LUND UNIVERSITY
School of Economics and Management

Immigration and House Prices in Sweden

Master's Thesis submitted

to

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by

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Abstract

Over the last two decades Sweden became one of the European countries with the highest levels of immigration. About the same time the country experienced a substantial boom in house prices. Since many analysts view a housing shortage as the main driver for the increase in prices it seems natural to ask if immigration has the potential to accelerate prices in the housing market. This paper analyses the nexus between immigration and house prices for the period between the years 2000 and 2016. Based on a newly compiled panel data set, I analyse 286 Swedish municipalities by the means of a fixed effects regression model. To account for possible endogeneity, I present a strategy to apply the widely used shift-share methodology. The results show that a 1% increase in population from immigration is associated with a rise in purchase prices for housing between 0.7 and 1.8 % in Swedish municipalities. These results are supported by an extensive number of robustness checks. The findings from this study have relevant implications for Swedish policy makers, especially when considering that immigration levels are expected to stay on a high-level in the foreseeable future.

Keywords

housing market, immigration, house prices, Sweden

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1 Introduction

In recent years, immigration has become one of the most discussed topics in European public debates. Some might even argue it was *the* predominant matter of discussion in European politics. Much of the increased attention has to be attributed to the refugee crisis in 2015, during which about 1.3 million people applied for asylum in the EU, more than twice as many as in 2014 (Eurostat, 2018). The sheer amount of applications did not only create organizational challenges, but also politically heated debates about immigration and asylum legislation sparked off in many European countries. Some policy makers even began to question the extent of their responsibility for those seeking refuge.

The European political landscape opened up for stronger protectionist and hostile attitudes towards immigrants in general. Indeed, according to Edo et al. (2018) high immigration levels in French regions are associated with a higher share of right-wing voters. Over the loud discussion it is often overlooked that the asylum crisis is not a self-contained development. Labour migration, especially within EU member states fuelled by the act of free movement of workers, is on the rise as well. Around 4% of the total European population moved across states in 2016 alone (Fries-Tersch et al., 2016). Also labour and educational migrants from outside Europe and overseas are becoming a more and more important factor for increasing international migration numbers. Societies in receiving regions become more and more diverse in terms of country of birth, especially those with traditionally low levels of inflow. Thus, the current global situation is rather a general rise in international mobility, than a mere inflow of asylum seekers.

Sweden poses an interesting example in this respect. Compared to other Nordic countries, Sweden experienced a relatively steeper increase in immigration. Figure 1 illustrates how the numbers drift apart, especially from 2004 onwards. While the total share of foreign-born persons in Sweden is still at EU average, Sweden is ranked fifth in the countries with the highest number of immigrants relative to population in 2016 (see Figure 6, Appendix A). Not to forget, the country took in the Europe-wide largest amount of refugees per capita in 2015. Thus, Sweden is currently experiencing a shift from relatively low immigrant inflows towards becoming a designated destination country.

While this development is a major topic of political and public debate, especially in view of the upcoming elections in September 2018, it might come as a surprise how little is known about the economic impact of the increasing immigrant numbers. While some authors have analyzed the Swedish situation in wage and employment assimilation, studies about local distributive effects on natives are basically

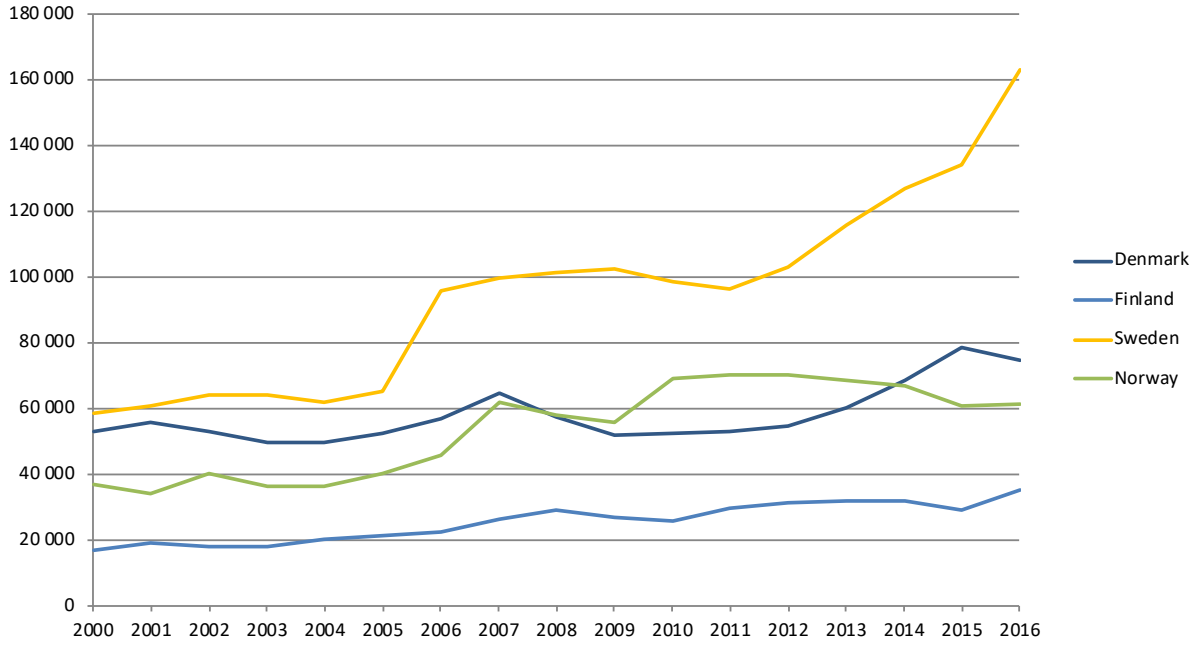

Figure 1: Immigrants in Nordic countries, excl. Iceland (Source: Eurostat).

non-existent[1]. This paper fills the gap by providing a first quantitative analysis of local economic effects of immigration inflows in Sweden. In particular, I investigate the effect of immigration on house prices in Swedish municipalities. Why is it informative to consider the housing market in this respect? The answer to this question is twofold. First, immigration might be part of the puzzle behind the recent house price boom that took place in Sweden. Over the last two decades house prices rose to unprecedented levels. Figure 2 shows the evolution of the Swedish house price index in comparison to the EU index. Clearly, Swedish house prices experienced a stronger increase and eventually surpassed EU levels. House prices play an important role in macroeconomic considerations and are driven by many different factors such as inflation or interest rates. However, the actual drivers behind housing booms are not yet well understood (Gonzalez and Ortega, 2013). Early research has shown that demographics seem to play a role, thus high levels of immigration might matter and explain why increases have been relatively stronger.

A second argument for the study of house prices is that they often present a large burden for the household budget. Increasing housing costs can seriously affect purchasing power. Saiz (2007) showed that in the US immigration inflows decrease natives' household budget more via the house price channel than via wage effects. Thus, if immigration influences house prices, it is in turn an indicator for their distributive effect on natives' purchasing power. The impact might be even more severe in a situation with high house prices and a large share of homeownership, which is both the

[1]For immigrant assimilation studies, see Edin et al. (2000), Åslund and Rooth (2007) and Gustafsson and Österberg (2001)

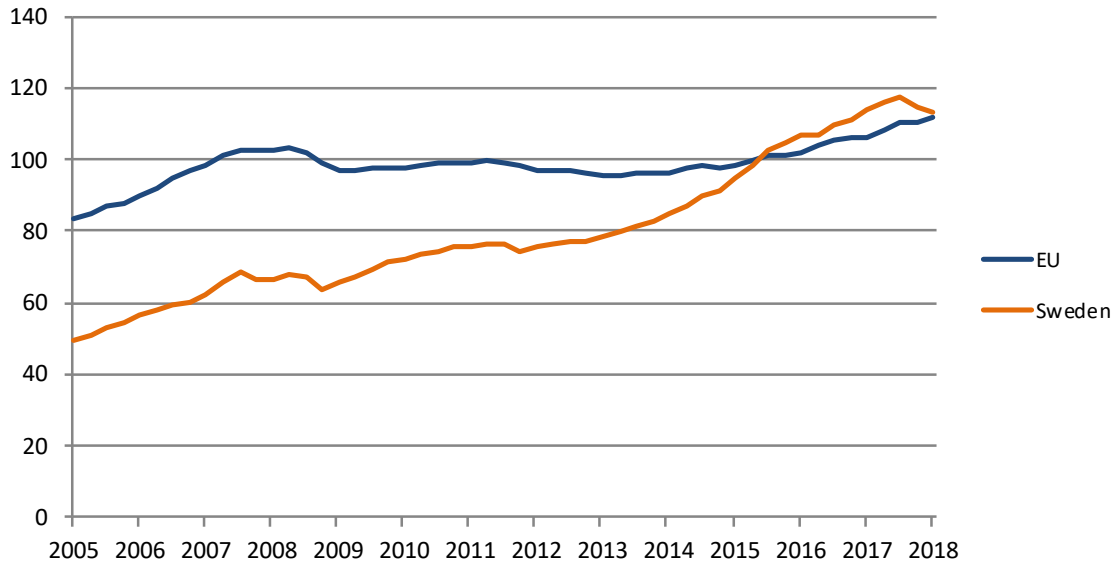

Figure 2: House price index in Sweden and the EU, 2015=100 (Source: Eurostat).

case in Sweden.

In this paper I study the effect of a change in the number foreign-born persons on house prices for 290 Swedish municipalities by the means of a fixed-effects ordinary least squares (OLS) model, and using Swedish registry data for the years 2000 to 2016. The data set comprises yearly information on all foreign-born persons, purchase prices for houses and some control variables. To account for the endogeneity issue that the location decision of immigrants is not random, I propose an instrumental variables (IV) strategy based on historical immigrant settlement patterns. An important factor in this analysis is the spacial heterogeneous distribution of immigrants. Possible regional effects might not be observable at the national level. From the OLS regressions I find that an immigration equal to 1% of local population leads to an increase in house prices of about 1.8%. While the results from the IV regression do not turn out to be significant, the coefficients exhibit similar magnitudes. I attribute this outcome to data limitations. In order to reassess the OLS results, I apply a wide range of robustness checks. This strategy also allows for the first time a comparison of methods disparately used in studies in this field of research. The outcome from the robustness checks suggest a slightly weaker price effect of about 1%. I thus conclude that a 1% population increase due to immigration has a positive effect on house prices of at least the 0.7%. These findings add to the understanding of the effects of immigration in Europe and Sweden in particular. They are a first quantification of local effects of immigration and are therefore particularly informative for policy makers. Even with more restrictive laws, migration movements will maintain on high levels, especially within Europe. By highlighting the link immigration and house prices this paper shows that in order to protect locals and prevent social

segregation it is important for policy makers to consider the consequences from the housing market.

The remainder of this paper is organized as follows. Section 2 describes the Swedish housing market and immigration developments. It also reviews the findings and considerations of previous literature in this area. Section 3 introduces the methodology, Section 4 presents the data and descriptive statistics. Section 5 and 6 present the results and the robustness checks, respectively. Section 7 concludes.

