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First-Come First-Served: Identifying the Demand Effect of Immigration Inflows on House Prices

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Abstract
An inflow of immigrants into a region affects house prices in three ways. In the short run, housing demand increases due to the increase in foreign-born population. In the long run, immigrants affect native location decisions and housing supply conditions. Previous research on the effect of immigration on local house prices has argued that the impact of immigrant demand cannot be separated from the demand changes due to native relocation or that the impact of immigrants on native mobility has no consequences on the estimates. In this paper I propose a methodology to pin down the immigrant demand effect. I apply it to Spanish data during the period 2002-2010 and I show that overlooking the impact of immigration on native mobility induces a sizeable bias in the short-run estimates. My results are robust to controlling for changes in housing supply.

Keywords: Immigration, housing markets, instrumental variables
JEL classification: J61, R12, R21

1 Introduction

The study of the local economic impact of immigration has been a very active area of research in the last 20 years. Large immigration inflows impact the spatial distribution of population within a country. The location choices of the foreign-born directly change the composition and size of the population residing in a given area. An inflow of immigrants directly increases the population of a region. Immigrants also influence the location decisions of natives, indirectly changing the population size of different locations. Changes in population affect the labour force of an area, and therefore impact not only average wages and employment rates, but also their distribution. Changes in the labour market conditions will, as a result, affect other economic aspects such as productivity, skills composition, and ultimately growth and welfare. Not only do immigrants affect the production factors, they also consume amenities and housing services in the places to which they locate and thus influence the spatial equilibrium. As a consequence, the study of the local effects of immigration on housing markets is central to urban economics.

Most of the theoretical and empirical contributions on the study of the impact of immigration in receiving regions have originated from the analysis of their labour market effects[1]. Recently, research has focused on the impact of immigration on a richer set of economic and social outcomes like productivity, crime or consumption (see Ottaviano & Peri, 2013; Nathan, 2013, for recent reviews). A small number of papers have provided evidence on the effect of immigration on (consumption) goods prices (Lach, 2007; Cortés, 2008; Zachariadis, 2011). They have mostly found negative effects of an increase of low-skilled immigration on (generally immigrant-labour intensive) goods prices. For a given supply, following an increased in foreign-born population, intensified spatial competition on the consumption of goods, amenities and housing services may push prices up in the short run. In the long run, the sign and size of the impacts does not only depend on the response of the supply of goods but also on any induced relocation of natives following the immigrant inflows. The net effect on prices would therefore be the result of total changes in the demand side (from immigrant and natives) and of changes in the supply side. These supply-demand mechanisms operate in the analysis of the effects of immigration on house prices. Previous evidence for the US (for example Saiz, 2003, 2007; Ottaviano & Peri, 2011) has generally found positive (long-run) impacts of immigration on both rents and prices[2].

There are two major challenges when estimating the causal effect of immigration inflows on local house prices. The first one relates to the fact that immigrant location choices and house price dynamics might be driven by the same underlying unobserved factors. An estimate of the impact of immigrant inflows on average house prices that fails to take this into account will be biased. For example, if immigrants locate in areas where prices are growing slower, coefficients obtained using OLS estimation techniques would be too small. This issue is generally addressed in the literature using instrumental variables, panel data estimates and control variables. The second challenge relates to the interpretation of the estimates. As noted by Saiz (2007), in the long run we need to take into account not only the

[1]Hanson (2008), Dustmann et al. (2008), Longhi et al. (2009), Pekkala-Kerr & Kerr (2011) and Nathan (2013) provide recent reviews of the literature.

[2]Other studies are Greulich et al. (2004), which assesses the impact of immigrant on native renter households housing consumption opportunities; Stillman & Maré (2008), which provide estimates for New Zealand and Nathan (2011) which provides estimates for the UK.

impact of immigrants on housing demand but also the changes that immigration inflows induce on housing supply, density of housing and native mobility. A well-identified long-run reduced-form estimate is a combination of all these effects. However, the interpretation of the underlying channels is unclear.

The current paper addresses both issues. First, I estimate the long-run effect of immigration inflows on average local house prices using a first differences and instrumental variables (IV) approach, adding a large set of area trends and controls. In order to obtain unbiased causal estimates, I construct an improved shift-share instrument that combines historical immigrant location patterns with predicted national inflow by country of origin obtained from a push-factors gravity model (full details are given in Sections 2.3 and A.2). Next, I propose a methodology to identify the short-run effect of immigration: their direct demand impact on local prices. With this strategy, the estimated coefficient isolates the effect of the increase in the immigrant demand on prices from the effect of immigrations on housing supply and native mobility. This enables a clearer economic interpretation of the estimates. This latter issue has drawn little attention in the literature, where the effect of immigrants on housing supply or native mobility has been studied separately.

The proposed strategy is applied to investigate the impact of the large immigration inflows on house prices using Spanish data. Between 2001 and 2010 both the number of foreign-born residing in Spain and house prices significantly increased, providing a suitable setup to gain further insights on the impact of immigrations on prices. Motivated by the substantial size of the immigration inflows, a number of recent empirical works have analysed the impact of immigration in Spain on various economic outcomes. Most of the papers have focused on the labour market impacts (Bentolila et al., 2008; Carrasco et al., 2008; González & Ortega, 2010; Amuedo-Dorantes & de la Rica, 2011; Amuedo-Dorantes & Rica, 2013), but a number of contributions have studied other aspects like the effect of immigration on output mix (Requena et al., 2009), trade (Peri & Requena, 2010), productivity (Kangasniemi et al., 2009), or even crime (Alonso-Borrego et al., 2011).

A handful of recent works have also provided some evidence of the impact of immigration on house prices in Spain. Talavull de la Paz (2003) explores their different determinants using a sample of Spanish cities during the period 1989 to 1999. She investigates the role of population and economic activity specialisation as explanatory variables of city price differentials. She finds that population is strongly significant in explaining house price levels while economic structure does not appear to have any significant effect on house prices. Sosvilla-Rivero (2008) analyses the effect of immigration during the period 1995-2007 using regional data and assesses the over-valuation of the house prices with respect to economic fundamentals. He finds that almost half of the over-valuation can be attributed to immigration flows, which he interprets as a positive relationship between immigration and prices. García-Montalvo (2010) explores the role of land regulation and immigration on Spanish municipalities during the period 2001 to 2005 but, conversely to the other studies, he finds no effect of immigration inflows using a long-differences IV estimation. Finally, González & Ortega (2013) investigate the impact of immigrant inflows on sale prices and housing construction during the Spanish recent house-boom period. They find substantial positive causal effects of immigration inflows on both outcomes. Their paper is the closest to the present one, but the period of analysis, empirical strategy and research aim is different.

Building upon these contributions, the present paper estimates both the short-run (demand driven) and the long-run (after supply and mobility adjustments) impact of immigration on local house prices. I estimate this impact both on sale and rental prices. To obtain the coefficients I exploit a panel dataset for Spanish provinces (NUTS3) for the period 2001-2010. This period of analysis covers a subperiod of high boom (2001-2008) and bust of the housing markets (2008-2010), which provides sufficient variation in the data to adopt a very demanding empirical strategy.

Most existing papers (Saiz, 2007; Cortés, 2008; González & Ortega, 2013) rely on the existing US evidence[3] to argue that native area displacement due to immigration is small or not large enough to cancel increased demand stemming from increased area population. Even if natives were displaced by immigrant inflows, the reduction in native demand would be smaller than the increase in foreign-born demand and therefore area demand would increase. Finding a positive (long-run) impact of immigration on local house prices is generally interpreted as supportive of no or little native displacement. If the effect on native mobility is small enough, the short-run and the long-run estimate would be of very similar magnitude. Thus, these papers make no distinction between short and long-run adjustments when interpreting their results.

