure 1 of Section 2 and in Figure B.2 of the Appendix, alongside with the findings of the literature on the unexpectedness of the SNB intervention (Colella, 2022; Kaufmann and Renkin, 2019; Mirkov et al., 2016).

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 higher increase in the number of CBWs, while total employment levels remained largely unchanged. This pattern points toward residential relocation as 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 housing 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 house prices per meter squared 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 grew of about 15% relatively to 2014 levels (see figure B.3b). This wage increase applied to both Swiss native workers and cross-border workers (CBWs), who typically spend their earnings outside of Switzerland.[8] This wage appreciation provided a strong incentive for Eurozone (EZ) citizens to seek employment as CBWs, which would increase labor supply in border regions. Additionally, the higher Swiss wages may have encouraged some citizens to relocate, a mechanism primarily affects residential patterns rather than labor supply.

On the labour demand side, Kaufmann and Renkin (2017) found that labor demand in the manufacturing sector declined following the currency appreciation, while Gatti (2023) reported that manufacturing export-intensive and import-intensive firms suffered, respectively, a decrease and an increase in employment. However, our analysis focuses on a comparison between border and non-border regions, where we find no significant differences in the employment shares within the import, export, or manufacturing sectors. This suggests that, while shifts in labor demand may have occurred at the national level, the relative comparison between border and non-border municipalities, object of our analysis, should remain unaffected by these sectoral shifts.

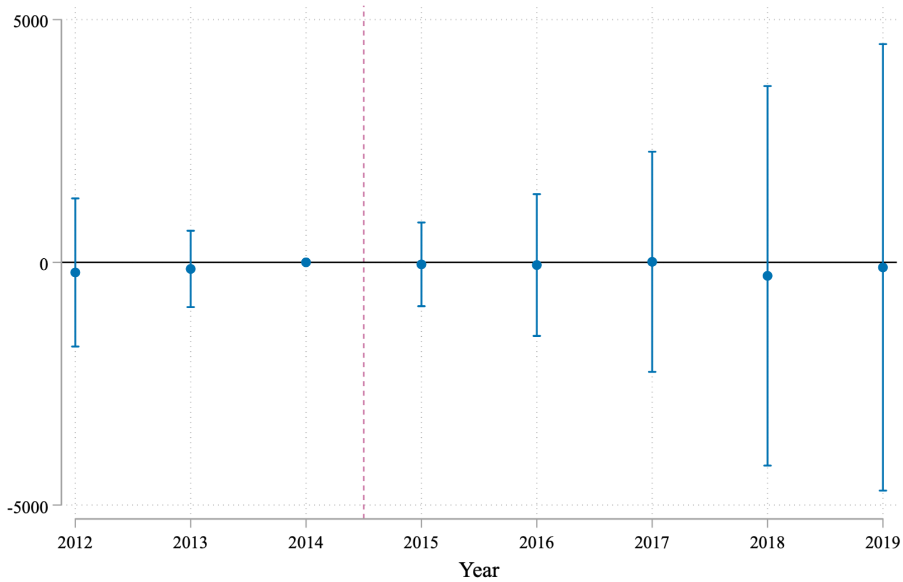
In Figure 3 we analyze the difference in total employment, measured as the number of employees at the municipal level, between border and non-border municipalities. The results show no statistically significant effect of the exchange rate shock on employment in border municipalities. Figure C.1 reports the time trends for both border and non-border municipalities, showing consistent trajectories across groups before the shock.

[8] One potential concern is that, after 2015 employers reduced the CBWs wages to maintain the same purchasing power. This is not the case, between 2014 and 2016 nominal wages in CHF increased 0.8% for natives and 0.7% for cross-border workers.

Consistent with Kaufmann and Renkin (2017), Figure C.2 , indicates a decline of approximately 10% in manufacturing sector employment. However, there is no statistically significant difference in this decline between border and non-border municipalities. Since Kaufmann and Renkin (2017) identifies the drop as driven by labour demand, the results suggest that there was no differential labour demand effect in the manufacturing sector in the comparison between treated and controls. Similarly, Figure C.3 shows that employment in import and export sectors did not differ significantly between the treatment and controls, further indicating no differential impact of the shock.

Because our data captures employment only in equilibrium, we cannot explicitly disentangle the separate effects of labor supply and demand from the coefficients presented in Figure 3. One possible explanation is that there were no labour demand and supply effect between treatment and controls. Alternatively, an increase in labor supply—possibly driven by wage growth for cross-border workers—may have been offset by a corresponding decline in labor demand. This combination would typically result in downward pressure on wages. In Figure C.4 in the Appendix, income per capita, which we use as a proxy for wages (given the lack of municipality-level wage data), shows no significant differences between border and non-border municipalities during this period.[9] These findings suggest that, despite the exchange rate shock, there were no differential impact on the labor supply or demand between border and non-border municipalities.

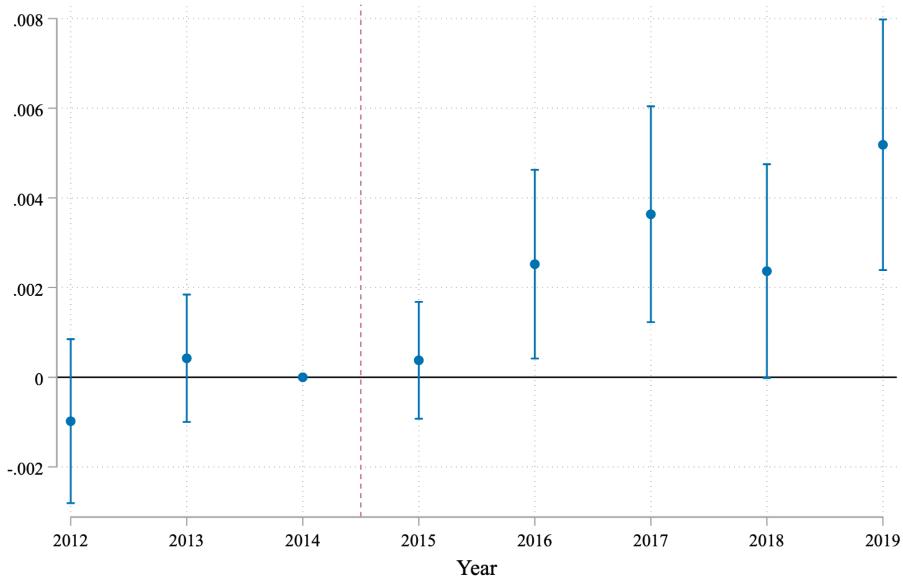
Figure 3: The Effect on the Total Employment



Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the number of workers (i.e. the total employment) between border and non-border Swiss municipalities at the shock. The total number of observations is $17'032$. We control for municipality and year-fixed effects. We use municipal population analytic weights. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

[9] This proxy is appropriate assuming that wages constitute the primary component of income in most municipalities.

Figure 4: The Effect on CBWs



Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the share of cross-border workers per full time equivalent worker between border and non-border Swiss municipalities at the shock. 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 4 illustrates the share of cross-border workers (CBWs) in full-time equivalent positions as a percentage of total full-time employment. After a period of relative stability, we observe a marked expansion in the cross-border labor market in border municipalities following the 2015 appreciation of the Swiss franc (CHF). On average, the share of CBWs increased by approximately 6% after 2015—double the annual growth rate observed in the pre-2015 period. Figure C.5 in the Appendix shows the effect separately for treatment and control municipalities to visualize the parallel trends.

Additionally, Figure C.6 in the Appendix, validates this result by showing the corresponding increase in average daily traffic at border crossings during working hours. These findings align with Bello (2020), who shows that similar exchange rate shocks have historically led to a surge in CBWs, particularly along the Swiss border.

Following 2015, the Swiss labor market contracted (Kaufmann and Renkin, 2017). As a result, the findings in Figures 3 and 4 indicate a composition effect within the labor force in border regions. Specifically, the appreciation of wages seems to have increased the labor supply of cross-border workers (CBWs). Since CBWs typically have lower reservation wages, they gradually replaced portions of the resident labor force. Gatti (2023), when analyzing unemployment disaggregated by residence permit, finds rising unemployment among foreign residents in Switzerland and a corresponding increase in CBW employment in border regions, particularly in sectors affected by the 2015 economic shock.

The central mechanism explored in this paper is the shift in relocation choices. After 2015, the economic incentives for residing in Switzerland changed significantly. Being a cross-border worker became more advantageous than participating in the Swiss labor market as a resident. Consequently, fewer individuals chose to join the labor force as residents, while a growing proportion opted for

CBW status. We term this phenomenon *residential relocation*. It represents a shift not just in labor supply, but in the preference for residency status. Individuals who might have previously settled as Swiss residents now favor CBW status, drawn by the increased economic benefits.

The residential relocation involves two distinct processes: the relocation of workers from Switzerland to neighboring countries like Italy, and the shifting preferences of new workers entering the Swiss labor market, with both groups favoring CBW status over residency. This argument presents a new perspective on labor supply. The number of CBWs did not increase due to an overall expansion in labor supply; rather, the composition of the labor force shifted due to changing residency preferences.

It is important to note that this residential relocation phenomenon is concentrated in border regions. For workers residing farther from the border, commuting costs become prohibitive, making cross-border work less feasible. As a result, CBWs tend to cluster near the Swiss border (see Figure B.4 and Section D.2 in the Appendix).

In the following section, we test our residential relocation hypothesis by comparing the residential outcomes in border and non-border municipalities across Switzerland, Italy, and Germany. This analysis will shed light on how labor market dynamics have evolved in these transnational regional economies.

5.2 Residential Outcomes

As discussed earlier, the economic shock led to an increase in cross-border workers (CBWs) in border municipalities resulting in a composition effect on the labour force. In this section, we examine the residential relocation resulting from the 2015 appreciation of the Swiss franc (CHF).

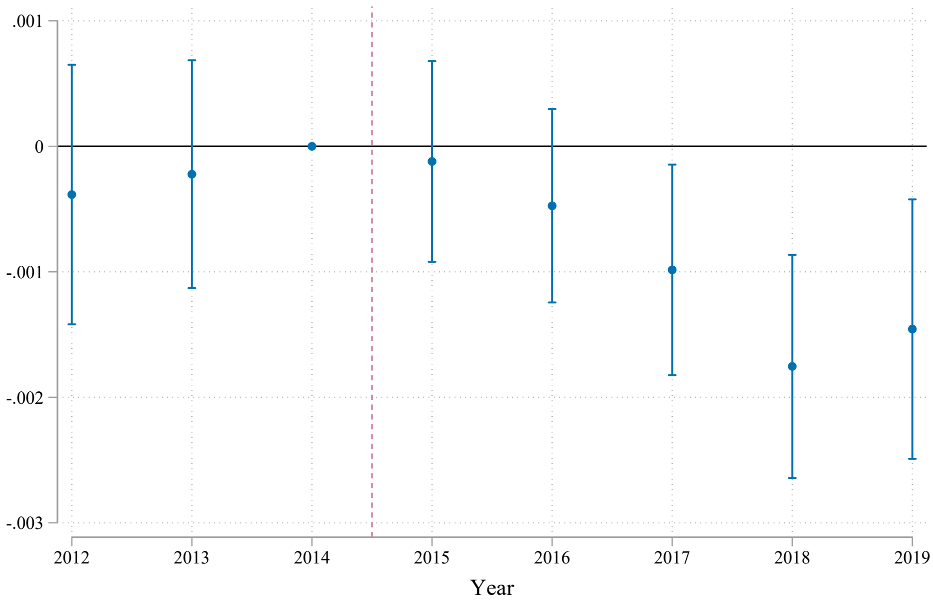
5.2.1 Switzerland

The 2015 Swiss Franc appreciation had significant impacts on residential preferences, particularly among Eurozone (EZ) workers.This group was more likely to shift their residency for several reasons. First, relocating to neighboring EU countries entails lower legal costs for EZ nationals. Second, there is a strong cultural proximity between these regions, which facilitates integration. Additionally, often EZ workers possess social and professional networks across the border, making them more responsive to the economic shock. These factors make EZ workers the most responsive, facilitating the transition to the cross-border worker (CBW) status.

Figure 5 illustrates the effect of the 2015 shock on the share of working-age EZ residents as a percentage of the total population across border and non-border municipalities. The results show that municipalities within 20 km of the Swiss border experienced a significant decline in the share of EZ residents 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 residents relative to pre-shock levels. Figure C.7 of the Appendix, shows the parallel trends prior to 2015 and also demonstrates that there were a general slowdown in the growth of EZ residents, but more pronounced in border municipalities. As a robustness check, Figure C.8 in the Appendix shows a concurrent increase in the share of migrants relocating from Swiss border regions to EU countries. This supports the hypothesis of a cross-border shift in residency preferences, driven by the economic advantages of remaining in the labor market as a cross-border worker rather than a resident.

To determine whether this decline represents a compositional effect or an absolute reduction in the population, we refer to Figures C.9 and C.10 in the Appendix. These figures reveal that the decrease in EZ residents was not offset by an increase in other nationalities, including Swiss natives, indicating an overall decline in demand for residency in border municipalities.

Figure 5: The Effect on the EZ Working-age Residents' Share



Notes: For each year, the Figure displays the estimate of the γ^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 2015 Swiss Franc appreciation had significant repercussions on Switzerland's housing and rental markets, particularly in border regions. Figure 6 presents the impact of the 2015 CHF appreciation on house prices per square meter in Swiss border municipalities. The shock triggered a decrease in house prices of approximately 1.7%, which translates to an average reduction of CHF 15,000 given the mean house size of 145.04 m^2. This decline was sharp and sustained over the post-shock years, reflecting a strong and persistent market response. The pre-shock trends of house prices are available in Figure C.11. Panel A of Table D.2 provides lower-bound estimates for the direct impact of EZ migration on house prices, specifically, a 1% decrease in the share of EZ residents in Swiss border areas resulted in a 1.7 percentage point reduction in housing prices.

The sharp drop in house prices can be largely attributed to the fact that, there were strong incentives to sell properties in 2015 given the new residential choice. Due to the CHF appreciation, selling at a lower price still resulted in substantial capital gains when converted in Euros. Residents could afford to sell their homes for up to 20% less in CHF in 2015 without suffering financial losses in Euro terms. The willingness to sell is driven by the perspective of residing in a neighbouring country and become cross border workers, enjoying higher relative wages. The effect is magnified in border regions, where the feasibility of cross border work make relocation more attractive. Their familiarity with the job market at the border even allows for easier relocation, perhaps without forfeiting the previous employment positions. As a result, the sharpest price reductions were observed in border municipalities.

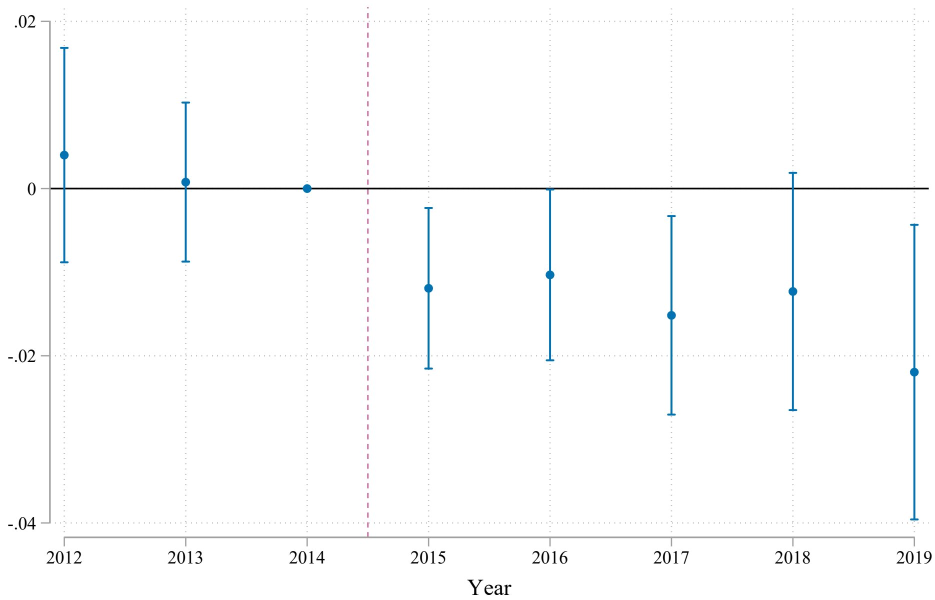
The timing of the price reduction reflects the urgency to capitalize on favorable currency conditions. Although the willingness to sell was immediate, real estate transactions tend to involve delays, taking around six months on average in our sample. Furthermore, the administrative procedures for residential relocation, such as changing permits, extend the timeline for formally exiting Switzerland after the house selling. This helps explain the discrepancy between the rapid decline in house prices shown in Figure 6 and the more gradual reduction in EZ redisents illustrated in Figure 5.