2 Background

2.1 Housing market developments

This paper analyses a period in Sweden that is characterized by both high immigration and a substantial housing boom. Swedish house prices began to rise in the mid 1990s, but the price acceleration intensified in the period from 2000 to 2016. Only in the years most affected by the financial crisis, 2008 and 2011, the price increase slowed down temporarily (Statistics Sweden, 2018). In recent years, the gap between house prices and the consumer price index seemed to widen even further. See Figure 7 in Appendix A for an illustration of the development. The house price data used in this analysis - purchase prices for one- and two-dwelling buildings - also clearly reflects the development (see Figure 3). Not a part of this analysis, but yet an important aspect is the recent drop in prices. Between the summer of 2017 and the spring of 2018 prices fell about 10%, a development that sparked fears of the burst of a housing bubble (Bloomberg, 2018).

The long lasting period of price increase led to a surge in household debt. Since the easing of credit access in the 1980, the debt-to-income ratio increased continuously along with house prices (Bjørnland and Jacobsen, 2010). Household debt levels thus experienced an additional boost in the 1990s. Since 1995 indebtedness has doubled and reached 180% of household income in 2016 (Dermani et al., 2016). Both developments caused serious concerns among experts as to whether the economy would overheat. Analysts were reminded of the US subprime crisis and Sweden's experiences in the late 1980s where a fall in house prices coincided with a recession and banking crisis. In response, the Swedish central bank has repeatedly demanded more regulatory action against the price leap (Megaw, 2017). Furthermore, the high price level encouraged construction activity. The level of dwellings per capita, however, does not show any specific upward trend. Figure 10 in Appendix A displays the long term development of the dwelling stock per person in Sweden.

The tense situation in the Swedish housing market has given rise to a vivid debate about the possible causes of the surge in prices. Gonzalez and Ortega (2013) note that the drivers behind housing booms in general are not yet well understood by sci-

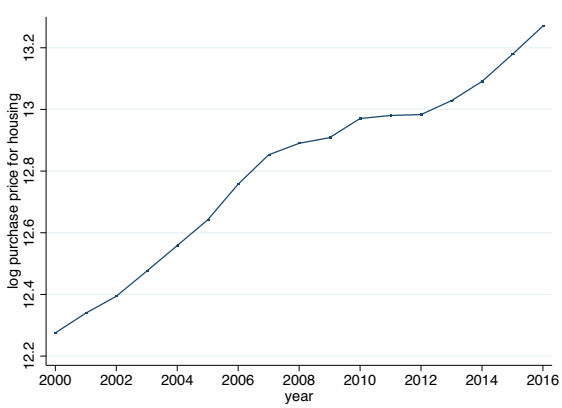

Figure 3: Development of the log purchase price of housing in Sweden, 2000 - 2016.

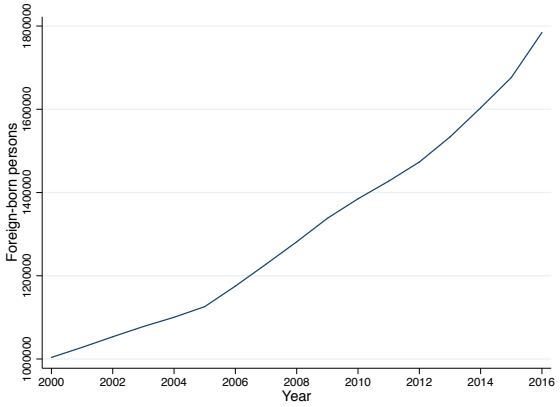

Figure 4: Development of the total number of foreign-born persons in Sweden, 2000 - 2016.

entists. Presumably, many factors contribute. An important role can be attributed to extraordinary low interest rates. Despite economic growth, the Swedish central bank kept the benchmark rate at -0.5 %, pushing house prices up, particularly in recent years (Megaw, 2017). The Swedish National Board of Housing, Building and Planning sees higher income levels as the main mechanism behind the boom (Boverket, 2013). Other analysts, however, speak of a severe housing shortage grounded in a lack of construction. In an article by The Economist (2015) it is argued that construction has not been keeping up with native population growth as well as increased influx of migrants who added to demand. In fact, pressure in the housing market is most apparent in the university cities and large metropolitan areas, most notably Stockholm, which is one of Europe's fastest growing cities (The Economist, 2015). But not only urban areas seem to be affected. In a recent report published by Boverket (2018b), more than 85% of Swedish municipalities state that they experience a deficit in housing. Part of the puzzle might also be the traditionally very restricted rental market in Sweden. Most rental apartments are distributed according to accumulated time in a waiting queue. As an extreme example, the waiting time required for an apartment in central Stockholm in 2015 was around 25 years. Since migrants do not have access to the queue system before arrival, they are generally pushed out of the rental market (The Economist, 2015). In the yearly report by Boverket (2018a) it is stated that next to students and elderly, the housing situation is especially tense for immigrants.

2.2 Immigration

Sweden poses as special case among Western countries when it comes to immigration. The country has become highly diverse in terms of the origin of its inhabitants. More than 20% of the Swedish population are foreign in first or second generation

(Schierup and Ålund, 2011). Another special characteristic is the very liberal attitude of Swedish immigration politics over long periods of time. Compared to other Western countries it is still relatively easy to acquire Swedish citizenship. Moreover, the country is internationally well known for its principles of tolerance, equality and openness (Schierup and Ålund, 2011). Krzyżanowski (2018) argues that the openness towards immigrants stems from the positive experience with labour force immigration in the post-war period. The mainly blue collar workers performed economically very well in the country and temporarily reached higher employment rates than natives (Ekberg, 1999). In turn, Sweden became internationally known for its openness and principle of equal treatment of foreigners. From 1975 onwards the share of refugee immigration started to increase reaching a first peak in the 1990s with record numbers of refugees that arrived from the Balkan states. At that time, the Swedish government started to aim at a more regulated immigration policy as well as more temporary forms of protection for the refugees (Krzyżanowski, 2018). Also, labour market conditions for immigrants began to deteriorate. The government could not reach its goal of full labour market integration of all arriving migrants anymore. Even phases of economic upswings could not improve this situation. Ekberg (2009) finds that around the mid 1980s the net fiscal contribution of immigrants turned negative. A later study by Ruist (2015) demonstrated that non-refugee immigrants have a positive impact on Swedish public finances while refugees are net recipients of public resources.

In the period of interest of this paper, from 2000 to 2016, there were two specific events that increased the number of arriving migrants significantly. First, Sweden entered the act of free movement of workers which entailed an increasing number of labour migrants from Europe. Second, the share of non-EU born immigrants rose simultaneously, a development that was further intensified by the refugee crisis in 2015 when Sweden took in the largest amount of refugees relative to their population size in the EU. Figure 4 displays this increase. The development significantly changed the composition of immigrants in the country. While the largest group of foreigners in Sweden were traditionally of Finnish origin, in 2017 they were outgrown for the first time by the number of people born in Syria. The large amount of asylum seekers sparked an intense political and public debate. As a consequence, Sweden introduced more restrictive asylum regulations as well as border controls. Now, refugees can only get a residence authorization for a limited amount of time and have to leave the country after expiration (Migrationsverket, 2018). The new policy strategy and the EU treaty with Turkey led to a significant decrease in asylum applications in 2016, however, numbers remain at a high level.

In general, in Sweden asylum seekers are offered housing in a refugee center called anläggningsboenden (ABO) by the Swedish migration agency but they can also choose

to look for private housing under the period that their application for asylum is evaluated. Migrants who live in an ABO and are granted asylum have to move and thus enter the housing market. These persons can also choose to ask for help from the migration agency to find housing but then have to accept the municipality of placement (Boverket, 2018a).
As a final point, it is important to note that the influx of foreign-born persons is not equally distributed throughout the country. Some regions experienced a strong immigration inflow while other areas were practically unaffected. This is related to the exceptional low levels of population density in some Swedish regions. Overall, Sweden has a relatively low population density with 24.5 persons per square kilometer in comparison with other European countries (Statistics Sweden, 2016). In Appendix A, Figure 8 displays the settlement patterns of immigrants in Swedish municipalities and Figure 9 shows the differences in population density, both for the year 2016. Spacial heterogeneity is a well known characteristic of immigration inflow that constitutes an important cornerstone of analyses in immigration literature.

2.3 Literature Review

The effects from immigration inflows are most commonly studied in terms of labour market outcomes. Due to the large existing body of research in this area, arguments and findings from the labour literature are often adopted when the effects of immigration on the housing market in receiving regions are studied. Prevalent research on local labour market outcomes in response to immigration covers questions concerning immigrant assimilation in terms of unemployment and wages, as well as the impact on native wages (Kerr and Kerr, 2011), famously represented by the analysis of the Mariel Boatlift migration shock in 1980 in Miami by Card (1990). Contrary to economic theory, Card (1990) found little effects of this mass immigration of Cubans on native wages, a result that was later supported by further empirical studies on this matter (Lewis, 2003; Butcher and Card, 1991). Borjas et al. (1997) and Borjas (2003) on the other hand find negative wage effects. Thus, a general conclusion about the direction of the effect remains controversial among researchers.
Other labour market studies find a wage gap between immigrants and natives that generally declines over time. Similarly, employment gaps are found to be larger among recently arriving immigrants, which can be seen as an indicator for assimilation (Kerr and Kerr, 2011). However, there is usually large heterogeneity in terms of skill level among immigrants. As a result some immigrant groups exhibit even higher earnings levels than natives. To the best of my knowledge, there exists no analysis of the Swedish situation in terms of native wage effects, although there are studies that consider immigrant assimilation. In line with research for typical receiving countries like the US or Canada, immigrant workers in Sweden are for the most part worse off

than their native counterparts when it comes to labour income and employment rates (Kerr and Kerr, 2011). Higher unemployment is most apparent for workers originating from outside Europe while immigrants from other Nordic countries do not face a employment gap at all (Nekby et al., 2002; Hammarstedt, 2006). Such assimilation studies illustrate that immigrants are different in terms of skill-level, preferences and networks. As a result, increased immigration inflows are expected to effect local economic outcomes differently than sole population growth would. Borjas (2008) suggests that there are other mechanisms to consider, in particular concerning location decisions of natives and immigrants. Without native outflows, one immigrant adds one person to the local population. Yet, if immigrant inflows lead to native outflows, each newly arriving immigrant ultimately contributes less than one person to the absolute local population size (Card, 2001).
The findings above play an important role in the fundamental reasoning behind the relationship between immigration and house prices. The underlying theory is based on a simple demand and supply argument. An inflow of immigrants into a certain region immediately increases the population and hence the demand for housing. Since housing is characterized by fixed supply, prices are expected to increase in the short-run. Studies that analyze the relation of immigrant inflows and prices of consumer goods with a more elastic supply have only found small negative effects (Zachariadis, 2012). Authors attribute this finding mainly to demand side mechanisms (Lach, 2007). The inflow of migrants might also affect natives' residential choices. Prevalent preferences for ethnic or socioeconomic segregation among natives can cause them to locate in areas with lower immigrant shares (Saiz and Wachter, 2011). Hence, rising immigration inflows might entail an outflow of native population from a region. If immigration causes substantial outflows, such that the immigration-outflow ratio is larger than one, house prices are expected to fall according to the demand argument. In fact, studies analyzing smaller geographical areas where population flows are not averaged out often find negative effects (Saiz and Wachter, 2011; Hatton and Tani, 2005; Sá, 2015). Generally speaking, however, the direction of the effect of immigration on house prices and rents is a priori ambiguous and depends crucially on the magnitude of the displacement effect of natives (Sanchis-Guarner, 2017).

