Immigration and the Displacement of Incumbent Households*

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Abstract

We make use of information on the universe of immigrants to arrive in Switzerland between 1991 and 2013, regional house price and wage data, as well as details on individual Swiss households to show that incumbent families relocate in the presence of immigrants. While the effects of immigration on house prices and wages are heterogeneous, depending strongly on the characteristics of immigrants and incumbent households, we nevertheless document positive aggregate house and wage responses to immigration. We show that the decision of households to relocate instead seems rooted in homophily/sentiment about immigration. Our research provides valuable insights into some of the effects of large-scale immigration.

Keywords: Immigration, house prices, wages, employment, gentrification, displacement

JEL-Classification: *D14, D9, J61, R21, R23*

1. Introduction

Human rights groups report an increase in the number of people that have been driven from their homes by social conflict or poverty over the past few years[1]. Particularly in Europe and the United States, which have seen a surge in the number of people arriving each year, this has led to a renewed debate about the effects of immigration on the incumbent population. These debates have focused in part on whether immigrants may displace incumbent households.

The motivation for our paper is partly captured in Figure 1. We find a one quarter standard deviation reduction in the incumbent Swiss population following a one standard deviation inflow of immigrants from low income countries. The effects are similar, though less pronounced for immigration from high income countries. Our main objective in this paper is to quantify the economic mechanisms through which immigration may induce the incumbent population to relocate. In this context, we showcase which types of households benefit from and which are impaired by different types of immigration.

<< Figure 1 about here >>

Specifically, we analyze three distinct channels through which immigrants may affect the location choice of incumbents. Firstly, households may relocate due to changes in house prices and rents. Our motivation for this channel is based on the observation that certain neighborhoods experience price-hikes that follow immigration-induced demand for housing (Sá, (2014), Degen and Fischer (2017)). Secondly, immigration may affect wages (positively or negatively) through labor market complementarity or competition effects (Card (2009), Borjas (2006)). Households that experience wage changes might in turn be induced to move to a different region in search of alternate employment. Finally, households, which exhibit a strong preference regarding the composition of their neighborhood, might see immigration as an incentive to relocate. We label this a homophily or "sentiment" channel and define it as the displacement pressure exerted by immigration, when all neighborhood and household-level characteristics, which may induce relocation, are controlled for. We acknowledge that this channel may in part capture a household's very personal expectation of future labor- or housing-market competition, as opposed to a preference for neighborhoods of homogenous ethnicity.

[1] See UNHCR Statistical Yearbooks. Retrieved 09/2017 at: https://www.unhcr.org/en-us/statistical-yearbooks.html

We contribute to the existing literature in two ways. First, we study all three channels simultaneously, determining their relative importance. Second, we complement aggregate region level analyses with household-specific analyses. A joint study of the empirical evidence from both aggregation levels sheds light on the relationship between individual behavior and collective outcomes and helps resolve a number of conflicting findings in the literature. We draw our conclusions from four uniquely detailed and partly proprietary data sets that comprise information on every immigrant who arrived between 1992 and 2013, local wages and house prices, as well as detailed information on over 7000 Swiss households tracked for over 16 years.

Our findings can be very briefly summarized as follows: immigration exerts a net positive aggregate impact on both, house prices and wages. The extent to which individual families are affected varies strongly according to the origin of immigrants and whether they are tenants or owners, high- or low-income households, and have pre-existing pressure to move (e.g. due to changes in family composition). However, our results indicate that the house price and wage pressure from immigration is not sufficiently large to induce incumbent relocation. Instead, we find evidence of homophily as a primary driving force behind self-selected relocation of incumbent households.

Empirical identification is based on the "shift-share" instrument as first developed for this context by Card (2001). A number of additional techniques are used to address certain aspects of the data and to lend credibility to our results. We show that our empirical findings are similar when based on the instrumentation approach developed by Jaeger et al. (2018). We also apply a spatial regression framework to capture the dissemination of house price and wage shocks into neighboring regions.

Despite the topic's importance, little conclusive empirical evidence exists on the subject of immigration and its effects on the incumbent population. In part, this may be due to the fact that sufficiently detailed data, which includes heterogeneity in the immigrant and incumbent households, is hard to acquire. The data that we were able to use features exactly this heterogeneity and we consider Switzerland an optimal laboratory for analyzing the effects of immigration. Firstly, Switzerland has among the highest rates of per-capita immigration of any OECD country.[2]

[2] According to the OECD, the share of foreigners in Switzerland is currently 24%, the second highest in Europe behind the much smaller Luxembourg.

Concerns about the impacts of large-scale immigration is therefore a dominant topic in Swiss politics and society. Secondly, Switzerland underwent different phases of immigration which were characterized by a strong heterogeneity with respect to education, wealth and cultural background of immigrants. For instance, immigration flows at the beginning of our sample in the mid-90s, are dominated by refugees from the wars that followed the collapse of Yugoslavia. In contrast, immigrant flows in more recent years are mainly from Germany with immigrants pursuing higher paid jobs in the health or education sector. These two groups of immigrants differ with respect to the incomes they earn on the labor market and hence their potential to affect house prices and socioeconomic change. Finally, Switzerland is culturally and linguistically similar to its neighbors (France, Germany, and Italy) who are themselves currently dealing with high rates of immigration.[3] The implications of our results are therefore relevant for other countries.

Our empirical results, prefaced briefly above, can be summarized as follows: First, we find that exogenous immigration causes an increase in house prices. The exact nature of the increase depends on the origin of the immigrants in question. An increase of the population by one percentage point due to immigration from Western Europe or high-income countries (which we refer to as "Group 1" countries) cause a 2.13% increase in house prices on average.[4] Immigration from Eastern Europe or other low-income countries (referred to as "Group 2") have a slight negative -0.70% impact. This is possibly related to the more limited purchasing power of some immigrants. In line with these price reactions, we find evidence for price-induced relocation. A one standard deviation increase in group 1 immigration will increase the propensity at which home owning households relocate by 0.12 percentage points, but only if the household has a pre-existing desire to move. If a household has no desire to relocate, rising house prices even reduce the relocation probability[5]. Ultimately, the effect of immigration on relocation, via house price changes, is negligible.

[3] Based on current cohorts that will enter the labor market 10 or 15 years from now, Hanson and McIntosh (2016) project future long-term immigration flows and predict that by 2050, Europe will be surrounded by high-population-growth regions, including Africa and the Middle East.

[4] We exclude Portugal from this list because the characteristics of the Portuguese immigrants in our data are more similar to other rest of world immigrants.

[5] This finding can be explained in part by the peculiarities of the Swiss rental law, which "locks in" the price of existing rental contracts thereby making rising prices a deterrent to relocation.

Second, we find evidence of a positive wage effect. A one percentage point increase in the local population due to immigration from group 1 countries will increase local labor income on average by 2.27%. In contrast, a one percentage point increase in immigration from group 2 countries will have no significant impact on wages. At the household level, wage responses vary greatly; we find evidence of competition as well as complementarity, depending on the household. Higher wages are positively (if weakly) correlated with moving to a new municipality. This can be explained by households' desire to upgrade to a better housing standard once higher incomes are earned. It also implies that pre-existing rental contracts (with locked in rental rates) become more attractive in the face of falling wages. However, the pass-through effect of immigration on relocation decisions, through wages, is again negligible.

Finally, controlling for price changes and wages, we find that an increase of the population by one percentage point due to immigration from group 1 countries increases the propensity of tenants and owners to relocate by between 0.6 and 07 percentage points. The same immigration from group 2 countries increase the propensity that both home owners and tenants relocate by 0.6 to 1.2 percentage points. This effect is an order of magnitude larger than the effect directly related to observable house price changes or wage changes. The increased propensity of households to relocate, despite weak house price and wage responses to immigration, are possibly indicative of taste-based discrimination. It is important to note, however, that these results vary greatly between different types of households; some corresponding sensitivities are discussed in detail below[6].

There are several empirical studies that focus on house price dynamics as a driving factor of household location choice. Guerrieri et al. (2013) show for the U.S. housing market that a positive demand shock on the city level leads to substantial variation in house price growth across city neighborhoods. The authors find that households respond to the spatial price heterogeneity by relocating to cheaper neighborhoods which in turn has feedback effects on prices. In our paper, we use a spatial regression model that can capture this type of household behavior by transmitting house price shocks to cheaper neighboring regions[7]. Looking specifically at immigration, Sá (2014)

[6] Overall, our estimates are slightly larger than the displacement effects of immigration reported in other studies for the US and the UK (e.g. Borjas, 2006; Logan and Zhang, 2010; Hatton and Tani, 2005). This may reflect peculiarities of the Swiss market or, more likely, our detailed approach.

[7] Several studies deal not only with gentrification-based price pressure but also with its long-term neighborhood effects. These include McKinnish et al. (2010) and O'Sullivan (2005). Helms (2003) finds a strong relationship

examines the impact of immigration in the UK and finds a negative house price reaction. She conjectures that this is due to the fact that some households may leave areas of high immigration, thereby dampening prices. However, she cannot show this empirically. We can contribute to this discussion by showing that the sign of the house price response can change depending on the type of immigrants and the country of origin. Degen and Fischer (2017) and Basten and Koch (2015) specifically analyze the link between Swiss house prices and immigration. Similar to our study, they find that immigration can affect house prices. However, they do not link these dynamics directly to price-based relocation decisions of incumbent households.[8]

Several studies have analyzed the effects of labor market competition as induced by immigration[9]. Card (2001, 2007, 2009) finds little to no evidence of labor market displacement of incumbents by immigrants. Hatton and Tani (2005), looking at the UK, find that wages do not respond to immigration. They identify a strong relocation response from immigration as the main reason for this finding. As a consequence, the wage impact is spread out over several regions which explains why many studies find only small wage effects from immigration. In our study, we can capture this type of wage dissemination to nearby regions using a panel spatial autoregressive model. Kritz and Gurak (2001), in a US study, find little evidence that immigrants displace natives when accounting for local conditions. In contrast, Borjas (2006), Filer (1992) and Frey (1995) find evidence of a large displacement effect, particularly for low-skilled native workers who migrate in response to the arrival of low-skilled foreign workers[10]. We find a high degree of heterogeneity, depending on the type of immigration and the type of household in question. Our work thereby contributes to the above studies by using a rich dataset that allows us to make use of the universe of all immigrants on the one hand and controls of household-specific characteristics on the other.

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between renovation investment, associated house price improvements and gentrification of wealthy neighborhoods for inner Chicago. Sieg et al. (2004) show that, following clean air regulation, parts of Los Angeles that experienced an improvement in air quality saw more substantial gentrification in association with house price growth.

[8] Other studies focusing directly on the link between immigration and house price dynamics include Ley et al. (2002) and Akbari and Aydede (2012) for Canada, Saiz (2007) for the US, and Gonzalez and Ortega (2013) for Spain.

[9] Lester and Hartley (2014) specifically consider the labor market implications of gentrification to show that employment grows slightly faster in gentrifying neighborhoods.

[10] Differences in their findings and those of David Card can be traced back to different model specifications as well as their use of different data (e.g. city vs. census-level), as was highlighted by Peri and Sparber (2011).

Finally, we contribute to an as yet underdeveloped field of analysis in the context of displacement: sentiment about neighborhood composition or "homophily". Homophily can be difficult to disentangle from the above-mentioned labor market effects (or even house price effects). What we call "homophily or sentiment" may include a household's perception about increased labor market/housing market competition due to immigration (even though this expectation may be unfounded and consequently not fully reflected in prices and wages). Ha and Jang (2014) find evidence that increasing diversity brings a heightened ethnocentric response. Fitzgerald et al. (2012) and Wang (2012) show that immigration can be associated with a perceived threat: crime might increase and the host culture might be subverted. Similarly, Wright (2011), Esses et al., (2006) and Maddens et al. (2000) all show a correlation between feelings of national identity and public opinion regarding immigration. It seems plausible that households, with strong feelings regarding national identity, may leave areas affected by high rates of immigration. We extend these studies by documenting evidence of such a possible phenomenon for Switzerland, while also accounting for other channels through which dissatisfaction or the impulse to relocate might be affected.

The remainder of this paper is structured as follows. Section 2 outlines the empirical design used in this paper. Section 3 describes our data and presents some preliminary summary statistics and comparisons. Section 4 details our results. We make an effort to show the sensitivity of our results to various definitions of immigration, different household characteristics, or different regression specifications. Section 5 concludes our findings.

2. Economic Mechanisms underlying Immigration and Displacement

2.1 Overview

Immigration affects the housing market, the labor market, and the attitudes of the incumbent population in a number of ways. In this section, we aim to clarify the economic channels through which immigration operates. First, immigration can affect house prices and wages. Second, changes in house prices and wages, which have been caused by immigration, can influence the propensity of incumbent households to relocate to different regions. Third, immigration may not only affect households' relocation decisions through the housing market and wage channel but could have a direct impact, which we interpret as a residual or sentiment channel. The three channels are summarized in Figure 2.

<< Figure 2 about here >>

We gather empirical evidence for the transmission channels from two levels of aggregation. First, aggregate level regressions use data for all of Switzerland's 106 labour market (MS-[11]) regions and showcase a "regional response". These results are based on small geographic areas but are sufficiently aggregated to give representative effects. On the other hand, individual households are exposed to immigration in many different ways. While some households experience pressure others benefit. An aggregate analysis cannot capture the variation across individual households. We therefore also estimate a second, complementary set of regressions that can be related to specific household characteristics such as whether a household is a tenant or owner, has pressure to relocate or has high levels of income. We make use of a representative sample of 7000 Swiss households from the SHP Survey data, extended with proprietary information on the exact location of households. Since individual households are too small to cause feedback effects, household-level data also helps to address potential endogeneity within our regression models. A joint analysis of the empirical evidence from both aggregation levels sheds light on the relationship between individual behavior and collective outcomes and helps resolve a number of conflicting findings in the literature.

2.2 Immigration affects House Prices and Wages

Perhaps the most prominent effects of large-scale immigration, which also attracts considerable media attention, are the impacts on house prices and wages. In Figure 1, the house price and wage channel is denoted by Model I. Population is the main demand driver for residential real estate and an increasing population is expected to have a positive effect on house prices. The effects of immigration on wages can be either positive, when immigrant's skills are complementary to the local economy (Rath and Kloosterman, 2000; Zelekha, 2013, Beerli and Peri, 2017) or negative, when immigrants compete with incumbent households on the labor market (Card, 2001; Orrenius and Zavodny, 2007; Ottaviano and Peri, 2011). We explore the heterogeneity of immigration types and show that the effects are multifaceted.

When measuring the impact of immigration, it is not clear a priori whether house prices rise because of additional demand from immigration or whether immigrants choose to locate to booming regions that also experience rising house prices and wages. The raw immigration variable is therefore likely to contain some amount of endogeneity that needs to be addressed. We follow

[11] An MS-region is defined so that traveling from one part of the region to any other part takes less than 30 minutes. Switzerland contains 106 of these regions, so that even the largest are consequently smaller (in size and population) than all but the smallest US MSAs.

the labor market literature which has tackled this issue over the last years with the method of Card (2001) having become a popular approach. Card decomposed overall immigration in each region into "push" and "pull" immigration. The push factor refers to variables that push immigrants out of their home country such as social and political instability or a lack of job opportunities. Pull factors represent variables that attract immigrants to certain regions, such as job opportunities and a high standard of living. Pull factors are therefore likely to be endogenous. The aim of the Card (2001) decomposition is to instrument immigration with "exogenous" or "pushed" immigration. To conserve space, we refer to the detailed description of this approach in the data section and the appendix.

The impact of immigration on house prices HP_t^r is estimated in a panel regression for region *r* over the years 1993–2013. We make use of spatial estimation techniques as well as ordinary IV[12]. To facilitate the discussion and improve readability, we concentrate here on a simplified expression:

$$HP_t^r = \alpha_1 Group1_t^r + \alpha_2 Group2_t^r + \alpha_3' controls_t + \varepsilon_t^r \quad (1)$$

Our main coefficients of interest in this model are α_1 and α_2 which measure the effect of an increase in exogenous (instrumented) immigration from Group 1 and Group 2 countries.[13] We use these two aggregate groups for simplicity throughout the paper. The vector of control variables includes (MS-) region and time fixed effects as well as regional vacancy rates.[14] Eq.(1) serves as a benchmark model in which the regressors enter in contemporaneous form. Generally, the impacts from immigration on house prices, wages, and displacement can materialize over a course of

[12] Our regression specification accounts for the fact that house price effects from immigration are not confined to the shock originating region but are transmitted to neighboring regions (Guerrieri et al., 2013). We discuss the details of the specification in the empirical part below.

[13] Group 1 is comprised of Western Europe (without Portugal) and other high income OECD countries (Group 1 is dominated by immigration from Germany and France). Group 2 is comprised of immigration from Eastern Europe and Portugal as well as all remaining countries (Group 2 is dominated by immigration from the Balkan). In the Appendix, we also show regression results for individual countries.

[14] For instance, our municipality fixed effects control for the inflows of cross-border workers to municipalities which are within commuting distance to neighboring countries France, Germany, Austria, Liechtenstein, and Italy. Time fixed effects control for the gradual liberalization of the Swiss labor market for EU resident immigrants between 1999 and 2007 (Beerli and Peri, 2017)

several years. We therefore also make use of specifications that measure the impact of immigration over the last four years as backups, though the effects, when scaled, are indistinguishable.