To ensure that the observed price reduction is not driven by an increase in housing supply, we analyzed whether the housing stock in border municipalities expanded after 2015. As shown in Table D.6, the effect on the total square meters of properties for sale is zero, ruling out an supply-side factors as the primary driver of the price decline.

Finally, the possibility that lower foreign investment in housing as a driver of the post-2015 housing price changes is unlikely in the Swiss context. First, it is challenging to foresee why investments to be correlated with distance to the border. Second, 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, thus limiting potential distortions of the observed effects.

In summary, the decline in housing demand and prices in border municipalities is rational in light of the willingness to capitalize on the currency appreciation by relocating and selling their properties and the frictions in pursuing the actual relocation.

Figure 6: The Effect on Swiss House Prices per m^2



Notes: For each year, the Figure displays the estimate of the γ^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 have found that following the real wage shock induced by the 2015 Swiss Franc appreciation there was a reduction in an increase in CBW, a reduction in EZ residents, and a contextual decrease in house prices. Hence, the drivers of relocation are the opportunity gains derived from doing cross border work and live in cheaper Eurozone countries. While Swiss salaries are higher on average from the salaries in the Eurozone, there may be factors that attenuate these differences. For example, the incentive to relocate is strictly dependent between the wage differential between the average salary in Switzerland and the average salary on the country on the other side of the border. Furthermore, the level of economic activity, the average level of housing prices, and the general cost of living on the other side of the border may attenuate the decision to relocate.

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. reports the effects on cross-border workers (CBWs) share. After the 2015 CHF appreciation, CBWs increased at the borders with Italy and France, by 14% and 9%, respectively. In contrast, at the border with Germany, the CBW share decreased by 6%. On the other hand, at the border with Germany the CBWs decreased 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 in the Swiss-Italian and Swiss-French side of Switzerland, while on the German side we observe a 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 Swiss taxation for cross-border workers, benefiting from Switzerland's exceptionally low tax rates.[10] In contrast, German cross-border workers are taxed in their country of residence (European Parliament, 1997). Therefore, the shock can lead to significantly higher tax rates on these Swiss wages, dampening the appeal of Swiss wages and potentially creating a disincentive to relocate. Second, the neighboring German region of Switzerland is Baden-Württemberg, which is one of the most productive in Germany, displaying smaller wage differentials with Switzerland compared to the Swiss-French and Swiss-Italian regions,as shown in Figure B.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.[11] As shown by Burstein et al. (2022) post-2015 cross-border shopping has provided welfare benefits for border areas, potentially enhancing the value of residing in Swiss-German border regions.

Overall, the results in Table 2 provide further evidence supporting relocation. In the following section, we will validate these effects by examining patterns in Italy and Germany.

[10] 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 https://www.oecd.org/content/dam/oecd/en/topics/policy-issues/tax-policy/taxing-wages-switzerland.pdf

[11] See Figure B.9 in the Appendix and Kluser (2023), Figure 1.

Table 2: DiD Results in Switzerland by Bordering Country

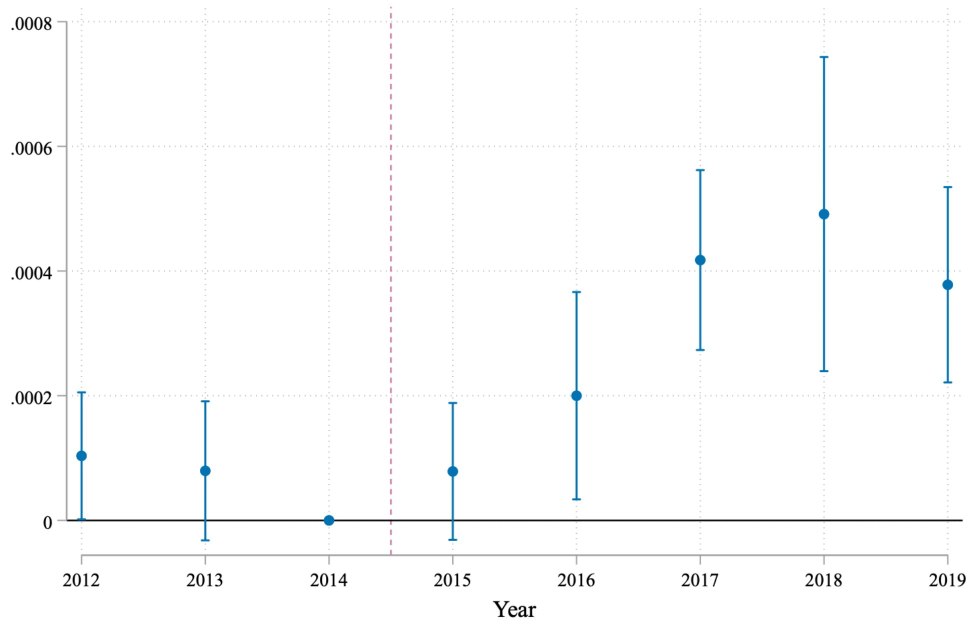
	Germany	France	Italy
Panel A: Employment			
Treat × Post	−262.11	429.71	−271.35
	(1688.16)	(1889.25)	(1681.61)
R-Squared	0.999	0.999	0.999
N	12’152	12’608	10’280
Municipality FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Panel B: CBWs’ Share			
Treat × Post	-0.002*	0.005***	0.015***
	(0.00118)	(0.00168)	(0.00373)
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***	−0.00219***	−0.0025**
	(0.00056)	(0.000612)	(0.00116)
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***
	(0.00543)	(0.00642)	(0.00866)
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 CHF 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) residents, alongside a 14.11% increase in cross-border workers (CBWs). Moreover, at the Swiss border with Italy house prices decreased of about 4% as shown in Table 2. Conversely, in Italy, Figure 7 highlights that the appreciation of the Swiss Franc (CHF) has driven a significant rise in immigration from Switzerland, particularly in border regions where living costs are substantially lower than in Switzerland, allowing workers to benefit from the real wage differential. This shift represents an approximate 30% increase in return migration relative to the pre-shock average. The trends in Figure C.12 show an important increase in return migration at the border municipalities while pre-2015 the trends were moving similarly. While we cannot establish a causal link between the decrease in the share of EZ residents in Switzerland (Figure 5) and the return migration to Italy (Figure 7), it is notable that the timing of the inflow to Italy closely mirrors the outflow of EZ residents from the treated Swiss municipalities. This temporal alignment suggests a potential relationship that warrants further exploration.

Figure 7: The Effect on Immigrations from Switzerland to Italy



Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the share of immigrants from Switzerland between border and non-border Italian municipalities at the shock. The total number of observations is $9'788$. We control for municipality and year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on ISTAT data.

Figure 8 presents the results of Equation 1 on the log house prices house prices per square meter at the district level (OMI) in the Italian border regions. The figure indicates a 3% to 4% increase in house prices in these areas after 2015, sustained throughout the years following the CHF appreciation. Panel B of Table D.2 provides lower bound estimates for the effect of relocation from Switzerland. A 1% increase in immigration from Switzerland to Italy led to a 1.8 percentage point rise in housing prices.

The spike in house prices at 2015 mirrors the sudden drop observed in Switzerland and shown in Figure 6. As mentioned earlier, the timing can be explained through the increased purchasing power of the Swiss Franc during this period. With exchange rate uncertainty, buyers that are relocating have strong incentives to buy when the Swiss Franc is the strongest, which allows for significant capital gains in Euros. However, the actual of residential relocation is delayed due to the administrative procedures required in both Switzerland and Italy.

A potential concern for the identification strategy in Italy stems from the increased demand for real estate in border areas potentially driven by Italian residents from control municipalities. Attracted by the wage differential in Euro terms, these residents may have chosen to relocate closer to the Swiss border to participate in the Swiss labor market as cross-border workers. For example, residents from Milan might choose to move to municipalities like Como or Varese, close to the Swiss border, and work in Ticino. However, as shown in Figure C.13 in the Appendix, there was no significant migration to the Italian border areas from either the control group or other regions of Italy. Furthermore, if such internal migration had occurred to access the Swiss labor market, we would expect to observe a differential effect on employment levels between Swiss border and non-border municipalities. Nevertheless, Figures 3 (also Figure C.1 and Figure C.2 in Appendix) indicate no significant differences in employment levels across border and non-border regions in Switzerland.

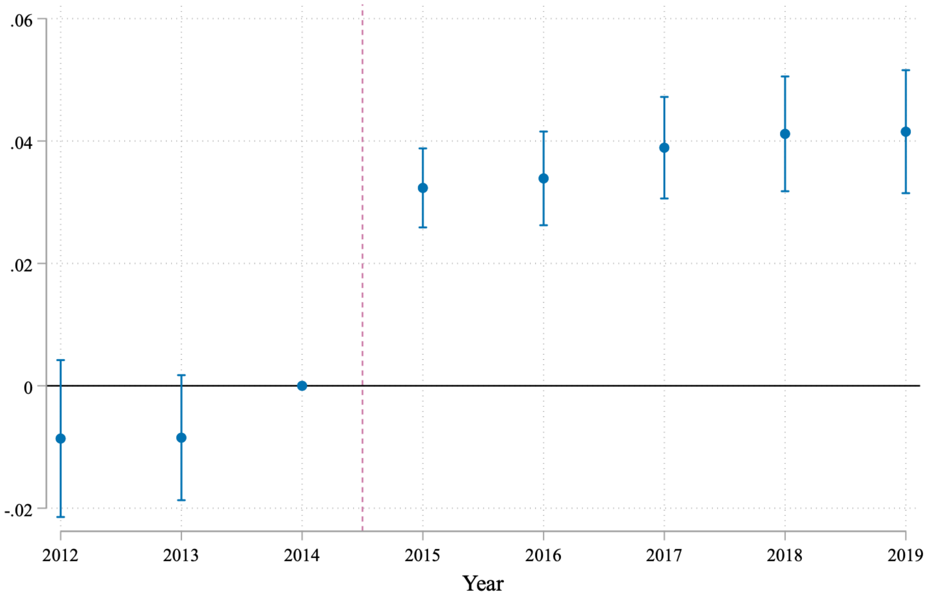
Another concern could be that higher housing demand in Italy was exported by residents from non-border areas of Switzerland, now willing to commute at the border municipalities even if we established that incentive to relocate is higher for individuals from Swiss border municipalities. In facts, Figure 7 only reports data on return migration from Switzerland to Italy, but does not allow us to isolate migration patterns from border or non-border areas. Figure C.8 in Appendix shows that after 2015, there were more emigrations from the Swiss border to EU countries than from the non-border regions. On the other hand, if return migration from non-border to border areas in Switzerland had increased, we would again expect to observe an effect on labour force participation, but we find no employment effect.

A third issue to consider is the potential role of Swiss investments in Italian real estate. However, for investment purposes, distance from the border is unlikely to be a significant factor: any incentive to invest should be similar across both border and non-border areas in Italy. Moreover, Article 16 of the preliminary norms of the Italian Civil Code, the "principle of reciprocity", restricts real estate purchases by non-resident Swiss citizens and companies not based in Italy.[12]

In summary, the rise in return migration from Switzerland and housing prices in Italy are coherent with the observed effects on Eurozone residents and real estate prices in Switzerland, particularly at the border with Italy. Overall, these results are consistent with the residential relocation hypothesis. Specifically, the increase in immigration flows into Italian border municipalities, as shown in Figure 7, combined with the rise in housing prices in Figure 8, provides consistent evidence that higher housing demand, driven by return migrants with greater purchasing power, has contributed to the escalation of property prices in Italy's border regions. This phenomenon highlights that sudden increases in the wage differentials can drive cross-border relocations, leading to significant economic and social disparities in housing markets, which are crucial for policymakers to address.

[12] 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 8: The Effect on Italian House Prices per m^2



Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the log of housing prices per meter squared between border and non-border Italian municipalities at the shock. The total number of observations is 140′171. We control for OMI, year-fixed effects, and housing characteristics. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Italian Revenue Agency data.

5.2.3 Germany

At the Swiss border with Germany, the effects after 2015 are the smallest in relative terms. Municipalities bordering Germany have experienced on average an increase of about 1.8% Eurozone (EZ) residents, an increase in cross-border workers (CBWs) of 14.11% while house prices have increased by 3%.

Figure 9 shows the effect on the log of German House Prices per squared meter; after 2015 there has been no increase in house prices at the border. If anything, there was a decrease in later years. The effect on housing prices in Germany is coherent with our findings for German-speaking Swiss municipalities in Table 2 of Section 5.2.1. However, this effects suggest that there was no residential relocation at the German border.

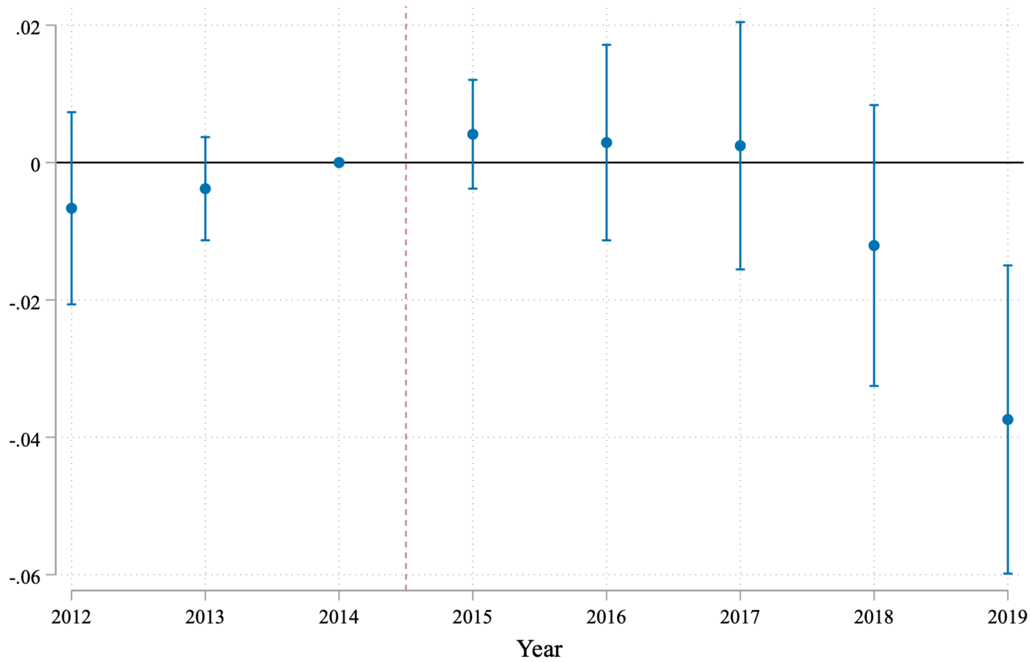
But why was there a different effect in the Germany and in Italy? First of all, in the sales housing market there is a well-known cultural division between Italy, and Germany. As shown in Figure C.15 of the Appendix, Germany has the lowest homeownership rate. It is possible that the German culture in German-speaking Swiss municipalities may affect the decision/type of relocation (renting vs owning) and consequently the house prices.

In addition to this cultural divide, there are also economic differences between Italy and Germany. As shown in Figure B.8 of the Appendix, Germany offers substantially higher hourly wages in the Swiss neighboring areas in contrast to Italy. Being the German wages higher, the economic gains from residential relocation in German-speaking municipalities are potentially lower with respect to Italian-speaking ones. In other words, since the differential between Swiss and German wages is lower, the degree of substitutability between the two labor markets is higher in Germany than in

Italy, making residential relocation less convenient.

Based on the previous considerations, the increase in the purchasing power of the Swiss salary after 2015 can be exploited through another channel: reducing labor time. Indeed, considering that residents at the border can engage in cross-border shopping, the higher Swiss salary in euros can be spent in the EZ bordering region without relocating. If this is the case, it might be that in Italian municipalities, the reaction is channeled through residential relocation, while in German-speaking ones through a labor-leisure time trade-off. We provide suggesting evidence by estimating the effect of the 2015 CHF appreciation on the log of total full-time equivalent workers at the municipal level. As shown in Table 3, we observe a reduction of -1.49% in total full-time equivalents only in Swiss German-speaking border municipalities.

Figure 9: The Effect on German House Prices per m^2



Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the log of housing prices per meter squared between border and non-border German municipalities at the shock. The total number of observations is 14′560. We control for municipality, year-fixed effects, and housing characteristics. Effects are detrendend by the pre period increase in house prices at the border. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on 21st Real Estate data.

In addition, cross-border shopping is particularly diffused at the German-speaking border, being many German stores located close to it and the travelling distances exceptionally contained.[13] Figure B.9 of the Appendix 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. This confirms that cross-border shopping is relatively more important in German-speaking municipalities than in other language areas, and also with respect to cross-border commuting, which is instead more intense in the Italian-speaking regions.

[13] Evidence can be found in Kluser (2023), Figure 1.