The relationship between immigration and housing market can be thought of in terms of rental and purchase prices alike. Even if Saiz (2003) argues that immigrants to the US tend to live in rental housing, the choice of the dependent variable should be grounded on the effect in question as well as local market conditions. The regulated price setting mechanism in the Swedish rental market might make it hard to detect any linkage at all for housing rents. 90% of the rents in Sweden are subject to negotiations conducted by the Swedish tenants association (Hyresgästföreningen, 2018). Moreover, strict regulations limit the level of allowed increases in rents. Thus,

shifts in demand are not expected to be heavily reflected in prices for rental housing. Some existing works compare the effects for prices and rents and generally discover that house prices are affected more severely than rents (Saiz, 2007; Sanchis-Guarner, 2017; Ottaviano et al., 2007).

The study by Burnley et al. (1997) is the first one that confirms the existence of a relationship between house prices and immigration. The authors analyse the market in Sydney, Australia, and find that the two series are positively correlated over time. Ley and Tuchener (1999) confirm this finding for the Canadian cities Toronto and Vancouver. It is in general the US housing market that has received the widest research attention in this field. In one of the first studies Saiz (2003) revisits the Mariel Boatlift in terms of housing rents. He finds that the incident lifted rental prices in the Miami area by about 8 to 11% between 1979 and 1981. Notably, the study implies a decrease in real wages even in absence of the negative wage effects found by Card (1990). Saiz (2003) points out that it is also important to account for the fact that immigrants tend to live in dwellings of low quality. He identifies a positive correlation between rents for moderate-quality housing in US metropolitan areas and the level of immigration. Ottaviano and Peri (2005) confirm this positive correlation for the US. In a subsequent study, Saiz (2007) assesses house prices in US metropolitan areas between 1983 and 1997. An immigrant inflow equal to 1% of a city's population is found to entail a house price increase of the same magnitude.

One of the contributions of Saiz (2007) lies in the methods that it applies. Contrary to the Mariel Boatlift, Saiz (2007) could not rely on a natural experiment to establish causality. In fact, two potential sources of bias threaten the analysis of immigration and housing prices. Firstly, omitted variables that drive the price could also have an effect on immigrants' location decision. Positive future expectations for example, could produce upward biased results. Secondly, immigrants may act on house prices. They could move to localities that exhibit a weaker increase in prices to save money (Saiz, 2007). This would result in downward biased estimates. To be able to provide meaningful conclusions, Saiz (2007) therefore introduces exogenous variation by means of the so-called "shift-share" methodology. More precisely, the fact that immigrants are highly spatially concentrated is used to construct an instrument for immigration inflows based on previous immigrants' settlement patterns. Validity of the instrument requires that settlement patterns do not influence house prices, except through their effect on immigrant location.

The shift-share strategy has been adopted in many different economic settings and was first applied to immigration research in a labour market study by Card (2001). The shift-share method is now widely used in immigration literature and is present in almost all studies concerned with housing market effects. A detailed description of the shift-share instrument is provided in Section 3. All further papers presented

in this literature review make use of some customised version of this instrument to establish causality. Ottaviano et al. (2007) apply the method in their analysis of immigration on natives' wages and rents, which they argue are the most important channels to understand welfare effects of immigration. They also differentiate between various skill levels of immigrant workers. They find small negative effects on native wages and positive effects on housing values from the inflow of low-skilled workers to the US.

Next to conclusions about the per capita welfare in a region with high immigration levels, the analysis of housing prices can also provide information about ethnic or socioeconomic preferences. Saiz and Wachter (2011) examine residential choices and housing market dynamics to draw conclusions about natives' preferences to interact with immigrants. If natives are in favour of segregation, immigration should be associated with decreasing neighborhood values. Saiz and Wachter (2011) confirm this hypothesis when studying small neighborhoods within US metropolitan areas instead of average city effects.

The US is a typical immigrant country and hence an obvious choice for the study of house price effects, yet in the recent decades European countries reached similar levels of influx from both other EU member states and from countries outside the EU (Kerr and Kerr, 2011). This development has drawn more and more research attention to the European perspective on immigration and house prices. Limited building space and stronger state support for housing substantiate this recent development in the immigration literature (Kerr and Kerr, 2011). In her analysis of the UK housing market, Sá (2015) not only incorporates house market dynamics, but she also provides a decomposition of the effect of immigrant inflows on native population growth and mobility. Moreover, local wage distribution and immigrant education are taken into account. Sá (2015) finds a negative effect of immigrants on house prices. She attributes this result to large regional outflows of natives with high incomes which negatively affects housing demand and prices.

A high number of immigrants as well as a housing boom in the beginning of the 21st century in Spain has brought about considerable research attention to the Spanish situation. Gonzalez and Ortega (2013) find positive effects of immigration inflows on both, house prices and construction activity. In view of this finding, the authors argue that the particular high immigration during that time played a crucial role in the house price boom. Sanchis-Guarner (2017) confirms these positive effects for Spanish housing rents and prices in her recent study. Degen and Fischer (2009) show that an elevation in house prices through immigration even holds in a country that is not characterized by specifically sharp increases in real estate prices. In their analysis of Switzerland the authors confirm that immigration is responsible for as much as two-thirds of total house price inflation.The magnitude of their finding underlines

the political importance of the effect.
Research considering the housing market in reaction to immigrant inflows has generally identified a positive effect on prices, only few found negative price responses. What all these studies have in common is their focus on economies that experienced strong increases in housing prices or rents and simultaneously high levels of immigration. Since the Swedish situation is a similar one, previous literature indicates that house price responses to immigration might very likely be present in the country. To account for location patterns of natives that influence demand it is smaller geographical units should be considered. An analysis of the Swedish situation on municipality level should therefore capture underlying location mechanisms discovered by previous studies. Finally, the relatively strong link between the house prices and immigration that the authors identified emphasizes the potential importance of the relationship for Swedish households and politics.

3 Methodology

3.1 The Regression Model

This paper tries to quantify the ceteris paribus impact of immigration on house prices in the 290 Swedish municipalities. Inspired by Saiz (2007), I propose the following regression model:

$$\Delta ln(P_{it}) = \alpha + \beta \cdot (\frac{\Delta FB_{it}}{Pop_{i,t-1}}) + \mu_1 \cdot \Delta Disposable\_income_{i,t-1} + \mu_2 \cdot \Delta Unemployment\_rate_{i,t-1} + \mu_3 \cdot \Delta Crime\_rate_{i,t-1} + \mu_4 \cdot \Delta Education_{i,t-1} + \lambda \cdot Year_t + \gamma_i + \epsilon_{it}\,, \quad (1)$$

where $\Delta ln(P_{it})$ is the logged and differenced price for one- and two-dwelling buildings. The indices i and t correspond to the municipalities and years, respectively. α denotes the constant. $\frac{\Delta FB_{it}}{Pop_{i,t-1}}$ is the change in the number of foreign-born persons relative to the total population in a given municipality and year. The controls are included in first differences and with one lag. In particular the control variables comprises disposable income, the unemployment rate, the rate of violent crimes and share of people with educational attainment higher than a high school degree. $Year_t$ are year dummies and γ_i depicts municipality fixed effects. Lastly, the error term is represented by ϵ_{it}.
Equation (1) depicts a dynamic panel data model where the dependent variable is the change in log house prices. Following previous literature, the model is written in first differences. This way, municipality-specific attributes are eliminated from the

prices series and the noise to signal ratio is increased Saiz (2007). The coefficient β in (1) thus refers to the percentage change in house prices following an immigrant inflow of 1% of the initial population in a municipality. The explanatory variable of interest is the measure for integration - the change in foreign born persons relative to the total population in a given municipality and year. Furthermore, I include the first differences of a set of time-varying control variables. The dynamic controls as well as the number of inhabitants of a municipality ($Pop_{i,t-1}$) are included with one lag due to the fact that they constitute end-of-year measures. To account for any aggregate time trends, year dummies are added across all specifications. The most restrictive specification includes municipality fixed effects.

Since the model is written in first-differences all time-invariant regional attributes that might influence house prices, have been differenced out. The fixed effects capture different house price trends in the included municipalities that might be spuriously correlated with immigrant settlement patterns (Saiz, 2007). On these grounds and contrary to previous studies, I restrain from including a large set of time-invariant municipality characteristics and opt for the fixed effects specification in (1) (Saiz, 2007; Sanchis-Guarner, 2017).

When calculating the immigration levels, I make use of the number of foreign-born persons in t-1. This entails a potential threat to the model in (1) as municipality-specific trends captured by the control variables might be correlated with immigration levels. In other words, the controls might well be outcome variables of the level of immigration. Considering the nature of the control variables, this is a very likely scenario. Including these bad controls might introduce a selection bias to the estimation (Angrist and Pischke, 2008). Thus, I include the control variables with an additional lag:

$$\Delta ln(P_{it}) = \alpha + \beta \cdot (\frac{\Delta FB_{it}}{Pop_{i,t-1}}) + \mu_1 \cdot \Delta Disposable\_income_{i,t-2} + \mu_2 \cdot \Delta Unemployment\_rate_{i,t-2} + \mu_3 \cdot \Delta Crime\_rate_{i,t-2} + \mu_4 \cdot \Delta Education_{i,t-2} + \lambda \cdot Year_t + \gamma_i + \epsilon_{it}\,, \quad (2)$$

where the notations are similar to those in (1). The control variables are now included with one lag with respect to immigration inflow and two lags with respect to the dependent variable. Thus, the controls are measured before immigration is determined and the bad control problem is eliminated (Angrist and Pischke, 2008). However, the gap between the time of measurement of housing prices and municipality-specific trends might cause the link between the variables to be considerably weaker and thus blur any effect. I will therefore consider the results obtained from (1) and (2) for comparison.

3.2 IV

The models presented above account for aggregate time shocks, municipality specific characteristics and some time-varying attributes. Another factor that may prevent causal interpretation is that treatment is not randomly assigned. In this case, treatment can be interpreted as the level of immigration in a Swedish municipality. Immigrants can decide freely where to locate. When doing so they might take housing market conditions, and thus prices, into consideration. Two scenarios are plausible. First, immigrants might decide to move to municipalities where they expect the house prices to be low in order to allocate a smaller fraction of their wealth to housing costs. Second, immigrants might prefer to locate in areas with high housing prices because they perceive these locations as more economically prosperous with a higher chance to find employment or with better prospects success for an own business. This decision cannot be filtered out by the previously presented models and hence it is unknown which effect predominates. The former scenario entails downward biased results while the latter introduces an upward bias.