The impact of immigration on wages W_t^r is estimated like the previous regression using wages for region *r* over the years 2002-2013:

$$W_t^r = \alpha_1 Group1_t^r + \alpha_2 Group2_t^r + \alpha_3' controls_t + \varepsilon_t^r \quad (2)$$

Like before, we are interested in the coefficients α_1 and α_2 which measure the percentage response in wages to an increase in immigration. As indicated, we estimate both above regressions as spatial models as well, which allow for the spatial diffusion of effects.

The specification in Eq.(2) is based on aggregate region level data and does not provide any information about the responses of individual households. The impact of immigration on individual households and the household choices that emerge as a consequence may differ considerably from the aggregate effects. We can learn more about the wage impact on different types of households such as tenants, property owners, wealthy or poor households by regressing on the wages of individual households:

$$W_{it}^{tenant/owner} = \beta_1 Group1_t^r + \beta_2 Group2_t^r + \beta_3' controls + \varepsilon_{it} \quad (2')$$

Equation (2') is estimated over the years 1999 to 2014, for which we have wages, immigration, and survey data for individual households[15].

We account for a number of important household level characteristics such as age, education, marital status, and number of children. The tenant/owner separation is one that is maintained throughout the paper. Given our ultimate focus on the propensity of households to relocate, it is important to account for the different preferences of owners and tenants for being in a certain location. We see that owners and tenants generally pursue different jobs and find themselves at different points in their life-cycle, making this distinction valuable for wage and sentiment analyses as well (this is discussed further below). In an extension, we show a version of Eq.(2') based on quantile regressions. Explicitly estimating the wage effects from immigration for different quantiles of the income distribution reveals a high degree of heterogeneity that is masked by the aggregate regressions as well as the average estimates at the individual household level.

[15] In backup regressions we again estimate regressions that make use of summed immigration over the past few years. Our results are unaffected.

2.3 House Prices and Wages affect Relocation

Immigration has a direct impact on real estate and labor markets. In this section, we are interested in the response of the incumbent Swiss population to these changes. In Figure 1, the causal chain is described as Model II where changes in house prices and wages form the transmission channels through which immigration affects incumbent households.

We begin by empirically quantifying the house price and the wage channel of displacement for individual incumbent households. We run two separate regressions for a household´s propensity to move, $Move_{it}^{tenant/owner}$. The first regression tests for the hypothesis that households relocate following a house price changes while the second regression estimates a household´s response to a change in wages. $Move_{it}^{tenant/owner}$ takes the value of 1 if the household moves to a new municipality and zero otherwise. There are over 2300 Swiss municipalities, implying a high degree of granularity.

The heterogeneity between households is higher than the heterogeneity between regions and the construction of household level regressions reflect that fact. For instance, homeowners are more sensitive to house prices while tenants respond to rents. In addition, tenants with existing rent contracts benefit from the peculiarities of the Swiss tenancy law. In Switzerland, landlords have little discretion to adjust existing contracts. Instead, rent contracts can only appreciate by a small amount each quarter.[16] As a consequence, prices paid by residents with old rental contracts are often far below market rates. These households would only be affected by higher local market rents if they would move to a new apartment. An increase in rents will therefore make relocating more unattractive for these types of households. Households that have relocation pressure, on the other hand, (for instance because of marriage, divorce, or the birth of a child) may have a higher propensity to move following a rent or house price increase. Such households may be induced to relocate to cheaper communities, where they can afford to rent or purchase a suitable accommodation. In many analyses below, we make use of a household's self-reported desire to move, which is strongly correlated with changes in a household's composition.

For tenants, we expect a positive coefficient on rent increases if the household intends to move but a negative coefficient if it does not. For owners, we also expect a positive price coefficient

[16] The exact price increase is determined by a rent index that is adjusted each month, taking into account mortgage rates. This rent index is called "Hypothekarischer Referenzzinssatz" and is available at https://www.bwo.admin.ch/bwo/de/home/mietrecht/referenzzinssatz/entwicklung-referenzzinssatz-und-durchschnittszinssatz.html.

if the owner indicates that he intends to move but a negative price coefficient if the owners is not planning to move. In a set of regressions, we therefore introduce a dummy D_{it} which captures a household's desire to move, as described above. For instance, it is set to 1 if a household intends to move and is zero otherwise.[17] We regress propensity to move, $Move_{it}^{tenant/owner}$, on house prices HP_t^r, the dummy D_{it}, and the interaction between house prices and D_{it}.

$$Move_{it+1}^{tenant/owner} = \beta_1 HP_t^r + \beta_2 D_{it} + \beta_3 HP_t^r \cdot D_{it} + \beta_4' \cdot controls + \varepsilon_{it}^r \qquad (3b)$$

The relocation variable $Move_{it+1}^{tenant/owner}$ enters the regression with a lead of one year. Although we obtain very similar results with a contemporaneous specification, this setup ensures that house prices and other regressors have changed before households decide to move. Equation (3) is estimated separately for owners and tenants. In the case of tenants, HP_t^r is replaced by rents. The estimate of β_3 can be used as a test of our hypotheses described in Table 1. In the empirical part of this paper, we verify that D_{it} is a key variable in understanding heterogeneous household responses to rising prices and rents.

<< Table 1 about here >>

Similar to the specification in Eq.(3b), we are further interested in the effects of immigration-induced wage changes on $Move_{it+1}^{tenant/owner}$. In Eq.(4) below we replace region specific house prices HP_t^r by household specific wages W_{it}.

$$Move_{it+1}^{tenant/owner} = \beta_1 W_{it} + \beta_2 D_{it} + \beta_3 W_{it} \cdot D_{it} + \beta_4' \cdot controls + \varepsilon_{it}^r \qquad (4)$$

The time lead of one year in the dependent variable removes all cases in our data in which wages increase after households move to a higher paying job. We keep the dummy D_{it}[18] from the

[17] "Intent to Move" is obtained from a survey question asked to households who participate in the Swiss household panel. Households can indicate their intention to move over the next 12 months on a range from 0 (no intention to move) to 10 (will certainly move). To facilitate interpretation in later regressions we generate a dummy that is 1 if intent to move is 8 or higher. Although this choice is to some extent arbitrary, it reflects a trade-off between restricting the variable to a relatively small number of households with high intention to move (intention = 10 is only 4% of the sample) and households with values around 5 which are still relatively undecided.

[18] Which indicates a household's willingness to move in the baseline specification, or relocation pressure, brought on by such things as divorce or additional family members, in some extensions

previous specification to allow for the possibility that wages can have a different effect on the propensity to move for households who plan to relocate. For instance, cash constrained households that intend to move will respond more strongly to rising wages than households that face no relocation pressure. Like before, we separately estimate two regressions for tenants and owners. We expect tenants to have a higher mobility and to respond more strongly to wages due to their lower average income levels and lower overall financial wealth (see table 2 below).

2.4 Sentiment based relocation pressure

We have identified house prices and wages as two important channels through which large-scale immigration affects the incumbent population's location decision. Although we consider these channels to be the main indirect effects from immigration, we should also consider the possibility that incumbent households directly respond to the presence of immigrants. This direct effect includes households' expectation about future house price and wage changes but also preferences for ethnic neighborhood composition (Logan and Zhang, 2010). In other words, we are interested in the direct effects of immigration on incumbent households once we control for changes in house prices and labor income. We therefore interpret the result as a "residual" or "sentiment" effect. In our model overview in Figure 1, the underlying specification is denoted as model III. The following specification estimates the fraction of immigration induced relocation that can be attributed to the sentiment effect:

$$\Delta Swiss_t^r = \alpha_1 Group1_{4yr}^r + \alpha_2 Group2_{4yr}^r + \alpha_3 HP_t^r + \alpha_4 W_{it} + \alpha_5' controls + \varepsilon_t^r \qquad (5)$$

Eq.(5) estimates the percentage change in the native population measured on the aggregate MS-region level. ΔSwiss measures the log change in the number of Swiss persons living in an area over a one-year period[19]. Here our specifications make use of immigration over the past 4 years (t to t-3) as it allows the effects of immigration on the propensity of a household to relocate to materialize over longer horizons (different households may react at different speeds). Results of these specifications are actually slightly smaller (when scaled) than the results of regressions making use of contemporaneous immigration. This possibly reflects the impact of a few outlier-years. However, differences are minimal and all interpretations, discussed below, are unaffected.

[19] Our household regressions do not explicitly capture "Swiss" households, as some persons who have lived in Switzerland their entire life are still not counted as Swiss (no birthright citizenship). At the aggregate level it is necessary to use the "Swiss" population not conflate arriving immigrants and long-term foreign residents.

The household level specification is similar but uses the probability to move as the dependent variable. As a consequence, negative coefficients α_1 and α_2 in Eq.(5) indicate a decrease in the number of incumbent Swiss households, but positive coefficients β_1 and β_2 denote an increase in the probability to move.

$$Move_{it}^{tenant/owner} = \beta_1 Group1_{4yr}^{r} + \beta_2 Group2_{4yr}^{r} + \beta_3 HP_t^r + \beta_4 W_{it} + \beta_5' controls + \varepsilon_{it}^{r} \quad (6)$$

Like before, we estimate Eq.(6) as two separate regressions where house prices HP_t^r are replaced by rents $Rent_t^r$ in the tenant regression. With house prices and wages explicitly accounted for, we can interpret the coefficients β_1 and β_2 as the sentiment effect from group 1 and group 2 immigration. In the following section, we will present the data that is used in the empirical part of the paper. It is worth noting that the individual household level regressions suffer from a general low mobility of households, with only 7% of households moving over the entire sample period. The empirical findings from the aggregate model therefore constitute an important complement the more granular household level regression.

3. Data

In this study, we combine data for Switzerland from four distinct sources; three government agencies and one private consulting firm. Some of the variables are measured on the aggregate MS-level, while others are available for individual households. Information on the number of immigrants (stock and flow) is provided by the Swiss Federal Statistical Office (Bundesamt für Statistik) on an annual basis between 1991 and 2013. Average wages per labor-market region are obtained from the Swiss federal tax authority (Eidgenössische Steuerverwaltung). Transaction level house prices and rents are obtained from the Zurich based company Fahrländer Partner Raumentwicklung. Finally, we observe relocation decisions of and other information on individual households from survey data taken from the Swiss Household Panel, administered by FORS at the university of Lausanne.

3.1 Immigration Data

The Swiss Federal Statistical Office (Bundesamt für Statistik, BFS) collects information on every immigrant arriving in Switzerland from 1991 to 2013. Our database consequently consists of over 15-million individual immigration and emigration entries. The data contains information

on first-time arrivals, departures, as well as the movements of foreigners within Switzerland. The data also records the numbers of native Swiss households per labor market region. This information is important to place absolute immigration into an economic context.

According to the OECD, Switzerland has the highest rate of immigration in Europe; the share of foreigners is currently 24% (OECD, 2015).[20] Immigrants to Switzerland vary considerably in terms of origin, education, and skill level. Figure 3 shows the net immigration flows over our sample period. The early 1990s saw a large inflow of immigrants from former Yugoslavia who arrived as refugees during the Balkan wars.[21] In contrast, many high skilled immigrants from Germany have been attracted by high wages and living standards in more recent years. These two immigrant groups differ with respect to skills and education, the wages they earn on the labor market, and consequently their potential to affect real estate prices and rents.

<< Figure 3 about here >>

The BFS tracks a number demographic characteristics for each immigrant: date of birth, year of arrival including the year of movement within Switzerland, gender, country of origin, type of residency permit, and the municipality in which the person is registered. Certain institutional details relating to permits in Switzerland are discussed in Appendix A.

Figure 4 shows important immigration information. Panel A shows the number of immigrants by country of origin measured in 1,000 persons. The two largest groups of immigrants are from Germany (net immigration of 211,000) and from former Yugoslavia (net immigration of 189,000 persons). These net immigration figures are the balance of much larger flows. The gross inflow from Germany over the 22-year period was over 1 million people while the gross outflow stood at 841,000. To put these numbers into economic context, the last column of Panel A shows net immigration as a percentage of the native Swiss population. For instance, the total net immigration over the period 1992 – 2013 amounts to almost 15% of the local population. Depending on the ability to consume housing and the absorption capacities of the local real estate and labor market, this increase in population due to immigration is likely to have substantial impacts on property

[20] https://stats.oecd.org/Index.aspx?DataSetCode=MIG. For context: neighboring Austria and Germany had foreigner shares of 14% and 12%, respectively, in the same period

[21] Immigrants from former Yugoslavia declared "Yugoslavia" as their home country until 1998 after which the main source countries are Serbia, Montenegro, and Madeconia. On a smaller scale, immigration also occurred from Bosnia and Herzegovina, Croatia, Kosovo, and Slovenia.

prices, rents, and wages.[22] In Panel B we look at the regional distribution of immigration. The major metropolitan municipalities Zurich, Geneva, and Lausanne receive large parts of the immigration flows. Empirical results based on absolute immigration numbers would therefore be dominated by major cities. However, these cities will also have the infrastructure and housing market flexibilities to handle large-scale immigration. To address this issue, we divide the number of immigrants by the Swiss population in that municipality. Panel C show immigration measured in this way. In contrast to the graph in Panel B in which immigration was averaged over time, Panel C shows every individual observation across time and municipality. Panel C highlights that in some municipalities the immigration flows are extremely large relative to the local Swiss population in some years. For instance, a number of regions, which are attractive tourist locations, have seen large inflows of immigrants that work in the tourism and service industry for a few months per year.[23]

<< Figure 4 about here >>

As mentioned above, we make use of "shift-share/pushed immigration" throughout the paper, unless specifically stated otherwise. Hereby, we aim to capture the exogenous part of immigration that caused individual immigrants to leave their original country. This circumvents the "pull" of economic developments and job opportunities of a particular community within Switzerland that attract immigrants. Since pull factors are likely to be endogenous to changes in house prices and wages, we use only the push components as a measure of exogenous immigration. The underlying methodology was first developed by Card (2001) and used in the Swiss context by Basten and Koch (2015). It starts with the empirical observation that early migrants facilitate the transition for later arrivals by providing a familiar environment and offering advice on how to find jobs and housing (Massey et al., 1987; Bartel, 1989; Munshi, 2003). As a consequence, new arrivals tend to migrate to certain areas where the concentration of other immigrants from the same ethnic background is high. "Shift-share" modified immigration can act as an instrument for the exogenous component of actual immigration. This is discussed in detail in Appendix B. An alternate instrument based on a novel approach is discussed in Appendix D.

[22] Another noteworthy observation from the data is that the largest group of arrivals are in prime working-age, i.e. between 25 and 35.

[23] Only 3.5% of all region-years ever see immigration of more than 15% of the local population, which represents 2-std deviations above the mean. Our results are almost identical if we winsorize our observations.

3.2 Wage Data

The Swiss federal tax authority collects detailed wage data for individual households in order to compute the tax burden. Unfortunately, this data is highly sensitive and generally not available for research. However, we obtained average wages, computed for many municipalities and all labor-market (MS-) regions in Switzerland over the period from 1993 to 2014. We have access to both mean and median wages, focusing on the median in the empirical part below to avoid distortions from a few high net-worth individuals.

3.3 Swiss Real Estate Prices and Rents

Residential property prices and rents are provided by Fahrländer Partner Raumentwicklung (FPRE). The data contains annual observations from 1992 to 2013 for all labor market (MS-) regions in Switzerland. The prices provided to us are based on actual sales data, combined with a hedonic pricing model developed by Fahrländer (2006, 2008). Figure 5 shows the geographic distribution of house price levels and growth rates across the 106 regions. Panel A shows the log house price levels in 2013. One observation that follows from Panel A is the concentration of high price regions in and around agglomeration centers such as Zurich, Basel and Geneva. For instance, average log CHF house prices in Zurich are 14.67 (approximately EUR 2,067,000). These regions also experience above average price growth since 1992.[24] Panel B shows house price growth rates for the period 1992–2013. Areas shaded in dark red indicate overall growth rates of 120% and more.

<< Figure 5 about here >>

With a homeownership of only 44%, Switzerland has a large rental market.[25] Tenants respond differently to changes in real estate markets than owners, and most immigrants are likely to rent rather than buy in their year of arrival. FPRE provides historical data at the MS-region level for single family homes and apartment rents.

Finally, we compute the vacancy rate as the number of empty houses divided by the total number of houses in each region. Regions with a significant stock of empty houses can more easily

[24] For instance, nominal CHF house prices across Switzerland increased on average by 50% from 1992 to 2013. During this period, house prices in Geneva almost tripled and those in Zurich doubled.

[25] For historical data on the homeownership rate in Switzerland see https://tradingeconomics.com/switzerland/home-ownership-rate

absorb an inflow of immigrants and should therefore show smaller property price responses than regions with no excess capacity.

3.4 Household Panel Data

We use survey data from the Swiss Household Panel (SHP) to estimate the effect of immigration on wages and, ultimately, the decision of individual households to relocate. Household-level data allows us to observe which type of households are affected and by how much. Household-level data also has the advantage that individual observations are too small to generate feedback effects. The SHP is based on surveys administered by FORS in Lausanne and covers the years 1999 to 2014.