In this paper, I first obtain the impact of immigration inflows on prices by estimating a specification and strategy similar to Saiz (2007). I regress the annual local house price growth on an immigration ratio, which is defined as the total immigrant inflow normalised by the beginning-of-the-year area population. To obtain unbiased causal parameters, I use a shift-share instrument. The estimated elasticities are 1.1% for rental prices and between 2.2 and 3% for sale prices. These coefficients correspond to the long-run effect. I then explicitly test the impact of immigrant inflows on native mobility and, consistently with existing estimates for Spain (Fernández-Huertas et al., 2009), I find that immigrants attract natives to areas in which they locate (approximately 6 natives for each 10 foreign-born). Given this finding, I argue that ignoring this effect induces a sizeable bias in the short-run estimates. To identify the impact that is only due to increased immigrant housing demand, I re-estimate the coefficient using solely the variation on population growth which is due to exogenous location of foreign-born. The estimated elasticities using my proposed methodology are 0.7% for rental prices and between 1.4 and 2.1% for sale prices. This implies that the long-run estimates are up to 60% larger when we ignore the relationship between immigration and native location decisions. I furthermore explore the impact that changes in housing supply have on the estimates and I find that they have very little effect on the coefficients. These results are robust across specifications, to different data sources and to the use of different definitions of the instrument.

By providing a strategy to separate the long and short-run immigration impact, the main contribution of this paper is methodological. My results add to the evidence on the area effects of the recent immigrant wave in Spain. Contrary to existing estimates, I isolate the effect due to direct increases in immigrant local house demand from long-run adjustments affected by changes in local housing supply and native spatial relocation. I also obtain the long-run estimate. The comparison of both coefficients informs us about the role of direct (foreign-born) and indirect (native) demand on increasing local house prices, and on the role of housing construction on mitigating price increases. Finally, I add to previous evidence on the effect of immigration on Spanish housing market by estimating the effect not only for house sale prices but also on rental prices.

[3]See Peri & Sparber (2011) for a recent critical review of this literature.

The rest of the paper is organised as follows. Section 2 describes the empirical strategy: the empirical specification is explained in 2.1, the strategy to identify the effect of foreign-born demand in 2.2 and the identification strategy in 2.3. Descriptive statistics are provided in 2.4. Section 3 discusses the results and the robustness tests. Finally, Section 4 contains the conclusions and the discussion of the limitations of the analysis.

2 Methodology

2.1 Empirical specification

In order to estimate the causal effect of changes in foreign-born population on the growth of house prices, I use a linear empirical specification similar to Saiz (2007). The 50 Spanish provinces i are the geographical unit of observation, which are grouped into 17 regions r[4]. t denotes time periods (years). $\Delta \log(hpr_{i,t})$ is the change of the natural logarithm of house prices in province i during year t, $FBinflow_{i,t-1}/population_{i,t-1}$ is the immigration ratio during $t-1$, λ_t are time fixed effects, γ_r are regional fixed effects, Z_i is a matrix of province time-invariant attributes and $\Delta X_{i,t-2}$ is a matrix of province time-varying controls. Finally, $\varepsilon_{i,t}$ is the random shock. The empirical equation takes the form:

$$\Delta \log(hpr_{i,t}) = \beta \frac{FBinflow_{i,t-1}}{population_{i,t-1}} + \phi' Z_i + \delta' \Delta X_{i,t-2} + \lambda_t + \gamma_r + \varepsilon_{i,t} \quad (1)$$

The independent variable of interest is the immigration ratio: it is defined as the inflow of immigrants into province i during a given period divided by the population in the province initial population)[5]. The inflow of immigrants during $t-1$ is calculated as the change in the foreign-born population between January $t-1$ and January t . Population in $t-1$ denotes the stock of total residents (natives and foreign-born) at the end of period $t-2$. Given the nature of housing services, the main specification uses the immigration ratio lagged one period with respect to the changes in prices[6].

Using an immigration ratio instead of gross inflows as the measure of “immigration” has three advantages. Firstly, for a given housing stock, the changes in demand affecting house prices depend on the number of immigrants moving into the province (new demand) and on the demand from area residents (existing demand). If we aim to measure the impact of demand from immigrant arrivals, we need to take into account how large new demand is as compared to demand from existing residents. For a given size of the immigrant inflows, the impact of new arrivals on housing demand would be relatively smaller in more populated regions. This would lead to different house price growth dynamics than in less populated regions. Using the ratio over population we can take into account the “relative” size of the immigration inflow, which better captures the effect of immigration on housing demand. Secondly, by using the ratio we also eliminate any unobservables that might equally affect both the numerator (immigration inflow) and the denominator (original province’s population). As explained in Peri & Sparber (2011), and suggested by Card (2001), standardising

[4]Provinces correspond to the European NUTS3 and regions to NUTS2. I exclude the African territories due to their historical particularities and the lack of reliable data.

[5]The Spanish administrative population data is dated on the 1^{st} of January. Referring to the beginning $t-1$ is equivalent to referring to the end of $t-2$.

[6]I also investigate the contemporaneous relationship as a robustness test.

the immigration inflow by the size of the population allows us to eliminate the spurious correlation between higher inflows and higher price changes. This correlation could arise due to the fact that the average and standard deviation of both variables are likely to be proportional to the total population in the province. Finally, this setup allows us to interpret the coefficient β as an elasticity: a 1% increase in the ratio has a β% effect on the change in prices.

The first differences setting of equation (1) eliminates any unobservable province characteristics which might be correlated with the level of house prices and the level of foreign-born population in the province. Time fixed effects λ_t control for common shocks affecting the growth of prices of all provinces in Spain in a given year (for example, a tax deduction on mortgage payments, a subsidy to renting or a better financial climate). There could still exist some unobserved factors at the area level which are correlated with the changes in house prices and the changes in foreign-born stocks (numerator of the immigration ratio). Not including these would bias the estimation of β. To tackle this issue, first I include region fixed effects γ_r and regional trends $\gamma_r * t$. These fixed effects control for time-invariant regional characteristics (or trends) which might affect the price growth and the immigration ratio and which are not common to the whole country. In the most demanding specification I include province fixed effects (γ_i). These control for unobservables at the province level which are correlated with changes in prices and in the immigration ratio. This specification corresponds to a first differences fixed effects estimation.

Vector Z_i contains time-invariant province attributes. These variables control for the fact that provinces with different levels of the time-invariant characteristics might have different growth trends in the house prices levels and in the stocks of foreign-born population. Given that region fixed effects (γ_r) are also included, the province attributes control for differential growth trends of the provinces around their common regional trend. The vector includes a set of geographical (coast dummy, length of the coastline, surface of the national parks) and weather (average temperature and average rain precipitation in January) characteristics and beginning of the period amenities (number of restaurants and bars in 2000, number of retails shops in 2000, number of doctors in 2000 and a comparative index of the importance of the tourism sector in 2000).

In order to control for the role of housing supply in driving both house price dynamics and immigration inflows I add time-invariant province housing controls. I include the share of developable land in 2000 and a proxy for land regulation (the share of municipalities in the province which had land use plans in 1999). More developable land and regulation could directly affect the rate of construction in the province. Different construction dynamics could drive immigrants to the province as it provides working opportunities and more affordable housing. I also account for beginning-of-the-period housing market characteristics that could affect prices and immigrant inflows. These are the proportion of rented properties and the proportion of empty dwellings, both in 2001. Provinces in which renting is more common can have different trends in the growth of supply and attract immigrants differently as these are more likely to rent[7]. Prices in provinces in which the proportion of unoccupied dwellings is larger could be growing at a slower rate because the supply of homes is effectively higher in these locations. When I use province fixed effects, I control for all time-invariant attributes, so Z_i drops.

[7] According to the 2007 National Immigration Survey (*Encuesta Nacional de Inmigrantes 2007* around 77% of immigrants rent the properties where they live (20% of them for free).