A common strategy in the immigration literature to account for the above mentioned problem is to apply a shift-share IV (Card, 2001). This strategy exploits the fact that immigrants tend to locate where the share of immigrants from their ethnicity or nationality is already high. In particular, the instrument predicts the immigration inflow to a specific region based on historical shares of immigrants in this region. The method exploits the common characteristic of immigrant groups to act on ethnic networks (Card, 2001). In previous literature, depending on data availability and data characteristics, different versions of the shift-share instrument were applied. Here, I follow Gonzalez and Ortega (2013) and define the IV as follows:

$$Z_{i,t} = \sum_{c} \left(\frac{FB_{c,i,t_o}}{FB_{c,t_o}}\right) \cdot FB_{c,t}\,, \quad \text{for } t_0 < t\,, \tag{3}$$

where FB_{c,i,t_o} is the number of foreign-born persons from country c in municipality i in base year t_o. I use 1997 as my base year as it is the earliest year for which data is available. The term in the brackets thus depicts the share of foreign-born persons from country c in each municipality. It can be interpreted as the size of the country of origin network in a given municipality. It is then multiplied by the number of foreign-born persons from country c in t. It is therefore possible to predict the amount of foreign-born persons from some country in a Swedish municipality according to the proportion of their historically existing network (Gonzalez and Ortega, 2013). Summing over all countries, I end up with a predicted total number of foreign-born persons in each municipality. The variable ΔFB_{it} from (1) and (2) can then be instrumented with ΔZ_{it}. For this strategy a rich set of data on the origin

countries of all foreign-born persons needs to be available. The data set used in this paper has some drawbacks in this respect. The Swedish statistical office only provides information about EU or non-EU origin of the foreign-born inhabitants in each municipality. Hence, I can only distinguish between two networks. This can be the source of serious noise to the results. Considering especially that one expects very different location patterns within either EU or non-EU foreign-born groups. Thus, I do not expect to see clear results from the IV strategy. However, I still report the results for comparison purposes.

For the IV strategy to be valid, two identifying assumptions are made (Saiz, 2007). First, the location decisions by the immigrants in the base year, 1997, cannot predict future prices better than other market participants. Put differently, immigration in 1997 is not driven by unobservables that affect prices in the period of study. This is the usual "exclusion restriction" which is crucial to hold for a valid application of IV. Here, the historical settlement patterns can only affect prices through the channel of current immigration inflows, conditional on controls. Second, the total number of foreign-born persons from some country might be endogenous if the decision to move to Sweden is influenced by prevalent housing prices (Sanchis-Guarner, 2017). This might be even more so in periods of economic booms. I can relax this assumption by additionally predicting the total number of people from country c arriving in Sweden in each year. I do this by the means of a simple OLS model of the form:

$$\begin{aligned} FB_{c,t} = \alpha + \beta_1 \cdot GDPcapita_{c,t} + \beta_2 \cdot InfantMortality_{c,t} + \beta_3 \cdot Population_{c,t} \\ + \beta_4 \cdot BattleDeaths_{c,t} + \gamma_c + v_{c,t}\,, \end{aligned} \tag{4}$$

where $FB_{c,t}$ is the number of foreign-born persons in Sweden from country c in year t. The constant is denoted by α. The independent variables are GDP per capita, infant mortality, the population size and deaths in battle in a country of origin c in year t. γ_c constitutes country fixed effects and $v_{c,t}$ is the error term.
This specification corresponds to similar equations formulated by Sanchis-Guarner (2017). The country fixed effects γ_c capture underlying national characteristics and additionally make the inclusion of EU dummy variables redundant. The control variables should capture the push-factors that influence the decision to migrate, they are however strongly limited by data availability. Equation (4) lets me consistently estimate $\widehat{FB}_{c,t}$. With the predictions of the number of foreign-born persons by country I can construct the instrument $\hat{Z}_{i,t}$ in the following manner:

$$\hat{Z}_{i,t} = \sum_c \left(\frac{FB_{c,i,t_o}}{FB_{c,t_o}}\right) \cdot \widehat{FB}_{c,t}, \quad \text{for } t_0 < t \tag{5}$$

When instrumenting the number or foreign-born persons with the predicted share of foreign-born persons according to historic location patterns, the part of the variation exposed to bias should be accounted for. Hence, the presented econometric strategy should produce consistent results.

4 Data and Descriptive Statistics

4.1 Data Sources and Variable Motivation

The data for the main specifications is extracted from three different Swedish public databases. A detailed overview of the data sources for each variable is given in Table 11 in Appendix B. All data is observed yearly on municipality level. Sweden is divided into a total of 290 municipalities. However, due to some geographical reorganization in the period of interest, the municipalities of Uppsala and Knivsta are excluded from the analysis. For the same reason and some missing data issues, the municipalities of Heby and Nykvarn are dismissed when applying the IV regressions. This leaves me with 288 and 286 municipalities in the OLS and IV specifications respectively. The 290 municipalities are part of 20 counties which correspond to the statistical region NUTS1. NUTS2 refers to the eight Swedish national regions or *Riksområden*. The largest entity, NUTS1, is not part of this analysis. It includes the three Swedish lands South Sweden, East Sweden and North Sweden.
The dependent variable is the purchase price of sold one- or two-dwelling buildings for permanent living and is provided by Statistics Sweden. The data is available from 2000 until 2016, which limits the analysis to this period. Two important considerations motivate the choice of this variable. First, the price refers to small-scale housing, thus the risk of bias through purchases out of purely speculative reasons is diminished. Second, due to the size and explicit purpose of residential housing, the houses are very likely to be demanded by immigrants and Swedish citizens alike.
The main explanatory variable - immigration - can be defined differently. The most natural definition is the inflow of persons to a country from a foreign country. In the Swedish official statistics this inflow includes Swedish nationals moving (back) to Sweden. This measure might incorporate a source of bias since the location decisions of inflowing Swedish citizens are possibly based on different considerations than those of foreign citizens. They are more likely to move to places with existing family networks and might be more informed about local labour and housing market conditions. Another possibility is to use changes in the number foreign nationals as a measure for immigration. However, as Kerr and Kerr (2011) point out, this definition presents a drawback: attainment of citizenship confounds the measure. In fact, the attainment rate in Sweden is high compared to those of other Western countries,

mainly due to the fact that foreigners can apply for Swedish citizenship after having resided permanently in the country for five years (Kerr and Kerr, 2011). Using the change in the number of foreign-born persons eludes these issues and is therefore the preferred definition in this study. It is also widely used in related literature (Gonzalez and Ortega, 2013; Sá, 2015). I use data on total immigration into Sweden as a robustness check. Both series stem from the Statistics Sweden database. Statistics Sweden also provides municipal data on total population, disposable income, unemployment and education. Since GDP data is only available for larger regional entities, I have to rely on disposable income as a proxy.

As already mentioned, I try to eliminate the bad control problem as well as reverse causality issues by using lags. Jud et al. (1996) point out that income and unemployment are key determinants of prices for housing. Further, Glaeser and Shapiro (2001) confirm the importance of weather and average education levels. While there are no consistent data on temperature for Swedish municipalities, I can control for educational attainment. The measure for higher education refers to the number of persons who have obtained any kind of educational diploma that is more advanced than a Swedish high school degree. Following Sanchis-Guarner (2017) I also control for prevalent violence and criminality. The variable used in this analysis is the sum of all declared violent crimes in a municipality. The included offences are attempted murder or homicide, violent abuse, rape, violation of integrity, illegal persecution, violence against civil servants and robbery. The definition and corresponding statistics stem from the Swedish crime office.

In general, the data collection by the Swedish authorities is very thorough and reliable. This study is therefore based on a unique data set with yearly observations for (nearly) all Swedish municipalities. The possibility to conduct the analysis for the whole country of Sweden and to work with a detailed panel data set is a major advantage to many other studies in this field that rely on repeated cross-sections, limited household surveys or census data (see, for example, Saiz, 2007; Sá, 2015). I have information on the number of people that are born in Sweden or in a foreign country for all municipalities. Moreover, the data for the differentiation between EU and non-EU born persons is available at the Swedish regional database *Kolada* from 1997 onwards. The number of foreign-born persons born within the EU also includes those originating from Liechtenstein, Norway and Switzerland. Due to data availability, 1997 is the year where the early immigrant settlement patterns are based on. A three year distance to the analyzed period is relatively small compared to other works (Saiz, 2007; Gonzalez and Ortega, 2013). A larger time gap decreases the possibility of the instrument to be correlated with house prices apart from its influence through immigration inflows. Finally, in order to predict the number of foreign-born persons in Sweden by country for the IV strategy I compiled a data set from the World Bank

data source "World Development Index". To be able to make appropriate predictions of the number of foreign-born persons entering Sweden, the data set used for the estimation must contain information on all countries of origin of immigrants living in Sweden.

On average over the sample period there are 199 countries, many of which are developing countries or countries at war with severe data limitations. This technical problem restricts me to include a larger set of controls than presented. In general, the controls include common push-factors such as bad health care conditions and armed conflict (Schoorl et al., 2000). These factors are measured by infant mortality and the number of military and civilian deaths in battle. Economic factors are captured by per capita GDP. Data on population size accounts for country scale effects. Further controls such as a measure for legal rights or average age as Mayda (2010) suggests to include are omitted due to incomplete data availability. Finally, I am able to include 190 countries in the estimation for predicting the level of immigration inflow by country.

4.2 Descriptive Statistics

Descriptives statistics of the variables for the main regressions are displayed Table 5 in Appendix B. The statistics refer to the differenced, averaged and in some cases logged series as used in the analysis. Since the transformation leads to values very close to zero that are difficult to interpret, I multiplied all series by 1000. For better tangibility, I additionally present the descriptive statistics for the raw data (see Table 1). Both tables display overall means and standard deviations. In general, the data can be characterized by high standard deviations that I attribute to strong heterogeneity across municipalities combined with a timing effect. The mean purchase prices for housing lies at 1,294,000 SEK with a standard deviation of 1,092,000 SEK. As already mentioned, Figure 3 shows the strong increase in prices over the sample period. The average increase from 2000 to 2016 in Sweden was about 77,200 SEK per

Table 1: Descriptive Statistics - Total Values

Variable	(1) Mean	(2) Std.Dev.	(3) Min	(4) Max
Purchase price in 1000 SEK	1,294	1,092	198	11,428
Δ Purchase price in 1000 SEK	77,16	136.29	-624	2,067
Foreign-born persons	4,444	13,841	66	225,203
Population	31,624	62,973	2,421	935,619
Disposable income per capita	156,000	33,153	80,000	413,000
Unemployment rate	6.232	2.461	1.061	19.51
Total nr. of violent crimes	324.6	1,039	0	17,677
Persons with higher education	7,119	21,033	253	370,441
No. of observations	4896			

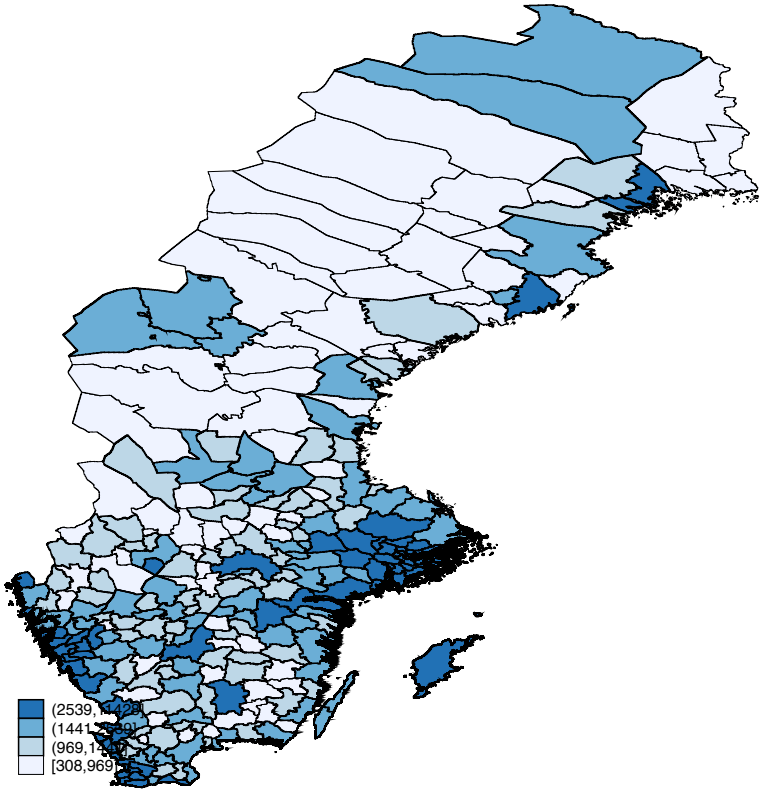

Figure 5: Increase in house prices in Swedish municipalities between 2000 and 2016. The colouring refers to the strength of the price increase according to the four quartiles of the mapped variable. A darker shade of blue refers to a stronger rise in prices over the sixteen-year period.

year which relates to an increase of nearly 100% over the whole period.