The survey gathers information on the specific location of a household, whether the households is a tenant or owner, as well as some basic indicative data on socioeconomic characteristics. These include household composition as well as information about the size and the source of income.[26] The SHP data has several advantages. First, it has a very high retention rate: households appear in the survey for an average of more than six years. A high retention rate allows us to control for household level fixed effects as well as time-varying aspects of a household's composition in regression specifications. It is important to see, for instance, whether households change their behavior following a "life-changing event" such as the birth of a new child, divorce, or marriage. Moreover, we are able to explain the observed heterogeneity across different subsamples, as households are more likely to respond to changes in property prices or wages following a shock to income, expenses, or housing needs.

Table 2 shows summary statistics for a number of household-specific variables. We differentiate between households that are owners or tenants (measured at first observation). As well as between households that relocate and those that do not. Households that relocate constitute a small subsample of all households. However, the comparison between both types of groups are informative, as they reveal significant differences along a number of dimensions, for which we subsequently control in the remaining analyses.

<< Table 2 about here >>

[26] One problem that can arise when tracking household financial information through self-reported surveys is that households may misreport data (Pissarides and Weber, 1989). However, we believe that the benefits that come with the important information on household behavior more than compensates for these potential shortcomings.

4. Empirical Findings

In this section, we interpret our empirical findings concerning the impact of large-scale immigration to Switzerland. We place particular emphasis on the joint analysis of aggregate and individual household level results. While our findings from household level regressions generally support the aggregate estimates, they also reveal economically important differences that can be explained by variation in household characteristics. This section follows the structure from section 2: First, we report the findings concerning the effects of immigration on house prices and wages (model I). Second, we show how house prices and wages can serve as a transmission channel to cause displacement of incumbent households (model II). Finally, we show that immigration also has an economically large direct effect on displacement, which we interpret as a residual or sentiment effect (model III). Table 3 summarizes this structure and shows the estimating equations that are used to identify the economic channels. The equations in this table are taken from section 2, but show the complete specification including the full set of control variables. For instance, regional regressions include a spatial lag $\rho(W_N \otimes I_T)$ that allows for a more realistic dissemination of shocks to nearby regions (this is discussed in Appendix C). Household level regressions control for a number of time-varying household characteristics including the level of education, age, and the number of children. Since children are themselves drivers of relocation pressure, we include changes in the number of children as well as "new marriage" (co-habitation) as explanatory variables.

<< Table 3 about here >>

The last column of Table 3 indicates whether the regression was estimated using aggregate regional- level data or more detailed data based on individual households. If possible, we include both specification to show the overall effects as well as the heterogeneous responses among individual households.

4.1 The Effects of Immigration on House Prices and Wages

Table 4, Panel A shows the house price impact from a 1 percentage point increase in new immigrants. The house price response is estimated across 106 Swiss labor market regions over 22 years resulting in 2,332 total observations. Panel A shows standard IV estimates. A one percentage

point increase in the share of foreigners from Group 1[27] countries increases house prices on average by 3.3%. The same increase Group 2[28] immigrants decreases prices by 1.01%.[29] A 1%-pt. increase in the vacancy rate lowers house prices on average by 0.29%.

<< Table 4 about here >>

In recent years, the spatial regression model appears to have replaced the ordinary least squares method as the canonical methodology for dealing with real estate data (LeSage and Pace, 2009; Elhorst, 2014; LeSage and Chih, 2016). A major drawback of OLS/IV estimates is that the entire response is assumed to occur within the shock originating region but drops to zero when crossing the border into the neighboring region. In practice, however, we can observe that shocks easily transmit to neighboring regions so that the house price response is somewhat lower in the shock originating region compared to OLS, but larger overall when neighboring regions are taken into account. Column (2) highlights this. We re-estimate the same equation using a panel spatial autoregressive (SAR) model (LeSage and Pace, 2009) with instrumented immigration. The estimate of the spatial lag indicates that house prices in one region are 73% of the average house prices in the six nearest neighboring regions. This suggest a very strong spatial dependence structure and a pronounced spatial diffusion of shocks. In the spatial model, a 1%-pt. increase in the share of foreigners from Group1 countries in a specific region *i* increases house prices on average by 2.13% in the same region *i*. The coefficient is less than the IV estimate, which is a typical finding for spatial models since the total effect is now distributed over several regions. For instance, it increases house prices in the long run by 0.39% in regions that are first-order neighbors, and by 0.18% in second-order neighbors. Due to feedback effects from neighboring regions, house prices in region *i* also increase by an additional 1.43% in the long run.[30] Like before, the house price response from Group 2 country immigrants is somewhat negative. The results mask a high

[27] Comprised of Western Europe (excluding Portugal) and other high income OECD countries such as USA, Canada, Japan, etc.)

[28] Comprised of Eastern Europe and Balkan states (including Portugal) as well as all low income countries

[29] The house price changes estimated here should be regarded as conservative since some incumbent households might react immediately to the arrival of immigrants (Hatton, 2005). This could drive house prices down and bias our price estimates towards zero. Running a similar regression using rents instead of prices as the dependent variable gives comparable results.

[30] The panel SAR model is a static model so that the concept of "long run" is not well defined. Since the economic mechanism behind spatial price diffusion depends on the price elasticity and the mobility of households, long-run effects are likely to take 5 to 10 years (see also Fitzgerald (1999) and Thornton (2011)).

degree of heterogeneity within the constituent countries of each group. In Appendix C of this paper, we discuss the spatial panel model in more detail and show a table of the house price effect for individual countries.

Table 4, Panel B shows the aggregate (regional) level effect of immigration on wages. We measure wages as the average income per labor market region. Panel A shows the benchmark IV estimates which indicate that immigration from Group 1 countries has a positive effect on wages whereas Group 2 country immigration is estimated to have a negative impact. In particular, a 1%-pt. increase in immigration from Group 1 countries increases wages on average by 3.5% while the same increase in immigration from Group 2 countries lowers wages by 1.5%. A wage decrease of 1.5% is slightly larger though comparable to what Peri and Sparber (2009) estimated for the U.S. in case of perfect native-immigrant substitution. The aggregate wage impact of immigration will likely be positive. This is confirmed in a recent paper by Beerli and Peri (2017) who examine the wage effects of cross-border workers in Switzerland and find a high degree of complementarity.

<< Table 5 about here >>

Column 2 shows the coefficient estimates of the same model using a spatial autoregressive (SAR) model. Hatton et al. (2005) note that in empirical work, the wage effect of immigration is often measured inaccurately because most studies ignore that fact that local workers can be displaced, so that the total wage effect is spread out over several regions. The coefficients in Panel B accommodate for the spatial dissemination of the wage effect. For instance, a 1%-pt. increase in immigration from Group 1 countries increases wages in the immigration region by 2.3% within the same year, and by 0.91% in the long run. The effect of immigration from Group 2 countries becomes insignificant, reflecting the aggregate ability of the labor market to absorb new immigrants well overall. The spatial dissemination of wages is stronger than that of house prices.

While the regional estimates show important aggregate wage changes, they cannot show the large heterogeneity in the wage response at the household level. Some households will compete with immigrants on the labor market while others benefit from the additional demand for goods and service that new inflows of immigrants generate. Panel A of Table 5 shows the wage response to immigration for individual households where we again distinguish between tenants and owners for consistency with all sections of the paper.[31] This split also separates households by a number

[31] We measure wage as the self-reported labor income recorded in the Swiss household panel. We take the income of both respondents in a two-person household and the income of one respondent in a single person household.

of other characteristics such as education, wealth, and wage brackets.[32] The coefficients in Panel A show important differences to our previous aggregate estimates. For instance, immigration from Group 1 countries was shown to have positive wage effects on aggregate, but is estimated to impact owners negatively (even if the coefficient is insignificant). Group 2 countries only really impacts tenants.

<< Table 5 about here >>

At first glance, our results for individual household are difficult to reconcile with our aggregate estimates obtained before. However, they are in line with previous findings from Ottaviano and Peri (2012) who demonstrate that immigration leads to some degree of substitutability between natives and immigrants but at the same time can have complementary effects with the wages of other natives so that the overall wage response differs strongly across households. One of the differences between owners and tenants are wealth and income (often as a function of education and position in a household's lifecycle). To illustrate this point, Panel B of Table 5 shows the estimated wage coefficients for different wage quantiles. These quantile regression coefficients measure the degree to which different income groups are affected by immigration from Group 1 countries (red line) and Group 2 countries (blue line). The wage coefficients show that low income households respond positively to immigration from Group 2 counties, while high income households respond positively to immigration from Group 1 countries. Given that we would expect some degree of competition here; this result is surprising. This result seems to derive from the fact that the Swiss labor market is recording full employment and has been able to absorb new arrivals. Additional workers seem to boost the productivity of natives. Peri discusses similar findings in a 2011 NBER report (Peri, 2011). Some immigrants enable incumbents to access cheaper labor and become entrepreneurs; especially in Switzerland, other authors (such as Beerli and Peri) have discovered complementarity in the labor market (Beerli and Peri, 2017; Rath and Kloosterman, 2000, and Zelekha, 2013).

We find that immigration from Group 1 countries depress the wages of low-income incumbents (and Group 2 immigrants depress wages of high income incumbents). This result too is somewhat surprising. We relate this result to the change in neighborhood composition, discussed below, which may change the nature of work available. To sum up, the wage changes experienced

[32] See Blickle and Brown (2018) for an extended discussion of the socioeconomic differences between initial renters and owners as well as table 2 for an overview of the differences along observable dimensions.

by individual households can differ considerably from the aggregate level effect, depending on where the household is employed. There is significant potential for complementarity. However, given some changes in the composition of neighborhoods, the overall effect for individual households is largely negligible.

4.2 Immigration, Prices, Wages, and Displacement

In the previous section, we have presented empirical evidence that immigration affects house prices and wages. In this section, we examine the response of the incumbent population to these changes. We are interested in the role of housing and labor markets as transmission channels of immigration. We find that both, house price growth and income shocks, affect the propensity of native households to relocate to a new region. In case of house price and rent changes, we take into account the particular regulatory environment under which these changes occur.

Table 6 shows the potential of rising house prices to generate relocation pressure for individual households. Like before, we run separate regressions for tenants and owners. Panel A shows the effects of a one percent increase in rents. The dependent variable takes the value of 1 in the year before the household relocates, after which the household is removed from our data.[33]As discussed in section 2, the response for individual households will differ depending on their "relocation pressure based on changes in composition" and resulting "intent to move".[34] For instance, a one percent increase in rents reduces the likelihood that tenants will move to a new municipality by 0.05 percentage points. Since existing rent contracts provide full protection against rent increases, current tenants will not be affected by higher market rents. In contrast, tenants with a preexisting need for a new home will need to pay the higher current market rate in that municipality and are therefore 0.05 percentage points more likely to move to a new municipality than tenants without relocation pressure.[35]

<< Table 6 about here >>

In the regressions for owner-occupied houses, we find that a one percent increase in house prices decreases the propensity to move by 0.02 percentage points. Like tenants, homeowners

[33] If the household is an owner, the variable in question are house prices

[34] Relocation pressure may be induced by marriage, birth of a child, divorce, or death of a household member.

[35] By construction, households with a preexisting desire to move have a higher unconditional propensity to relocate. The 0.05 %-pts. denote the sensitivity of these household to changes in rents.

prefer not to move if housing costs increase in their municipality, as their property (and consequently their wealth) are increasing in value. In contrast, a preexisting relocation pressure increases the propensity to relocate by 0.03 (0.047-0.021) percentage points.

A drawback of our interpretation so far is the fact that the marginal effects in our model differ across variables in terms of size and dimension. For instance, net immigration shocks are measured as a one *percentage point* increase in immigration relative to the incumbent population while house price and wage shocks are measured as a one *percent* increase. The economic size of a one percentage point increase in net immigration is considerably larger than the economic size of a one percent increases in house prices or rents. To facilitate the comparison of shocks across variables, Panel B of shows the response in the propensity to relocate to a one standard deviation shock. For instance, a one standard deviation increase in rents (which corresponds to an annual increases of CHF 2,249, (1CHF = 1USD) decreases the propensity to move to a new area by 0.5%-pts for tenant households without relocation pressure. On the other hand, a one standard deviation increase in house prices (CHF 172,306) increases the propensity that homeowners with relocation pressure relocate by, in total, 0.33%-pts.[36] The results from Panel B suggest economically large relocation responses from typical house price movements: homeowners' unconditional probability to move is just under 3%, so that an increase of 0.3%-pts. translates to a 10% higher relocation probability.

In this paper, we are interested in house prices a transmission channel of immigration. In Panel C, we show the relocation response from a one standard deviation increase in net immigration from Group 1 countries. We use Group 1 countries as an illustrative example, as these often induce larger price and wage reactions. To obtain these indirect effects, we multiply three coefficients: (1) the standard deviation of net immigration, (2) the house price response from net immigration (see above), and (3) the propensity to move due to house price changes. Through this "back of the envelope" calculation, we measure how a one standard deviation increase in immigration affects house prices and how this house price increase in turn affects the propensity to move. One standard deviation in immigration from Group 1 countries corresponds to a 1.4 percentage point increase relative to the incumbent population.[37] From our findings in Table 4 above we know that a one percentage point increase in immigration translates into an at most 3.3% increase in house prices.

[36] 0.47-0.14 = 0.33.

[37] The house price effects from immigration are estimated in a two-way panel regression. Hence, one standard deviation (0.59 pct.pts.) is also from double demeaned data.

According to our estimates, a one s.d. increase in net immigration will therefore decrease the propensity of an average tenant to move by 0.25%-pts.

The economic size of the coefficients reported in Table 6 vary considerably and require some comments. While the direct effects from housing costs are economically large, the indirect effects from immigration are small for tenants and almost negligible for home owners. This does not mean that immigration is not an important driver of relocation decisions. It shows that house prices, are not an important transmission channel for the effects of immigration on the propensity of incumbent households to relocate.

In Table 7, we turn to the investigation of the relocation impact of labor income; the table is structured similarly to table 6 above. Panel A shows that tenants respond positively to an increase in income. Homeowners, which tend to be less cash constrained, appear less affected. For tenants, a 1% increase in wages increases the propensity to move by 0.016 percentage-points. For tenant households who have indicated that they intend to move, this effect grows to 0.05 percentage-points. A positive impact of wage-growth indicates that households may upgrade to larger and higher quality homes following a positive income shock. In addition, a positive coefficient can be explained by the fact that moving to a new municipality involves social but also considerable monetary costs. Although the response is fairly small in absolute terms, it indicates that cash constrained households may be forced to retain "locked-in" rents that lie below current market rates. As a consequence, tenants are more likely to move when additional resources become available. Since household relocation enters the regression with a lead of one year, we can rule out the reverse causality case in which households move because of a better-paying job.

<< Table 7 about here >>

To put the coefficients into economic context, Panel B reports the relocation response following a one standard deviation increase in wages. A one standard deviation increase corresponds to CHF 56,861 (1CHF = 1 USD). Tenants are 0.6 percentage-points more likely to move following a one standard deviation increase in wages and even 2 percentage-points if they "intend to move". These findings suggest that household income can serve as a strong motivator in the decision process to relocate to a new municipality.

Finally, Panel C shows the indirect effect of income when the source of change is a one standard deviation increase in immigration from Group 1 countries. A one standard deviation change corresponds to a 1.4 percentage-point increase in immigration, as a share of the existing

population. We find that a 1 percentage-point increase in immigration increases the income of the average household by over 3%, which in turn increases the propensity of tenants to relocate by 0.08 percentage-points. One of our main findings from the analysis of immigration on wages was that tenants and owners respond differently to immigration. This would mean that a comparable increase in immigration from Group 2 countries would predict an effect in the opposite direction. However, the pass through effect is negligible or insignificant, especially for group 2 counntries. To conclude, we find that both house prices and wages can have economically large effects on the relocation decisions of households. However, as displayed by our simple "back of the envelope" calculations, their role as transmission channels of the effects of immigration is negligible.

4.3 Homophily and Sentiment

The empirical evidence presented so far shows limited pass-through from housing and labor markets. In this section, we estimate the direct effects from immigration on the propensity to move, controlling for house prices/rents, and wages. A direct relocation effect implies that households do not move because of the changes that result from immigration but because of the presence of immigrants themselves. In Figure 2, this situation was illustrated as "model III". In this setup, house prices and wages no longer take the role as transmission channels but are simple control variables. Households move if they have a preference for neighborhood composition (Bruch and Mare, 2006; Logan and Zhang, 2010). However, an alternative explanation may be that households form expectations about the future development of house prices and wages. Although the direct impact of immigration on labor markets may be initially small, households are likely to form individual expectations about the long-term effects of immigration, which may be inaccurate.[38] As a consequence, expectations about future changes may lead households to relocate themselves ex-ante. We interpret the combined effect from perceptions, preferences, and expectations as a variable that is uncorrelated with our measures for housing and labor market outcomes and that reflects household's "sentiments" about its neighborhood.

Table 8 shows the annual change in the local Swiss population following a one percentage point increase in immigration.[39] Annual movements of the local Swiss population are based on 106

[38] An implicit assumption of this argument is that household's expectations are less than perfectly correlated with actual house price changes so that these expectations enter the model as a separate sentiment variable.

[39] The "Swiss" population in a municipality is defined as all residents with Swiss citizenship.

labor market regions over 19 years. The results in Table 8 show a decline in the incumbent population following an inflow of immigrants. In particular, a one percentage point increase in net immigration from Group 1 countries, relative to the local population, leads to a 0.9% to 1.9% outflow of the Swiss population[40]. The effect of Group 2 immigration is larger. Although our findings in Table 8 cannot reveal the extent to which relocation decisions are driven by household characteristics, they are quite suggestive of the economically large response of the incumbent population.