Vector $\Delta X_{i,t-2}$ contains time-varying characteristics (in changes). However, if the variables included in $X_{i,t-2}$ are "bad" controls – variables that could well be outcome variables in equation (1) (Angrist & Pischke, 2009) –, their inclusion would not reduce the omitted variable bias. To mitigate the effect of bad controls, I use a lag with respect to the immigration ratio, so the variables are measured one year before the immigrants locate in the province. Hence, I use the changes in the variables during $t-2$, one period before the inflows ($t-1$) and two periods before the change in prices (t). I control for the growth in gross domestic output (GDP) and the changes in the unemployment rate. Richer provinces which are growing faster and employing more people could be attracting more immigrants and thus could also have higher growth in house prices. I also control for changes on the number of credit establishments and on the share of saving banks because they could have affected the availability of credit, which might have pushed sale house prices up by influencing housing tenure decisions (Cuñat & Garicano, 2010).

If we believed there is substantial time dependence on both the immigration ratio and on the growth of house prices[8], lagging the controls one period with respect to the immigration ratio would not be enough to overcome the problem of bad controls. In this case, we would not be sure whether our control, for example GDP growth, was not directly determined by prospects of future changes in prices and immigration. Given that equation (1) controls for area and time fixed effects, the time-varying controls would only be eliminating the bias induced by annual changes in the province characteristics which are not captured by these fixed effects and which are affecting the change in prices and the change in immigration ratio at the same time. In other words, an annual shock in GDP in province which is not common to all provinces in Spain and which is different from the average growth in the period. These changes are likely to be small, so the reduction in the bias caused by the introduction of time-varying controls is likely to be small (which is the case, as explained in Section 3). The empirical results are very robust to the exclusion of $\Delta X_{i,t-2}$, and the estimated β coefficient is very similar with and without time-varying controls. The main results are obtained including time-varying controls, but the qualitative conclusions would remain unaltered if we excluded them.

To carry out the empirical analysis I used data from several sources. Immigrant and population data comes from the Municipal Register (*Padrón Municipal*), which keeps an annual record of all registered individuals in a municipality over time regardless of their legal immigration status. This is the most reliable source to study the impact of the size of immigration on area economic outcomes. House sale price data was obtained from Uriel-Jiménez et al. (2009), who provide an improved version of the Housing Department[9] Average Province House Price Index. Data on rental prices was obtained combining data from the Housing Department and the National Institute of Statistics. Finally, data on the controls comes from several sources including the National Institute of Statistics, the Housing Department, the 2001 Census and the *La Caixa* Spanish Economic Yearbook. Full details on the data sources is provided in Section A.1 in the Appendix. Table 1 provides summary statistics for these variables.

[8]The correlation between the immigration ratio and the lagged immigration ratio is 0.60, between changes/lagged changes in sale prices is 0.76 and changes/lagged changes in rental prices 0.50.

[9]The *Ministerio de Vivienda* was absorbed by the Ministry of Public Works *Ministerio de Fomento* in 2010.

2.2 Identifying the impact of immigrant demand on prices

Foreign-born population inflows, by increasing local population (Card, 2007), have a positive impact on the growth of house prices in the short run, due to increased demand. The economic intuition behind this is a simple demand-supply result. For a given level of population in a region, after a large immigration inflow, increased competition in housing markets forces both newly arrived immigrants and stayers to bid higher to buy or rent a property. For a given supply, a positive immigration inflow into a region could be translated into an increase in demand of housing services, thus pushing up house prices.

This is the intuition behind the model developed in Saiz (2007). An increases in foreign-born population in a given location raises total population and then pushes demand and prices in the short run. In the long run, we also need to take into account the effect of the changes on housing supply (construction), on housing consumption (density) and on the mobility of natives or previous residents (displacement) on prices. These three channels can be affected by immigration. Unless we directly control for these, an estimate of β in equation (1) would capture the combination of all these mechanisms. The use of instrumental variables and controls yields unbiased estimates of the long-run coefficient. In this section I propose a method to isolate the immigrant demand effect (short-run) from the long-run effect. To do this, we need to consider the three long-run adjustment mechanisms: housing density, housing stock and native mobility. I discuss each of these channels in detail below.

The first one is housing density. Table 2 displays the total population and the number of residential dwellings in the 50 provinces of study for every year between 2001 and 2010. The table shows the ratio of total (private) housing stock over total population[10]. Housing density remained relatively stable during the period. Even if we cannot draw definitive conclusions, mainly due to the lack of reliable yearly data on housing vacancies, these numbers suggest that, if anything, intensive construction together with large immigrant inflows kept the ratio of houses/population relatively constant (or even increased it)[11]. Directly including changes in house density in the regressions is problematic as both population and housing stocks are endogenous to house prices, given how little it changed over the period of analysis, it is unlikely that differences in housing density substantially affected house prices in the long run.

Table 2 also shows that a large number of new housing units were constructed between 2001 and 2010, almost 5 million (4.45 million if we take into account empty properties). We would expect that increased supply would, at least partially, mitigate the rise in prices caused by the increase in demand. House construction could also be correlated with immigration inflows if immigrants locate in areas where house construction is higher (due to job opportunities or more availability of housing). I account for the effect of housing supply on house prices in two ways. Firstly, in the estimation of (1) I include time-invariant province characteristics related to housing supply (geographical and housing market characteristics). As the model is estimated in first differences, these variables control for differential trends correlated to both immigration inflow and house price changes. Including time-varying supply changes in the estimation of equation (1) as an additional control is very problematic,

[10]Private housing in Spain represents around 90% of the total stock.

[11]I used empty dwelling data to recalculate the ratio in 2001 and 2011 using only occupied properties. Doing this, the ratio only increased 3 percentage points during the period (from 0.44 to 0.47), which is less than 0.3% per year.

because even if lagged, housing construction is a "bad" control given that construction is directly affected by immigration[12]. In Section 3.4, I include time-varying housing supply (log changes in the stock of residential dwellings) as an additional control and deal with the bad control problem using an IV strategy. When I control for housing supply, β does not capture the effect of immigration inflows on housing construction and thus the estimated coefficient is closer to the short-run immigrant demand effect.

The long-run effect of immigration inflows on any local economic outcomes also depends on what the literature has called "native displacement"[13]. Any estimated area effect of an inflow of immigrants would be the net result of changes in labour supply which stems from the foreign-born inflows plus any changes from natives relocation. The existence of native displacement has been used as an explanation for the lack of robust estimates of the impact of immigration on wages across US labour markets. The relocation of population across regions within a country would hinder the identification of any area-level effects, as the effects would dissipate throughout the country.

Numerous papers have investigated the relationship between immigration and natives displacement[14]. Most of them assume that immigrants displace natives from the regions they settle in (Card, 2001). However, as noted by Ottaviano & Peri (2013), this assumption relies on immigrants and natives being homogenous in labour market characteristics. Immigrants and natives of similar characteristics (for example low-skilled) would be competing for the same (low-paid) jobs, thus we can expect immigrants to have some displacement effects on natives within narrowly defined labour market. In contrast, recent papers (Peri & Sparber, 2009; Manacorda et al., 2012; Peri, 2012; Ottaviano et al., 2013) show that, if native and immigrants are imperfect substitutes and specialise in different tasks, immigrants can promote efficient task specialisation and have a productivity-enhancing effect, increasing native wages.

In a recent article, Peri & Sparber (2011) review the existing evidence of native displacement in the US and, using simulated data, they assess the relevance of the tests which have been previously performed in the literature. They conclude that, based on the existing methods, there is no robust evidence in favour of the existence of native displacement in the US. The authors suggest to test the native displacement hypothesis using a variation of the test proposed by Card (2007)[15]. We can use a "native ratio" in the left-hand-side of a specification similar to (1) and estimate:

$$\frac{natives\_inflow_{i,t}}{population_{i,t}} = \alpha \frac{FBinflow_{i,t}}{population_{i,t}} + \gamma_t + \gamma_r + \phi' Z_i + \delta' \Delta X_{i,t-1} + \varepsilon_{i,t} \tag{2}$$

where the variables in the right-hand-side denote the same elements as in equation (1). The sign and size of α captures the relationship between immigration inflows and native loca-

[12]In particular, González & Ortega (2013) find that immigrants have a positive causal impact on housing construction.