A special interest of this paper lays in the spacial heterogeneity of house price developments. Figure 5 displays the increase in house prices in the different Swedish municipalities from 2000 to 2016. The colouring refers to the five quantiles of the data. The darker the shade of blue, the stronger increase in house prices in the respective municipality. The map confirms the particularly sharp price hikes in the metropolitan areas: Gothenburg in the south-west, Malmö in the south and Stockholm in the east. In general, the south of Sweden seems to be affected most by rising prices, while in middle and north Sweden the situation is more erratic. The mean of the foreign-born inhabitants on municipality level is 4,444 persons. However, the standard deviation is very large which probably has to be ascribed to the strong increase in foreign-born persons in general over the whole period coinciding with substantial heterogeneity across municipalities (see Figure 1 and Figure 4 for a visualization of both phenomena). The spacial distribution of foreign born persons is shown in Figure 8 in Appendix A. Immigrants are mainly concentrated in Sweden's south and coastal areas. Observe that the immigrant concentration seems to be fairly congruent with the house price development shown in Figure 5.

The descriptive statistics for the IV strategy are presented in Table 6 in Appendix B. While Panel I refers to the construction of the instrument, Panel II displays characteristics of the data used for the prediction of the number of foreign-born persons in Sweden.
A final issue is the possible presence of heteroskedasticity in the data. A Breusch-Pagan test performed on the model without fixed effects rejects constant variance. In order to obviate deceptive standard errors and ensure robust inference, I use errors clustered by municipality.

5 Results

5.1 OLS Results

The results from the fixed effects OLS regressions can be found in Table 2. Note that the immigration rate refers to the relative change in foreign-born persons as defined in Equations (1) and (2), $\frac{\Delta FB_{it}}{Pop_{i,t-1}}$. Column one displays the results when including only year fixed effects. They capture national trends in economic variables such as inflation or growth. Time-varying controls are added with one lag in column two and three. In column two the controls are added with one lag, followed by the third column which displays the results when additionally including the municipality fixed effects. Column four and five are similar to the previous ones, except the controls are included with their second lag in order to mitigates the bad control problem (Angrist and Pischke, 2008). Thus, column three and five display the results under the most restrictive specification including municipality fixed effects and are therefore the preferred ones. The coefficients of the main explanatory variable are significant on the 1% level across all specifications. Their magnitude varies from about 1.0 to 1.8. Clearly, the municipality fixed effects have a relatively strong impact on the magnitude of the coefficient. Considering my preferred specifications, an increase in immigration of 1% relative to initial population is associated with an increase in house prices between 1.66% and 1.77 %. The controls with one lag all have their expected sign. Yet, under municipality fixed effects only the unemployment rate remains significant on the 1% level. When the controls are included with their second lag, they are no longer significant, except for education under the most general specification. This might be due to either a lack of explanatory power for house prices or because of the fact that in this specification there is a one period gap between the time of their measurement and the one of house prices.

5.2 IV Results

The first step in the IV strategy is to estimate the number of immigrants, or in this case foreign-born persons, in Sweden. I do this by the means of a simple OLS model that includes characteristics for 190 countries of origin of the foreign-born persons present in Sweden between 2000 and 2016. Table 7 in Appendix B displays the results. As the table makes clear and as I have already mentioned, I could only include 190 countries of origin of foreigners since there are serious issues with data collection in some regions, especially countries in crisis such as Syria or Afghanistan lack substantial data coverage.In order to prevent flawed results I add the share of those foreigners with missing data to the predicted number of people. I can then calculate the predicted number of foreign-born persons in each municipality according to local historic shares of people born in EU and non-EU countries. Finally, I end up with the number of foreign-born person on municipality level according to settlement patterns from 1997. Table 8 in Appendix B displays the first-stage regressions. The dependent variable is now the lagged immigration rate and the instrument is the main explana-

Table 2: OLS Results

	(1)	(2)	(3)	(4)	(5)
	Change in log prices in t				
Immigration rate (t-1)	1.145***	1.189***	1.773***	1.013***	1.658***
	(0.328)	(0.341)	(0.447)	(0.334)	(0.452)
Δ Disposable income (t-1)		0.116*	0.0825		
		(0.0675)	(0.0718)		
Δ Unemployment rate (t-1)		-0.00574***	-0.00596***		
		(0.00169)	(0.00182)		
Δ Crime rate (t-1)		-0.302	-0.233		
		(1.116)	(1.096)		
Δ Higher education (t-1)		2.131***	0.131		
		(0.729)	(0.940)		
Δ Disposable income (t-2)				0.0396	0.00781
				(0.0679)	(0.0705)
Δ Unemployment rate (t-2)				0.000836	0.000661
				(0.00245)	(0.00254)
Δ Crime rate (t-2)				-0.988	-0.912
				(1.027)	(1.056)
Δ Education (t-2)				2.665***	0.783
				(0.699)	(0.931)
Constant	0.0450***	0.0226***	0.0320***	0.0502***	0.0585***
	(0.00471)	(0.00697)	(0.00716)	(0.00698)	(0.00758)
Observations	4,320	4,320	4,320	4,032	4,032
R-squared	0.110	0.116	0.118	0.119	0.121
Year FE	YES	YES	YES	YES	YES
Municipality FE	NO	NO	YES	NO	YES
Number of Municipalities	288	288	288	288	288

Robust standard errors clustered by municipality in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Included years: 2003 - 2016

Table 3: IV Results

	(1)	(2)	(3)	(4)	(5)
	Change in log prices in t				
Immigration rate (t-1)	1.290	1.415	2.161	0.797	1.469
	(1.039)	(1.073)	(3.427)	(1.099)	(3.334)
Δ Disposable income (t-1)		0.108*	0.0725		
		(0.0605)	(0.0626)		
Δ Unemployment rate (t-1)		-0.00590***	-0.00595***		
		(0.00184)	(0.00191)		
Δ Crime rate (t-1)		-0.239	-0.168		
		(0.673)	(0.701)		
Δ Higher education (t-1)		2.118***	0.125		
		(0.751)	(1.009)		
Δ Disposable income (t-2)				0.0344	0.00334
				(0.0622)	(0.0648)
Δ Unemployment rate (t-2)				0.00106	0.000892
				(0.00187)	(0.00193)
Δ Crime rate (t-2)				-1.043	-0.965
				(0.715)	(0.736)
Δ Education (t-2)				2.568***	0.636
				(0.767)	(0.943)
Constant	0.0451***	0.0230***	0.0323***	0.0520***	0.0604***
	(0.00516)	(0.00730)	(0.00847)	(0.00773)	(0.0102)
Observations	4,290	4,290	4,290	4,004	4,004
Number of Municipalities	286	286	286	286	286
Year FE	YES	YES	YES	YES	YES
Municipality FE	NO	NO	YES	NO	YES

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

tory variable. The columns are defined as previously under the OLS specification. The instrument is significant over all specifications. The coefficients constitute the 'first-stage effect' (Angrist, 2006). Here, the effect is larger than one over all specifications. In fact, in the preferred specification (Column 5) the coefficient even exceeds three. Moreover, a F-statistic below 10 over all specifications indicates weak instruments. Table 3 presents the main results from the IV regressions. The columns are again defined as before. Now, the coefficients are no longer significantly different from zero over all specifications. This result is not surprising. Insignificant coefficients are not unusual in IV regressions, where the application of a poor instrument blows up the standard errors (Nelson and Startz, 1988). Here, data constraints let me only distinguish between EU and non-EU foreign-born persons. Thus, location patterns based on ethnic networks are probably not very well captured.The coefficients on the main explanatory variable are, however, fairly similar in magnitude to the ones in the main OLS specifications found earlier. Since the IV estimations did not produce reliable results, I will henceforth refer to the findings from the OLS specifications for interpretation and comparison with related analyses. These results are generally in line with the findings of a large part of previous studies that also identify positive

effects. Saiz (2007) finds a slightly lower coefficient for US metropolitan areas where the influx of 1% of a cities population causes house prices and rents to increase about 1%. Stronger results were found by Gonzalez and Ortega (2013) and Sanchis-Guarner (2017) who determine the increase in the Spanish market to be at 3.2% or between 2 and 3% respectively. In Switzerland, the effect is estimated to be 2.7%. In general, my results lie within the range of these previous findings which is reassuring. The only exception is the paper by Sá (2015) who finds the nexus between immigration and housing prices to be negative, more precisely house prices are decreasing by 1.6 to 1.7% when the population increases 1% by immigration.

6 Robustness

Since the IV results are not particularly informative, I make use of a large set of robustness checks in order to establish more support for the findings from the OLS fixed effects regression. This approach is unique in that it tests many different specifications that have been applied in related literature but have never been thoroughly compared with each other in one analysis. This section presents the outcome of these robustness checks. It can generally be concluded that the OLS results found earlier are confirmed by the various control estimations. The outcomes from the robustness regressions can be found in Table 4 as well as Tables 9 and 10 in Appendix B. The tables are structured alike: two columns comprise one type of robustness check, where the first column includes controls with one lag and the second includes the same controls with two lags.

In the first step I control for different trends on a regional level. I do this by including regional dummies instead of fixed effects on municipality level. Regions refer to the NUTS2 statistical units. These eight Swedish national areas may encompass different trends than prevalent on municipality level. The results can be found in columns one and two in Table 4. A 1% population increase from an inflow of immigrants coincides with a house price increase of about the same size. Under regional fixed effects the coefficients on immigration turn out to be considerably smaller than in the main specification. But the effect still turns out to be positive. The unemployment rate and the share of persons with higher education levels are significant when included with one lag. Both variables also have the expected sign. Unemployment is negatively correlated with house prices and educational attainment exhibits a positive relation with the series. When applying the controls with two lags, only the variable capturing educational attainment remains significant.