<< Table 8 about here >>

Household-level relocation effects are shown in Table 9. Panel A shows the impact from a 1% increase in net immigration using house prices (or rents) and wages as control variables. Panel A shows that tenants are about 0.7 percentage points more likely to move to a different municipality, following a one percentage point increase in immigration from Group 1 countries. However, the effects are insignificant. The findings for individual households therefore confirm our previous aggregate-level results. However, Panel A also shows new results that were masked by previous aggregate estimates. For instance, the effect of immigration from Group 2 countries on tenants is primarily driven by households with a pre-existing desire to move. The effect of Group 2 country immigrants remains strong for owners, no matter the initial desire to move. Appendix C contains a version of table 9 that does not make use of instrumented immigration as a comparison[41].

<< Table 9 about here >>

The sentiment based relocation coefficients are at least 10 times large than our previously reported housing and labor market effects. However, this comparison ignores the fact that immigration changes by one *percentage point* which is economically large compared to a one *percent* increase in wages. Panel B facilitates comparison by converting the shocks into one standard deviation. Given that regressions on household movement take a longer time horizon of immigration into account, standard deviations are large. Panel C makes use of a 1.4 %-pt increase

[40] This effect is similar though larger than Borjas (2006) who reports roughly 3 natives displaced for every 10 immigrants.

[41] While the coefficient magnitudes are somewhat different the overall interpretation of our results remains similar. We see, that primarily households with a preexisting desire to move respond to immigration. Overall, the results imply that the assumptions imposed by instrumentation do not drive results, instead they help mitigate the potential endogeneity bias.

in immigration, to facilitate comparison with the tables above. The coefficients in Panels B and C are comparable to those found for one standard deviation effects of house prices and wages. An important result from this section is therefore that (*i*) housing markets, labor markets, and immigration induce similar displacement effects on Swiss households, but that (*ii*) housing markets and labor markets do not hold the same importance as transmission channels of immigration. Immigrants do not have a large enough effect on house prices or wages. Instead, the displacement effect from immigration is direct.

The empirical evidence on the displacement effects of immigration was dispersed over three tables each featuring different sub-panels. In Figure 6 we summarize these findings in a compact way. We distinguish between tenant households (left graph) and homeowners (right graph). Within each graph, we further group by immigration type and preexisting relocation pressure.

<< Figure 6 about here >>

The blue bars show the unconditional propensity to move which is 3.6% for tenants and 1.2% for owners who do not intend to move. By construction, the unconditional propensity is higher if households intend to move (7.8% for tenants and 4.3% for owners). The red bars show the increase in the propensity to move from a one standard deviation increase in net immigration. In every graph, the first bar denotes the housing market channel of immigration, the second bar denotes the direct immigration effect, and the third bar indicates the wage channel of immigration. The red bars show the long-run SAR coefficients that are obtained from summing over all regions.[42] Figure 6 highlights the economic size of the coefficients and confirms our previous findings: immigration affects household relocation decisions directly. Housing and labor markets have economically insignificant effects and are unlikely to serve as important transmission channels of immigration.

4.4 Immigration and Satisfaction

For many households, leaving a familiar environment and relocating to a new region involves high social costs. The empirical results in this paper have shown that a preexisting relocation pressure due to changes in familial composition (and the resulting desire to move) is an important factor to cause households to decide that relocating is in their best interest. However, the Swiss

[42] The SAR coefficients shown in the Table 6, 7, and 9 denote the short-run effects in the immigration region. These effects ignore the additional impact that follow from the dissemination to neighboring regions. The long-run coefficients presented here in Figure 6 correct for this.

household panel does contain a number of complaint items related to the accommodation and the neighborhood of a household. For many households we expect "satisfaction" to be influenced by immigration. A decrease in satisfaction could constitute the driving force behind a relocation. In Figure 6, we provide empirical evidence that is in line with this notion. Panel A shows the estimated increase in probability that an incumbent household reports a complaint following a one percentage point increase in net immigration over the previous three years. Blue bars denote regression coefficients for immigrants from Group 1 countries. Red bars denote the coefficients Group 2 country immigration. Statistically significance is denoted by a solid color. Statistically insignificant coefficients are denoted by faded bars.

<< Figure 6 about here >>

Panel A shows that households are between 0.1% and 1.2% more likely to complain about different issues such as general levels of noise and pollution, vandalism, and financial problems following a one percentage point increase in immigrants from Group 2. Similar results have been documented in social survey data and in the literature on racial preference and patterns of residential segregation (Bruch and Mare, 2006).

Panel B regresses the total satisfaction (on a scale of 1-10) on immigration and the usual control variables.[43] The first two columns show conventional IV estimates. The last two columns show similar results based on a panel poisson regression which may be more effective at capturing the count-nature of the dependent variable. From the empirical results presented in Figure 6 we conclude that immigration flows can impact the satisfaction levels of incumbent households.

[43] The control variables include house prices or rents, wages, average years of education, household age, number of children, and three binary variables indicating whether the household is a family household, has recently married, or recently had a new child.

5. Conclusion

We analyze the displacement effects of households in response to large-scale immigration to Switzerland. We identify three channels that induce households to seek a new accommodation. First, immigration generates demand for housing space, thereby driving up prices and rents. Higher prices in turn can affect the location decisions of households. Second, immigration increases the labor supply, which can lead to labor market competition and reduced wages. Lower wages may act as financial constraints and can affect the ability of households to move to a new area. Finally, a household may relocate due to homophily (which would be indicative of possible taste-based discrimination). In this case, relocation could be driven by preferences regarding the composition of its neighborhood.

Switzerland has experienced large-scale immigration over the past few decades and is culturally and linguistically similar to its neighbors (Germany, France Austria and Italy). It therefore serves as an ideal setting to test the effects of immigration on an incumbent population. Our uniquely detailed data and approach, which considers the effects of wages, house prices and sentiment simultaneously, allows us to add valuable insights to the discussion surrounding immigration in Europe.

Our empirical results reveal a high degree of heterogeneity in the impacts of immigration on the incumbent population and, ultimately, its effect on their decisions to relocate. Immigration from Western Europe and generally high-income countries have a larger effect on house prices than a comparable inflow of immigrants from Eastern Europe and lower income countries. Their respective impact on wages are less clear. There seems to exist significant room for complementarity in the labor market, causing an aggregate increase in wages following immigration and differential effects at the household level. However, we find that housing and labor markets are not important channels through which immigration causes household displacement. In fact, the main impact on displacement appears to come from immigration directly. Our findings suggest that households decide to move due to preferences and possible sentiment about immigration, despite the fact that these same households are not negatively impacted by immigration. Our findings may reveal evidence of taste-based discrimination and are consequently important for policy makers and academics alike who are considering the impact of recent large-scale immigration to Europe or even the United States.

References

Akbari, A. H., and Y. Aydede (2012). "Effects of immigration on house prices in Canada", *Applied Economics* 44(13), 1645–1658.

Bartel, A.P. (1989). "Where do New U.S. Immigrants Live?", *Journal of Labor Economics* 7(4), 371–391.

Basten, C., and C. Koch (2015). "The causal effect of house prices on mortgage demand and mortgage supply: Evidence from Switzerland", *Journal of Housing Economics* 30, 1–22.

Beerli, A., and G. Peri (2017). "The Labor Market Effects of Opening the Border: Evidence from Switzerland", Working paper available at https://www.research-collection.ethz.ch/bitstream/handle/20.500.11850/169157/wp_431.pdf?sequence=1&isAllowed=y

Becker, G.S., and K.M. Murphy (2003). "Social Economics: Market Behavior in a Social Environment", Belknap Press.

Blickle, K., and M. Brown (2018). "Borrowing Constraints, Home Ownership and Housing Choice: Evidence from Intra-Family Wealth Transfers", Journal of Money, Credit, and Banking (forthcoming)

Borjas, G.J. (2006). "Native Internal Migration and the Labor Market Impact of Immigration", *Journal of Human Resources* 41(2), 221–258.

Bruch, E., and R. Mare (2006). "Neighborhood Choice and Neighborhood Change", *American Journal of Sociology* 112(3), 667–709.

Card, D. (2001). "Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration", *Journal of Labor Economics* 19(1), 22–64.

Card, D. (2007). "How Immigration Affects U.S. Cities", *CReAM Discussion Paper* No.11/07, available at http://www.cream-migration.org/publ_uploads/CDP_11_07.pdf

Card, D. (2009). "Immigration and Inequality", *American Economic Review* 99(2), 1–21.

Cortes, P. (2008). "The Effect of Low-Skilled Immigration on U.S. Prices: Evidence from CPI Data", *Journal of Political Economy* 116(3), 381–422.

Degen, K., and A. M. Fischer (2017). "Immigration and Swiss House Prices", *Swiss Journal of Economics and Statistics* 153(1), 15–36.

Elhorst, P. (2014). "Spatial Econometrics: From Cross-Sectional Data to Spatial Panels", Springer.

Esses, V. M., U. Wagner, C. Wolf, M. Preiser, and C. J. Wilbur (2006). "Perceptions of national identity and attitudes toward immigrants and immigration in Canada and Germany". *International Journal of Intercultural Relations* 30(6), 653–669.

Fahrländer, S. (2006). "Semiparametric Construction of Spatial Generalized Hedonic Models for Private Properties", *Swiss Journal of Economics and Statistics* 142(4), 501–528.

Fahrländer, S. (2008). "Indirect Construction of Hedonic Price Indexes for Private Properties", *Swiss Journal of Economics and Statistics* 144(4), 607–630.

Filer, R. (1992). "The Effect of Immigrant Arrivals on Migratory Patterns of Native Workers. Immigration and the Workforce: Economic Consequences for the United States and Source Areas", in Borjas, G. and R. Freeman (eds.), *NBER book*, 245–270.

Firpo, S., N.M. Fortin, and T. Lemieux (2009). "Unconditional Quantile Regressions", *Econometrica* 77(3), 953–973.

Fitzgerald, J. (1999). "Money Growth and Inflation: How Long is the Long-Run?", *Economic Commentary Federal Reserve Bank of Cleveland*.

Fitzgerald, J., K. A. Curtis, and C. L. Corliss (2012). "Anxious Publics: Worries about Crime and Immigration", *Comparative Political Studies* 45(4), 477–506.

Frey, W. H. (1995). "Immigration and Internal Migration "Flight": A California Case Study", *Population and Environment* 16(4) 353–375.

Gonzalez, L., and F. Ortega (2013). "Immigration and Housing Booms: Evidence from Spain", *Journal of Regional Science* 53(1), 37–59.

Guerrieri, V., D. Hartley, and E. Hurst (2013). "Endogenous Gentrification and Housing Price Dynamics", *Journal of Public Economics*, 100, 45–60.

Ha, S. E., and S. J. Jang (2014). "Immigration, Threat Perception, and National Identity: Evidence from South Korea", *International Journal of Intercultural Relations* 44, 53–62.

Halla, M., A. Wagner and J. Zweimüller (2017). "Immigration and Voting for the Far Right", *Journal of the European Economic Association* 15(6), 1341–1385.

Hanson, G.H. and C. McIntosh (2016). "Is the Mediterranean the New Rio Grande? US and EU Immigration Pressures in the Long Run", *Journal of Economic Perspectives* 30(4), 57–82.

Hatton, T.J., and M. Tani (2005). "Immigration and Inter-Regional Mobility in the UK, 1982–2000", *The Economic Journal* 115(507), 342–358.

Helms, A. C. (2003). "Understanding Gentrification: An Empirical Analysis of the Determinants of Urban Housing Renovation", *Journal of Urban Economics* 54(3), 474–498.

Jaeger, D.A., J. Ruist, and J. Stuhler (2018). "Shift-Share Instruments and the Impact of Immigration", *NBER Working Paper No. 24285*, available at http://www.nber.org/papers/w24285.

Kritz, M., and D. T. Gurak (2001). "The Impact of Immigration on the Internal Migration of Natives and Immigrants", *Demography* 38(1), 133–145.

LeSage, J., and Y.-Y. Chih (2016). "Interpreting Heterogeneous Coefficient Spatial Autoregressive Panel Models", *Economics Letters* 142, 1–5.

LeSage, J., and K. Pace (2009). "Introduction to Spatial Econometrics", London: CRC Press.

Lester, T. W., and D. A. Hartley (2014). "The Long-Term Employment Impacts of Gentrification in the 1990s", *Regional Science and Urban Economics* 45, 80–89.

Ley, D., J. Tutchener, and G. Cunningham (2002). "Immigration, Polarization, or Gentrification? Accounting for Changing House Prices and Dwelling Values in Gateway Cities", *Urban Geography* 23(8), 703–727.

Logan, J.R., and C. Zhang (2010). "Global Neighborhoods: New Pathways to Diversity and Separation", *Journal of Sociology* 115(4), 1069–1109.

Maddens, B., J. Billiet, and R. Beerten (2000). "National Identity and the Attitude Towards Foreigners in Multi-National States: The Case of Belgium", *Journal of Ethnic and Migration Studies*, 26(1), 45–60.

Massey, D., R. Alarcón, J. Durand, and H. Gonzalez (1987). "Return to Aztlan: The Social Process of International Migration from Western Mexico", Berkley: University of California.

McKinnish, T., R. Walsh, and K. White (2010). "Who Gentrifies Low-Income Neighborhoods?" *Journal of Urban Economics* 67(2), 180–193.

Meen, G. (2010). "Regional House Prices and the Ripple Effect: A New Interpretation", *Housing Studies* 14(6), 733–753.

Munshi, K. (2003). "Networks in the Modern Economy: Mexican Migrants in the US Labor Market", *Quarterly Journal of Economics*, 118(2), 549–599.

Orrenius, P.M., and M. Zavodny (2007). "Does Immigration Affect Wages? A Look at Occupation-Level Evidence", *Labour Economics* 14, 757–773.

O'Sullivan, A. (2005). "Gentrification and Crime", *Journal of Urban Economics* 57(1), 73–85.

Ottaviano, G., and G. Peri (2011). "Rethinking the Effect of Immigration on Wages", *Journal of the European Economic Association* 10(1), 152–197.

Peri, G., and C. Sparber (2009). "Task Specialization, Immigration, and Wages", *American Economic Journal: Applied Economics* 1(3), 135–169.

Peri, G., and C. Sparber (2011). "Assessing Inherent Model Bias: An Application to Native Displacement in Response to Immigration", *Journal of Urban Economics* 69(1), 82–91.

Pissarides, C.A., and G. Weber (1989). "An Expenditure-Based Estimate of Britain's Black Economy", *Journal of Public Economics* 39, 17–32.

Rath, J., and R. Kloosterman (2000). "Outsiders' Business: A Critical Review of Research on Immigrant Entrepreneurship", *International Migration Review* 34(3), 657–681.

Sá, F. (2014). "Immigration and House Prices in the UK", *The Economic Journal* 125(587), 1393–1424.

Saiz, A. (2007). "Immigration and Housing Rents in American Cities", *Journal of Urban Economics* 61(2), 345–371.

Saiz, A. (2010). "The Geographic Determinants of Housing Supply", *Quarterly Journal of Economics* 125(3), 1253–1296.

Sieg, H., V.K. Smith, H.S. Banzhaf, and R. Walsh (2004). "Estimating the General Equilibrium Benefits of Large Changes in Spatially Delineated Public Goods", *International Economic Review* 45(4): 1047-77.