[13]This issue gained renewed interest after the publication of Borjas (2003). This paper criticized regional immigration studies of the labour market impacts of foreign-born inflows, claiming that the United States (US) works as a single labour market and that the existence of displacement hampers the estimation of regional effects.

[14]For example Card & DiNardo (2000), Card (2001), Hatton & Tani (2005), Borjas (2006), Card (2007), Cortés (2008) and Mocetti & Porello (2010).

[15]Card's specification uses population growth as the left-hand-side variable, which includes both natives and immigrants.

tion. If the estimated α is negative this would indicate that natives are leaving the regions where the immigrants locate: displacement would be complete if $\alpha = -1$ or less than proportional if $-1 < \alpha < 0$[16].

As in the case of labour markets, native mobility affects the estimation of the effect of immigration on local house prices. For a given population and housing stock in the area, immigration inflows would increase prices through increased housing demand in the short run. In the long run, native location decisions could be affected by the foreign-born inflows. Total housing demand would changes as consequence of total population changes, induced by immigrant and native spatial mobility. Thus, total changes in housing demand in the long run depend on how and if the natives relocate spatially after or at the same time as the immigrants arrive.

Previous authors have assumed that immigrants would displace natives in the housing markets in which they locate (Saiz, 2007; González & Ortega, 2013). As in the labour market case, this assumes that immigrant and natives are perfect substitutes. If native and immigrants compete for the same type of housing or jobs or natives dislike immigrants, an inflow of immigrants could displace natives from a given housing market. If immigrants are heterogeneous and complementary to natives they might mitigate the displacement effect or even co-locate in the same regions as natives. Some possible explanations are that immigrants specialise in different tasks than natives (Ottaviano & Peri, 2008; Ottaviano et al., 2013), so they do not compete for the same jobs, or that they consume different goods (Mazzolari & Neumark, 2011). Natives could co-locate with immigrants ($\alpha > 0$) if these are attractive to them because they provide cheaper labour-intense goods (as suggested by Cortés, 2008) or because they generate positive externalities on natives wages or rents (Ottaviano & Peri, 2006, 2007).

In his study of the effect of immigration on American rents, Saiz (2007) claims that if native outflows completely off-set immigration inflows, we would expect the increase in housing demand by immigrants to be completely balanced out by a decrease of housing demand from natives. The total (long-run) effect, and parameter β in equation (1), would be zero. If natives leave the area in greater numbers than immigrants enter, β would be negative because it would mean total housing demand (for a given supply) is decreasing. He suggests that finding a positive local effect of immigration in rents allows us to reject the complete native displacement in the labour market. Thus, the long-run coefficient provides indirect evidence of the relationship between immigrant inflows and native location.

As the aim of my paper is to estimate demand effect of immigration on prices, I directly estimate the effect of immigration inflows on native location decisions. If no causal relationship exists between immigration and native location, we can be quite certain that, conditional on supply, coefficient β in equation (1) is only capturing the effect (increased demand from) immigration on prices. In this case, the short and long-run impact would be the same, conditional on changes in housing supply. However, if a sizeable causal relationship exists, we need to be more cautious about the interpretation of the results[17]. In section 3.2,

[16] As before, the native or foreign-born inflow is defined as the change in numbers during t while population in t refers to the stock at the beginning of the year (January).

[17] In their report, Fernández-Huertas et al. (2009) provide some non-causal evidence on the relationship between immigration and native location. They find positive correlations although they claim that the size is negligible and cannot have any considerable impact on the estimation of local effects of immigration. González & Ortega (2013) also argue that native displacement would have no impact on the area level estimates. My results in Section 3.2 suggest differently.

I estimate the displacement hypothesis with Spanish data. I find substantial causal positive co-location of immigrants and natives. In section 3.3, I propose a methodology to pin down the immigration demand effect of immigration on prices (short-run effect). I estimate the effects using solely the variation on population growth which is due to exogenous location of foreign-born. I construct an instrument to predict the location of immigrants based on past ethnic networks. This is explained in the following section.

2.3 Instrumental variables strategy

As detailed in Section 2.1, the first step to achieve correct identification of the effects of immigration on prices is to include area fixed effects. These control for time-invariant unobservables at the region or province level correlated at the same time with the immigration ratio and the growth in prices. When we include province dummies, the fixed effect estimator exploits the variation in price changes and immigration inflows within provinces across time around the average changes during the period 2001-2010 (net of common national shocks as time dummies are included). We need a substantial amount of variation to be able to identify the β parameter precisely. Because our period of analysis covers both a period of high growth (2001-2007) and of economic crisis (2008-2010), there is a fair amount of variation in the data to be able to identify the parameter of interests using a demanding empirical specification (first differences and including year and area fixed effects and trends).

Nevertheless, even after including area dummies and trends, consistent estimation of β still requires the regressor of interest to be uncorrelated with the time-varying part of the error term (local time-varying shocks affecting price growth and immigrant location at the same time). If this is not the case, we would still be finding inconsistent estimates of the coefficient of interest. There is no prior on the direction of the bias. The estimated β would be upward biased if immigrants are going to provinces with positive shocks or unobserved better economic prospects, while it would be downward biased if, for some reason, immigrants locate in province in which prices are growing slower.

In order to infer causality on the relationship between immigration and house prices growth, I estimate equation (1) using an IV approach. I construct the instrument adopting the "shift-share" methodology, which has extensively been used before, for instance by Card (2001), Ottaviano & Peri (2006) or Peri (2009). Intuitively, the instrument is constructed by distributing year-to-year national variation of the variable of interest, –the "shift"–, using some rule, –the "share"–, to allocate this magnitude over space. In order to be a good instrument, both elements involved in the construction predicted regional yearly inflow must be orthogonal to local shocks related to the outcome variable, conditional on controls.

The most common immigration shift-share instrument exploits the fact that, to take advantage of social and economic established networks, immigrants tend to disproportionately locate in areas where immigrants from the same nationality or ethnicity have located before. To predict current location patterns, I use historical location patterns to construct the "share" rule. For the national yearly immigration inflow, I use different approaches (details below). By combining these, I compute predicted local immigrant inflows which are used to construct an IV for the immigration ratio.

The immigration ratio in equation (1) is defined as the immigration inflow during $t-1$ divided by total population (foreign-born plus natives) at the beginning of $t-1$. Denoting foreign-born population as $FBstock$ we can express the immigration ratio for province i as:

$$\frac{FBinflow_{i,t-1}}{population_{i,t-1}} = \frac{FBstock_{i,t} - FBstock_{i,t-1}}{FBstock_{i,t-1} + natives_{i,t-1}} = \frac{FBinflow_{i,t-1}}{FBstock_{i,t-1} + natives_{i,t-1}} \quad (3)$$

I construct the instrument following Peri (2009). I predict the stock of foreign-born $FBstock_{i,t-1}$ by year and nationality, and I use this prediction to calculate the immigration inflow of the numerator (calculated as change in the stock) and I also use it in denominator as part of total population.

To impute the yearly immigrant population in each province by nationality of origin, I first calculate, for each province and each nationality, the share of immigrants (over the total number in Spain) that were located in that province in the base year. I denote provinces with r[18], time periods with t, nationalities or ethnic groups with n (N being the total number of nationalities). The base year used as the reference year of "past" location patterns is 1991. A list of the nationalities used (119 groups) appears in Table A.1. It is defined as:

$$share^{n}_{i,1991} = \frac{FBstock^{n}_{i,1991}}{\sum_{r}^{R} FBstock^{n}_{r,1991}} = \frac{FBstock^{n}_{i,1991}}{FBstock^{n}_{Spain,1991}} \quad (4)$$

This share is the proportion of immigrants located in a particular province i over the total immigrants from the same nationality located in Spain in 1991.