In the next robustness check, I also include region-year fixed effects in order to be able to capture business cycles in a Swedish region (Gonzalez and Ortega, 2013). Again

the NUTS2 classification is used, since I expect business cycles to evolve over larger regional areas than on the level of municipalities. Here, the nexus between immigration and house prices turns out to be even weaker than before. Table 4, columns three and four contain the the results, which suggest an increase in house prices between 0.7 and 0.84%.

The final robustness check in 4 performs the same regressions as before but with a different cross-sectional unit. In particular, I aggregate all data to the NUTS3 division, which constitutes 20 Swedish lands. I am using the NUTS3 classification in this case to get insights about the robustness of the results when considering the next larger territorial unit. The results in column five and six in Table 4 do not support a relationship between immigration and house prices. Furthermore, the controls also have no explanatory power and exhibit varying signs. Note that the region fixed effects now refer to the NUTS2 units. Since native in- and out-flows affect housing demand only on a local level, mobility responses might no longer be observable when the territorial unit is defined more coarsely (Sá, 2015). Sá (2015), who adopts the same method for the UK, argues that economic effects of immigration can be diffused when examining broader regions. Borjas (2006) analyses this phenomenon in terms of wages and concludes that an inter-regional comparison might be misleading since effects that exist on a local level do no longer appear in a supra-regional analysis. This reasoning also seems to hold for Sweden. But the result reveals an important additional insight of this study. While up to this point of the analysis, immigration seems to be associated with increasing house prices on municipality level, the relation is no longer observable on the next larger territorial unit. Thus, the geographical unit in question proves to be an important factor in the analysis of immigration effects.

I now turn to the results of some further robustness checks that are presented in Appendix B. In Table 9 columns one and two report the results when using population growth (weighted by total population) as the main explanatory variable in contrast to the relative change in foreign-born population before. Columns three and four refer to the situation when I directly use immigration data provided by Statistics Sweden. As noted before, this data includes Swedish-born immigrants. Relative population growth is highly significant and both estimates are suggestive of a house price effect of about 1%. This coefficient corresponds to a direct demand elasticity (Sanchis-Guarner, 2017). Since it is weaker than the effect found in Table 2, I expect that immigration causes an outflow of native population to some extent. An econometric assessment of this effect is, however, not within the scope of this paper.

Moving on, I recalculated the main explanatory with conventional data on immigration such that the measure is again relative to population size in a given municipality. The underlying data is available for the whole period of investigation from 2000 to 2016. While most papers directly associated with this work use changes in the

foreign-born population as their main explanatory variable, the pioneering paper by Saiz (2007) also uses data on immigration inflows to the US. For the Swedish housing market the effects when using immigration data turn again out to be smaller than the effect found in the main specification when the main explanatory variable is based on changes in the number of foreign-born people. A 1% population increase due to immigration is linked to a slightly less than 1% acceleration in house prices over both specifications including controls with one and two lags, respectively. A possible explanation for this result lied in the fact that the series includes inflows of persons born in Sweden. Since the law on the general freedom movement within the EU was introduced in Sweden in 2005 it became more common to work and study abroad temporarily. In fact, the data shows that the share of Swedish-born returnees increased. In view of the refugee crisis, however, their share stagnated in the later years of this study. Strikingly, both robustness checks presented in Table 9 produce significant coefficients on the crime rate when included with one lag. A 1% increase in the local crime rate is associated with small negative development of house prices.

Table 4: Robustness Checks I

	(1)	(2)	(3)	(4)	(5)	(6)
			Change in log prices in t			
Immigration rate (t-1)	1.054***	0.938***	0.836**	0.689**	2.348	1.738
	(0.347)	(0.341)	(0.340)	(0.331)	(1.387)	(1.359)
Δ Disposable income (t-1)	0.109		0.0929		0.363	
	(0.0677)		(0.0702)		(0.248)	
Δ Unemployment rate (t-1)	-0.00634***		-0.00589***		-0.00137	
	(0.00175)		(0.00195)		(0.00491)	
Δ Crime rate (t-1)	-0.321		-0.230		-3.290	
	(1.126)		(1.114)		(3.252)	
Δ Higher education (t-1)	1.618**		1.613**		-2.095	
	(0.757)		(0.746)		(3.372)	
Δ Disposable income (t-2)		0.0340		0.0425		-0.0746
		(0.0693)		(0.0740)		(0.247)
Δ Unemployment rate (t-2)		0.000362		0.00145		0.000529
		(0.00246)		(0.00259)		(0.00552)
Δ Crime rate (t-2)		-1.096		-1.152		5.198
		(1.036)		(0.990)		(3.751)
Δ Higher education (t-2)		2.274***		2.344***		0.437
		(0.729)		(0.782)		(4.634)
Constant	0.0306***	0.0556***	0.0490***	0.0340***	0.0265	0.0612**
	(0.00702)	(0.00694)	(0.0152)	(0.0124)	(0.0197)	(0.0241)
Observations	4,305	4,018	4,305	4,018	300	280
R-squared	0.117	0.119	0.160	0.165	0.522	0.530
Nr. of Municipalities/Regions	287	287	287	287	20	20
Year FE	YES	YES	YES	YES	YES	YES
Region FE	YES	YES	YES	YES	YES	YES
Region-Year FE	NO	NO	YES	YES	NO	NO

Robust standard errors clustered by municipality in parentheses *** p<0.01, ** p<0.05, * p<0.1

This finding is somewhat surprising considering the earlier models where crime did not exhibit any effect on house price levels.
The final outcomes of the sensitivity analysis are reported in Table 10. Here, I estimate the model in second differences. More specifically, the dependent variable as well as the time-varying controls are included in second differences. This strategy is adopted from Saiz (2007) who uses it as one of his primary methods. Again, I also include the controls with a one period gap with respect to the dependent variable. The results are very close to the main OLS fixed effects ones for both specifications. Lagged once, unemployment shows a negative and educational attainment a positive correlation with house prices which is in accordance with prior expectations.

Overall the findings from the robustness checks confirm the main results. I can conclude that immigration has an accelerating effect on house when considering Swedish municipalities. The magnitude of the effect however depends on the particular model applied to the question. I found the effect to lay in the range between 0.7 and 1.8 which refers to a increase of 0.7% to 1.8% in house prices associated with a 1% increase in population from immigration inflows. These results are in line with previous findings, but cannot be interpreted as purely causal. This and other shortcomings of the applied methodology, as well as political and social implications from my findings will be discussed in the next section.

7 Discussion

The level of immigration in Swedish municipalities is positively correlated with house prices. An immigrant inflow equal to 1% of a municipality's population is associated with a house price increase quantified in the range between 0.7% and 1.8%. As already discussed earlier, the main drawback from this paper is that the IV methodology does not produce significant outcomes due to limits in the available data. At the same time, the results from the fixed effects model cannot be interpreted as causal since the location decisions of immigrants are not random. Indeed, previous analyses have found both, upward and downward biased OLS estimates when compared with the results from the IV estimations. Saiz (2007) as well as Gonzalez and Ortega (2013) identified a stronger effect of immigration on house prices when instrumenting with historical settlement patterns. Sá (2015) on the other hand, detected a positive bias in her OLS results. Clearly, I cannot make any statement about the size and direction of the potential bias in my OLS results. Another point is the relatively short distance in time between the historical settlement patterns to the actual period of interest. This displays a potential threat to the assumption that immigration in 1997 is not driven by unobservables that affect prices in the period of study. In order to mitigate the

possibility that this assumption, the exclusion restriction, is not valid a earlier base year than 1997 would be preferred.
A remedy for these problems is of course access to more detailed data on the countries of origin. This additional information could be easily applied in the presented set-up and would presumably enable the researcher to draw more meaningful conclusions and identify the true causal effect. However, since this data is not publicly available at the moment, or might in part not be collected on municipality level, the OLS specification is the best alternative and it still provides important insights about the immigration and housing market nexus in Sweden. Especially, when considering the relative closeness in magnitude of the - though insignificant - IV results, as well as the corroborative outcomes from the robustness checks.
Beyond that, there exists a growing number of literature that criticizes the shift-share instrument methodology. Jaeger et al. (2018) argue that it is likely that the IV is correlated with previous supply shocks if the distribution of immigrant inflows is stable over time. Following this argument, the establishment of causality fails. Nevertheless, the shift-share methodology is still very broadly applied in research concerned with the analysis of various mechanisms associated with immigration. Also, alternative methods do not present an optimal remedy because they often entail additional levels of complexity in the estimation (Jaeger et al., 2018). Nonetheless, the shortcomings of the shift-share method should be considered when the IV is utilized.
Even if no causal relationship could be established, the results give some important insights about the Swedish housing market and immigration question. The fact that house prices are positively correlated with immigration is an important insight for policy makers and planners. I might not be able to fully draw the conclusion that immigration levels drive house prices, but they still seem to be an important part of the Swedish house price boom. As high levels of immigration coincide with larger increases in house prices, some foresight about future immigration levels will be beneficial for municipalities. Particularly in long-term housing supply planning it is vital to take the positive correlation of the two variables into account.
Currently, asylum applications experience a downward trend. This is however mainly attributable to the exceptional high levels of applications in 2015. Thus, numbers are expected to maintain a relatively high level. More importantly, legal migration levels are not predicted to fall in the medium-run, in spite of the emergence of protectionist attitudes in many Western countries. When municipalities have a broad expectation of future immigrant numbers, early action can be taken to secure more stability in the housing market. This is still valid in view of house price drop of 2017 since the demand pressure is still up (Bloomberg, 2018). Especially, the larger Swedish cities have already shown that counteraction is possible. The city of Gothenburg predicts a growth in size of about one third over the next two decades. This equals an influx

of about 150,000 people, surely in part immigrants. City planners act on this forecast with high and forward-looking building activity. Until 2035 construction of 80,000 residential units is scheduled (Göteborgs Stad (2015)). Such forward-looking plans would also be beneficial for smaller communities.

A stabilization of the national housing market would not only be advantageous for the Swedish macroeconomy, it would also limit the burden for the household budget of private individuals. Since immigration coincides with a rise in house prices of at least 0.7%, high levels of immigration potentially induce a relocation effect among natives to protect their household wealth. Especially so for households that spend a relatively large share of their income on housing. Moreover, research has shown that rising house prices induce increases in consumer prices which can imply additional stress for household finances (Stroebel and Vavra, 2014; Berger et al., 2017). In order to prevent ethnic segregation and spark more acceptance for immigrants among natives, their relation to house prices must be considered. In periods of high immigration policy makers should therefore be particularly aware of developments in the housing market and changes in the purchasing power of Swedish families.