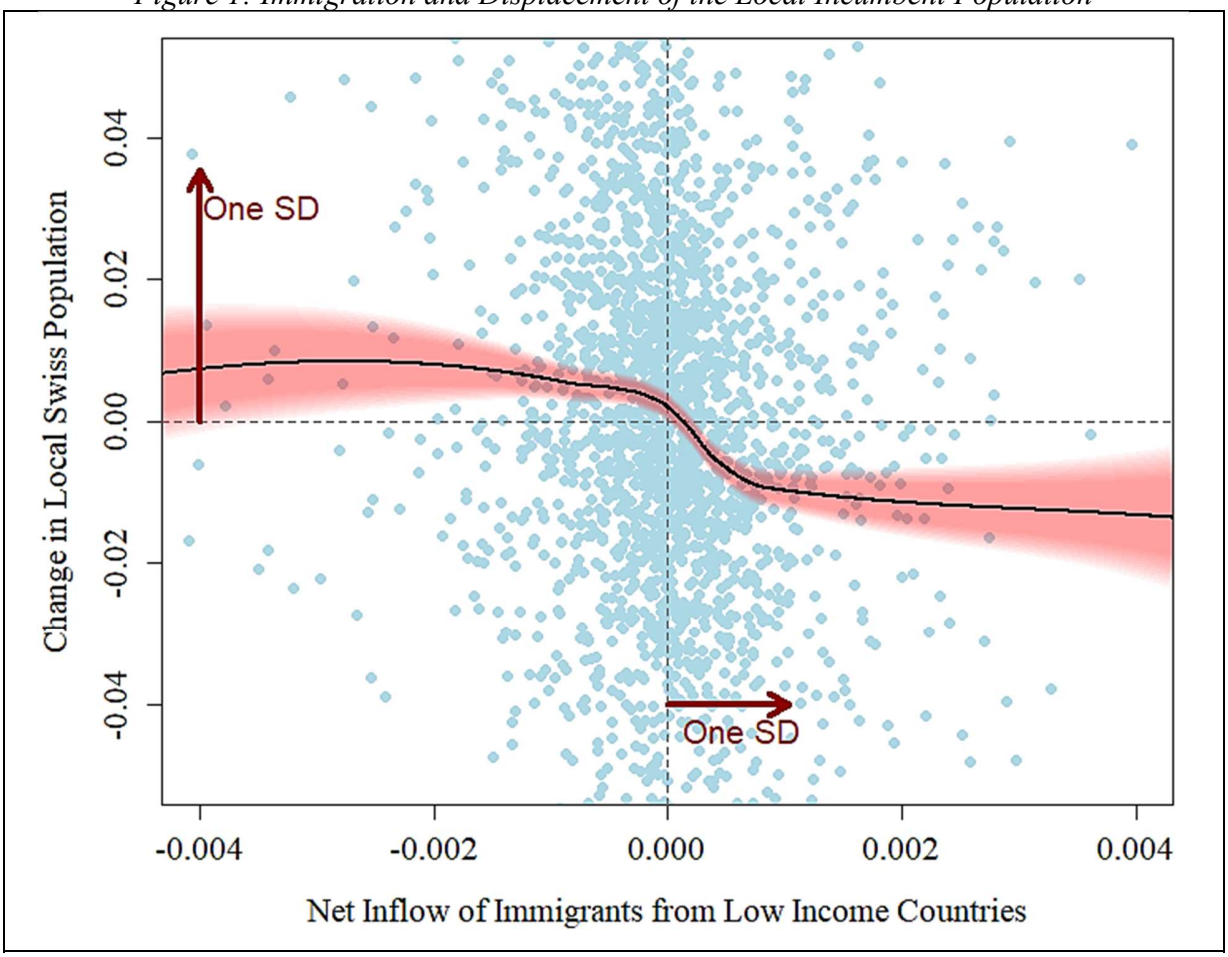
Thornton, D.L. (2011). "The FOMC's Interest Rate Policy: How Long is the Long Run?". *Economic Synopses Federal Reserve Bank of St.Louis*, No.29.

Wang, X. (2012). "Undocumented Immigrants as Perceived Criminal Threat: A Test of the Minority Threat Perspective", *Criminology* 50(3), 743–776.

Wright, M. (2011). "Diversity and the Imagined Community: Immigrant Diversity and Conceptions of National Identity", *Political Psychology* 32(5), 837–862.

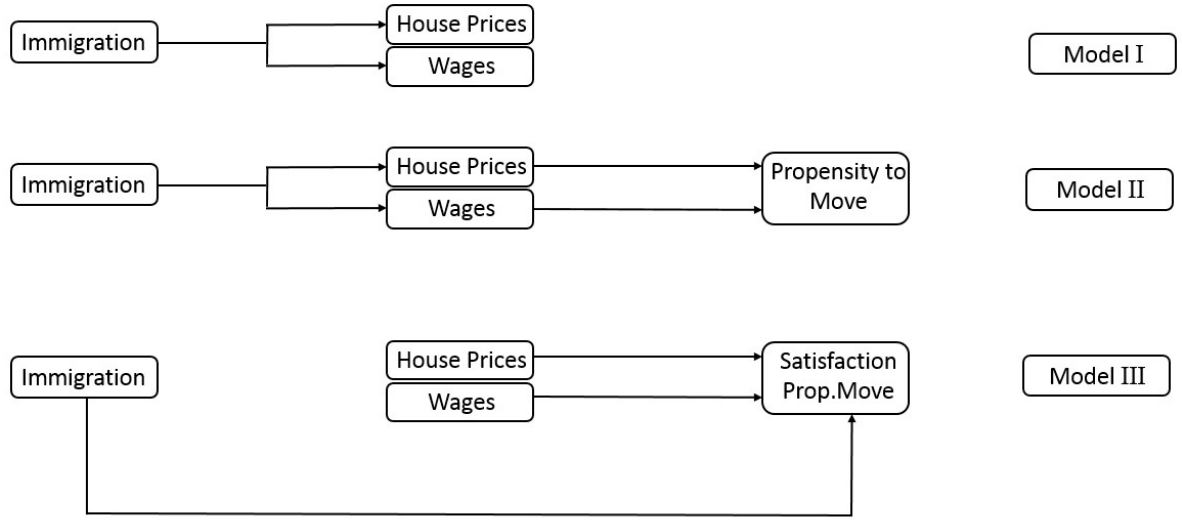
Zelekha, Y. (2013). "The Effect of Immigration on Entrepreneurship", *Kyklos* 66(3), 438–465.

Figure 1: Immigration and Displacement of the Local Incumbent Population



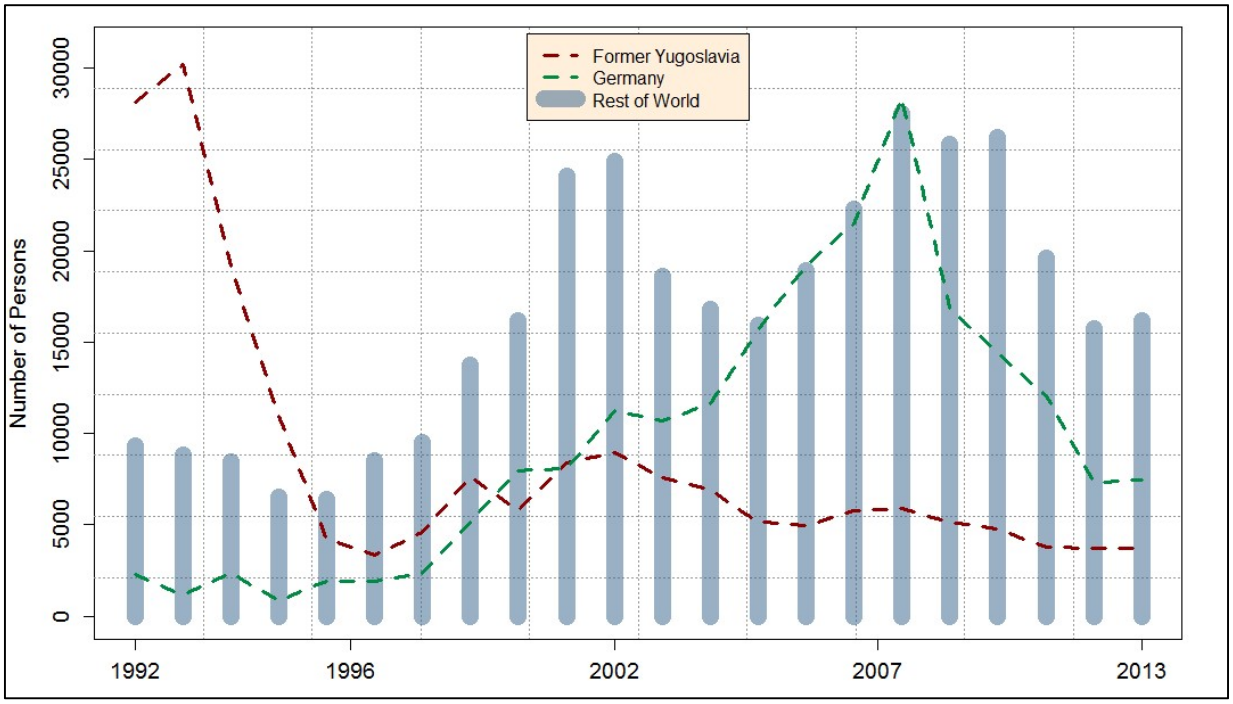
This graph shows the relationship between immigration from Group 2 countries (in our analysis defined as Eastern Europe, Portugal, and non-OECD countries, I.e. immigrants from traditionally low income countries) leads to a relocation of the local Swiss population of about one quarter standard deviation. Immigration flows are correlated with a number of confounding variables that have been removed before plotting. The superimposed regression fit is a nonparametric regression line.

Figure 2: Economic Channels of Immigration



This figure shows the three channels that we aim to investigate in this paper. In model I we estimate the exogenous impact of immigration on house prices and labor income. In model II, we are interested in the indirect effect of immigration on households' propensity to relocate. House prices and wages thereby serve as transmission channels through which immigration causes displacement. Finally, in model III, we explore the remaining direct effect of immigration, once house prices and wages are accounted for. We interpret this remaining effect from immigration as a homophily or sentiment channel.

Figure 3: Net Immigration Flows (1992 – 2013)



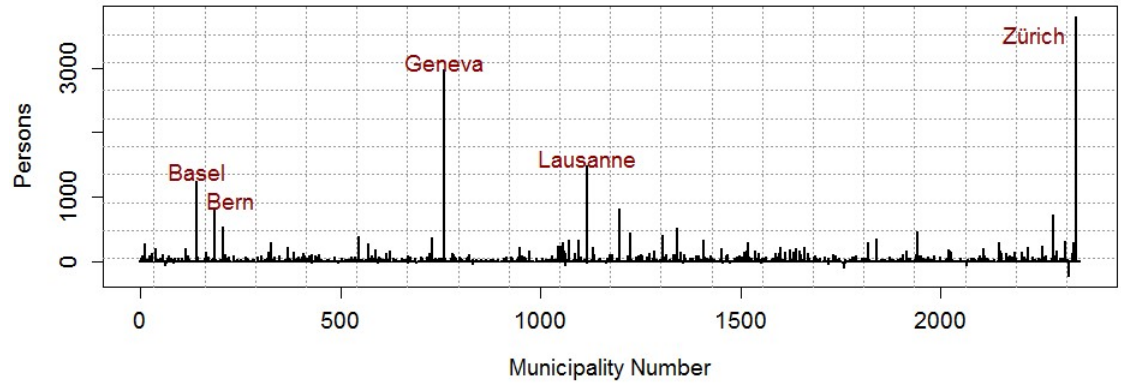
This figure shows the net immigration flows into Switzerland for selected countries. Immigrants from former Yugoslavia were the dominant group at the beginning of our sample in the early 1990s. Over time, immigrants from Germany became the main contributor to total immigration. Taken together, immigration flows from these two countries are comparable in size to the net immigration form all remaining countries.

Figure 4: Immigration Statistics and Spatial Clustering

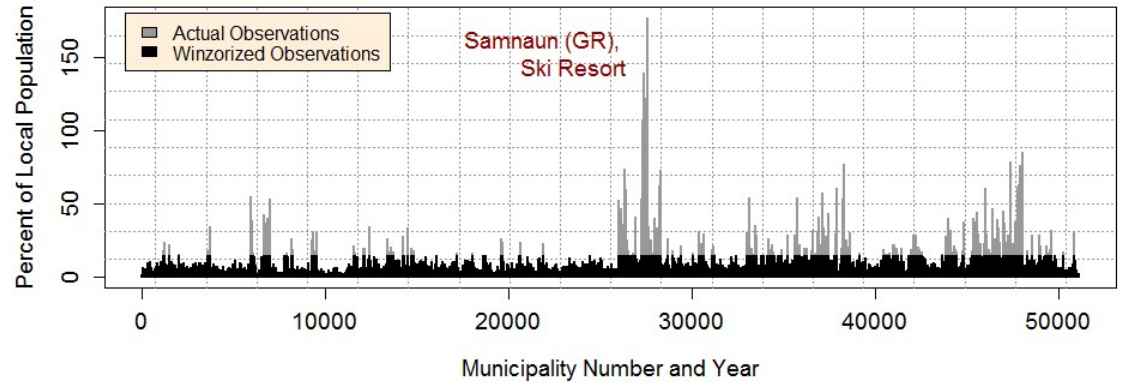
Panel A: Immigration by Country of Origin (in '000 persons)

	Immigration	Emigration	Net Immigration	% of Swiss Population
Austria	178	166	12	0.2
Former Yugo.	772	583	189	3.1
France	405	342	63	1
Germany	1052	841	211	3.4
Italy	658	672	-14	-0.2
Portugal	877	801	76	1.2
Spain	197	238	-41	-0.7
Turkey	163	139	24	0.4
United Kingdom	169	145	24	0.4
United States	117	104	13	0.2
Rest of World	1,809	1,449	360	5.9
Total	6,397	5,480	917	14.9

Panel B: Average Net Immigration by Municipality (1992–2013)



Panel C: Total Immigration by Municipality and Year in % of Swiss Population

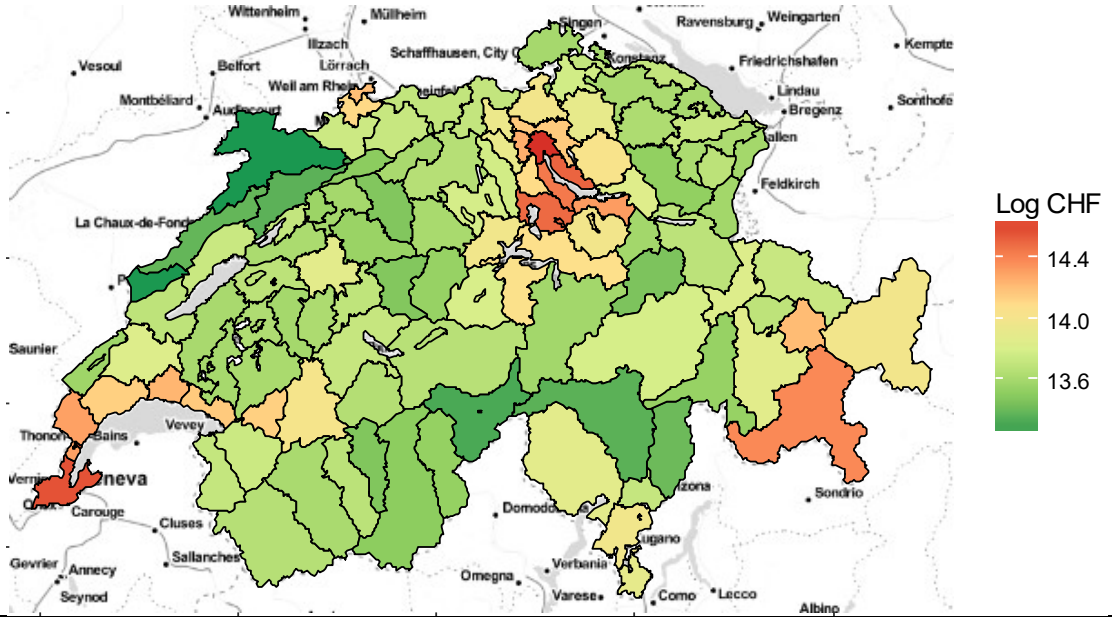


This figure shows immigration flows to Switzerland from 1992–2013. Panel A shows immigration numbers by country

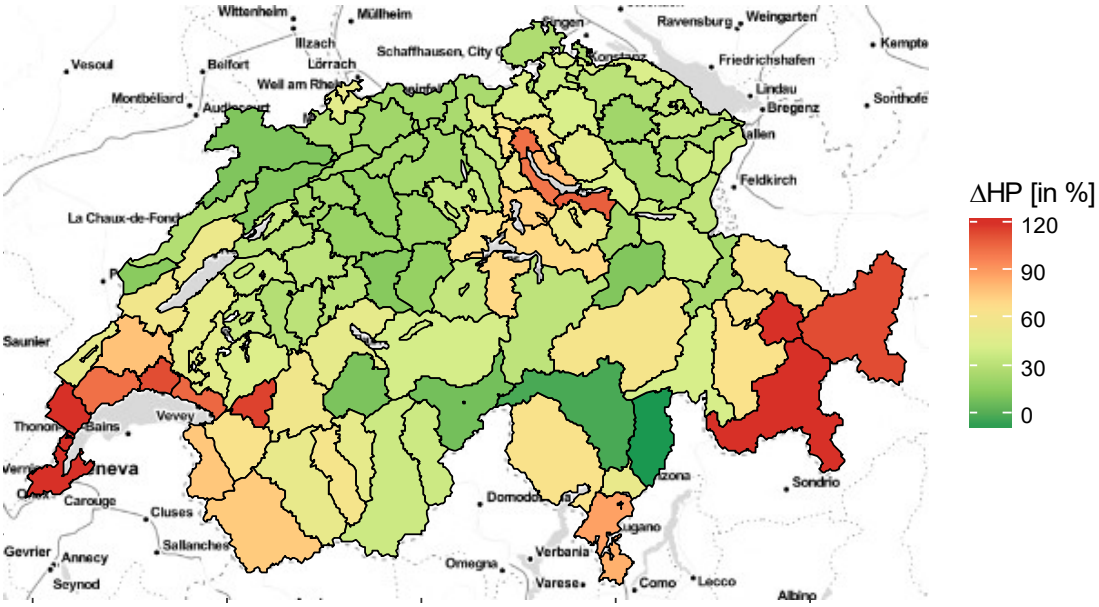
of origin. Immigration is measured in thousand persons. The last column of Panel A relates net immigration numbers to the average native Swiss population over this period. For instance, total net immigration from 1992–2013 amounts to 14.9% of the Swiss population. Panel B shows that a number of metropolitan regions receive the majority of immigration flows. In order to prevent the metropolitan regions from driving our results, we measure immigration as a percentage of the Swiss population in that municipality. Panel C shows the distribution of immigration measured in this way. In some robustness analyses, we winsorize the observations at a cap of 15% to prevent the generation of outliers in popular tourist regions (the effect is shown in light grey). Winzorization affects only 3.5% of our observations and the visualization indicates the extent to which the overwhelming majority of communities see very limited immigration.