Table 3: Effect on Total Full-Time Equivalents by Language Region

Log Total Full-Time Equivalents	German-speaking	French-speaking	Italian-speaking
Treat × Post	-0.0149^{**}	0.0117	-0.0096
	(0.0059)	(0.0078)	(0.0123)
R-Squared	0.997	0.997	0.997
N	13'384	12'256	10'056
Municipality FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Notes: The Table displays the estimated difference in the log of total full-time equivalents by language region between border and non-border Swiss municipalities after the removal of the EUR/CHF exchange rate floor in 2015. We compute the DiD effect for German-speaking (column 1), French-speaking (column 2), and Italian-speaking municipalities. 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 Swiss Federal Office of Statistics data.

5.3 Transnational Bid-Rent Model

In Table D.3 of the Appendix, we find that the effect on housing prices is mainly driven by municipalities closer to the border, namely municipalities in the 0-5km, those displayed in Figure C.16 of the Appendix. In Switzerland, municipalities within 5km from the border experienced a -2.7% decrease in house prices per squared meter, while those further away, -1.16%. In Italy, in the 0-5km house prices increased by 5.49% and 3.96% in the 6-20km one. In Table D.4 of the Appendix we also show that comebacks from Switzerland were more intense at the Italian border. This spatial gradient exists for at least two reasons. First, there are cheaper transaction and relocation costs the lower the distance between provenience and destination. Second, the agent has the incentive to minimize the distance between the residence in the EZ country and the workplace in Switzerland, containing commuting costs.

To investigate deeper this gradient effect, we attempt to summarize our findings for Switzerland and Italy with an empirical transnational Bid-Rent model. Inspired by the classical urban models of Alonso (1964), Mills (1967) and Muth (1969), we essentially replace the Central Business District with the border separating the two national regions of the transnational economy: the Swiss (Canton Ticino and Vallese) and the Italian (Lombardy and Piedmont) side. We design an integrated model where on the left-hand side of the border, there is the Swiss bid-rent curve while on the right, the Italian one.[14]

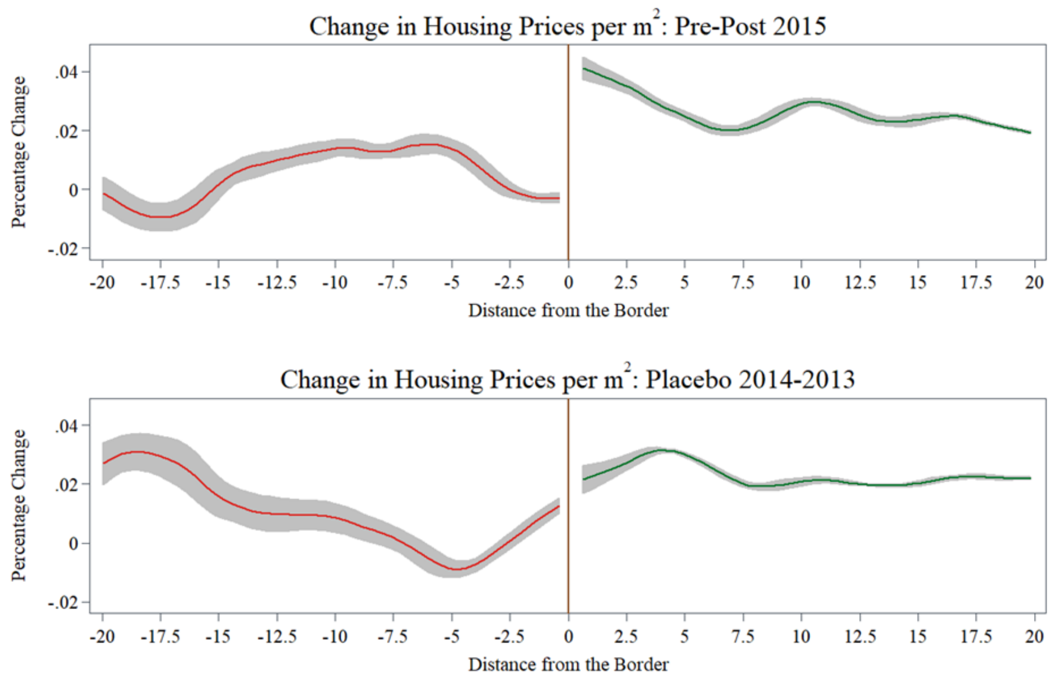
In Figure D.6 of the Appendix, we plot the bid rent curves of our empirical model. To do so, we compute the average house price at each units of distance, and we represent their values for the pre- (2012–2014) and post-treatment (2015–2019) periods. For the sake of comparability, for Switzerland, we use only Ticino, which is the neighboring canton of Piedmont and Lombardy. Due to Ticino's geographical conformation, Swiss data are sparse after a 10km distance. We convert

[14] Figure D.5 of the Appendix depicts a stylized representation of our transnational bid-rent model. Section D.4 describes the empirics behind these graphs.

prices in the same unit of account using the EUR/CHF exchange rate in 2014. To represent the change in the bid-rent curves after the policy, we fit a polynomial function of degree 1 to the data, and we compute the percentage changes in the polynomial values between the pre (2012–2014) and post (2015–2019) period by unit of distance.[15]

In the top graph of Figure 10, we represent the percentage changes in house prices between pre-post for municipalities in Ticino (on the negative axis) and Piedmont and Lombardy (on the positive axis). In addition, in the bottom graph of Figure 10, we perform a placebo test on the change in the bid-rent curves from 2013 to 2014. We find that between 2014 and 2013 there were no changes in the square meter house prices at the border, while in the pre-post analysis, we observe a significant discontinuity: Italian prices grew significantly more than Swiss prices, mirroring our findings on the housing market on the two sides of the border.

Figure 10: 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, in red) and Italy (Piedmont and Lombardy, in green) by distance in kilometers from the border. We also report 95% confidence intervals. Source: Our elaboration on Metasys AG and Italian Revenue Agency data.

6 Conclusions

In this paper, we investigate the existence of a transnational residential relocation due to a change in economic incentives, and how it may affect labor market outcomes and non-tradable goods (housing) in the Swiss and EZ transnational economy. We contribute to various fields of economic literature. First, we enrich the literature on workers' migration and exchange rate shocks, finding that following the increase CBW employment at the border there was no total employment effect, suggesting that

[15] Section D.4 describes the empirics behind these graphs.

workers change residence status, a mechanism typically neglected in the literature. Second, we enlarge the literature on place attachment, observing that improving living conditions in the place of origin increases the probability of returning home also in advanced economies: we find that the increase in the purchasing power of a Swiss salary spent in the EZ consumption market, following the 2015 currency shock, has been exploited through relocation in EZ only by residents living in Switzerland but native of EZ. This economic improvement has incentivized residents to re-migrate to their country of origin. Finally, this paper extends the results concerning the effect of exchange rate shocks on goods and services: we provide the first contribution on the consequences of the 2015 EUR/CHF lower-bound remotion on the real estate markets due to the residential relocation within the economic regions exposed to the shock. We find that similar to goods, individuals react to exchange rate policies by "exporting themselves" (i.e. relocating), therefore affecting housing prices.

In detail, we propose a theoretical model for residential location choices in a transnational regional economy with an integrated labor market but with heterogeneous preferences for consumption, housing, and amenities. Then, we test this model with the 2015 CHF appreciation, which caused an increase in the purchasing power of a Swiss salary spent in the EZ consumption market. In detail, the CHF appreciation led to a reduction of consumption prices (expressed in CHF) in the EZ, incentivizing workers located in Switzerland to spatially relocate to the other side of the border, while maintaining their Swiss jobs.

In the analysis, we use a dynamic difference-in-differences (DiD) approach to the empirical setting provided by the 2015 CHF appreciation. The treatment group is composed of the Swiss municipalities at the 0-20km bandwidth (the same treatment selection has been applied to Italy and Germany). In this context, we find that, in reaction to the CHF/EUR exchange rate shocks, cross-border workers have increased in all the Swiss territories and that the increase was more intense at the border. However, at the same time, the total employment and the average income did not follow the same pattern. These results are suggestive that labor supply did not change between border and inner municipalities after the shock, and that the higher inflow of CBWs in the treatment might be due to the residential relocation in EZ of residents precedently working and leaving in Switzerland. Moreover, in the same jurisdictions, there has been a 1.5% decrease in EZ working-age resident share and a 1.7% reduction in housing prices per squared meter. As a result, EZ residents relocate to the EZ counterpart of the transnational economy while maintaining their jobs on the Swiss side; in other words, some EZ residents turn into CBWs. The fact that only EZ residents relocate is consistent with the theory on place attachment: given all other things equal, the average utility of residing in the place of origin should be higher; thus, for an economic improvement in the EZ bordering region, EZ resident should be more likely to relocate in their country of origin. Putting together labor market and residential outcomes, we find that while in control municipalities there exists only an increase in total employment (new CBWs that before the shock lived and worked in EZ border regions) in municipalities at the border there is by design both a total employment and a residential relocation effect. This happens because relocation is only possible at the border due to the trade-off between transportation costs and exchange rate gains. Hence, the greater inflows of cross-border workers in border areas after CHF appreciations are overestimated in the literature and should be adjusted for the component of residential relocation. Furthermore, implementing various heterogeneities tests, we find that the effects on CBWs, EZ working-age residents, and housing prices are consistent only in Italian and French-speaking municipalities, while we observe the reverse pattern in German-speaking ones. To validate these different spatial results we estimate the impact in Italy and Germany. On the one hand, we find that Italian municipalities in the 0-20km bandwidth from the Swiss border experienced a rise in immigration from Switzerland and a 3% increase in housing prices. On the other hand, the 2015 CHF appreciation did not influence the German real estate market. To understand other potential mechanisms explaining the effects on the German border, we study possible changes in hours worked, finding a reduction of -1.49% in the number of total full-time equivalents only in Swiss German-speaking treated municipalities. Thus, there are heterogeneous responses at the regional level: in Italian and French-speaking municipalities the relocation effect prevails, while in German-speaking ones it seems more a matter of labor-leisure time trade-off. The results on the other side of the border (Italy and Germany) are coherent with our effects in Switzerland.

In conclusion, we find differentiated distributional effects of exchange rate policies within and across countries, potentially leading to discriminating regional housing effects. Across countries, the Swiss intervention has determined an opposing effect between the Swiss and the EZ side of the transnational economy. Additionally, there have been different impacts within each country between border and inner areas.

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A Appendix: The Residential Location Model

A.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 $r = 1,\dots,s,\dots R$. The *RE* is populated by a fixed measure of N workers, which earn an exogenous income level y, which is constant across workplaces w. We assume that within the *RE* there is an official border that divides it into two national sub-regions called Ch and Ez:

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

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

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

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 A.6 of the Appendix, we present a two-location model which specifically describes the mechanism in our empirical setting.

A.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 ε 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:

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

A.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 γ is a positive constant. Housing supply is allowed to vary across locations according to the tightness of topographical and administrative constraints on construction (Brülhart et al., 2021; Hilber and Vermeulen, 2016; Saiz, 2010). The housing market equilibrium is determined by the equality of H_s^D and H_s^S.

A.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:

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

A.5 Comparative Statics

In this section, we explain the comparative statics on the main equilibrium parameters for a given change in consumption prices.[16] 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 $Q_r(d)$:

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

[16] 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:

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

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 $Q_r(d)$.

A.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:

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

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).

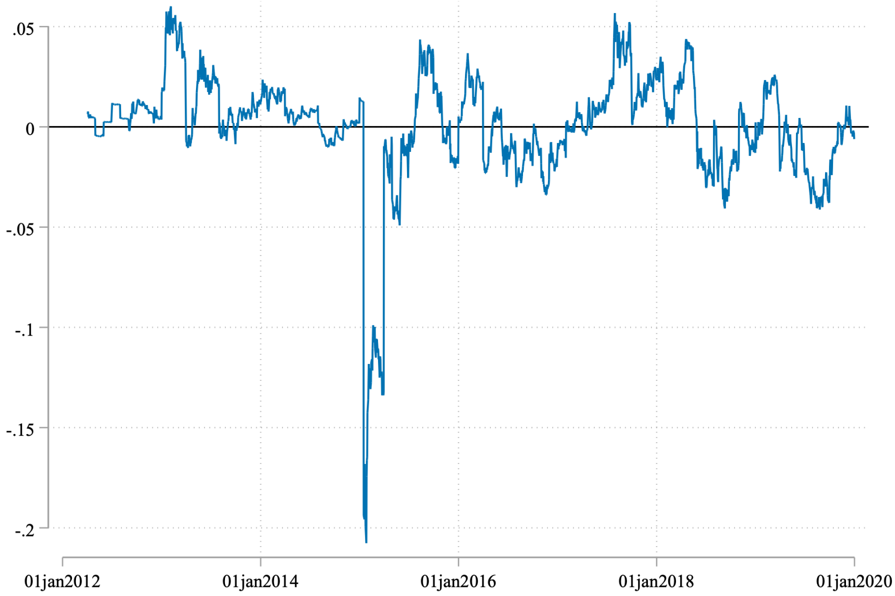
Notice that the change in housing prices in Ez and Ch relative to the distance from the border between these two regions is such that:

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

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.

B Appendix: Additional Figures

Figure B.1: Difference between EUR/CHF 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 EUR/CHF exchange rate is regressed against itself three months prior, along with month-fixed effects.

Figure B.2: CHF/EUR expectations, KOF Consensus Forecast

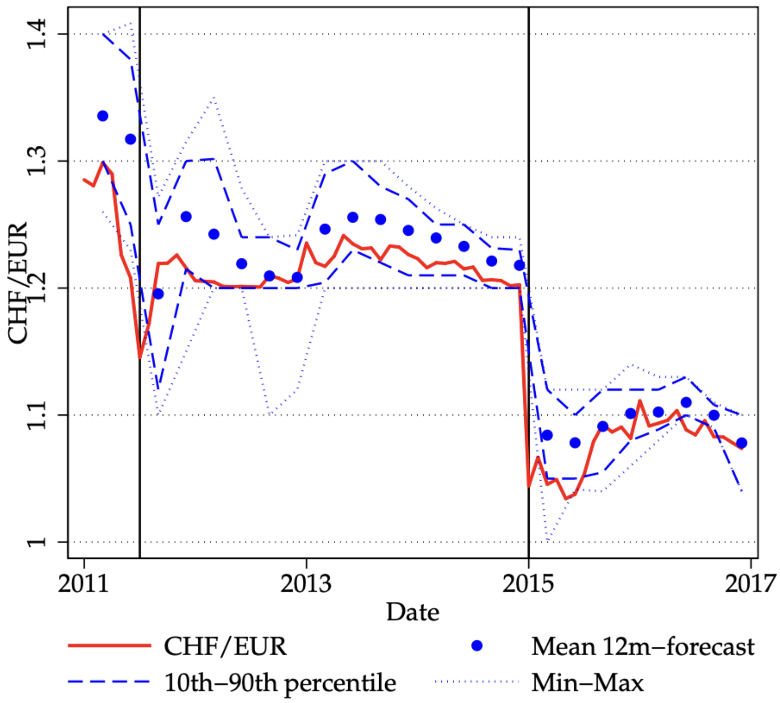
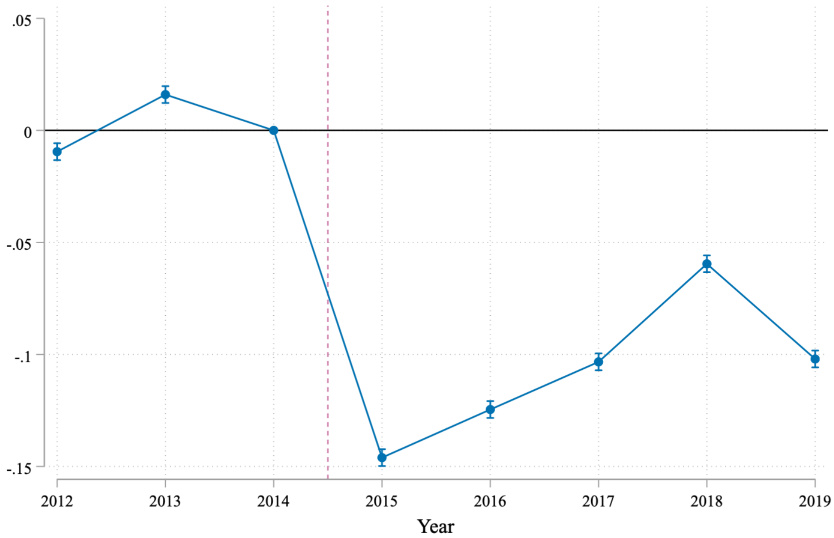
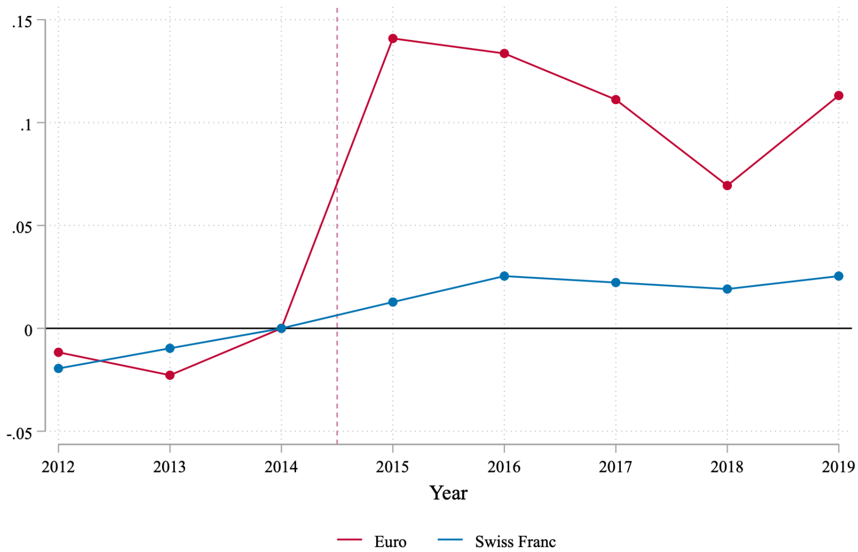