To obtain yearly predictions of the number of immigrants by nationality n, I multiply expression (4) by the current national stock of immigrants of nationality n. This stock is calculated summing the number of foreign-born of that nationality in all provinces in Spain except i, in year t. I exclude province i from the summation to avoid using the stock I am trying to instrument for in the construction of the prediction of foreign-born. This stock is province-specific because for each province i we exclude its own immigrant stock:

$$FBstock^{n}_{Spain\_i,t} = \sum_{r \neq i}^{R} FBstock^{n}_{r,t} \quad (5)$$

The imputed foreign-born stock of a specific nationality n in province i at time t is thus calculated allocating yearly total national stocks (5) weighted by its historical share (4):

$$imp\_FBstock^{n}_{i,t} = \left(FBstock^{n}_{Spain\_i,t}\right) * share^{n}_{i,1991} \quad (6)$$

To calculate the imputed total (all nationalities) foreign-born stock in province i at time t, I sum (6) across nationalities:

$$imp\_FBstock_{i,t} = \sum_{n}^{N} \left(imp\_FBstock^{n}_{i,t}\right) \quad (7)$$

I use the change of the imputed total foreign-born population to calculate the imputed total inflow of immigrants (recall that population data is dated 1^{st} January). In order to obtain the first instrument for the immigration ratio as defined in expression (3), this imputed inflow is divided by the imputed population (imputed foreign-born plus native stock) in

[18] i is the specific province for which we are calculating the share and R is the 50 provinces in Spain

province i at the beginning of the period $t-1$. The instrument is constructed as follows:

$$IV1\_imm\_ratio_{i,t-1} = \frac{(imp\_FBstock_{i,t} - imp\_FBstock_{i,t-1})}{imp\_FBstock_{i,t-1} + natives_{i,t-1}} = \frac{imp\_FBinflow_{i,t-1}}{imp\_population_{i,t-1}} \quad (8)$$

For this instrument to be valid it has to be sufficiently correlated with the immigration ratio but uncorrelated with the local shocks that affect house price variations, conditional on the controls and area and time fixed effects. The relevance of the instrument can be assessed by the value of the F-statistics of the instrument in the first stage of the 2-stage-least-squares (2SLS) regressions, and additionally by using under-identification and weak identification tests.

The exogeneity of the instrument depends on several conditions. Given the way the predicted foreign-born stock (6) is constructed, we need that[19]:

1. The unobserved factors determining the location of immigrants in one province with respect to another in the base year (1991) is uncorrelated with the relative economic prospects of the two provinces during the period of analysis (2001-2010). In other words, immigrants in 1991 did not locate in Spain in the prospects of future relative growth during the 2001-2010 decade.
2. The only channel through which foreign-born geographical distribution in 1991 (second term in 6) affects current changes in house prices is through its influence on shaping the current immigrants location patterns, conditional on controls (exclusion restriction).
3. The total (national) flow of immigrants in a given year (first term in 6) has to be exogenous to specific province unobservable local shocks.

The choice of the base year determines the validity of conditions (1) and (2) but also the strength of the instrument. If the base year is very close to t, the instrument would be strong but its exogeneity can be questionable. If the base year is very far from t, it is more likely that the instrument is exogenous, but it may not be strong enough. The instrument is computed using data for the 1991 Census (foreign-born by country of nationality). In 1991 there was a sufficient stock of foreign-born in each province from each nationality to assure that our instrument is strong. Conditions (1) and (2) require that, conditional on controls, location choices in the base year are not driven by factors correlated to current changes in house prices (Saiz, 2007). These conditions are quite likely to be valid given that between 1991 and 2001 there was an important economic crisis (1992-1993) followed by economic recovery and growth (from 1997). It is unlikely that 1991 immigrants were able to predict these future shocks (or any other shock not captured in the province nor in the time fixed effects) ten years before our period of analysis starts.

The validity of condition (3) depends on the way the current national stock of immigrants of nationality n is constructed. First, to avoid using the inflow for that we want to instrument for in our prediction (just scaled by $share^{n}_{i,base}$), term (5) is defined as the total inflow of immigrants from nationality n coming to Spain at time t minus the inflow of immigrants from nationality n coming to province i at time t. Yet, we still require this term to be orthogonal to current local shocks. This assumption may be violated if location in provinces other than i is correlated with unobservable economic conditions of province i at a given

[19] Adapted from Cortés (2008).

point in time t. This is probable, specially if our spatial units are small and the economic conditions that attract immigrants are spatially correlated. For example, the economic condition in "economically big" provinces (like Madrid or Barcelona) could influence the total number of immigrants deciding to come to Spain, even if they end up locating somewhere else (based on their ethnic networks).

To solve this issue, a similar strategy to Saiz (2007) and Ortega & Peri (2009) is adopted. I compute the yearly predicted total stock and inflow by country of origin from the results of a gravity model which depends only on push factors. These predictions replace term (5) in equation (6). Details of this procedure are given in the Appendix (section A.2.1). Using the predictions from estimating equation (A.1) in (A.2) to obtain (A.3), I redefine the instrument as:

$$IV2\_imm\_ratio_{i,t-1} = \frac{imp\_pred\_FBinflow_{i,t-1}}{imp\_pred\_FBstock_{i,t-1} + natives_{i,t-1}} \tag{9}$$

However, there could still exist a final issue with the construction of (9) which might make the instrument invalid. Total population stock, which appears in the denominator, is the result of the sum of the foreign-born (imputed prediction) plus the natives. As discussed in Section 2.2, the number of total natives residing in a given province might depend on the number of foreign-born in the same location or on unobservables correlated with house price growth. For this reason, I use a similar shift-share strategy to compute a prediction for the location of natives $imp\_natives_{i,t-1}$, based on past location patterns. Details are given in the Appendix (section A.2.2). Replacing the actual native stock by its prediction in equation (9), I finally define the main instrument as:

$$IVmain\_imm\_ratio_{i,t-1} = \frac{imp\_pred\_FBinflow_{i,t-1}}{imp\_pred\_FBstock_{i,t-1} + imp\_natives_{i,t-1}} \tag{10}$$

I use $IVmain\_ratio_{i,t-1}$ in the main IV estimation results and different variations of it in the robustness checks.

2.4 Descriptive statistics

Table 1 contains summary statistics of all the variables for the 50 provinces over the 9 year period (2002–2010 for the prices and 2001–2009 for the population variables) i.e, for the all the 450 observations of the pooled panel. The mean total change in log (annual growth) for rental prices is 3.3%, while for sale prices is between 6.4 and 7.2%, depending on the source. Average provincial population growth is 1.25%, while the immigration ratio is 1.05%. The table also displays the summary statistics for the province time-invariant attributes and the time-varying controls. The final rows present summary statistics of the variables related to the supply of housing, which are used in Section 3.4.

[INSERT TABLE 1 HERE]

[INSERT FIGURE 1 HERE]

Figure 1 shows the evolution over time of the average stocks (top panel) and inflows (middle panel) of foreign-born and the share of foreign-born over population (bottom panel), between years 2001 and 2010 (long-differences). The share of foreign-born over total population rose almost 10 percentage points (from 4.8% to 14%) and the number of foreign-born increased 237% (from 1,950,452 on the 1^{st} January 2001 to 6,579,121 on the 1^{st} January 2010). In every year of the period, the inflows of foreign-born were over 100,000 persons, and the average for the period is over 650,000. The three spikes in the inflows in figure 2(b) correspond to three events described in Bertoli & Fernández-Huertas (2011): the 2000 law which allowed access to municipality public services when registered, the 2004 illegal immigration amnesty and the accession of Romania and Bulgaria to the EU in 2007.