Figure 5: Spatial Distribution of House Prices and Growth Rates

Panel A: Log House Prices in 2013

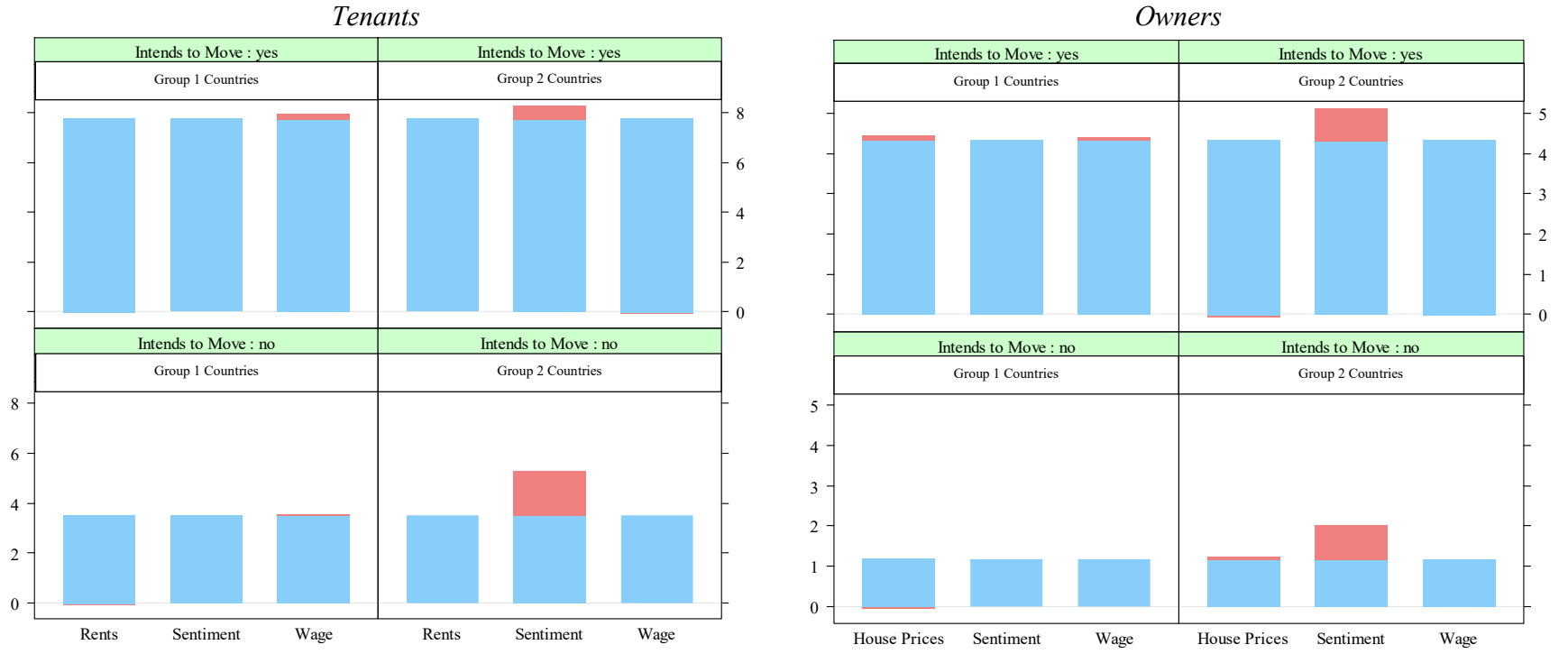


Panel B: House Price Growth Rates (1992–2013)



This figure plots house prices in log Swiss Francs for the 106 Mobilité Spatial regions in Switzerland. High price metropolitan regions are Geneva in the West with average log house prices of 14.58 (about EUR 1.9 million), Basel in the Northern part of the country with average log house prices of 14.21 (EUR 1.3 million) and the Zurich metropolitan area at the center of Switzerland with average house prices of 14.67 (EUR 2.06 million). The lowest house price region in 2013 was Jura in the North-Western part of Switzerland with average log CHF house prices of 13.22 (EUR 485,000). Panel B shows the growth rates over the period 1992–2013. House prices located in red areas increased by 120% and more.

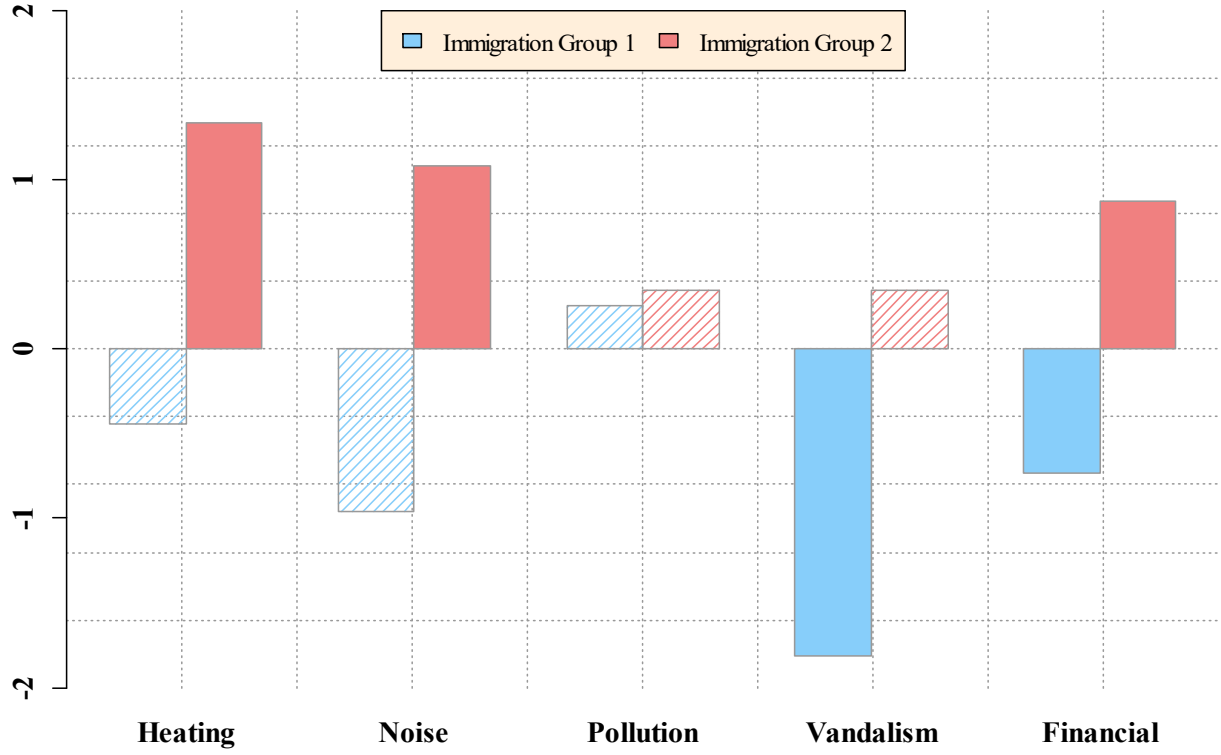
Figure 6: Summary of Estimated Transmission Channels:



This figure shows a graphical summary of the marginal effects from a one standard deviation increase in immigration. The blue bar shows the percentage point unconditional propensity to move to a new municipality, which is 4.3% for tenants and 1.5% for owners. For households who have indicated that they intend to move this probability is somewhat higher (7.8% for tenants and 4.3% for owners) and correspondingly lower for households who do not intend to move. The red bars show the increase in the propensity to move where we distinguish between housing market effects (rent and prices), wages, and the remaining residual or sentiment effect. If the marginal impact on the propensity to move is negative, the red area is added at the bottom of the blue bar. The marginal effects from changes in house prices, rents, and wages are based on the short-run direct impacts of the SAR estimates. The results show that the main way through which immigration affects incumbent households' moving decisions is not through the house price or the wage channel but through immigration directly (sentiment channel).

Figure 7: Immigration and Satisfaction

Panel A: Immigration and Household Complaints



Panel B: Immigration and Satisfaction

	Tenants	Owners	Tenants	Owners
Net Immigration Group 1 countries	**-6.17****	0.68	-6.13	2.16
Net Immigration Group 2 countries	**5.48***	**2.77***	**7.61****	6.31
Household Fixed Effects	YES	YES	YES	YES
Time-Varying Household Controls	YES	YES	YES	YES
Observations	20,487	18,245	20,487	18,245
Regression Type	Panel OLS	Panel OLS	Panel Poisson	Panel Poisson

This figure shows the estimated change in the satisfaction level of Swiss households following an increase in immigration over the last three years. Satisfaction is measured by five complaint items that are collected every year as part of the Swiss Household Panel. Panel A shows the estimated increase in probability that an incumbent household reports dissatisfaction with his accommodation concerning heating, noise, pollution, vandalism, or reports financial problems. In Panel B, an aggregate dissatisfaction variable (1-10) is regressed on immigration over the last three years. The number of reported zeros in the data is less than 1%. A zero-inflated Poisson regression is therefore not necessary here. $p<0.10$ *, $p<0.05$ **, $p<0.01$ ***.

Table 1: Propensity to Move Following an Increase in House Prices or Rents

	Tenants: Rent Increase	**Owners: House Price Increase**
Household Intends to Move	Higher rents *increase* propensity to move	Higher prices *increase* propensity to move
Household Does Not Intend to Move	Higher rents *decrease* propensity to move	Higher prices *have no effect* on the propensity to move

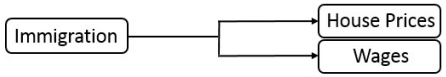
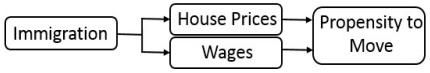
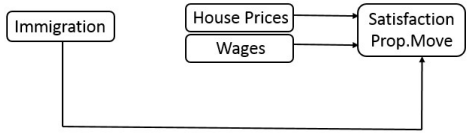
This figure summarizes our hypotheses concerning households' propensity to move after a change in house prices. Tenants respond to rent changes while owners react to house prices. The sensitivity of these changes depends to a large extent on whether the household intends to move and therefore cares about current market rents and prices. For instance, tenants will be more likely to respond to rising rents if family or job related factors are already generating relocation pressure. In contrast, tenants who do not intend to move respond negatively to higher rents because they benefit from the lower rent on existing contracts. Relocation would mean having to rent at the higher current market rate.

Table 2: Summary Statistics

	N	Mean	Stdv.	Tenant mean	Owner mean	Diff.	HH never moves region	HH moves to new region	Diff.
Dependent Variable									
Propensity to move	5468	0.03	0.05	0.04	0.02	0.02***			
Satisfaction with neighborhood	3519	8.50	1.72	8.04	9.18	-1.13***	8.66	8.16	0.50***
Independent Variable									
Years of education (HH average)	5468	13.29	2.59	13.28	13.32	-0.04**	13.15	13.60	-0.45***
married/living together	5468	0.65	0.48	0.58	0.75	-0.17***	0.65	0.66	0.00
Age of primary respondent	5468	51.80	15.45	48.34	56.47	-8.13***	54.57	45.83	8.74***
Number of observations	5468	11.97	3.77	11.61	12.44	-0.82***	11.83	12.27	-0.44***
Number of children	5468	0.56	0.97	0.56	0.56	0.0011	0.53	0.63	-0.09***
New Marriage	5468	0.08	0.28	0.11	0.05	0.05***	0.05	0.15	-0.09***
New Children	5468	0.11	0.32	0.15	0.06	0.08***	0.08	0.18	-0.09***
Vacancy rate	5468	0.01	0.01	0.01	0.01	-0.0	0.01	0.01	0.00
Mediated Variables									
Income	5468	98,401	76,859	86,012	117,463	-31,451***	99,192	96,648	2544
Log house price	5029	13.5	0.3	13.5	13.4	0.13***	13.5	13.5	-0.02**

This table displays summary characteristics of key variables employed in household specific regressions. We difference variables by whether a household was a tenant or an owner at first observation as well as by whether a household moves while in the sample or not. All variables are measured at first observation or average across all observations of eth household, where applicable (with the exception of "new marriage" or "new children" which take the value of 1 if the respective event occurred while the household was in the sample). Satisfaction with neighborhood is measured from 1-10 (10 is highest). $p<0.10$ *, $p<0.05$ **, $p<0.01$ ***.

Table 3: Estimating Equations

Eq.	Economic Channel	Estimating Equation	Controls	Agg. Level
1		$ln\left(HP_t^r\right)=\left(I_N\otimes\iota_T\right)\mu+\rho\left(W_N\otimes I_T\right)ln\left(HP_t^r\right)$ $+\alpha_1 Group1_t^r+\alpha_2 Group2_t^r+\alpha_3'\cdot controls_t+\varepsilon_t^r$	*MS Region FE, time FE, vacancy rate*	MS Region
2		$ln\left(W_t^r\right)=\left(I_N\otimes\iota_T\right)\mu+\rho\left(W_N\otimes I_T\right)ln\left(W_t^r\right)$ $+\alpha_1 Group1_t^r+\alpha_2 Group2_t^r+\alpha_3' controls_t+\varepsilon_t^r$	*MS Region FE, time FE*	MS Region
2'		$ln(W_{it}^{tenant/owner})=\beta_1 Group1_t^r+\beta_2 Group2_t^r+\beta_3' controls_t+\varepsilon_{it}$	*household FE, educ, fam, age, chld, nmarr, ricd*	Household
3		$Move_{it+1}^{tenant/owner}=\beta_1 HP_t^r+\beta_2 D_{it}+\beta_3 HP_t^r\cdot D_{it}+\beta_4'\cdot controls_t+\varepsilon_{it}$	*household FE, w, educ, fam, age, chld, nmarr, ricd*	Household
4		$Move_{it+1}^{tenant/owner}=\beta_1 W_{it}+\beta_2 D_{it}+\beta_3 W_{it}\cdot D_{it}+\beta_4'\cdot controls_t+\varepsilon_{it}$	*household FE, hp, educ, fam, age, chld, nmarr, ricd*	Household
5		$ln\left(Swiss_t^r\right)=\left(I_N\otimes\iota_T\right)\mu+\rho\left(W_N\otimes I_T\right)ln\left(Swiss_t^r\right)$ $+\alpha_1 Group1_{4yr}^r+\alpha_2 Group2_{4yr}^r+\alpha_3' controls_t+\varepsilon_t^r$	*MS Region FE, time FE, hp, wages*	MS Region
6		$Move_{it+1}^{tenant/owner}=\beta_1 Group1_{4yr}^r+\beta_2 Group2_{4yr}^r+\beta_3' controls_t+\varepsilon_{it}^r$	*household FE, hp, w, educ, fam, age, chld, nmarr, ricd*	Household

This table shows the estimating equations that correspond to the three economic channels of interest. For instance, Equations 1, 2, and 5 are estimated in a spatial autoregressive framework that accounts for the spatial diffusion of house prices, wages, and relocation flows to neighboring regions. All municipality level regressions are estimated in a standard panel 2SLS (IV) framework. The "Controls" column lists the complete set of control variables that are used in each specification. Code description: *hp* = average log CHF house price or rent in a MS region, *w* = annual log household CHF wage, *educ* = years of education, *fam* = dummy (1 = family/cohabitation, 0 = single household), *age* = household primary respondent age in years, *chld* = number of children, *nmarr* = dummy (1= recently married), *ricd* = dummy (1 = if number of children increased over the last five years). The last column of the table indicates whether the regression is estimated in the aggregate MS region level or the household level. Group 1 and Group 2 refer to instrumented immigration from high income and low income countries respectively. Please refer to the Appendix for a discussion of the instrument's construction.