Figure B.3: Yearly Average EUR/CHF Exchange Rate and Nominal Wage (Euros) in Switzerland

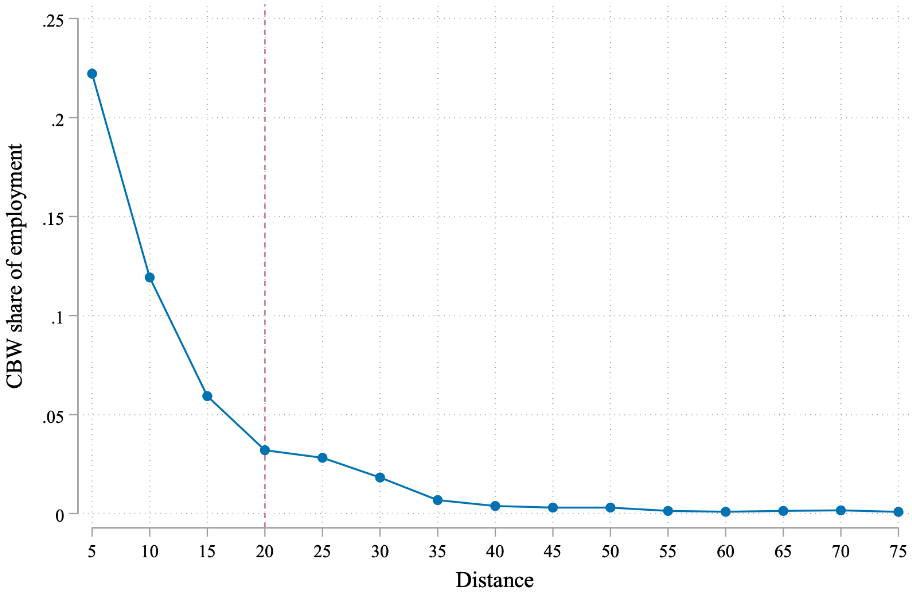


(a) EUR/CHF Exchange Rate



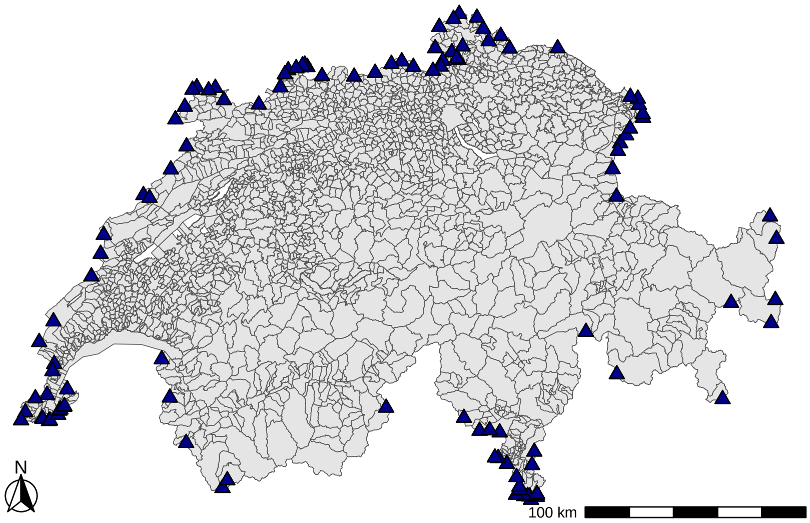
(b) Nominal Swiss Wage

Figure B.4: 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 B.5: 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 B.6: Treatment Municipalities in Italy

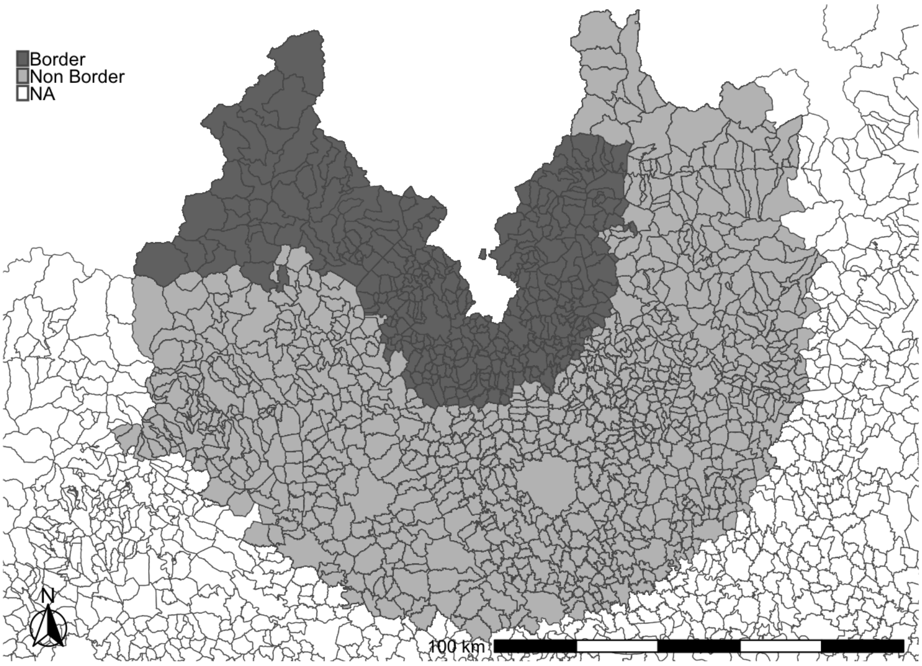


Figure B.7: Treatment Municipalities in Germany

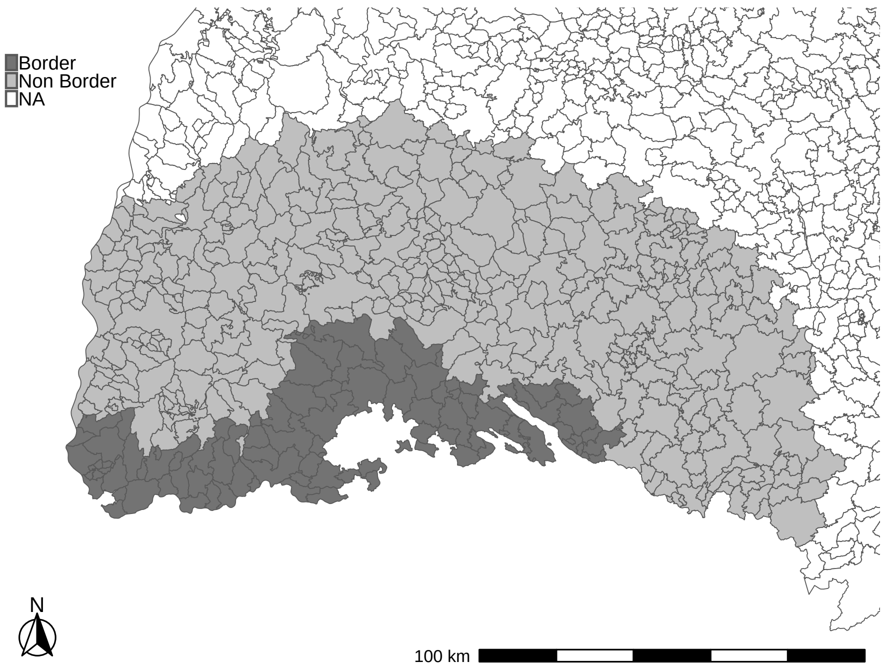
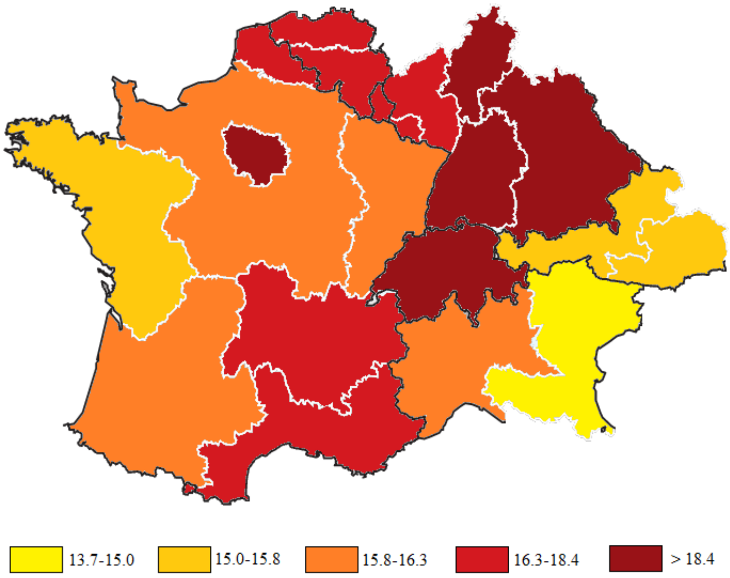
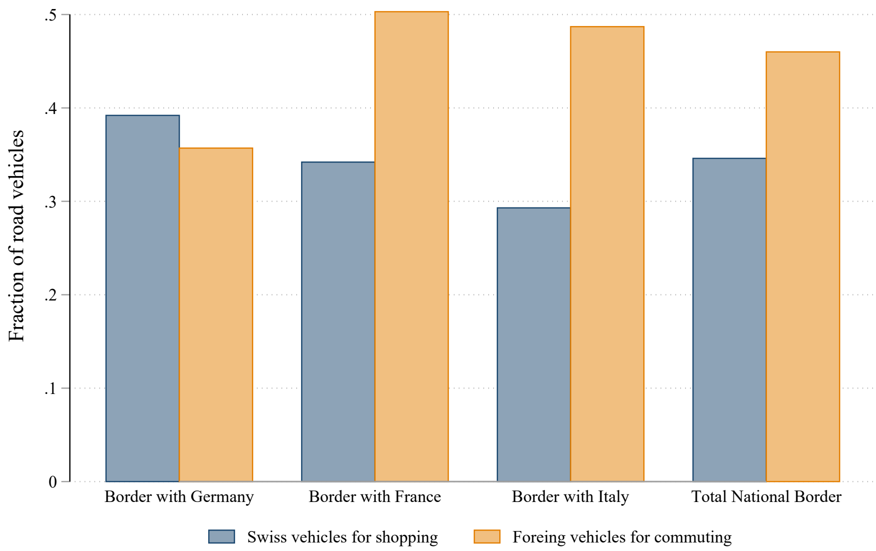


Figure B.8: 2014 Gross Hourly Wages in Euros



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.

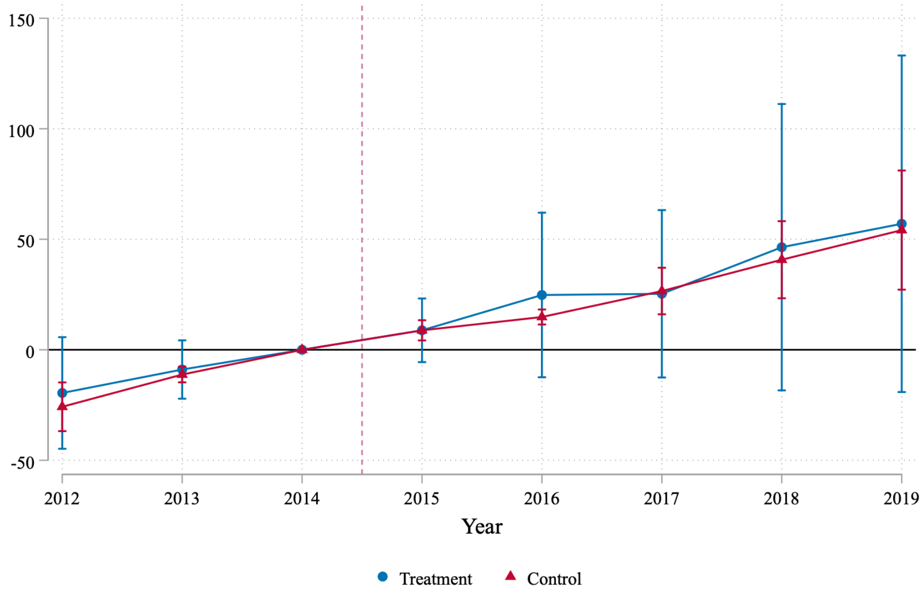
Figure B.9: Fraction of Vehicles Entering and Leaving CH by Purpose of Travel



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).

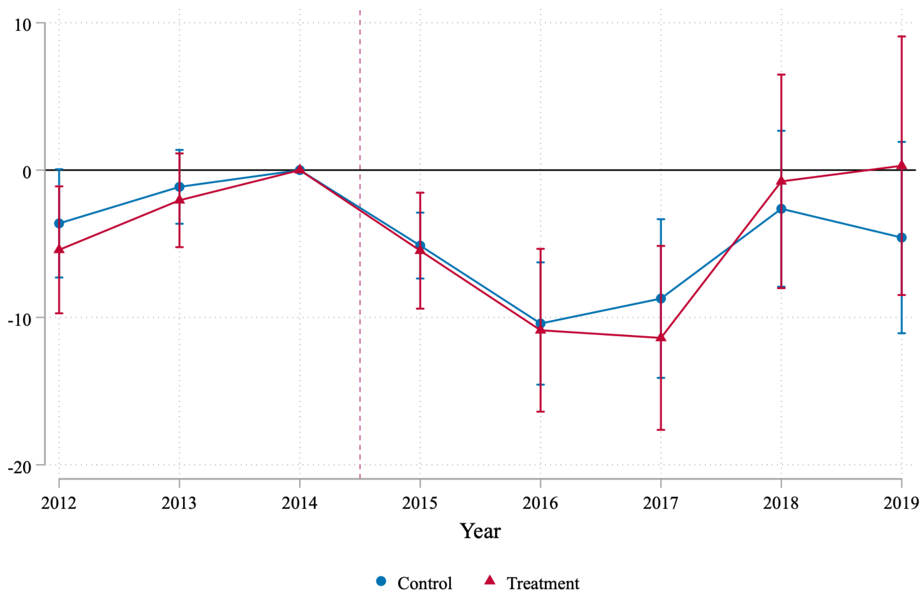
C Appendix: Additional Results

Figure C.1: The Effect on Total Employment



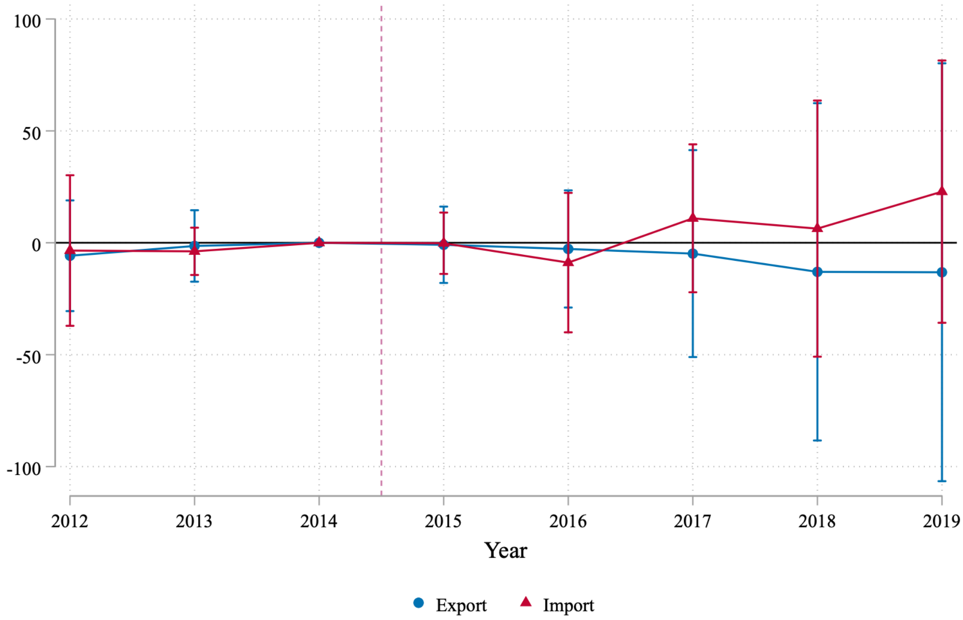
Notes: For each year, the Figure displays the estimate the estimated year dummies for overall FTE employment for border and non-border municipalities at the shock separatedly. The total number of observations is 16′992. We control for municipality fixed effects. We also report 95% level confidence intervals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