Finally, as already mentioned wage effects from increasing inflows of migrants have been found to be small by previous literature. This study therefore highlights the importance of the housing market in this respect. In his study of rents in US metropolitan areas Saiz (2007) finds a coefficient similar to the lower limit established in this analysis. He concludes when an inflow of immigrants equal to 1% of the city population causes a 1% increase in housing rents, the loss in purchasing power is almost tenfold compared to the loss caused by decreasing wages. Responses in wages are not yet studied for the Swedish economy but the example shows the magnitude and relevance of the house price impact. Consequently, a more thorough understanding of the mechanisms would be desirable. One idea is to also consider the impact of immigration on construction activity, due to prices being naturally affected by changes in supply (Gonzalez and Ortega, 2013). I restrained from an analysis of this effect since the population/housing ratio in Sweden remained relatively stable over the period in question (see Figure 10).

A very informative extension of this thesis would be the identification of the different channels that drive the total house price increase. How much of the effect has to be attributed to direct immigrant demand and how much is indirectly caused by the relocation decisions of the population in Swedish municipalities? Such a decomposition is presented by the studies of Sá (2015) and Sanchis-Guarner (2017). These analyses reveal the magnitude of a displacement effect of natives. Moreover a decomposition allows to trace back how much of the house price change is solely attributable to the additional demand arising from arriving immigrants taking construction activity and displacement into account. Such an investigation could be part of subsequent

analyses about general native mobility and housing demand in Sweden.

8 Conclusions

Considering the media attention and political discussion, research on the economic effects of high immigration levels in the receiving regions is still scarce. Existing studies are mainly centered around impacts on the labour market in terms of wages effects and assimilation. Results showed that the effects on native wages are ambiguous and generally small. Does immigration have no effect on natives' economic situation? It is expedient to expand the scientific analysis to other economic settings than just the labour market (Borjas, 2008). Saiz (2003) was the first one to consider the nexus between immigration and house prices and rents. Housing costs make up a considerable share of a household's income at the same time housing is an inelastic good that potentially shows price responses to increased demand. In a subsequent study Saiz (2007) showed that in US metropolitan areas house prices increased 1% in response to a 1% population increase from immigration. Similar studies were realized for classic receiving countries like Canada, the UK and Spain.

In recent years, Sweden experienced an extraordinary acceleration of immigrant numbers. Simultaneously, the country faced an unprecedented boom in the housing market. House prices underwent a fast and strong increase, especially when compared to the situation in other European countries. Up until now, analyses of this development are just at the starting point and little is known about a possible connection between house prices and immigration. This paper fills the gap by analyzing the relation of house prices and immigration levels in Swedish municipalities. I make use of a detailed panel data set of house prices for one- and two-dwelling buildings, the change in the number of foreign-born persons in the period from 2000 to 2016, and some controls. By applying a rigid fixed-effects model, I find that a immigration inflow equal to 1% of the population in a municipality is associated with a 1.8 % increase in house prices. To back these findings, I perform various robustness checks. In general, the checks confirm my baseline results but suggest the effect to be slightly weaker. The fact that the outcomes do not vary substantially also validates their individual application. I conclude that that immigration is positively correlated with house prices. More precisely, a population increase of 1% due to immigration coincides with a rise in house prices of minimum the 0.7%.

A common way to establish causality in previous literature is the application of the so called shift-share instrument. It exploits the fact that immigrants are in general more spacially concentrated than natives. Immigrants tend to settle where they find existing networks based on ethnicity or nationality (Card, 2001). This observation is

utilized to predict the number of immigrants in a municipality based on local settlement patterns. Thereby, it needs to be assumed that the exclusion restriction holds: settlement patterns can only influence house prices through their effect on future immigration to a region. The Swedish Statistical office merely provides information about the birthplace of a foreign-born person according to two categories: either non-EU or EU countries (including Norway, Switzerland and Liechtenstein). The settlement effect based on only two networks is thus too vague to produce significant results in my analysis. However, the proposed IV strategy can easily adapted to when access to a richer data set is available. Moreover, the resulting coefficients - though insignificant - are close to the ones found in the OLS specification.

Next to this drawback, it would be of interest to the investigate potential effects of immigration inflows on construction activity or waiting time durations for Swedish rental apartments as well as a decomposition of the total effect. Nevertheless, this thesis gives important insights about the economic effect of immigration in a highly affected country that was traditionally characterized as being particularly liberal towards immigration.

The results from this analysis show that policy makers in Sweden should be aware of the positive correlation between immigration and house prices. In order to provide sufficient housing for natives and immigrants, construction activity needs to be encouraged more when high levels of immigrant inflow are expected. Thus, forward-looking planning will be crucial for a successful immigration and housing policy. This is first of all important for protecting low income groups such as retirees and unemployed persons. Second, since house costs constitute a considerable financial burden for households, it could become profitable for natives to move to areas with less immigrant settlement in order to protect their budget. Such behaviour encourages ethnic segregation and prevents appropriate integration of the arriving persons. This paper thus highlights the economic and political significance of the housing market.

High levels of immigration inevitably pose challenges to governments, especially if they occur as abruptly as in Sweden. Immigrants influence the receiving country in many ways, not only economically such as in the labour and housing market, but also on a social and political level. Understanding the consequences of increasing migrant inflows is a first step towards a sustainable integration policy.

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A Figures

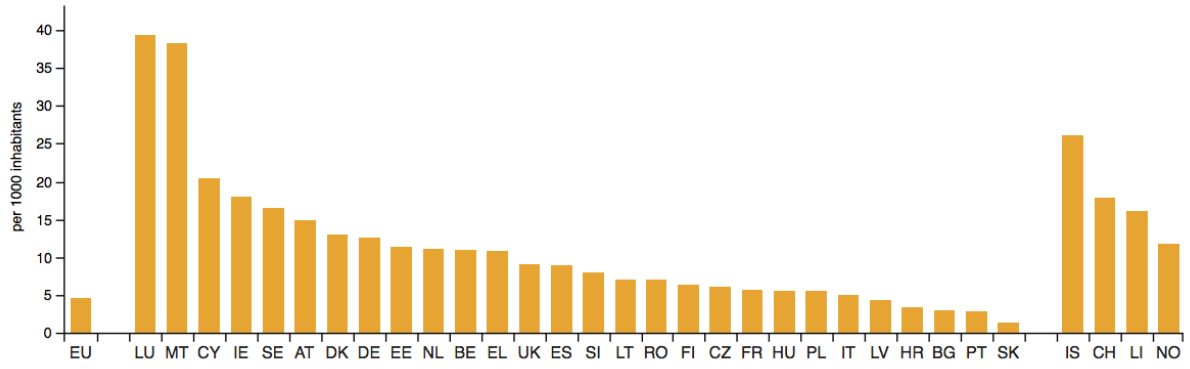

Figure 6: Immigration per 1000 inhabitants in 2016 to the 28 EU and four EFTA (European Free Trade Association) countries. Country abbreviations according to the ISO Alpha-2 standard (Source: Eurostat).

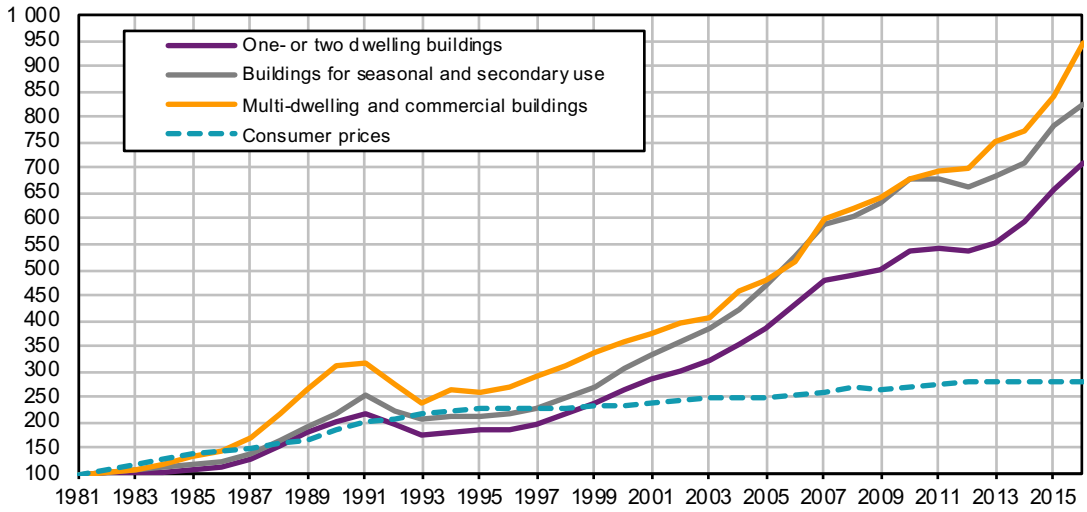

Figure 7: Long-term house price development compared to the consumer price index in Sweden (Source: Statistics Sweden)

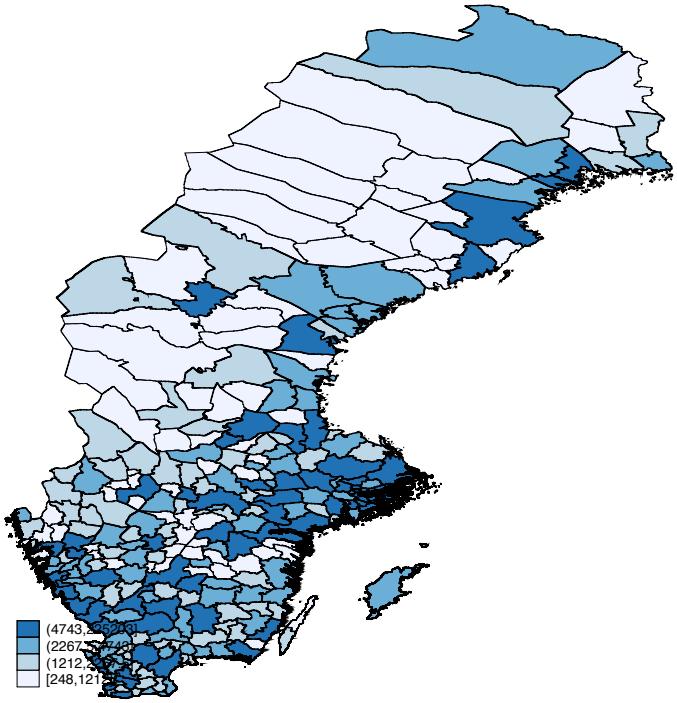

Figure 8: Spacial dispersion of foreign-born persons in 2016 on municipality level in Sweden according to the four quartiles of the mapped variable. A darker shade of blue refers to a higher number of foreign-born persons in a municipality.