Table 4: Immigration, House Prices, and Wages (Aggregate Level Effects)

Dependent Variable	**Log House Prices**		**Log Wages**	
	Panel IV	**FESAR**	**Panel IV**	**FESAR**
Spatial Lag	–	**0.73*****	–	**0.86*****
Inst. Net Immigration Group 1	**3.31*****	**2.13*****	**3.47*****	**2.27*****
Inst. Net Immigration Group 2	**-1.27*****	**-0.70*****	**-1.49***	**-0.52**
Vacancy Rate	**-3.07*****	**-1.31*****	–	–
MS Region Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Observations	2,332	2,332	2,332	2,332
Adj.R-Squared	0.92	0.96	0.97	0.99

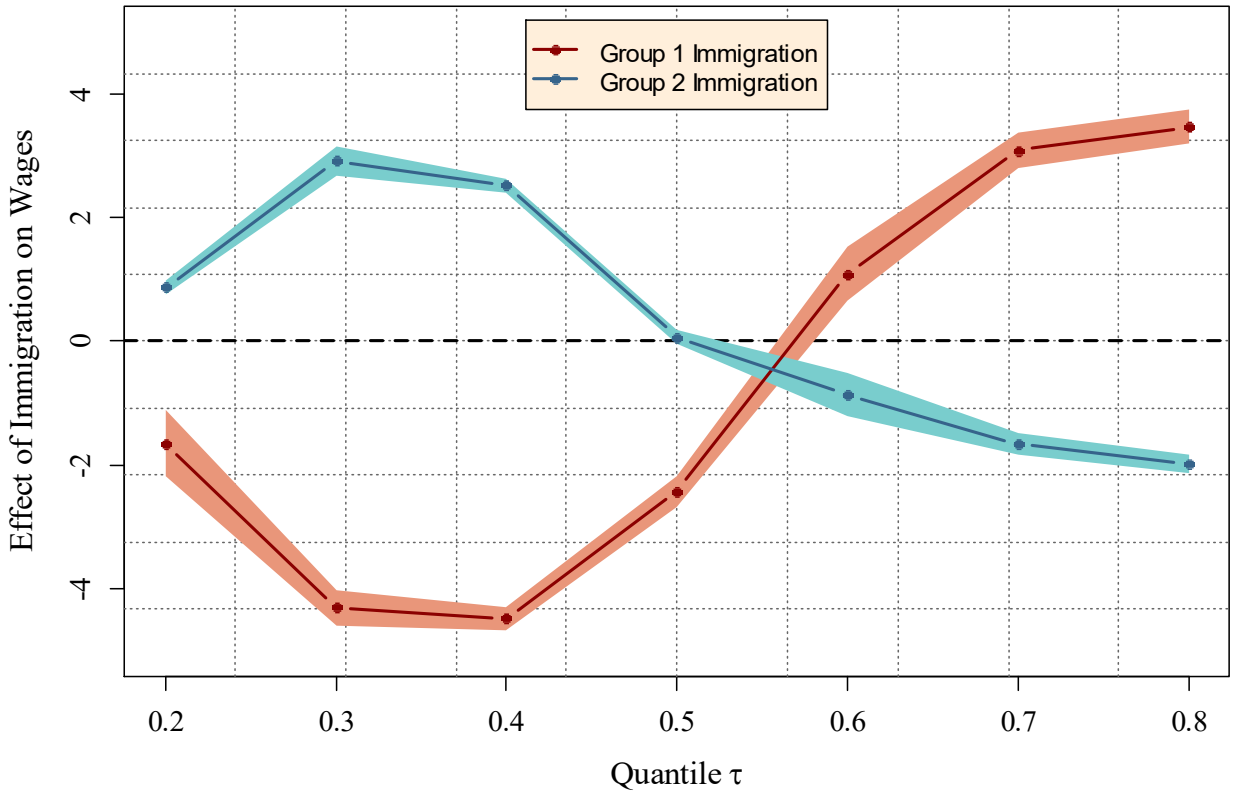
This table shows the impact of immigration on house prices and wages. The table shows both conventional panel IV estimates and spatial estimates based on a fixed effects panel SAR model (see Table 3 Eq.(1) and Eq.(2) for regression specifications of the SAR). Immigration denotes exogenous net immigration, as a share of the local population from Group 1 (Western Europe without Portugal and high income OECD countries) and Group 2 (Eastern Europe incl. Portugal as well as low income countries) countries respectively. The adjusted R-squared values include the explanatory power from municipality and time fixed-effects and are much lower when estimated on demeaned data. The sample period is from 1992 to 2013 (annual data). Independent controls are described in Table 2. $p<0.10$ *, $p<0.05$ **, $p<0.01$ ***.

Table 5: Immigration and Wages (Individual Household Level Effects)

Panel A: Individual Household Level IV Estimates

	Tenants	Owners
Inst. Net Immigration Group 1	0.92	-1.27
Inst. Net Immigration Group 2	-0.94	0.61
Household Fixed Effects	Yes	Yes
Time-Varying Household Controls	Yes	Yes
Observations	25,415	21,786
Adj.R-Squared	0.80	0.79

Panel B: Individual Household Level IV Quantile Regression Effects



This table shows the impact of immigration on household level wages. Panel A shows the wage response of tenants and owners to instrumented immigration from Group 1 (Western Europe without Portugal and high income OECD countries) and Group 2 (Eastern Europe incl. Portugal as well as low income countries) countries at the household level (Eq.(2) from Table 3). Panel B shows the wage response in a panel quantile regression framework. The estimates are based on the unconditional quantile regression methodology of Firpo, Fortin, and Lemieux (2009). The results in Panel B show that the wages of low income tenants respond positively to low skilled immigration but decrease following an inflow of high skilled immigrants. These results are in line with findings from previous studies on complementarity and substitution effects in labor markets. $p<0.10$ *, $p<0.05$ **, $p<0.01$ ***.

Table 6: The House Price Channel of Displacement

Panel A: One Percent Increase in Rents and House Prices

	Tenants		Owners	
Log(Rents) or Log(Prices)	**-0.054***	**-0.059***	**-0.018***	**-0.021***
Interaction: HH. Intends to move	–	**0.050***	–	**0.047***
Household Fixed Effects	YES	YES	YES	YES
Time-Varying Household Controls	YES	YES	YES	YES
Observations	24,237	20,347	20,083	17,285
Adj.R-Squared	0.33	0.40	0.21	0.34

Panel B: One Standard Deviation Increase in Rents (CHF 2,249) and House Prices (CHF 172,306)

	Tenants		Owners	
Log(Rents) or Log(Prices)	**-0.53**	**-0.53**	**-0.13**	**-0.14**
Interaction: HH. Intends to move	–	**0.42**	–	**0.47**

Panel C: Indirect Effect of One Standard Deviation Increase in Immigration (1.4 pct. points)

	Tenants		Owners	
Log(Rents) or Log(Prices)	**-0.25**	**-0.27**	**-0.08**	**-0.09**
Interaction: HH. Intends to move	–	**0.23**	–	**0.22**

This table shows the effect of an increase in rents and house prices on the propensity that a household relocates to a new municipality. The estimating equation is Eq.(3) from Table 3. Panel A shows the regression coefficients for a one percent increase in house prices. We use rents if the households is a tenant and the average single family house price for that municipality in case the household is an owner. We run individual regressions for tenants and owners to accommodate the fact that both groups respond differently to house price or rent shocks. We include an interaction term "household intends to move" to incorporate the particular effects of the Swiss tenancy law and account for household specific pressure to relocate. The list of household control variables can be viewed in Table 2. Panel B shows the effects of a one standard deviation increase in rents and house prices, which correspond to an increase of CHF 2,249 and CHF 172,306, respectively (these standard deviations are calculated based on demeaned variables). Panel C shows the indirect effect on the propensity to move, if the shock occurs not at the house price level directly, but at the level of immigration. In particular, the coefficients show the effect of a one standard deviation increase in immigration from Group 1 countries (1.4 pct. points, variable is two-way demeaned) on the propensity to relocate using house prices as the transmission channel. $p<0.10$ *, $p<0.05$ **, $p<0.01$ ***.

Table 7 The Wage Channel of Displacement

Panel A: One Percent Increase in Wages

	Tenants		Owners	
Log(Wage)	**0.016***	**0.011***	-0.002	-0.003
Interaction: HH. Intends to move	–	**0.042***	–	**0.016***
Household Fixed Effects	YES	YES	YES	YES
Time-Varying Household Controls	YES	YES	YES	YES
Observations	24,237	20,347	23,419	23,419
Adj.R-Squared	0.33	0.40	0.21	0.34

Panel B: One Standard Deviation Increase in Wages (CHF 56,861)

	Tenants		Owners	
Log(Wage)	**0.60**	**0.35**	–	–
Interaction: HH. Intends to move	–	**1.68**	–	**0.95**

Panel C: Indirect Effect of One Standard Deviation Increase in Immigration (1.4 pct. points)

	Tenants		Owners	
Log(Rents) or Log(Prices)	**0.078**	**0.053**	–	–
Interaction: HH. Intends to move	–	**0.020**	–	**0.078**

This table shows the effect of an increase in wages on the propensity that a household relocates to a new municipality. The estimating equation is Eq.(4) from Table 3. Panel A shows the regression coefficients of a one percent increase in wages. We run individual regressions for tenants and owners to control for the possibility that both groups would respond differently to income shocks. The control variables for this regression is listed in Table 2. We include an interaction term "household intends to move" to incorporate the particular effects of the Swiss tenancy law and account for household specific pressure to relocate. Panel B shows the effects of a one standard deviation increase in wages, which correspond to an increase of CHF 56,861 respectively (these standard deviations are calculated based on demeaned variables). Panel C shows the indirect effect on the propensity to move, if the shock occurs not at the house price level directly, but at the level of immigration. In particular, the coefficients show the effect of a one standard deviation increase in immigration from Group 1 countries (1.4 pct. points, variable is two-way demeaned) on the propensity to relocate using house prices as the transmission channel. $p<0.10$ *, $p<0.05$ **, $p<0.01$ ***.

Table 8: The Sentiment Channel of Displacement (Aggregate Level Effects)

	IV	**SAR**
Inst. Net Immigration Group 1 (t-3 to t)	-0.84	**-1.90*****
Inst. Net Immigration Group 2(t-3 to t)	**-3.49****	**-3.78*****
Spatial Lag	–	**0.49***
Municipality Fixed Effects	YES	YES
Time Fixed Effects	YES	YES
Observations	2,329	2.332
Adj.R-Squared	0.99	0.99

This table shows the effects of a one percentage point increase in instrumented immigration on the annual percentage change in the incumbent Swiss population within an MS region. The estimating equation is Eq.(5) from Table 3. Immigration is measured as past settlement net immigration as a share of the local population over the last 4 years (from *t-3* to *t*). This reflects the fact that immigration may have a slow impact on relocation decisions. Results hold if we use contemporaneous immigration. The regression controls for MS region and time fixed effects, house prices, and wages. The coefficients for MS region and time fixed effects are included in the estimation which results in high R-squared values. Cross-sectionally augmented Im, Pesaran and Shin (2007) panel unit root tests reject the null hypothesis of a unit root in the variables. p<0.10 *, p<0.05 **, p<0.01 ***.

Table 9: The Sentiment Channel of Displacement (Household Level Effects)

Panel A: One Percent/Percentage Point Increase in immigration

	Tenant		Owner	
Inst. Net Immigration Group 1 (t-3 to t)	0.74	0.33	0.57	0.35
Inst. Net Immigration Group 2 (t-3 to t)	**1.28****	0.63	**0.60****	**0.55***
Interaction: G. 1 & HH. Intends to move	–	0.18	–	0.44
Interaction: G. 2 & HH. Intends to move	–	**0.37****	–	0.14
Household Fixed Effects	YES	YES	YES	YES
Time-Varying Household Controls	YES	YES	YES	YES
Observations	22,101	22,101	19,309	19,309
Adj.R-Squared	0.39	039	0.28	0.28

Panel B: One Standard Deviation Increase in immigration (5 pct. points)

	Tenant		Owner	
Inst. Net Immigration Group 1 (t-3 to t)	3.85	1.72	2.96	1.83
Inst. Net Immigration Group 2 (t-3 to t)	**6.65****	3.38	**3.12****	**2.86****
Interaction: G. 1 & HH. Intends to move	–	0.94	–	2.29
Interaction: G. 2 & HH. Intends to move	–	**1.92****	–	0.73

Panel C: One "shock" increase in immigration (1.4 pct. points)

	Tenant		Owner	
Inst. Net Immigration Group 1 (t-3 to t)	1.03	0.46	0.79	0.49
Inst. Net Immigration Group 2 (t-3 to t)	**1.79****	0.88	**0.84****	**0.77****
Interaction: G. 1 & HH. Intends to move	–	0.25	–	0.62
Interaction: G. 2 & HH. Intends to move	–	**0.51****	–	0.20

This table shows the direct effect from immigration on displacement. The estimating equation is Eq.(6) from Table 3. Panel A shows the effect from a one percentage point increase in net immigration. We run individual regressions for tenants and owners to control for the possibility that both groups would respond differently to the presence of immigrants. The list of control variables includes log rents in tenant regressions and log single family house prices in owner regressions, household-level wages as well as controls listed in Table 2. Panel B shows the effects of a one standard deviation increase in immigration, and Panel B shows an increase of 1.4 pct. percentage points (demeaned), for comparability with previous tables. $p<0.10$ *, $p<0.05$ **, $p<0.01$ ***.

Appendix A: Immigration In Switzerland – Supplementary Information

Switzerland defines several categories of permits at the federal level. The B-category denotes people who have been given a work or study permit for 5 years. In our sample, 42% of first-time arrivals, who have never lived in Switzerland, received this type of permit. These immigrants are unlikely to buy real estate but will likely compete on the rental market for attractive properties. Since the value of a property is defined by the present value of future rental streams, activity on the rental market will also affect house prices indirectly. Persons with a C-category (20% of immigrants) are long-term residents who have an unconditional right to remain in Switzerland. Some people with a C-category do buy properties. L-permits are given to persons who work in Switzerland for less than a year. This category of permit is still active and is typically given to immigrants from beyond the EU. Categories N, S and F, as well as several other categories for short-term residents, are given to refugees and other arrivals looking for asylum in Switzerland. In our sample the categories L, N, S, and F sum to almost 30% of our sample.

Appendix B: Exogenous Shift-Share Immigration and Actual Immigration

In this paper, we aim to measure the causal effect of immigration by instrumenting actual immigration with a transformed measure that captures the exogenous part of immigration. To this end, we transform raw immigration into "shift-share" transformed or "past-settlement" net immigration measured, as a percentage of the native Swiss population. This method follows Card (2001) and has been routinely used in the recent labor market literature (e.g. in Basten and Koch, 2015). We take the total immigrants of a particular nationality in a given year and manually distribute these to each municipality according to the share of immigrants from that nationality that lived in the area in our base year 1991.[44] We take actual immigration for the entire country but generate municipality level immigration flows that differ from their actual values. Thus, we look at how immigration would occur in each region, if it was entirely driven by the exogenous factor "past settlement of people from a certain nationality living in a region". To construct historical shares, we make use of historical immigration records. Our earliest records of municipality and MS region level immigration shares start in 1991.

$$\tilde{m}_{jt} = \sum_{o} \frac{stock_{ojt^{1991}}}{stock_{ot^{1991}}} \frac{im_{ot}}{pop_{jt-1}} \tag{A1}$$

Shift-share immigration $\tilde{m}_{jt}$ takes the relative number of foreigners from origin country *o* in region *j* to construct the historical proportions or "share", $stock_{ojt^{1991}} / stock_{ot^{1991}}$. Actual net immigration on the national level im_{ot} / pop_{jt-1}, i.e. the "shift", is multiplied with the share to construct municipality or MS region level immigration as a fraction of the local population. In a last step, shift-share immigration $\tilde{m}_{jt}$ and a number of excluded instruments are used in a first-stage regression to predict actual net immigration m_{jt}. The predicted values $\hat{m}_{jt}$ are used in the second-stage panel IV and fixed-effects SAR regressions in Table 4 to 9.

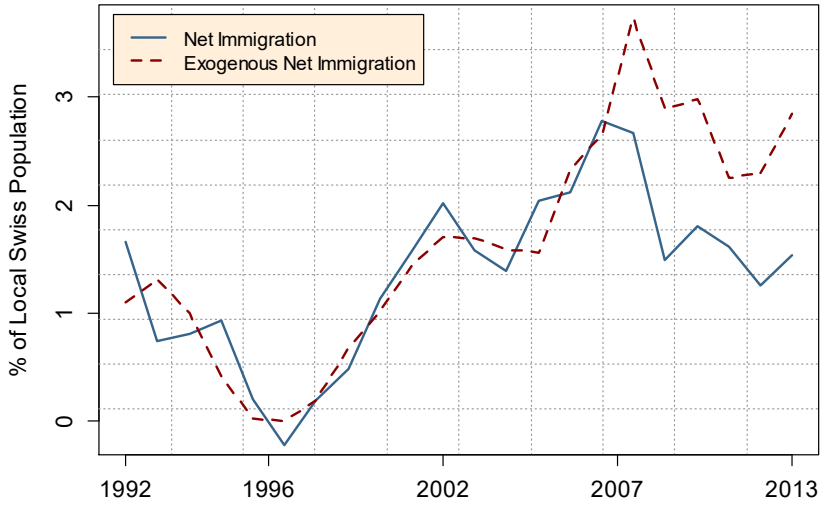
An example may help to illustrate the concept. The actual number of German immigrants moving to Zurich City in 2010 was 4,688. However, the share of Germans moving to Zurich City was lower in 1991 than in 2010. Using historic distribution of immigrants, we therefore allocate only 3,574 immigrants to Zurich from Germany. The remaining 1,114 are distributed to other regions that were more popular among German immigrants in the early 1990s. Figure A1 shows actual and transformed immigration for selected regions. Immigration is measured as net immigration relative to the local Swiss population. The

[44] The household level regressions are based on municipality level information and use municipality level shift-share instruments. Similarly, our aggregate level regressions use MS region level shift-share instruments.

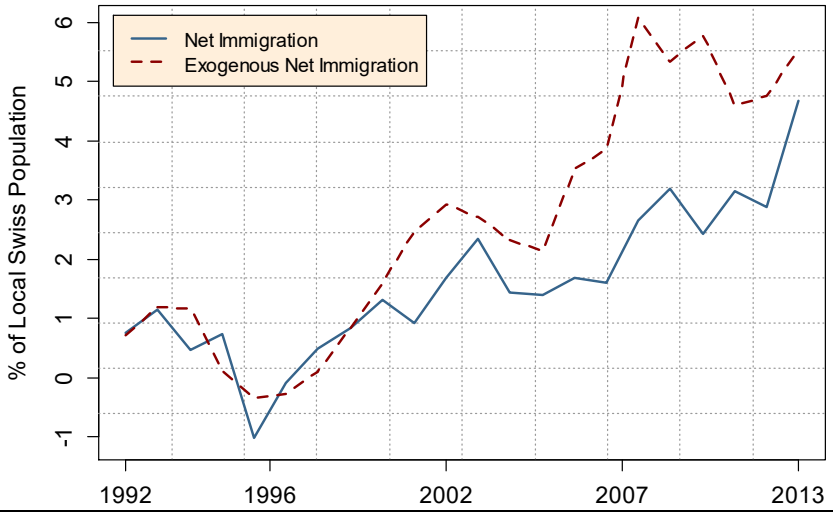
solid line shows the actual annual immigration numbers over the period 1992–2013 and the dashed line shows the transformed exogenous values. The two lines deviate to some extent, indicating the presence of endogeneity in the raw immigration numbers. However, the comovement between the lines is generally quite high. The sample correlation is 0.82 for Zurich, 0.89 for Geneva, and 0.72 for Lausanne. At first glance, Figure A1 suggests that endogeneity appears to be only a minor issue. However, we find that the correlation is only high for large municipalities and declines for smaller rural areas. The correlation between actual and exogenous immigration when averaged over all 2,323 municipalities is 0.2. Overall, these results indicate that endogeneity can have distorting effects that need to be properly addressed. According to the literature, the Card (2001) method that is used in this paper is one such tool.