Figure C.2: The Effect on the Manufacturing Sector



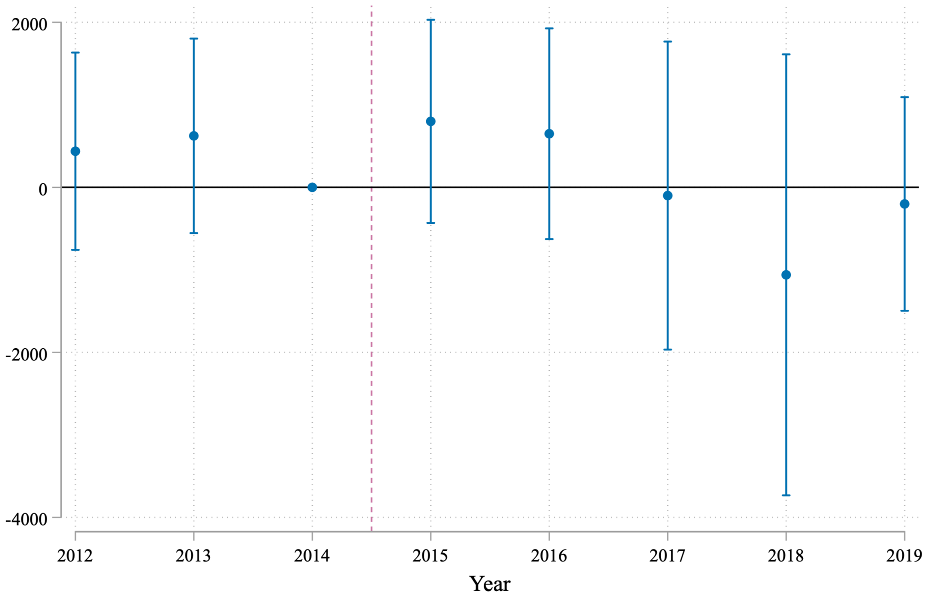
Notes: For each year, the Figure displays the estimate the estimated year dummies for FTE employment in the secondary sector for border and non-border municipalities at the shock separatedly. The average number of employees in the secondary sector by municipality in our sample is 50. The total number 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 C.3: The Effect on Import and Exports



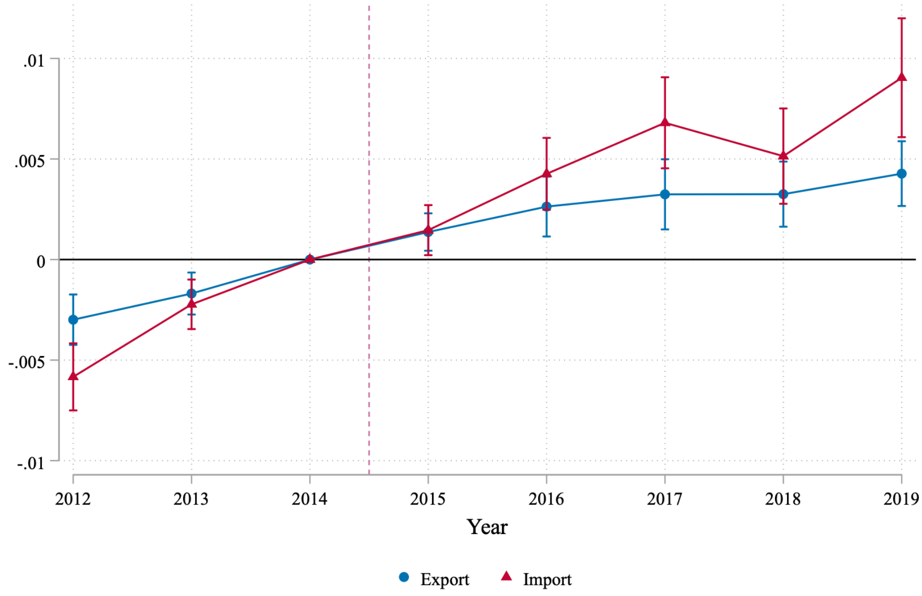
Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in employment in import and export sectors between border and non-border municipalities at the shock. The total number of observations is $4'431'104$. We control for 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 C.4: The Effect on Equilibrium Income



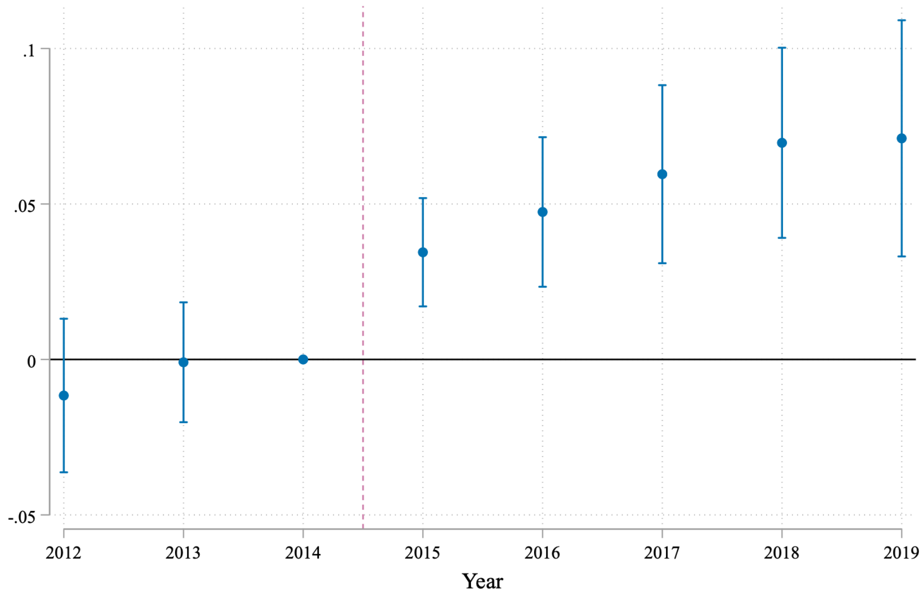
Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the income levels between border and non-border municipalities at the shock. The total number of observations is $16'867$. We control for municipality, year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure C.5: The Effect on CBW Share by Treatment



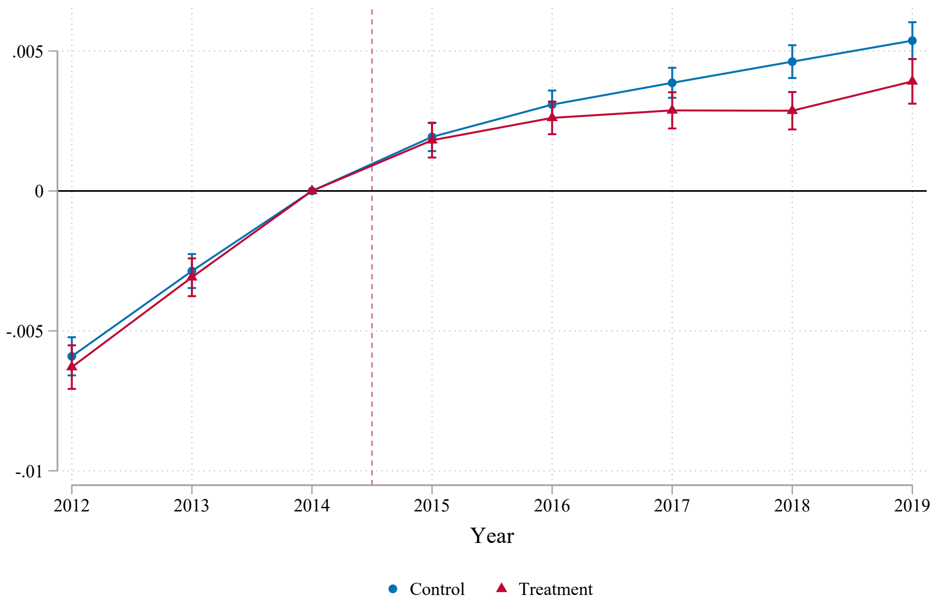
Notes: For each year, the Figure displays the estimated difference in CBW share at the shock for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is 16′992. We control for municipality and year-fixed effects. We also report 95% level confidence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

Figure C.6: The Effect on Traffic at border posts



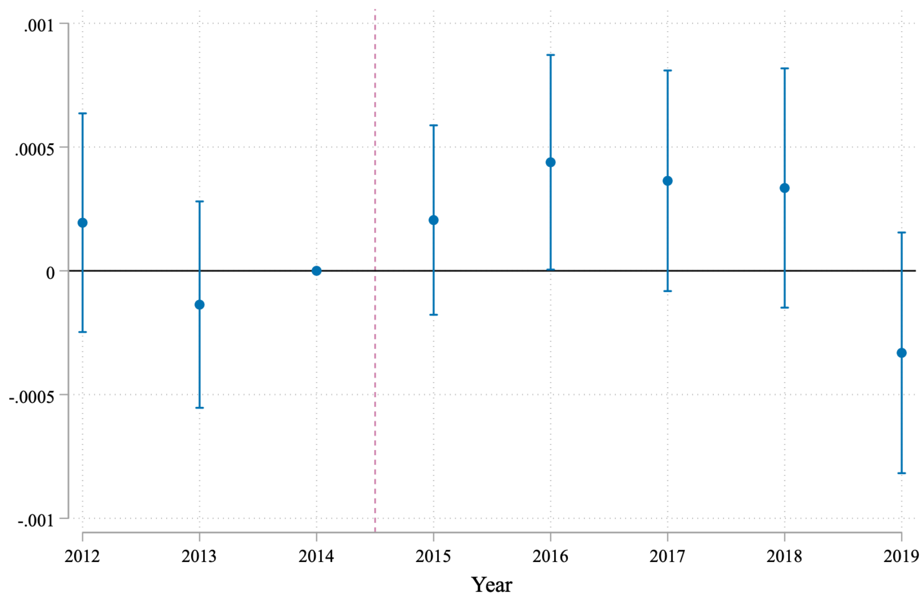
Notes: For each year, the Figure displays the estimated difference in traffic at the border posts between tuesday and thursday. The total number of observations is 358. We control for municipality and year-fixed effects and for identifiers for heavy commercial vehicles. We also report 95% level confidence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

Figure C.7: The Effect on the EZ Working-age Residents' Share by Treatment



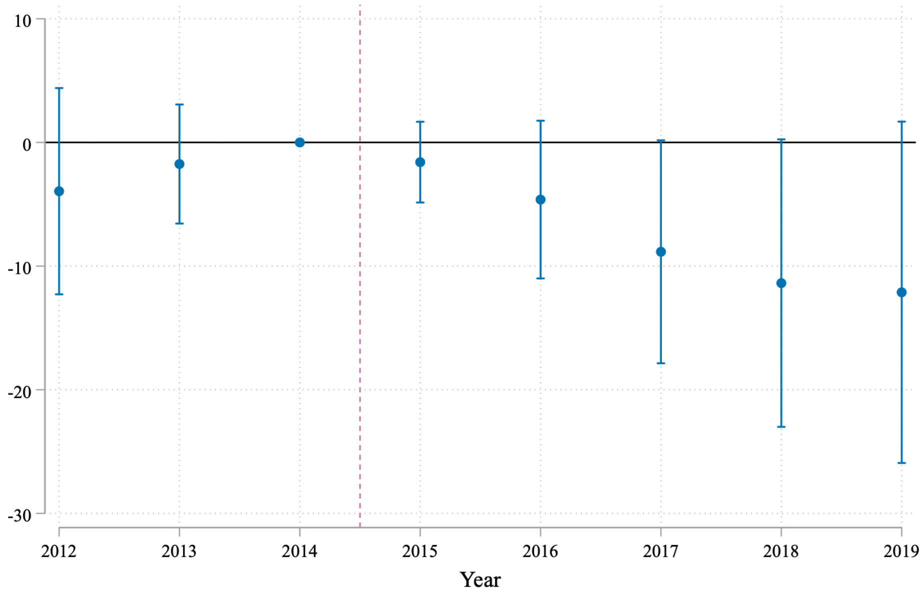
Notes: For each year, the Figure displays the estimated difference in Eurozone working-age citizens' share at the shock for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is $17'064$. We control for municipality and year-fixed effects. We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

Figure C.8: Emigrations from Switzerland to EU



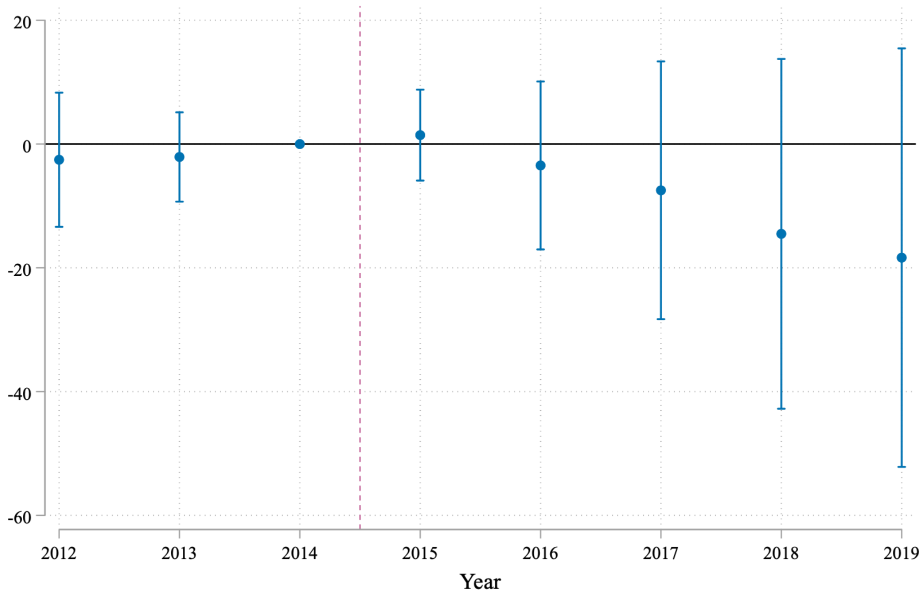
Notes: For each year, the Figure displays the estimated difference in the share of emigrations from CH to EU over total population for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is $17'064$. We control for municipality and year-fixed 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 C.9: Absolute value of EZ Residents



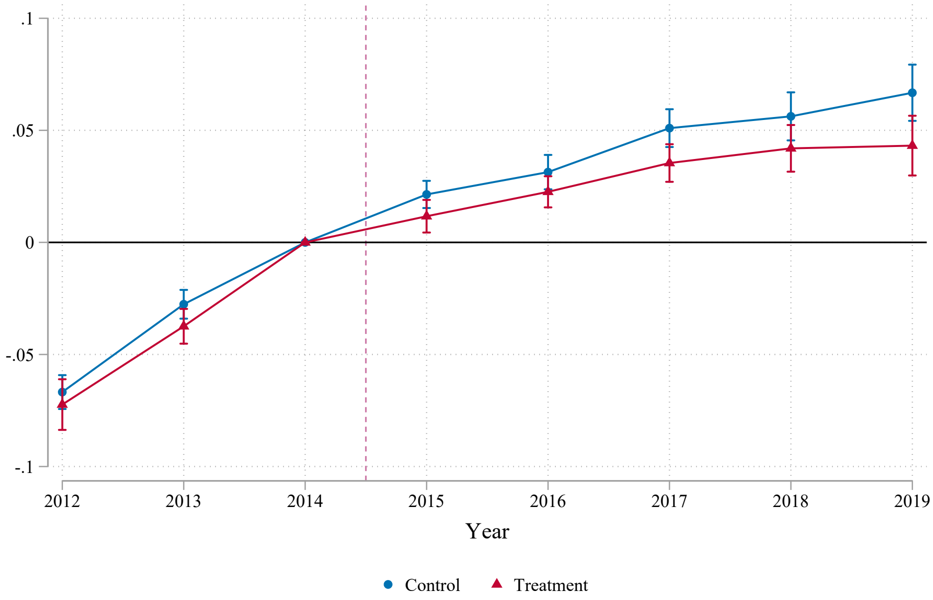
Notes: For each year, the Figure displays the estimated difference in the absolute value of EZ residents at the shock for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is 17′064. We control for municipality and year-fixed effects and urbanization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