Figures A.1 and A.2 in the Appendix display several maps which show the spatial distribution of the stocks of foreign-born, the changes in the stock between 2001 and 2010, the share of foreign-born at the beginning and the end of the period and the total growth of foreign-born population. The different colours represent the 5 quantiles of the values of the mapped variable. The provinces on the coast and Madrid are the ones which have higher levels of immigrants and have received most of the inflows. In 2001 the highest shares of immigrants were also concentrated on the coastal provinces and Madrid, but in 2010 many inner provinces have high shares of immigrants. This is confirmed in the bottom panel of Figure A.2, in which we can observe that the provinces with fewer immigrants in 2001 (top panel in A.1) have been among the ones which have experienced the highest growth rate in the amount of foreign-born population between 2001 and 2010.

[INSERT TABLE 2 HERE]

[INSERT FIGURE 2 HERE]

The top two panels of Figure 2 show the evolution of the average price in Spain for the period of analysis. During the "housing boom" years (2001-2008) housing sale prices rose around 110% (around 16% per year), followed by the construction sector crisis in which average prices decreased around 12% in two years. Rental prices also increased importantly during this period, around one point above the general consumer price index (CPI) during 2001-2010. During the whole period rents raised around 35%[20].

Construction of new dwellings also increased greatly during these years; between 2001 and 2010 5,312,245 new dwellings were built. The bottom panel of Figure 2 shows the evolution over time of the total and private housing stocks and Table 2 displays the total stock of dwellings in Spain during 2001-2010.

Figure A.3 in the Appendix shows the spatial distribution of the growth of prices and housing stock between 2001 and 2010. Sale prices increased substantially in all provinces. Some inner provinces (close to economic centers like Madrid, Barcelona, Sevilla or Valencia) experienced the highest growth rates in sale prices, probably due to the fact that prices were lower in those provinces in 2001. These seem to be also the locations in which construction has been concentrated, as shown in the bottom panel of the figure.

Most of the growth in prices and construction stopped in 2008 with the global economic crisis and between 2008 and 2010 prices have decreased and construction of new dwellings has virtually stopped, but their levels are still above the average values of the end of the 90s.

[20]Rental prices are based on the whole stock of properties available for renting (the already rented and the just rented), and are tightly connected to national CPIs, so the scope for growth is smaller than in the case of sale prices. Conversely, the changes on house prices depend solely on new properties sold. Therefore, one can expect the increase on sale prices to be much more volatile than that of rents.

3 Results

3.1 Effect of immigration on house prices

Table 3 presents the ordinary-least-squares (OLS) results of the estimation of equation (1), for rental prices (top panel) and for sale prices (bottom panel)[21]. These results are obtained using data on annual changes on prices during the period 2002-2010 and data on the immigration ratio lagged one period (2001-2009). The number of observations is 450 (50 provinces times 9 years). In all specifications the standard errors are clustered at the province level, to allow for arbitrary correlation of the idiosyncratic shocks for a given province across time, and are robust to heteroskedasticity. All specifications include time dummies to control for national shocks. Different columns show results for different specifications which diverge in the area dummies, the area trends and in the controls that are included (geography, amenities, housing supply and time-varying controls). Specifications range from more to less demanding in terms of data variation: OLS results (column 1) to first differences province fixed effects model (column 7).

[INSERT TABLE 3 HERE]

The first column of Table 3 shows the results obtained by OLS. This is the simple raw correlation of the two variables (conditional on year dummies). The coefficients are 0.346 for rental prices and 0.588 for sale prices. In columns 2 to 5 I include region (NUTS2) dummies (2) and, subsequently, province geography and amenity controls (3), province housing supply controls (4) and province time-varying controls, lagged two periods (5). The coefficient remains very similar for rental prices, but it increases for sale prices. In columns 6 I add region trends. The coefficients for both measures decrease. Column 7 presents the first differences province fixed effect estimates and includes time-varying province controls. This specification controls for province-specific time-invariant unobservables correlated with immigration inflows and house price growth at the same time. The coefficients are larger than in column 6, but not statistically different from the specification with region dummies and trends (column 5).

The estimated elasticities of the changes in the immigration ratio on log changes of rental prices presented in the top panel of Table 3 range from 0.35 to 0.28. These magnitudes imply that an increase of the share of foreign-born on the original population of a province of 10% would cause an increase on the rental prices between 3.5% and 2.8% the following year. These numbers are much smaller than previous estimates found by Saiz (2007), which are around 8-10%. A possible explanation is the legal environment in Spain, as compared to the US case. In Spain the standard legal tenancy agreement for privately let properties establishes that the annual increase on the rental price would of the same amount as the change in the national CPI (during a standard contract length of 3 to 5-year)[22]. Given the existing legal limits to its growth, we can expect the impact of immigration on rental prices to be much more limited in this context[23].

[21] For presentation purposes, I do not report the coefficients for the control variables and the fixed effects. These results are of course available upon request

[22] *Ley de Arrendamientos Urbanos 29/1994, del 24 de Noviembre de 1994.*

[23] Most of the variation in rental price growth over time stems from newly signed tenancy agreements. The smaller margin for adjustment of rents is illustrated in Figure 2. Rents grow less than prices in the boom years but they also slow down less after 2009.

The bottom panel of Table 3 displays the results for the effect of immigration on housing sale prices. As expected, The estimates are bigger than in the case of rental prices, and range between 0.6 to 1.18. A 10% increase in the ratio would imply an increase in the sale price of around 12% on the following year. As for the case of the effects on rental prices, these estimates are also below Saiz (2007) estimates.

In order to be able to infer causal effects from the estimates of coefficient β in equation (1), I implement the IV strategy explained in section 2.3 and use the immigration ratio as defined in equation (3) to capture the impact of immigration on prices. As explained in section 2.2, in this case β corresponds the long-run estimate and captures the combined impact of changes in demand, native location and in housing supply conditions[24]. Table 4 presents the results using the instrument as defined in equation (10). The predicted stocks and inflows of foreign-born by nationality used in the computation of $imp\_pred\_FBstock_{i,t-1}$ come from the gravity model estimation, in particular from columns 1 and 4 in Table A.2. Year 1991 is used as the base year for the predicted location patterns of both natives and foreign-born. Table 4 has the same structure as Table 3. As previously indicated, time fixed effects are included in all the specifications and the standard errors are clustered at the province level. The tables also display a test of the validity of the instruments (F-stat Kleibergen-Paap).

[INSERT TABLE 4 HERE]

The top panel of Table 4 presents the instrumental variable results for changes in rental prices and the bottom one, for changes in sale prices. As before, different columns show specifications with different sets of fixed effects and controls. The preferred specifications are those of columns 6 (which includes region fixed effects and trends) and column 7 (which includes province fixed effects). As expected, the standard errors increase when using instrumental variables. For both house prices, the estimated effect of immigration inflows is larger than in Table 3, in all specifications. This suggests that immigrants are moving, conditional on the controls and the area fixed effects, to provinces which are experiencing negative shocks in the growth of rental prices, and therefore the estimates of Table 3 are downward biased. In all cases the instrument is strong. The Kleibergen-Paap F-stat is always over 10 and above the Stock-Yogo critical values.

For rental prices, the estimates elasticity in column 6 is around 1.1% and the coefficient is insignificant in column 7. The standard errors of both estimates are very similar but the coefficient decreases substantially when province fixed effects are included. As noted above, this specification is very demanding and, given that rental price growth correlates highly with inflation, it is likely that the province trends absorb most of the variation. For sale prices the elasticities range between 2.2 (column 6) and 3% (column 7). Both coefficients are not statistically different from each other (I reject the null hypothesis that the coefficients are different with a p-value of 0.48). As rental prices are insignificant in column 7, without loss of generality for sale prices, in the following sections I consider the results of column 6 (region dummies and trends) as the baseline.