Figure B1: Exogenous and Actual Net Immigration

Zurich



Geneva



Lausanne

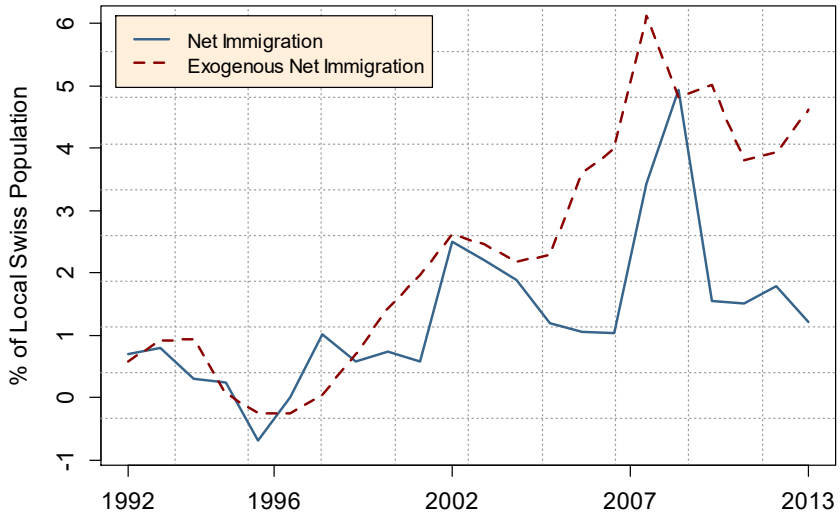


Table B1: The Sentiment Channel of Displacement (Household Level Effects)

Panel A: One Percent/Percentage Point Increase in immigration

	Tenant		Owner	
Net Immigration Group 1 (t-3 to t)	0.193	-0.09	0.57	0.01
Net Immigration Group 2 (t-3 to t)	**0.34****	**0.31*****	0.06	-0.08
Interaction: G. 1 & HH. Intends to move	–	0.03	–	**0.13*****
Interaction: G. 2 & HH. Intends to move	–	**0.24****	–	**0.12*****
Household Fixed Effects	YES	YES	YES	YES
Time-Varying Household Controls	YES	YES	YES	YES
Observations	22,101	22,101	19,309	19,309
Adj.R-Squared	0.31	0.32	0.25	0.27

This table replicates Table 9 but without instrumentation of immigration. It shows the direct effect from unmodified immigration on displacement. The estimating equation is Eq.(6) from Table 3, estimated in single OLS. The list of control variables includes log rents in tenant regressions and log single family house prices in owner regressions, household-level wages as well as controls listed in Table 2. $p<0.10$ *, $p<0.05$ **, $p<0.01$ ***.

Appendix C: The Panel Spatial Autoregressive Model and Individual Country Results

In this paper, we examine the relationship between house prices and immigration on the MS ("Mobilité Spatiale") level. As the typical MS region is rather small we expect a strong spatial interaction with house prices in neighboring regions. The standard specification for a spatial interaction process in which house prices in one region are jointly determined by the house prices in neighboring regions is the spatial panel fixed effects lag model (Anselin et al., 2006; Elhorst, 2010)[45]:

$$\begin{aligned} HP &= \left(I_N \otimes \iota_T\right)\mu + \rho\left(W_N \otimes I_T\right)HP + X\beta + \varepsilon \\ \varepsilon_{it} &\sim IID\left(0, \sigma_\varepsilon^2\right) \end{aligned} \tag{B1}$$

House prices, *HP,* depend on a set of individual specific effects μ, a spatial lag $\left(W_N \otimes I_T\right)HP$, and the regressor matrix *X*. The individual specific effects μ capture characteristics that vary across municipality but do not change over time. For instance, house prices in heavily urbanized areas such as Zurich city are higher on average than in more rural areas. House prices along the lake of Zurich are also known to have higher levels of house prices and those level shifts are captured in μ. The individual specific effects are removed by pre-multiplying the variables with the fixed-effects transformation matrix $Q = I_{NT} - \frac{1}{T} I_N \otimes \iota_T \iota_T'$.[46] The spatial lag $\left(W_N \otimes I_T\right)HP$ models the spatial dependence among house prices. With neighboring municipalities well within driving distance, we expect an increase in house prices to spill over to neighboring municipalities. The spatial lag coefficient ρ measures the strength of spatial interactions and, for most practical applications, is in the range between 0 and 1.[47] Ignoring the spatial interaction among regions carries the implicit assumption that a positive demand shock in one municipality increases house prices equally within that region but has no effect when crossing the border into another municipality. This strict assumption is unlikely to hold in practice. If ignored in the model, the spatial link between regions appears in the error term and leads to biased coefficient estimates (LeSage and Pace,

[45] An alternative model specification would be the spatial panel error model that does not incorporate the spatial interaction directly but controls for its effects in the error term. In our paper, we are interested in directly measuring the spatial dissemination of housing market, labor market, and immigration shocks so that the fixed effects lag model is a better choice.

[46] In this paper, we stack our data in the classical panel form (Hsiao, 2003) with time as the fast index and municipalities as the slow index. We thereby do not follow the majority of the spatial panel literature who use individuals as the fast index and time as the slow index. Our specification therefore differs slightly from standard textbook forms. For instance the standard specification for the *Q* matrix in the spatial econometrics literature would be $Q = I_{NT} - \frac{1}{T} \iota_T \iota_T' \otimes I_N$.

[47] Technically speaking, stationarity requires that $1/\omega_{\min} < \delta < 1/\omega_{\max}$ where $\omega_{\min}$ and $\omega_{\max}$ denote the smallest and the largest eigenvalue of the weight matrix W. In our case, this would be $-2.18 < \delta < 1$.

2009). Explicitly modeling the spatial interaction among regions not only avoids this bias but also allows to estimate house price spillovers across regions.

Finally, the regressor matrix *X* includes our measure of exogenous net immigration and a number of control variables. In our specification in Eq.(B1), the regressors have no direct spatial interaction but can cause indirect spillovers via house price changes. For instance, immigration to region *i* does not increase house prices in neighboring region *j* directly (immigration is confined to region *i*), but increases house prices in region *i* which in turn lead to higher house prices in region *j*. Therefore, the only variable in our model that is allowed to propagate spatially is house prices. All other variables function indirectly through the house price link.

An important issue in the application of spatial regression models is the correct interpretation of the marginal effects. In standard OLS, the marginal effect of variable x_r in region *i* is defined as:

$$\frac{\partial HP_i}{\partial x_{i,r}} = \beta_r \quad ; \quad \frac{\partial HP_i}{\partial x_{j,r}} = 0 \quad \forall j \neq i \tag{B2}$$

Since there is no spatial interaction in OLS, shocks that occur outside of region *i* have no effect on that region. The situation is more elaborate for spatial autoregressive models:

$$Y\left(I_{NT} - \rho\left(W_N \otimes I_T\right)\right) = X\beta + \varepsilon \tag{B3}$$

$$Y = \left(I_{NT} - \rho\left(W_N \otimes I_T\right)\right)^{-1} X\beta + \left(I_{NT} - \rho\left(W_N \otimes I_T\right)\right)^{-1} \varepsilon \tag{B4}$$

$$\frac{\partial HP_i}{\partial x_{i,r}} = S_r\left(W\right)_{ii} = \left(I_{NT} - \rho\left(W_N \otimes I_T\right)\right)^{-1} \beta_r \quad ; \quad \frac{\partial HP_i}{\partial x_{j,r}} = S_r\left(W\right)_{ij} \tag{B5}$$

The marginal effect in spatial autoregressive models is therefore not a scalar β_r but a large *NTxNT* coefficient matrix showing the interaction between a change in house prices in one region at one point in time and all other regions during all points in time. Since our model is a purely static model, there is only contemporaneous spatial interaction and we can reduce the $S_r\left(W\right)$ matrix to a smaller *NxN* coefficient matrix. This reduced $S_r\left(W\right)$ matrix shows the direct impacts on the main diagonal, i.e. the response of the region in which the shock originates. The off-diagonal elements denote the indirect impacts or spillover effects. The column sum of the $S_r\left(W\right)$ matrix shows the total impacts, the effect of a shock in one region on itself and all other regions. To facilitate the interpretation of the coefficients, LeSage and Pace (2009) propose an estimate of the average direct effect as the average of the main diagonal of $S_r\left(W\right)$:

$$\bar{M}\left(r\right)_{direct} = n^{-1} tr\left(S_r\left(W\right)\right) \tag{B6}$$

The average direct effect is similar to the coefficient vector β from Eq.(B1) but contains the feedback effects that are returned from neighboring regions. The coefficient vector β can be interpreted as the immediate or first round effect while $\bar{M}(r)_{direct}$ measures the long-run effect that includes β but also the feedback effects that accumulate over time. Note that the term "long-run" is not well defined in our context since our model is purely static and hence, the dynamic path to the long run is unknown. The average total effect that includes the direct effect but also the indirect effect that result from spillovers can be estimated as the average of all entries of the $S_r(W)$ matrix:

$$\bar{M}(r)_{total} = n^{-1} \iota_n' S_r(W) \iota_n \tag{B7}$$

A vector of ones, ι_n, first generates the column sums $\iota_n' S_r(W)$ and then generates the total sum as the sum of the column sums $\iota_n' S_r(W) \iota_n$. Finally, the indirect effects can be obtained as the difference of the total effect and the direct effect:

$$\bar{M}(r)_{indirect} = \bar{M}(r)_{total} - \bar{M}(r)_{direct} \tag{B8}$$

Spatial models therefore require more effort in their interpretation but in return offer a much richer interaction than simple non-spatial OLS regressions.

Table 4 in the paper showed that house price and wage effects from immigration differ between Group 1 countries on the one hand and Group 2 countries on the other. The classification of countries into these two groups had the advantage that sufficient observations for each MS region and year are available. For completeness, we show the house price effects of individual countries in Table B1 below. The first specification shows the effect from all countries. The second specification uses the groups from the paper and repeats the results from Table 4. The third specification shows individual country effects. Germany provides the largest group of immigrants but house price effect is small compared to other countries such as France, Spain, and the UK. Other countries such as former Yugoslavian countries, Italy and Turkey have negative coefficient estimates, suggesting that an increase in immigration from these countries can lead to lower house prices in the target municipalities and neighboring regions. The last specification distinguishes between residency permits and shows that the effects of medium-term residents having permit B do not differ from those with a long-term residency permit C. Immigrants with refugee status are estimated to have slightly negative house price effects.

Table C1: The Effects of Immigration on House Prices

	SR	LR	1ON	2ON	SR	LR	1ON	2ON	SR	LR	1ON	2ON
Spatial Lag ρ	**0.77***	–	–	–	**0.73***	–	–	–	**0.72***	–	–	–
All Countries	**0.39***	0.44	0.09	0.05	–	–	–	–	–	–	–	–
West. Eu. & OECD	–	–	–	–	**2.13****	2.44	0.52	0.27	–	–	–	–
Germany	–	–	–	–	–	–	–	–	0.24	0.28	0.06	0.03
Former Yugoslavia	–	–	–	–	–	–	–	–	0.15	0.17	0.04	0.02
France	–	–	–	–	–	–	–	–	**1.44****	1.64	0.33	0.17
Portugal	–	–	–	–	–	–	–	–	-0.14	-0.17	-0.03	-0.02
U.K.	–	–	–	–	–	–	–	–	**5.69****	6.46	1.31	0.69
Italy	–	–	–	–	–	–	–	–	**0.50****	0.57	0.12	0.06
Rest of World	–	–	–	–	**-0.70****	-0.81	-0.17	-0.09	**-0.74***	-0.85	-0.17	-0.09
Vacancy Rate	0.19	0.23	0.05	0.02	**-1.32****	-1.51	-0.32	-0.17	-0.06	-0.07	-0.01	-0.01

This table shows the impact and spatial diffusion of immigration on house prices. SR denotes the short-run response of house prices to a 1% increase in immigration. LR denotes the long-run response of house prices in the same region. 1ON denotes the long-run response of house prices in the first order neighbors of the region that experiences an immigration inflow. First order neighbors are the 6 closest MS regions to the immigration region. 2ON denotes the house prices response in second order neighbors, which are the neighboring regions to the first order neighbors. Immigration is measured as exogenous net immigration as a percentage of local Swiss population. For instance, the first column of the table indicates that a 1% increase in immigration increases house prices in the same year by 0.39%. In the long run, house prices increase by 0.44%. House prices in first order neighboring regions increase by 0.09% and in second order neighboring regions by 0.05%.

Appendix D: Jaeger, Ruist, and Stuhler (2018) Shift-Share Instruments

In a recent influential working paper, Jaeger, Ruist, and Stuhler (JRS) (2018) challenge the view that regression estimates based on the conventional Card (2001) shift-share instrument can identify exogenous immigration shocks. First, local immigration shocks can trigger adjustments over the following years. For instance, an inflow of immigrants is likely to increases local house prices in the short run, but will induce a partially offsetting housing supply response in subsequent periods. Second, local immigration patterns tend to be highly correlated over time. As a consequence, the estimated local house price response in one year is conflated with a housing supply reaction triggered by similar immigrant inflows from previous years. The combination of serially correlated immigration flows on the one hand and long-term adjustments on the other can explain why estimated immigration effects for a number of outcome variables ranging from house prices to wages are often smaller than anticipated.

The data used by JRS is in decadal frequency to allow for economic adjustments to respond to previous shocks. JRS propose an identification strategy that is based on instrumenting both current and past immigration inflows with the past settlement instrument to identify the variation in inflows that is uncorrelated with adjustment effects from previous immigration flows. In this appendix section, we follow the approach of JRS and split our panel into three decadal observations: 1991 is the base year and generates the immigration shares which are used to allocate inflows on the national level (the shifts) to each of the 106 MS regions. Outcome variables are observed for the years 2001 and 2011 over 106 regions. The conventional shift share instrument is computed for origin countries *o*, in region *j*, with base year 1991:

$$\tilde{m}_{jt} = \sum_{o} \frac{stock_{ojt^{1991}}}{stock_{ot^{1991}}} \frac{im_{ot}}{pop_{jt-1}} \tag{C1}$$

The first term denotes the fraction or "share" of immigrant stocks in region *j* in our base year, while the second term denotes the net inflow or "shift" of immigrants at the national level as a percentage of region *j*'s population. JRS propose the following first-stage regressions:

$$\begin{aligned} m_{jt} &= \alpha_{10} + \alpha_{11}\tilde{m}_{jt} + \alpha_{12}\tilde{m}_{jt-1} + u_{jt} \\ m_{jt-1} &= \alpha_{20} + \alpha_{21}\tilde{m}_{jt} + \alpha_{22}\tilde{m}_{jt-1} + v_{jt} \end{aligned} \tag{C2}$$

Where m_{jt} denotes the net immigration flows im_{jt} in region *j* as a fraction of the local population pop_{jt-1}, $m_{jt} = im_{ot} / pop_{jt-1}$. The purpose of m_{jt-1} in Eq.(C2) is to address the biases introduced by

economic adjustment forces responding to past immigration flows. Similarly, $\tilde{m}_{jt}$ and $\tilde{m}_{jt-1}$ address the endogeneity of current and past immigration inflows to housing demand shocks. When using decadal frequency, the number of lags in Eq.(C2) can be limited to one. We also tried annual data with up to seven lags (and therefore eight equations) which resulted in similar but more erratic outcomes. The fitted values from Eq.(C2), $\hat{m}_{jt}$ and $\hat{m}_{jt-1}$ are then used as exogenous immigration flows in the second stage regressions. The results for this approach are shown in Table D1. Compared to our conventional "shift-share" regressions presented in the paper, the estimated effects appear somewhat smaller and the house price and wage effects from group 2 immigration are now insignificant. However, the conclusion about the effects from immigration are unchanged.

Table D1: Immigration, House Prices, and Wages (Aggregate Level Effects)

Dependent Variable	**Log House Prices**		**Log Wages**	
	IV	**FESAR**	**IV**	**FESAR**
Spatial Lag	–	**0.80*****	–	**0.74*****
Inst. Immigration Group 1 countries	**1.69*****	**1.08*****	**2.36*****	**1.63*****
Inst. Immigration Group 2 countries	0.53	-0.12	-0.21	-0.34
Vacancy Rate	3.24	**1.98***	–	–
MS Region Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Observations	212	212	212	212