Figure C.10: Absolute value of native and other nationality Residents



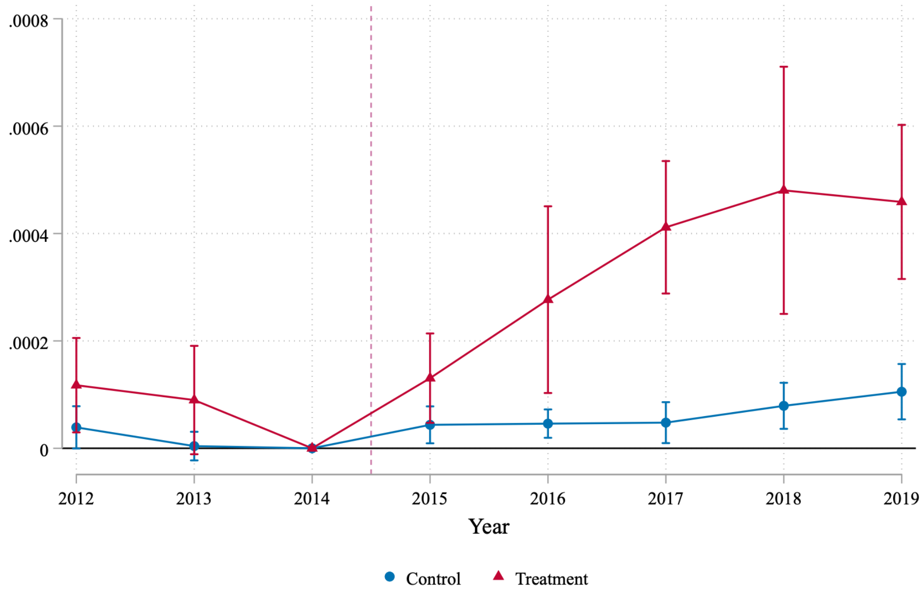
Notes: For each year, the Figure displays the estimated difference in the absolute value of residents not from EZ at the shock for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is 17′064. We control for municipality and year-fixed effects 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 C.11: The Effect on Swiss House Prices per m^2 by Treatment



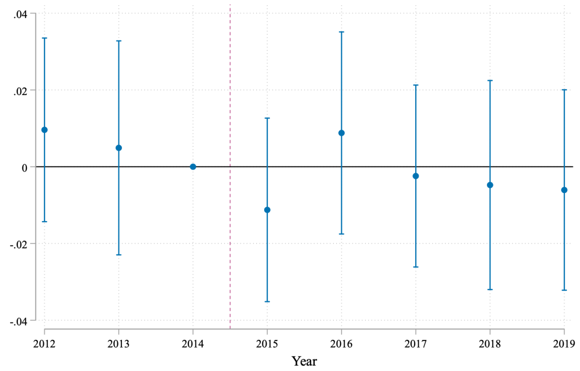
Notes: For each year, the Figure displays the estimated difference in the log of house prices per meter squared at the shock for border (treatment group) and non-border Swiss municipalities (control group). The total number of observations is 503′743. We control for municipality, year-fixed effects,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

Figure C.12: The Effect on Immigration from Swtizerland to Italy

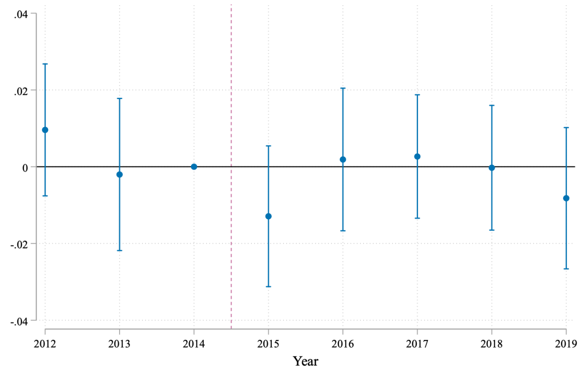


Notes: For each year, the Figure displays the estimated difference in the share of changes of residence from Switzerland to Italy by Italian municipality. The total number of observations is 139′832. We control for municipality, year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on ISTAT data.

Figure C.13: Migration to Treatment Group in Italy



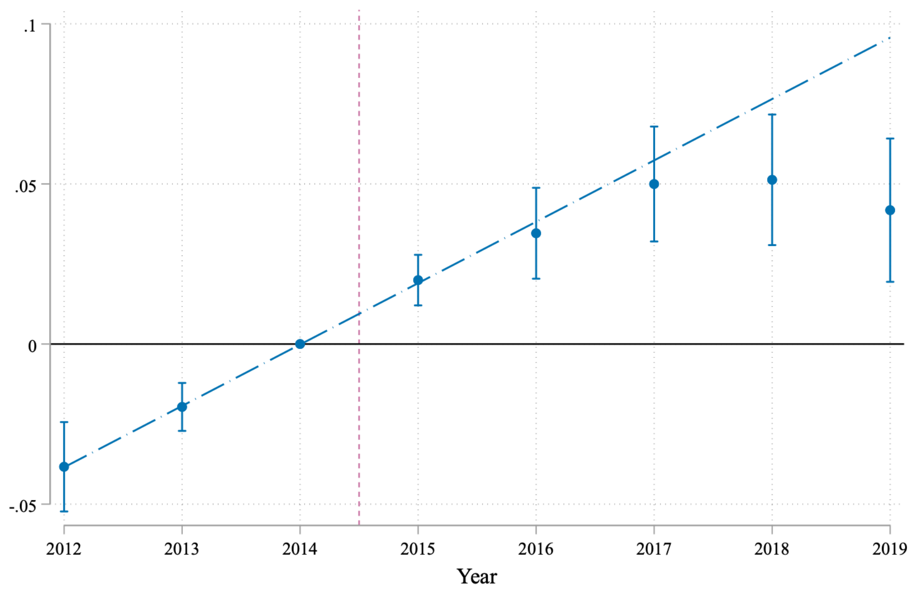
(a) Migration from Control to Treatment



(b) Migration from all Italy to Treatment

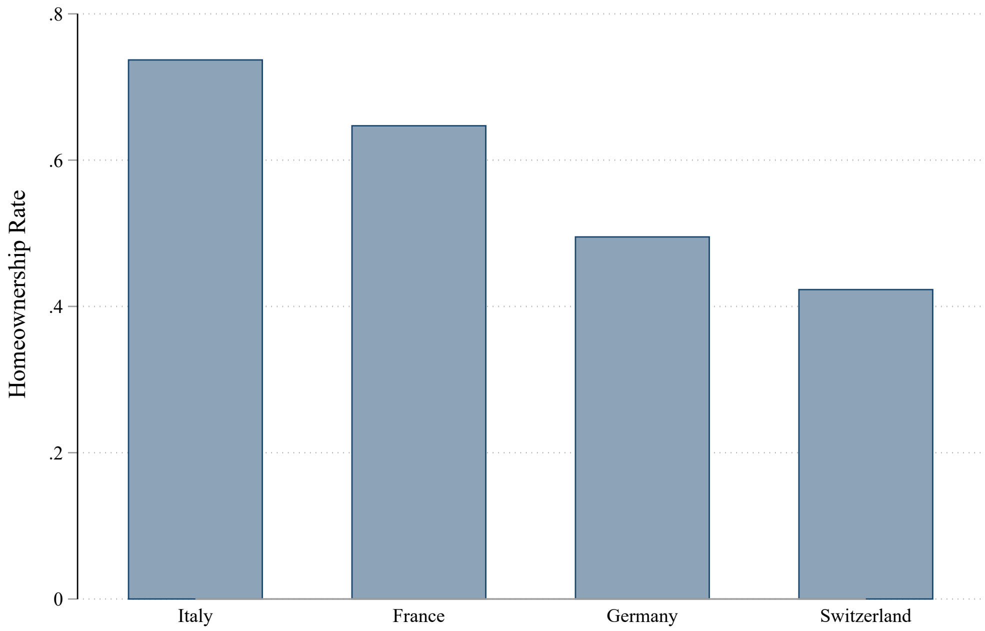
Notes: For each year, the Figure displays the estimated year fixed effect from 2014 of the logarithm of migrations in Italy, controlling for municipality fixed effects. We also report 95% level confidence intervals clustered at the municipality level. In sub-figure (a) we focus on migrations between 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 C.14: The Effect on German House Prices per m^2



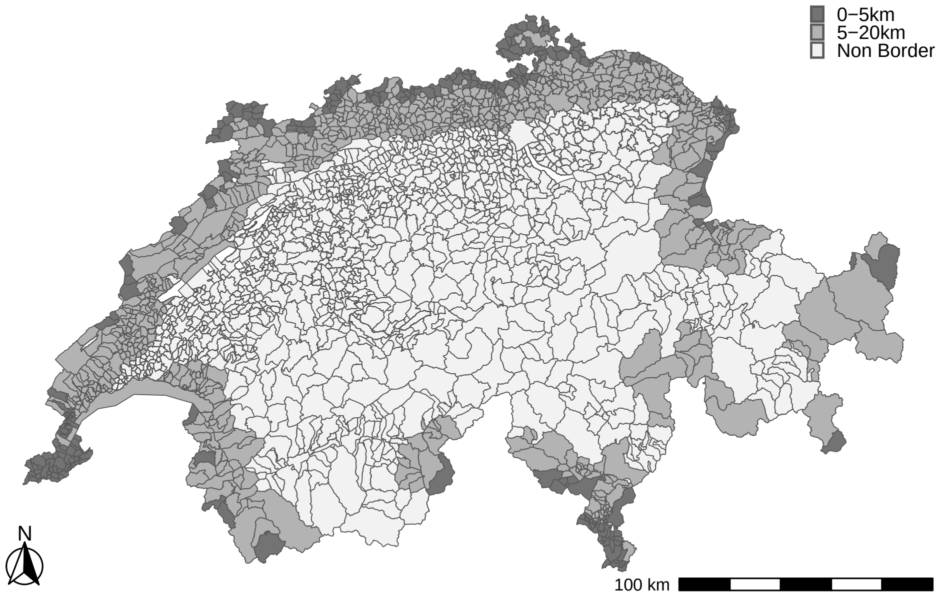
Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the log of house prices per squared meter between border and non-border German municipalities at the shock along with the pre-trend in house prices (dashed line). The total number of observations is $14'560$. 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 Swiss Federal Office of Statistics data.

Figure C.15: Homeownership Rates



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

Figure C.16: Treatment Selection: Proximity to the border



D Appendix: Additional Tables

Table D.1: European Transnational Areas

Alpine area	Switzerland, Liechtenstein, eastern France, southern Germany, northern Italy, Austria, 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).

Table D.2: Effect of Migration on House Prices

	Log House Prices m^2
Panel A: Effect of EZ in Switzerland	
Treat × Post × EZ Share	0.0178*
	(0.01069)
R-Squared	0.539
N	493'511
Municipality FE	Yes
Year FE	Yes
House Characteristics	Yes
Panel B: Effect of Immigration in Italy	
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 (EZ resident share, Immigrations from Switzerland to Italy) on the log of housing prices per square meter between border and non border municipalities in Switzerland and Italy after the removal of the EUR/CHF exchange rate floor in 2015. We control for municipality, year fixed-effects, and housing characteristics. Panel A reports the triple difference coefficients for Switzerland. Panel B reports the triple difference coefficients from Italy. 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, Italian Revenue Agency data, and ISTAT.

Table D.3: Proximity to the border: house prices

Log House Prices m^2	0–5 km	6–20 km
Panel A: Gradient Effect in Switzerland		
Treat × Post	-0.0274^{***}	-0.0116^{**}
	(0.0073)	(0.0063)
R-Squared	0.541	0.513
N	337’776	417’110
Municipality FE	Yes	Yes
Year FE	Yes	Yes
House Characteristics	Yes	Yes
Panel B: Gradient Effect in Italy		
Treat × Post	0.0622^{***}	0.0469^{***}
	(0.0062)	(0.0034)
R-Squared	0.921	0.919
N	114’739	128’935
OMI District FE	Yes	Yes
Year FE	Yes	Yes
House Characteristics	Yes	Yes

Notes: Panel A of the Table displays the estimated difference in the log of housing prices per square meter in the 0-5km (column 1) and 6-20km bandwidth (column 2) between border and non-border Swiss municipalities after the removal of the EUR/CHF exchange rate floor in 2015. We control for municipality, year fixed-effects, and housing characteristics. Panel B of the Table displays the estimated difference in the log of housing prices per square meter in the 0-5km (column 1) and 6-20km bandwidth (column 2) between border and non-border Italian municipalities after the removal of the EUR/CHF exchange rate floor in 2015. We control for OMI, 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 Italian Revenue Agency data.

Table D.4: Proximity to the border: immigration

Immigration Share	0–5 km	6–20 km
Treat × Post	0.0009^{***}	0.0002^{***}
	(0.0002)	(0.00004)
R-Squared	0.437	0.278
N	7’492	9’000
Municipality FE	Yes	Yes
Year FE	Yes	Yes

Notes: The Table displays the estimated difference in the share of immigrants from Switzerland between border and non-border Italian municipalities at the shock. 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 ISTAT data.

D.1 Exchange Rate Expectations

To determine expectations on the exchange rate we follow the standard approach in the monetary macroeconomics literature, which detects random monetary shocks as the unexpected interest rate changes identifiable through large departures of the fitted values to the actual ones. In this context, we implement an AR(1) regressing the Exchange rate between CHF and EUR on the 3-month prior rate regression, along with time-fixed effects. More in detail, we estimate the following regression,

$$E_t = \alpha + \beta \cdot E_{t-3} + \tau + \varepsilon_t$$

where is E_t represents the exchange rate in month t and τ represents a month of the year fixed effect. Thus, the fitted values of this regression represent the 3-month prior expected exchange rate path for the period t. We then define the forecast's error as the difference between the realized outcome and the predicted outcome,

$$\widehat{\varepsilon}_t = E_t - \widehat{E}_t$$

D.2 Treatment Selection Definition

The threshold of 20km is plausible for at least two reasons. First, 20km is the official distance bandwidth used in the bilateral agreement between Switzerland and the European Union to define cross-border workers with fiscal privileges.[17] Second, a simple calculation shows that 20km is the distance from the border which makes an agent indifferent by turning into a cross-border worker given the 2015 shock. To see this, consider that the average salary in Swiss Cross-border Regions in 2014 was around 6'000 CHF (Swiss Federal Office of Statistics, 2015) and that the average transportation costs per kilometer in Switzerland were 0.80 CHF (Touring Club Suisse, 2015). Call $y_t^{€}$ the average swiss salary at time t in Euro, then:

$$y_{2014}^{€} = \frac{6'000}{1.20} = 5'000€ \qquad y_{2015}^{€} = \frac{6'000}{1.07} = 5'600€$$

Thus, the gains from the 2015 CHF appreciation for the representative agent (i.e. the one gaining the average salary) were 600€. Define $\tau^{€}(d)$ the total monthly transportation costs in Euro at the distance from the border d. Then, the transportation costs for an individual who commutes back and forth daily over 20km for 20 working days is:

$$\tau^{€}(20) = \frac{0.8}{1.07} \times 20\text{km} \times 2 \times 20 \text{ days} = 600€$$

The total monthly transportation costs that equalize the gains are at the 20km bandwidth. Therefore, 20km is the level of distance from the border which makes the agent indifferent by turning into a cross-border worker given the 2015 Swiss franc appreciation.

[17] Fiscal privileges refer to wages and other work incomes that can be taxed only in the country of work (Switzerland) which are partly rebated from the Federation to border municipalities of the origin countries. Note that Switzerland is in the top five OECD countries with the lowest tax rates. More information is available at https://www.fedlex.admin.ch/eli/cc/1979/457_457_457/it

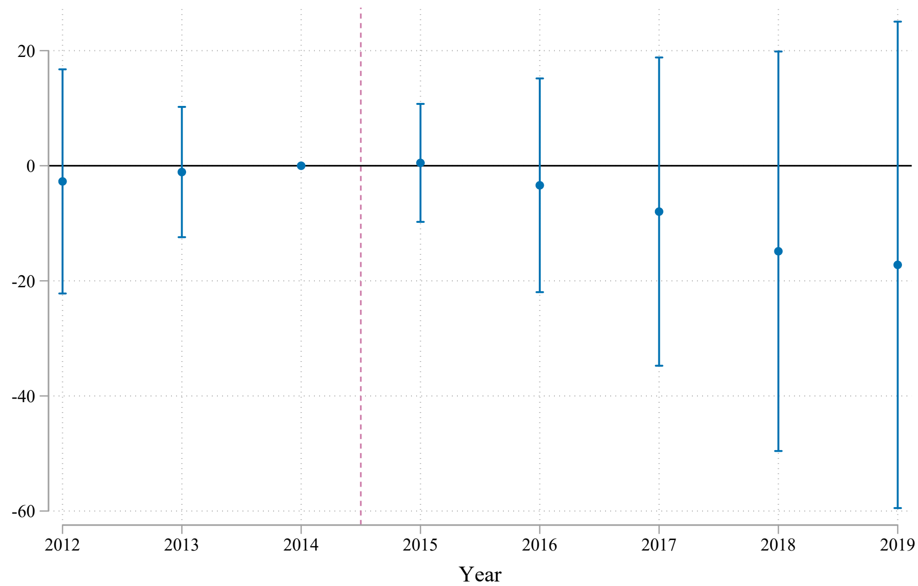
D.3 Robustness

In this section of the Appendix, we want to provide some robustness checks of our results and further heterogeneities tests to understand the empirical validity of the estimated effects. We present results on the effect of the 2015 CHF appreciation on the population composition of Swiss municipalities, EZ working-age residents' share by age category, housing supply, and on EZ working-age residents' share and house prices removing rural municipalities.