Previous research has found estimates of positive sign and similar magnitude. The coefficients for both house prices are very similar to the IV elasticities estimated by Saiz (2007) and also comparable to the estimates by González & Ortega (2013). As discussed above, the estimates obtained in this section do not take into account the relationship between immig-

[24]To the extent that the time-invariant house supply controls do not fully control for changes in supply.

rant and native location decisions or adjustment of housing supply. They correspond to the causal reduced-form long-run impact. In the next section, I propose and apply a strategy to obtain the short-run (demand) impact on prices. The role of housing supply is explored in section 3.4.

3.2 Effect of immigration on natives location

Section 2.2 discusses the issues related to the interpretation of the coefficient β when we do not take into account natives mobility. If immigrants do not affect native location choices, conditional on changes in supply[25], β captures the effect of increased immigrant demand. However, if immigrants have a substantial effect on native location decisions, the long-run β would be also affected by local changes in native demand. Depending on the sign of the effect, the short-run estimate would be above or below the long-run one. In order to uncover if this is the case, the first step is to study the relationship between natives and immigrant location decisions. In this Section, I estimate the causal relationship between native location and immigration inflows[26].

[INSERT TABLE 5 HERE]

Table 5 shows the results of the estimation of equation (2). Columns 1 to 3 show the results using regional dummies and province fixed effects and columns 4 to 6 repeat the estimations using instrumental variables (instrument 10). As the inflows of natives and immigrants are contemporaneous, the time-varying controls are lagged one period with respect to time t. I find positive significant impacts of immigrant inflow on native inflow in all specifications. As before, when instrumenting the immigration ratio, the coefficients increase substantially. My preferred estimates are those of columns 5 and 6. These estimates predict that a for each 100 immigrants locating in a given province in a given year, between 45 and 60 natives located in the same province.

These findings suggest that natives and immigrants are contemporaneously locating in the same provinces. As discussed in section 2.2, immigrants and natives might be heterogeneous in skills levels and tastes. Immigrants might be regarded as complementary to natives and thus positively affect their location decisions. Besides enhancing productivity through improved task specialisation, immigrants might have desirable attibutes for natives. For example, if natives like ethnic diversity or if immigrants are specializing in producing goods and services which are desirable for natives.

Finding substantial immigrant-native co-location is different from most estimates in the literature[27]. The IV results Table 5 control for endogenous co-location of natives and immigrants and thus the effect of immigrants on native location can be interpreted as causal. Fernández-Huertas et al. (2009) find a comparable result for a long-differences estimation

[25] In the results of Section 3.3, supply is already taken into account by including of time-invariant supply-related controls. As shown in Section 3.4, when I directly include house construction, the coefficients remain unchanged. For this reason, in the following I refer to the estimate that takes into account native mobility as the short-run effect without loss of generality.

[26] Other examples where the relationship between natives and immigration is explored are Card (2007), Stillman & Maré (2008) and Ortega & Verdugo (2011) and issues about its estimation are discussed in Peri & Sparber (2011)

[27] Most of the literature compares immigrants and natives which have comparable occupation or skill levels and thus expecting displacement is more correct in this context.

from population growth regressed on the immigration ratio for the period 2001-2008. Their prediction is of 11 natives for each 100 immigrants. They argue that this number is sufficiently small to have an impact on compensation or reinforcement of the impact of immigration inflows on the housing or the labour markets[28]. I find the size of the co-location to be substantially larger, suggesting that any impact of immigrants had on the housing markets would be amplified by the arrival of natives in the long run. I investigate this possibility in the following subsection.

3.3 Effect of immigration on house prices revisited

The estimates of the previous section suggest that the estimated coefficient β in equation (1) is captures the effects of increased demand from immigrants plus the increased demand from relocated natives. Here, I apply a methodology to isolate the effect that can be attributed to increases in immigration demand only. I use population changes as the main regressor in equation (1) and instrument it with expression (10). The instrument predicts exogenous foreign-born location, conditional on controls and fixed effects. By doing this, the population growth variable only captures the changes in population due to immigrant inflows and thus isolates the impact on house prices that stem from changes in foreign-born demand.

[INSERT TABLE 6 HERE]

The results of using this strategy are shown in Table 6. In this case, parameter β captures the causal effect of the growth in total population which is due to immigration inflow, because to estimate the coefficient I only use the variation in population growth which stems from exogenous changes in the immigration ratio. In this setting, we expect the parameter β to be smaller than the one found in column 1, because it would be only capturing the effect of immigration through their effect on population changes. Conditional on controls and fixed effects, and on housing supply in some cases, this procedure separates the effect of foreign-born demand from the total long-run effect of immigration on prices.

The structure of the table is the same as in previous sections. The coefficients show the estimates of regressing population growth in $t-1$ (defined as changes in total population during t divided by population stock at the beginning of t) on log change of house prices. I instrument population growth using $IVmain\_imm\_ratio_{i,t-1}$ as defined in (10). My preferred specifications are those of columns 6 and 7 which use the most demanding set of area fixed effects and trends. The estimated elasticities in these columns are around 0.7% for rental prices and between 1.4 and 2.1% for sale prices. The coefficients estimated in Table 4 are between 45 and 60% larger, in line with the co-location effect estimated in the native mobility results in Table 5. This suggests that, beyond the short-run impact, in the long-run, increased demand from natives has an additional impact on house prices. If we overlook the native-immigrant co-location, we largely overestimate the short-run impact of immigration.

The validity of these results relies on the assumption that, conditional on controls, the immigration instrument only affects prices via its effect on population changes. The instru-

[28]The difference in the results could be due to the fact that these authors do not use instrumental variables in their estimation and they use long differences between 2001 and 2008, so they only use 52 observations. In fact, when they perform the estimation at the municipality level, using over 8,000 observations, they find very similar estimates to mine.

ment only aims to predict the location of immigrants, not natives. If the instrument directly affects native location, this assumption would be invalidated. In order for the strategy to be valid, I need to rely on the use of controls and on the fact that in the construction of IV (10) I use a prediction of native location in the denominator. Since the difference between the estimates of Tables 4 and 6 is very similar to the co-location effect found in the previous section, it is quite likely that the threats to the identification assumption are not of major relevance.

3.4 The role of housing supply

Depending on the level of housing supply elasticity, increases in housing demand following the immigrant inflows would have different effects on house prices. In this Section, I explore the role played by housing supply on potentially mitigating the increase in prices[29]. In the previous results, the role of housing supply it is already partially taken into account when I include time-invariant controls in the models to control for differential price growth trends based on some attributes of the provinces related to supply (proportion of rented properties in 2001, proportion of empty houses in 2001, share of developable land in 2000 and regulatory index in 1999). In this section, I directly investigate the mitigating impact that supply changes might have on house prices by including the growth in the stock of (private) dwellings as an additional control variable.

[INSERT TABLE 7 HERE]

The results are presented in Table 7. I focus on the specification that includes region fixed effects and trends, but the results using province fixed effects are very similar. As my aim is to estimate the impact of immigration demand changes, I present the results using population growth (due to immigration inflows) and not the immigration ratio, instrumented as explained in section 3.3. Column 1 shows the results using region dummies and trends and all the controls except the supply time-invariant controls. In column 2 I introduce these variables to replicate the results from column 6 in Table 6. The coefficient of population growth barely changes when adding these controls. In Column 3 I include the time-varying supply control (log change housing stock in $t-2$). Now the coefficient of population growth captures the impact of changes in immigrant demand conditional on housing supply changes. The coefficient of population growth increases, suggesting that, if we not take supply changes into account, it is downward biased. The coefficient for housing construction is negative, suggesting that larger increases in supply yield lower increases in house price growth, conditional on changes in immigrant demand. However, it is insignificant. In column 4 I explore if the insignificance of the time-varying housing supply coefficient is due to lack of variation when controlling for time-invariant supply characteristics so I exclude these from the specification. The results are very similar to those of column 3 and suggest that housing supply growth has not direct effect on house price changes conditional on population growth.