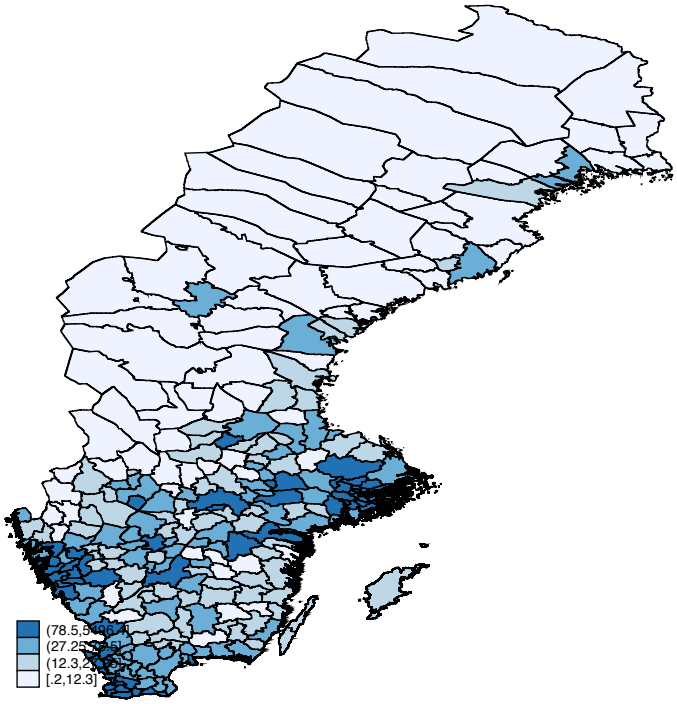

Figure 9: Population density on municipality level in Sweden in 2016 according to the four quartiles of the mapped variable. A darker shade of blue refers to a higher level of population density.

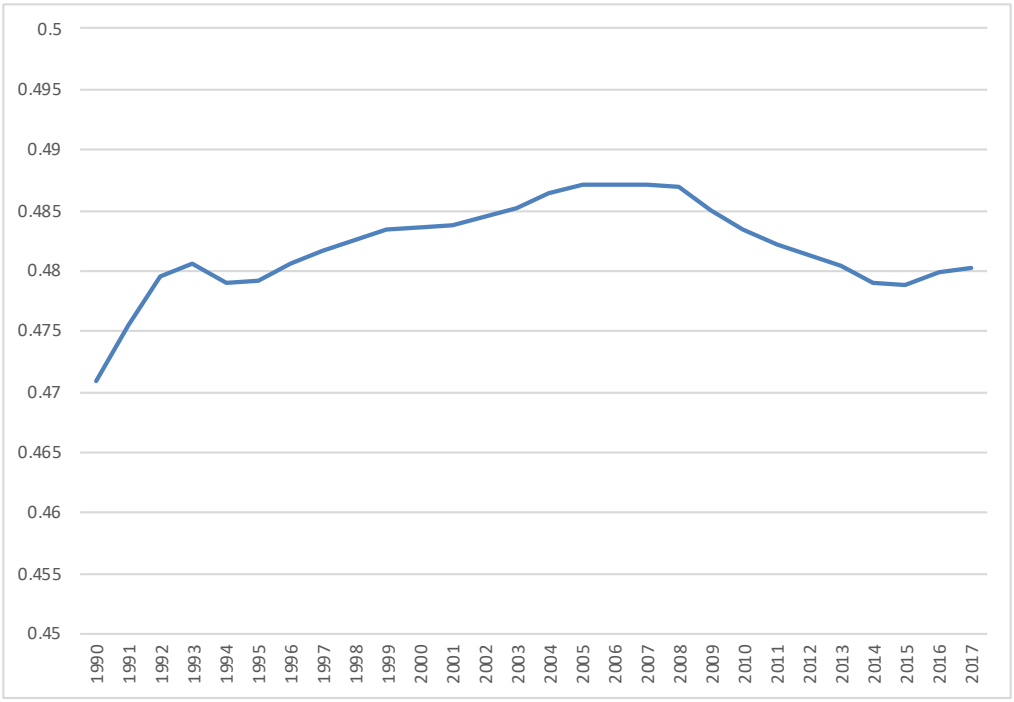

Figure 10: Development of the dwelling stock per person in Sweden (Source: Statistics Sweden, own calculations).

B Tables

Table 5: Descriptive Statistics - Transformed Variables

Variable	Mean	Std. Dev	Min	Max
Change in log purchase price	0.014	274.298	-2482.854	1250.464
Immigration over population (Δ FB/POP)	7.090	165.844	-387.527	9154.107
Change in log disposable income	0.116	148.682	-1118.173	336.473
Change in unemployment rate	0.217	1407.824	-9693.743	10802.67
Change in crime rate	-0.00042	2.233	-25.640	26.091
Change in higher education share	-0.00024	21.472	-340.845	149.484
No. of observations	4895			

Table 6: Descriptive Statistics - IV Strategy

		(1) N	(2) mean	(3) sd	(4) min	(5) max
I	% of EU-born 1997[1]	286	0.0349	0.102	0.001	1.329
	% of Non-EU-born 1997[1]	286	0.003	0.012	7.98e-06	0.141
	Foreign-born share	5,720	10.104	5.594	1.900	41.038
	EU-share of foreign-born	5,720	95.036	3.694	69.938	99.600
II	Number of foreign-born persons	3,171	6,172	17,830	0	195,447
	GDP per Capita	3,171	11,400	18,438	46.97	192,989
	Population	3,171	3.573e+07	1.343e+08	10,025	1.379e+09
	Infant mortality	3,171	30.01	27.35	1.600	142.4
	Battle death	3,171	151.3	1,039	0	25,050
	Number of Countries included: 190					

[1]Percentage in a municipality of total Swedish population in 1997

Table 7: Prediction of the number of foreign-born persons in Sweden

	(1) Nr. of foreign-born persons
GDP per capita	-0.0219**
	(0.0104)
Population	7.72e-05***
	(6.65e-06)
Infant mortality	32.36***
	(9.089)
Battle death	0.423***
	(0.0564)
Constant	1,233***
	(474.0)
Observations	3,171
Number of Countries	190
R-squared	0.161
Year FE	YES
Country FE	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: First stage regressions

	(1)	(2)	(3)	(4)	(5)
	Immigration rate (t-1)				
Z (t-1)	1.184***	1.152***	2.871***	1.160***	3.123***
	(0.052)	(0.052)	(0.370)	(0.055)	(0.395)
Δ Disposable income (t-1)		-0.004	-0.0002		
		(0.003)	(0.002)		
Δ Unemployment rate (t-1)		0.0003***	0.00009		
		(0.00008)	(0.00007)		
Δ Crime rate (t-1)		0.061**	0.045*		
		(0.028)	(0.026)		
Δ Education (t-1)		0.120***	0.138***		
		(0.031)	(0.033)		
Δ Disposable income (t-2)				-0.005*	-0.001
				(0.003)	(0.002)
Δ Unemployment rate (t-2)				0.0002**	2.75e-06
				(0.00008)	(0.0001)
Δ Crime rate (t-2)				0.021	-0.0004
				(0.031)	(0.028)
Δ Education (t-2)				0.040	0.051
				(0.033)	(0.035)
Constant	0.0003	0.0005	-0.002	0.001	-0.001***
	(0.0002)	(0.0003)	(0.0005)	(0.0003)	(0.005)
Observations	4290	4290	4290	4004	4004
Year FE	YES	YES	YES	YES	YES
Number of Municipalities	286	286	286	286	286

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Included years: 2003 - 2016

Table 9: Robustness Checks II

	(1)	(2)	(3)	(4)
	Change in log prices in t			
Population growth (t-1)	1.075***	0.935***		
	(0.280)	(0.294)		
Immigration rate** (t-1)			0.924***	0.850**
			(0.345)	(0.358)
Δ Disposable income (t-1)	0.0774		0.0829	
	(0.0697)		(0.0713)	
Δ Unemployment rate (t-1)	-0.177		-0.173	
	(1.095)		(1.098)	
Δ Crime rate (t-1)	-0.00562***		-0.00614***	
	(0.00182)		(0.00184)	
Δ Education (t-1)	-0.0684		0.244	
	(0.936)		(0.947)	
Δ Disposable income (t-2)		0.00529		0.00830
		(0.0705)		(0.0703)
Δ Unemployment rate (t-2)		0.000702		0.000493
		(0.00255)		(0.00255)
Δ Crime rate (t-2)		-0.915		-0.943
		(1.060)		(1.040)
Δ Education (t-2)		0.837		0.814
		(0.937)		(0.939)
Constant	0.0387***	0.0626***	0.0315***	0.0590***
	(0.00717)	(0.00771)	(0.00739)	(0.00764)
Observations	4,320	4,032	4,320	4,032
R-squared	0.118	0.120	0.116	0.118
Number of Municipalities	288	288	288	288
Year FE	YES	YES	YES	YES
Municipality FE	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Immigration rate** (t-1) refers to the rate based on immigration data.

Table 10: Robustness Checks III

	(1)	(2)
	Δ^2 log prices in t	
Immigration rate (t-1)	1.755***	1.626***
	(0.483)	(0.474)
Δ^2 Disposable income (t-1)	0.0919	
	(0.0629)	
Δ^2 Unemployment rate (t-1)	-0.00344**	
	(0.00170)	
Δ^2 Crime rate (t-1)	-0.347	
	(0.846)	
Δ^2 Education (t-1)	2.305***	
	(0.741)	
Δ^2 Disposable income (t-2)		0.0161
		(0.0619)
Δ^2 Unemployment rate (t-2)		-0.00139
		(0.00209)
Δ^2 Crime rate (t-2)		-0.923
		(0.901)
Δ^2 Education (t-2)		0.514
		(0.811)
Constant	0.0734***	0.128***
	(0.0101)	(0.0111)
Observations	4,032	3,744
R-squared	0.283	0.297
Number of Municipalities	288	288
Year FE	YES	YES
Municipality FE	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 11: Data Sources

Variable	Years available	Definition	Source
Purchase price	1982 - 2016	Pruchase price for sold one- and two-dwelling buildings in 1000 SEK excluding buildings for seasonal and secondary use	Statistiska Centralbyrån
Foreign born population	2000 - 2017	Foreign born population	Statistiska Centralbyrån
Swedish born population	2000 - 2017	Swedish born population	Statistiska Centralbyrån
Disposable Income	2000 - 2016	Disposable income of households per capita in 1000 SEK, current prices	Statistiska Centralbyrån
Unemployment	2000 - 2017	Unemployment rate between 24 - 64 years	Kolada
Crime	1996 - 2017	Number of all declared violent crimes	Brottsförebygganderådet (Brå)
Education	1985 - 2017	Population with education above highschool degree (including all levels of university studies and postgraduate studies)	Statistiska Centralbyrån
Immigration	1997 - 2017	Immigration from a foreign county to Sweden, including Swedish born persons	Statistiska Centralbyrån
Emigration	1998 - 2017	Emigration from Sweden to a foreign country	Statistiska Centralbyrån
Share of foreign born	1997 - 2017	Share of foreign born persons	Kolada
Non-EU foreign born	1997 - 2016	Share of population neither born in the EU nor EFTA countries	Kolada
Population Sweden	1980 - 2017	Total population in Sweden	Statistiska Centralbyrån
Population	1993 - 2016	Total population (all residents regardless of legal status or citizenship)	World Development Indicators, World Bank Data Bank
GDP per capita	1998 - 2016	GDP per capita in current US dollars	World Development Indicators, World Bank Data Bank
Battle deaths	1993 - 2017	Battle-related deaths (number of people). All deaths - military as well as civilian - are counted as battle-related deaths.	World Development Indicators, World Bank Data Bank
Infant mortality	1993 - 2016	Number of infants dying before reaching one year of age, per 1000 live births	World Development Indicators, World Bank Data Bank
Map coordinates		Shapefile Sweden	European Environment Agency
County levels		Divison of the municipalities into counties	Wikipedia