The first robustness check investigates the EZ-workers' changes' results. In particular, since we are showing the effect on the share of EZ workforce residents and taxpayers, we need to rule out changes in the denominator. Figure D.1 shows that there is no change in the total population between treated and control.

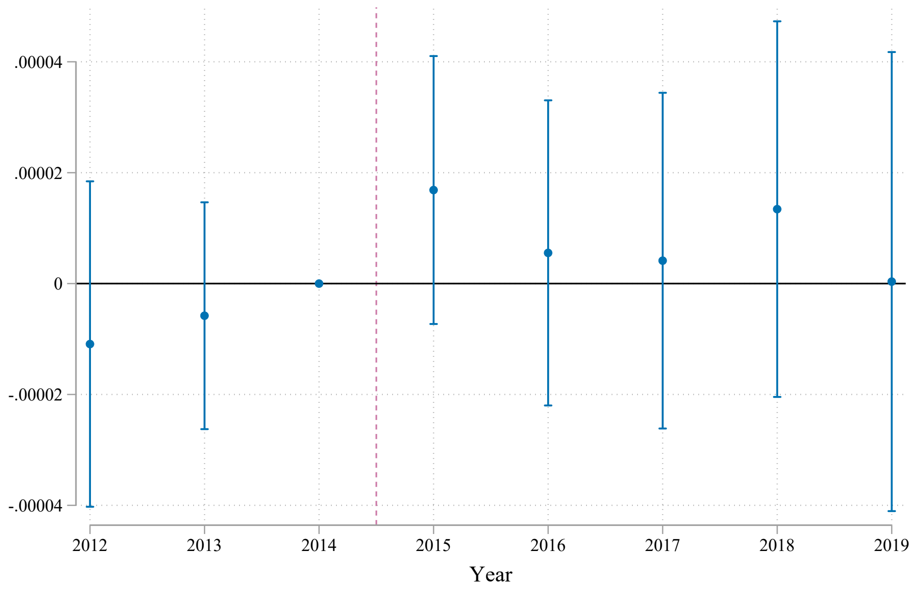
To validate the econometric and theoretic conclusions on the relocation of EZ workers, we would need to observe no differences in the shares of other foreign residents. Again, the idea is that relying on the place attachment theory, the EZ residents should be more inclined to relocate to European countries (with respect to non-EZ ones) since, given all other things equal, the average utility of residing in the place of origin should be higher. To demonstrate the above reasoning, we estimate the Difference-in-Differences coefficients for the change in European workers' share residing in Switzerland but coming from outside the Eurozone. The idea is that the 2015 EUR/CHF lower-bound remotion should not have altered the residential location preferences of individuals coming from non-EZ countries. The results are displayed in Figure D.2. As shown, we find no significant effect on the share of residents from other European countries between the border and non-border municipalities; this confirms that the 2015 Swiss Franc appreciation had an impact only on the Eurozone residents.

Figure D.1: The Effect on Total Working-age Residents



Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in total working-age residents 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 D.2: The Effect on Other European Working-age Residents' Share



Notes: For each year, the Figure displays the estimate of the γ^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.

Table D.5 reports the DiD coefficients for the EZ residents' working-age share decomposed by Young (20–39 y.o.) and Adult (40–64 y.o.). Interestingly, we find a higher relative effect for the younger workers, who are indeed those for which the incentive to relocate should be the highest: the relative decrease in the young EZ residents share is -4%, while for the adult, -3.11%.

Table D.5: Effect on EZ Working-age Share by Age-Group

EZ Share	Young Working-age Residents (20-39 y.o.)	Adult Working-age Residents (40-64 y.o.)
Treat × Post	-0.0016^{***} (0.00042)	-0.0014^{***} (0.00046)
Relative Change	-4.00%	-3.11%
R-Squared	0.944	0.962
N	12'904	12'904
Municipality FE	Yes	Yes
Year FE	Yes	Yes

Notes: The Table displays the estimated difference in the EZ working-age residents share by age between border and non-border Swiss municipalities after the removal of the EUR/CHF exchange rate floor in 2015. We compute the DiD effect considering only treated French-speaking, and Italian-speaking municipalities, given the consistency of the results. 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 Swiss Federal Office of Statistics data.

To ensure that the impact on the housing price is determined by the demand shock discussed but not by a supply one, Table D.6 displays the DiD coefficient of the 2015 CHF appreciation's effect on the log of total housing stock at the municipal level in the comparison between treated and control municipalities. Concretely, the DiD estimator does not identify any significant differences in the housing supplied between treated and control municipalities, giving additional evidence that the main driver is indeed the demand.

Table D.6: Effect on the Housing Stock

Log m^2 of new postings	House Prices	Rent Prices
Treat × Post	0.0035 (0.0201)	-0.1322** (0.0559)
R-Squared	0.825	0.896
N	14'599	14'807
Municipality FE	Yes	Yes
Year FE	Yes	Yes

Notes: The Table displays the estimated difference in the log squared meters of new postings of housing, for selling and for renting, between border and non-border observations after the removal of the EUR/CHF 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.

In table D.7 we display the relationship between cross border workers and house prices. In particular, for an increase of CBW from the 5% to the 95% percentile of the distribution, the house prices reduce by -0.1%.

Table D.7: DiD Results - CBW and House Prices

	House Prices
CBW	-0.00128^{**} (0.00052)
R-Squared	0.523
N	468'910
Municipality FE	Yes
Year FE	Yes

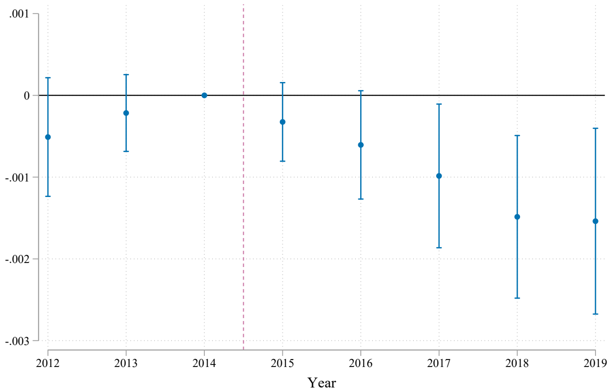
Notes: The table displays the estimated difference in house prices driven by the cross border workers. Standard errors are clustered at the municipality level. Significance levels: *** $p < .01$, ** $.01 \leq p < .05$, * $.05 \leq p < .10$. Source: Our elaboration on Swiss Federal Office Statistics data.

Since in the central Swiss Cantons, there is a concentration of small rural municipalities (usually mountain municipalities), one can be concerned that we are comparing them with relatively big cities in the treatment group. Thus, to solve this issue, we propose a robustness check (for all the outcomes of interest) centered on removing small municipalities from the sample.

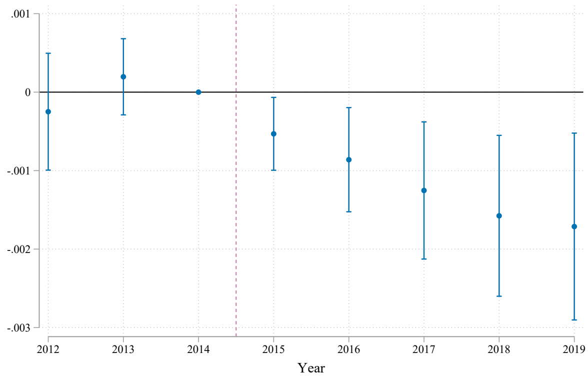
Figure D.3 shows the robustness check for the EZ-residents share. In sub-figure D.3a, we consider only municipalities with a number of residents higher or equal to 1'000, while in sub-figures D.3b, D.3c, and D.3d we respectively remove municipalities with a number of inhabitants lower or equal to 1’500, 2’000, and 2’500. As it can be denoted, the results remain robust to these modifications of the sample.

Figure D.4 shows the robustness check for the log of housing price per squared meter. Again, the results remain robust to modifications of the control group. We remove the rural municipalities in sub-figures D.4a, D.4b, D.4c, and D.4d as in Figure D.3.

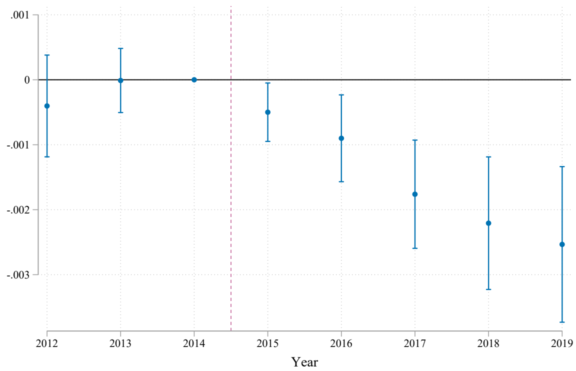
Figure D.3: Removing Rural Municipalities, Effect on EZ Working-age Residents’ Share



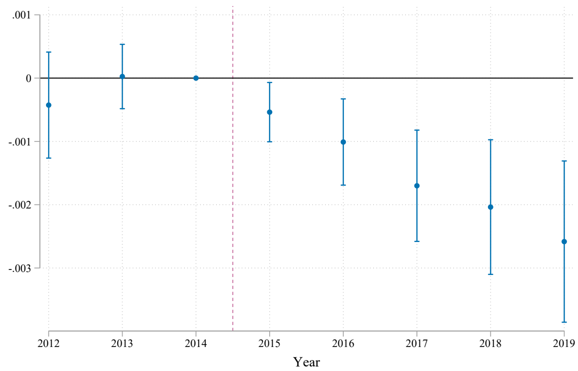
(a) Population $>$ 1’000 inhabitants



(b) Population $>$ 1’500 inhabitants



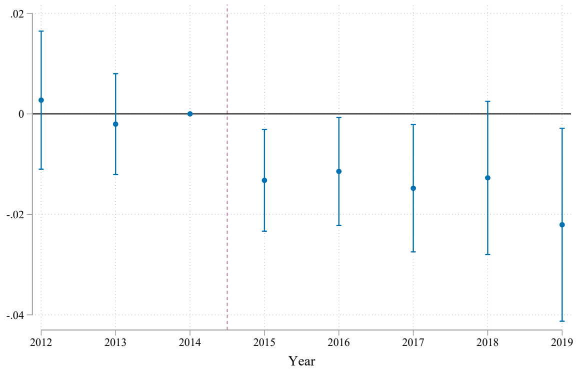
(c) Population $>$ 2’000 inhabitants



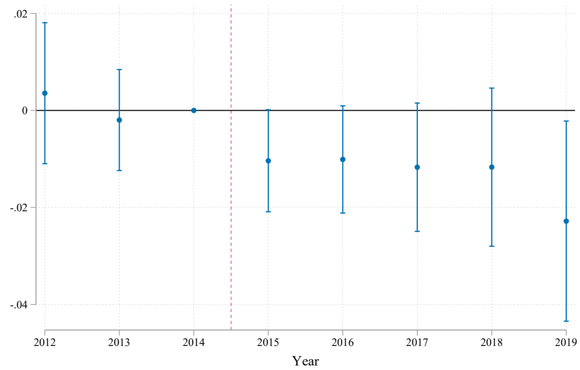
(d) Population $>$ 2’500 inhabitants

Notes: For each year, the Figure displays the estimate of the γ^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. We control for municipality and year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. In sub-figure (a) we exclude Swiss municipalities with a population lower than 1’000 inhabitants; in (b) we exclude Swiss municipalities with a population lower than 1’500 inhabitants; in (c) we exclude Swiss municipalities with a population lower than 2’000 inhabitants; in (d) we exclude Swiss municipalities with a population lower than 2’500 inhabitants. Source: Our elaboration on Swiss Federal Office of Statistics data.

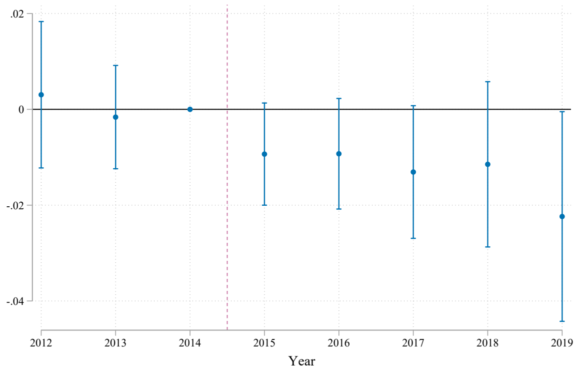
Figure D.4: Removing Rural Municipalities, Effect on Swiss House Prices per m^2



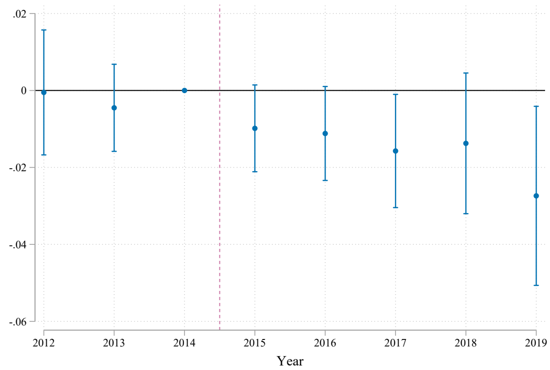
(a) Population $>$ 1’000 inhabitants



(b) Population $>$ 1’500 inhabitants



(c) Population $>$ 2’000 inhabitants



(d) Population $>$ 2’500 inhabitants

Notes: For each year, the Figure displays the estimate of the γ^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. We control for municipality, year-fixed effects, and housing characteristics. We also report 95% level confidence intervals clustered at the municipality level. In sub-figure (a) we exclude Swiss municipalities with a population lower than 1’000 inhabitants; in (b) we exclude Swiss municipalities with a population lower than 1’500 inhabitants; in (c) we exclude Swiss municipalities with a population lower than 2’000 inhabitants; in (d) we exclude Swiss municipalities with a population lower than 2’500 inhabitants. Source: Our elaboration on Meta-Sys AG data.

Table D.9 shows the pre-post coefficients for the log house prices in the three regions of the transnational economy. The table shows that the decrease in house prices in Swiss municipalities at the border corresponded with an increase in house prices in Italy with no effect on the detrended house prices in German municipalities at the border, as shown in the heterogeneity analysis. Table D.8 shows the pre-post coefficients for the residential mobility outcomes. The table shows that the decrease in EZ residents in Swiss municipalities at the border has corresponded both with comebacks in Italy and an increase in CBWs.

Figure C.13 reports the estimated year fixed-effects for the logarithm of migrations to the treatment group in Italy. The figure shows that the 2015 shock seems not to have changed the incentives of Italian workers residing in Italy further away from the border to relocate closer to the border to potentially work in Switzerland.

Table D.8: DiD Results - Residential Mobility

	EZ in CH	Immigrations in ITA	CBW in CH
Treat $\times$ Post	-0.0008^{*} (0.00045)	0.00025^{***} (0.00004)	49.37^{***} (17.552)
R-Squared	0.974	0.382	0.986
N	17'064	9'788	68'256

Notes: The table displays the estimated difference in eurozone working-age residents' share in Switzerland (column 1), immigration flows from Switzerland to Italy (column 2), and share of cross-border workers in Switzerland (column 3) after the removal of the exchange rate floor between Euro and Swiss Franc in 2015, between border and non-border observations. 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 administrative data and ISTAT.

Table D.9: DiD Results - Log of House Prices per m^2

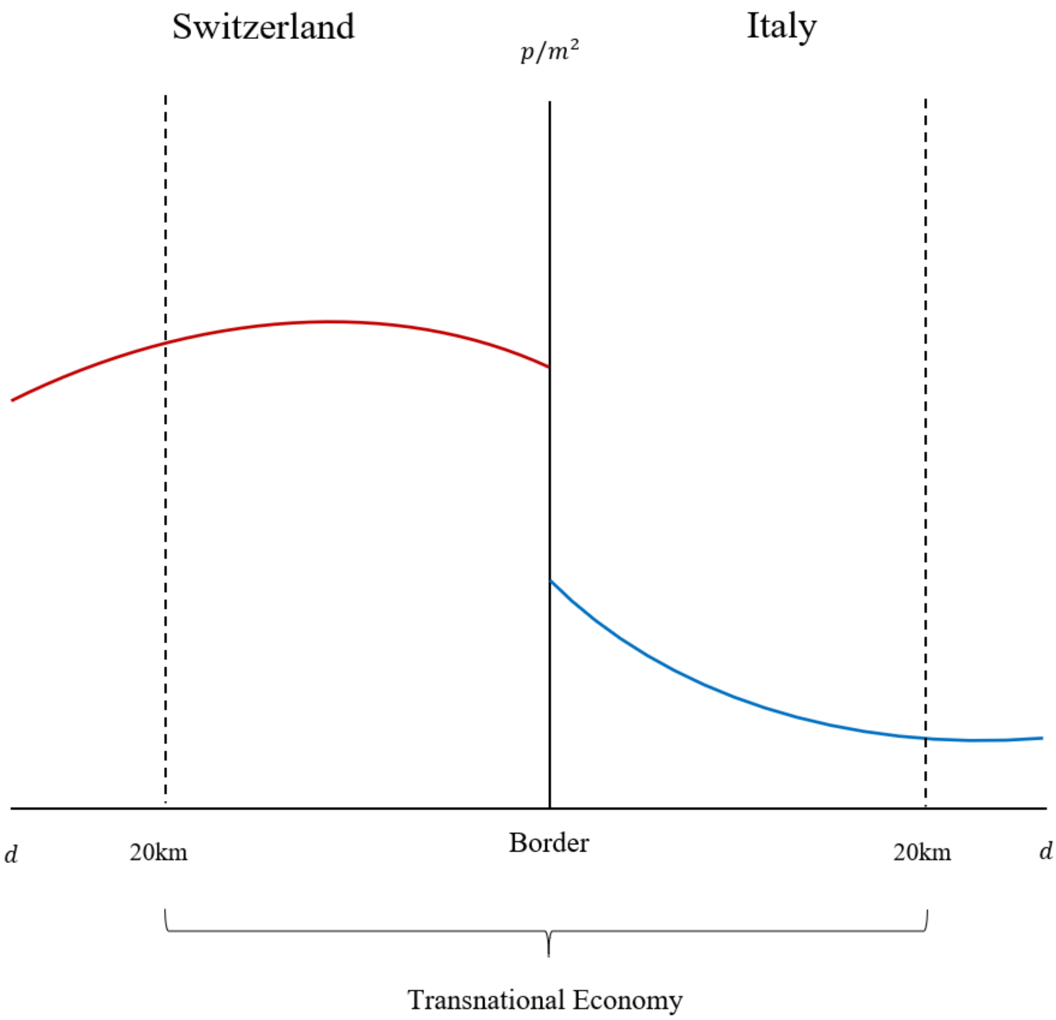
	Switzerland	Italy	Germany
Post	-0.0174^{***} (0.0055)	0.043^{***} (0.0029)	0.0074 (0.0088)
R-Squared	0.537	0.922	0.99
N	503'743	140'171	14'560

Notes: The table displays the estimated difference in the log house prices per squared meter in Switzerland (column 1), in Italy (column 2), and in Germany (column 3) after the removal of the exchange rate floor between Euro and Swiss Franc in 2015, between border and non-border observations. Standard errors are clustered at the municipality level. Significance levels: *** $p < .01$, ** $.01 \leq p < .05$, * $.05 \leq p < .10$. Source: Our elaboration on Metasys, Italian Revenue Agency, and 21st Real Estate's data.

D.4 Empirical Transnational Bid-Rent Model

The y-axis of Figure D.5 represents the meter-squared housing prices (p/m^2), while the x-axis shows the distance of each residence to the border (d). The housing price decreases with the distance in Italy because, being the workplace restricted in Switzerland, the nearer to the border the agent resides, the lower transportation costs are. Thus, the housing prices adjust to compensate: the lower the transportation expenditures, the higher the housing prices. On the other hand, in Switzerland, housing costs can either increase or decrease with the distance (its structure mainly depends on which municipality the labor market is concentrated). Despite also, in this case, the bid-rent curve inherits a transportation-living costs trade-off, we cannot declare ex-ante its shape as in the Italian case.

Figure D.5: The Transnational Bid-Rent Model

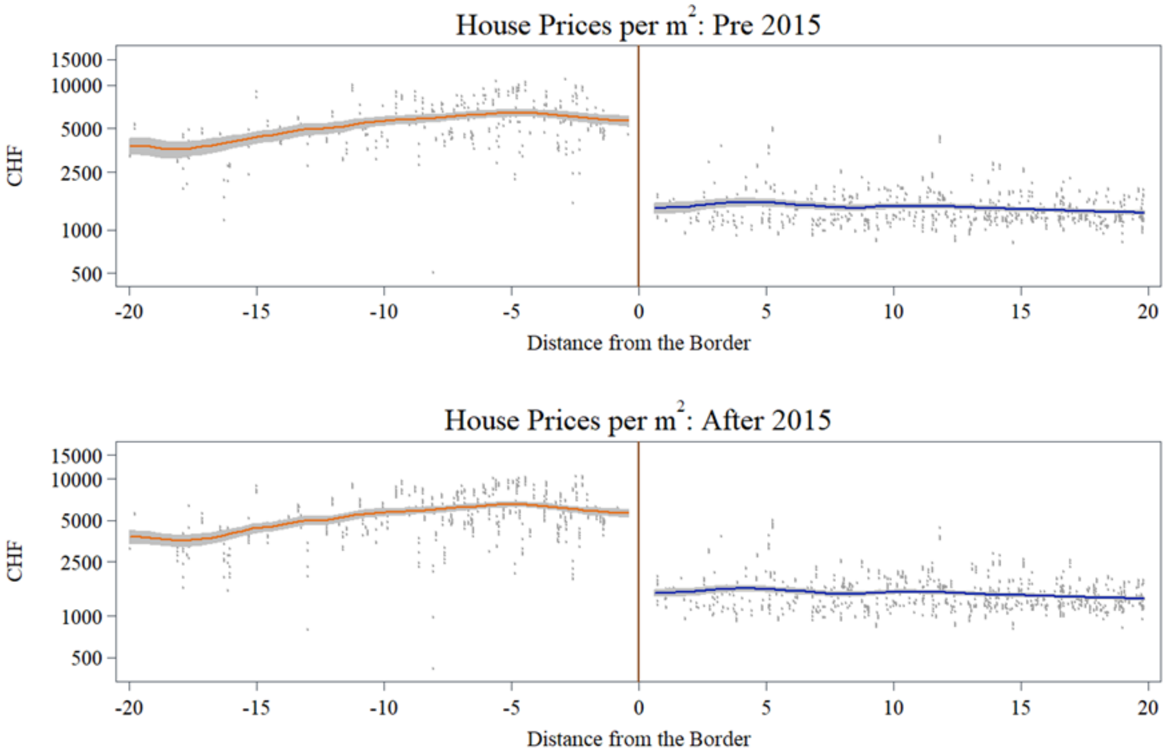


The polynomial of degree one in Figure D.6 is represented by the following Taylor expansion,

$$E[Y|X = x_0] = f(x_0) + f'(x_0) \cdot (x - x_0)$$

where f is the function approximated by the Epanechnikov kernel of the data, Y is the change in house prices in the pre or in the post period, X is the distance from the border and therefore x_0 represent each unit of distance.

Figure D.6: Transnational Bid-Rent Model Before and After 2015 CHF Appreciation



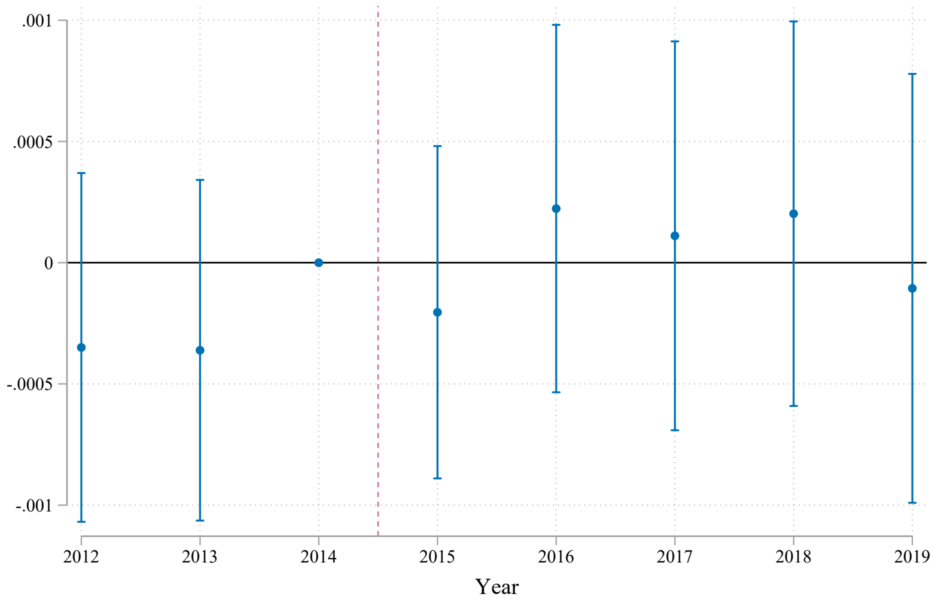
Notes: The Figure displays the local linear estimation of the bid-rent curves between municipalities in Switzerland (Ticino, in red) and Italy (Piedmont and Lombardy, in blue) by distance in kilometers from the border. Source: Our elaboration on Metasys AG and Italian Revenue Agency data.

D.5 Income Heterogeneities in Switzerland

In this section, we analyze the effect of the 2015 CHF appreciation by income classes. Consistently to what we have discussed in Section 4.1, the income gains from the shock (through the EUR conversion) come only for people with at least an average income of around 6'000 CHF. Indeed, we have to consider that residentially relocating on the other side of the border, and maintaining their Swiss job, increases the daily commuting costs; thus, a net increase in income is more likely if the individual earns at least the average salary. Additionally, this analysis allows us to comprehend some detailed heterogeneity effects of the agents interested in the residence change.

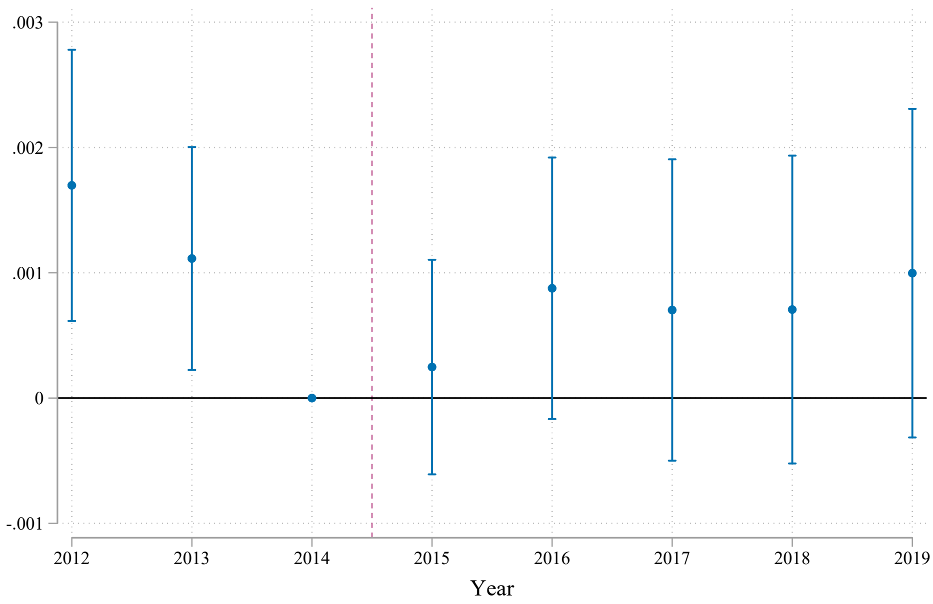
The following graphs depict the dynamic change in the shares of tax-payers by income classes over the total population between treatment and control municipalities before and after the shock. Figure D.7 represents the change in the share of low-income tax-payers; as it can be denoted, there is no effect. Moreover, Figure D.8 represents the change in the share of middle-income tax-payers; again, we cannot see any significant effect. Thus, the 2015 CHF appreciation did not cause any relocation of low and middle-income individuals. By contrast, in Figure D.9, we can see a significant impact on the share of high-income taxpayers in all the years after the shock. The relative effect in the difference between treatment and control municipalities is around 2%. This result confirms our hypothesis on the trade-off between exchange rate gains and commuting costs; in other words, after the 2015 CHF appreciation, only high-income taxpayers (here defined as individuals with an annual gross income higher than the average national one) relocate to the near EZ border countries because their earning allows them to obtain a real gain from the appreciation at the net of the higher transportation costs.

Figure D.7: The Effect on the Share of Low-income Taxpayers



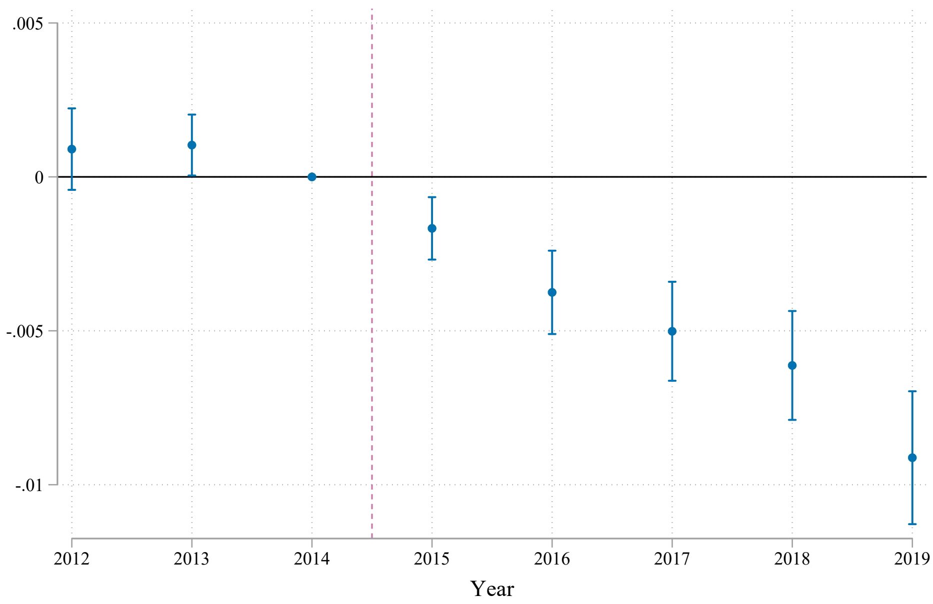
Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the share of low-income taxpayers between border and non-border Swiss municipalities at the shock. We control for municipality and year-fixed effects. We also report 95% level confidence intervals clustered at the municipality level. Source: Our elaboration on Swiss Federal Office of Statistics data.

Figure D.8: The Effect on the Share of Middle-income Taxpayers



Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the share of middle-income taxpayers between border and non-border Swiss municipalities at the shock. 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 D.9: The Effect on the Share of High-income Taxpayers



Notes: For each year, the Figure displays the estimate of the γ^k coefficients reported in equation (1), namely the estimated difference in the share of high-income taxpayers between border and non-border Swiss municipalities at the shock. 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.

Furthermore, we analyze the impact of the EUR/CHF cap removal on the log of housing prices relative to the average income per capita (defined as total income over the number of taxpayers) in treated and control jurisdictions. To do so, we implement a triple difference estimation (Olden and Møen, 2022; Wooldridge, 2020), where the log of house prices per squared meter is regressed against an interaction of the treatment and post-treatment period dummies and the average income per capita of the municipalities. The results are displayed in Table D.10. Formally, what we estimate is the effect of being in the ninetieth percentile versus the tenth percentile of the income distribution in border municipalities versus non-border municipalities by years away from 2015. In other words, this is the income intensity effect of our main specification. In column (1), we control for municipality fixed-effects, while in columns (2) and (3), we respectively add year fixed-effects and housing characteristics. Essentially, we find that the reduction in the log of housing prices in the treatment group is higher, in absolute terms, the higher the average income of the municipality. The effect is a reduction of around 150 CHF per meter squared in treated municipalities, and it is robust to housing controls and fixed effects. To conclude, putting together the results in Figure D.9 and in Table D.10, jurisdictions with a higher share of high-income taxpayers (those that are more likely to relocate) experienced a more intense drop in housing prices.

Table D.10: Triple DiD - Income Effect on House Prices per m^2

Log House Prices m^2	(1)	(2)	(3)
Treat × Post × Income per capita	-0.020^{**} (0.0081)	-0.016^{**} (0.0079)	-0.023^{***} (0.0076)
R-Squared	0.50	0.50	0.52
N	483’697	483’697	483’697
Municipality FE	Yes	Yes	Yes
Year FE	No	Yes	Yes
House Characteristics	No	No	Yes

Notes: The Table displays the estimated difference in the log of house prices per meter squared by a unit increase in the average income per capita between border and non-border observations after the removal of the EUR/CHF exchange rate floor in 2015. We control for municipality fixed-effects (col. 1, 2, 3), year fixed-effects (col. 2, 3), and housing characteristics (col. 3). 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.