Using the growth of housing stock as an additional control variable in Table 7 is highly problematic. Even if lagged two periods with respect to the outcome variable, and one period with respect to the population growth, this variable is likely to be endogenous. Un-

[29] This analysis applies mostly to the effect on sale prices. The impact of housing construction on rental prices is less straightforward, even if dwellings must always be bought before before they go to the rental market.

observable province trends could be affecting both the growth in prices and the construction of new housing units, particularly in a context of housing market boom where there were expectations on high capital gains. In periods of high price increases, it is likely that more housing units are constructed because developers expect house prices to rise even further in the future[30]. As it is likely that growth in house prices and changes in housing supply are both driven by the same underlying unobservable factors, I construct an instrument for this for the stock of private housing in a given province. I use a similar instrument as in Saiz (2010). I construct a predicted stock of housing combining the share of developable land in the provinces in 2000 (for the initial spatial distribution) and the changes in total annual national stock (excluding the own province changes). In columns 5 and 6, I drop the share of developable land from the supply time-invariant attributes controls and use the two instruments (for immigration and for construction). Both instruments are strong. The coefficient for changes in housing stock remains insignificant, close to zero and precisely estimated suggest that the increase in supply through construction of new dwellings did not have a causal impact on the mitigation of the growth of house prices.

A potential explanation for the lack of independent impact of increases in supply after controlling for changes in immigrant demand could be that even if a large number of new dwellings were constructed, they were not built in the places where immigrants wanted or could afford to live. Moreover, during most of the period of analysis Spain was experiencing a "housing boom" where house price growth might have not responded to economic fundamentals but to irrational expectations. Low interest rates and easy access to credit might have fueled housing demand. Conditioning for these factors, my results suggest that price growth dynamics during this period was not relieved by the high level of housing construction.

3.5 Robustness checks

In this Section, I present the robustness checks carried out in order to check the validity of the results of Section 3.3. As no significant effect of time-varying housing supply was found, I compare the results with the baseline estimates of column 6 in Table 6. These are an elasticity of 0.7% for rental prices and 1.38% for sale prices.

[INSERT TABLE 8 HERE]

Table 8 presents the robustness check results. Column 1 shows the results when I use immigrants aged 16-65 (working-age population) instead of total immigrants. As expected, the coefficients increase because this is the fraction of population with purchasing power. Column 2 uses contemporary inflows as opposed to lagged immigration inflows. The coefficient for rental prices is very similar to the baseline estimate (0.71%), but the coefficient for sale prices is now insignificant. This result is consistent with the fact that recently arrived immigrants are more likely to rent until they are in the country for a few periods of time and they can save and access credit to purchase a property.

[30]Immigrants can also have a direct impact on dwelling construction, so the growth of housing stock is a "bad" control by definition. Table A.3 in the Appendix shows the results of regressing the immigration ratio or the population growth on change in housing stock. The coefficients in the most demanding specification –column 7– show a substantial significant positive impact of immigration on housing construction. González & Ortega (2013) also find results that suggest this.

In the construction of the immigration instrument I use a prediction of inflow and stock of immigrants by year and country of origin (the "shift"). The baseline results are obtained constructing the instrument from the predictions of columns 1 and 4 of Table A.2, which uses country and year fixed effects (PR1). The inclusion of country and year fixed effects could be considered "problematic" if these are correlated with bilateral shocks. For this reason, I calculated two additional immigrant by country-year predictions. PR11 includes country fixed effects but no year dummies. PR2 includes year dummies but no country fixed effects. Instead, I use nationality group fixed effects (see Table A.1) and include country bilateral time-invariant characteristics. The coefficients estimated in columns 3 and 4 of Table 8 are very similar to the baseline results even if the instrument is weaker.

In column 5 I use an additional instrument to be able to test the exogeneity of the instrument by means of the Hansen J statistic. I constructed a second shift-share instrument using alternative shift and share definitions in the computation of the predicted inflow to a given province in a given year of each nationality (equation 6). It is defined as the product of the national inflow of a given nationality to Italy (shift) times the inverse distance between the country centroid to Madrid plus the euclidian distance from province i to Madrid (share)[31]. I use inverse distance to Spain to compute the prediction, inspired by Ottaviano & Peri (2006), who use the distance from the closest gateway into the US in the construction of the instruments for immigration[32]. I use the inflow from Italy because this country is not "too far" from Spain in terms of distance, culture and economic conditions. Italy had high rates of immigration during these years (Buonanno et al., 2011) and it is one of the few countries in the "OECD International Migration Statistics" dataset for which we have fewer missing values. This instrument is not strong enough by itself (the F-stat of the first stage is around 4.7) but, as it is based on different variation sources as our main instrument, it is sufficiently good to be used as a second instrument to allow for the testing of the orthogonality conditions. The last row of column 7 shows the p-value of the Hansen test which confirms the exogeneity of our instrument. The coefficients are very similar to the baseline estimates.

Finally, columns 6 and 7 check the robustness of the sale prices elasticity to using different data sources for the sale prices. I use the house price data provided by the Housing Department (now *Ministerio de Fomento*). This source provides the province average sale price at the end of four quarters (winter, spring, summer and autumn). In column 8 I use the average at the end of the 2^{nd} quarter and in column 9 I use the average of the four quarters. The coefficients are slightly larger that the baseline results but very similar.

4 Conclusions

This paper proposes a methodology to identify the (short-run) impact of changes in immigrant demand on house prices. According to Saiz (2007), the long-run impact of immigration

[31]The data sources for the construction of this instrument are the "OECD International Migration Statistics" for data on the stock and inflows of foreign-born by nationality during 2001-2008 and the CEPII gravity database for the distance from the country to Spain. The internal distance of Madrid is calculated as $(2/3) * \sqrt{(area/\pi)}$.

[32]I also computed distance to the closest port of entry, using the 5 airports which according to the Spanish Airports Regulator data on airport traffic in 2000 as the ports. According to the Spanish National Statistical Institute 63% of the immigrants between 1998 and 2010 arrived in Spain by plane. The results are very similar, mainly due to the fact that the majority of entries are through the Madrid airport.

on housing markets would be the combination of their impact on housing demand, their impact on native mobility and their impact on housing supply (construction and density). In this paper, I pin down the direct impact of immigrant demand on prices from their impact on native mobility and housing supply. I estimate the impact of immigration on native mobility and I find a strong causal positive relationship between immigrant and native location. This suggests that estimates that do not take this fact into account overestimate the demand effect of immigration on prices. Using population growth as the main regressor and instrumenting it with a prediction of the immigration inflows and stocks based on exogenous variation allows me to exploit only the variation in population growth which stems from immigration. I argue that, conditional on controls, this captures the impact of immigrant demand on prices. I find that using this approach yields substantially smaller short-run elasticities. The size of the reduction is in line with the impact of immigrants on native mobility. When I additionally control for the impact of changes in housing supply on the estimates, I find very similar results.

In this paper, I provide estimates for the short-run and long-run impact of immigration on prices and for the impact of immigration on native mobility. My findings validate the proposed strategy to pin down the effect of immigrant demand increases in on prices. They point towards the existence of a sizeable bias in previous short-run estimates because they disregard the causal relationship between immigrants and native location(for example Sosvilla-Rivero, 2008; González & Ortega, 2009; García-Montalvo, 2010; González & Ortega, 2013, for the Spanish case) or, at least, they suggest a misinterpretation of the coefficient. My methodology could be applied to other contexts and outcome variables.

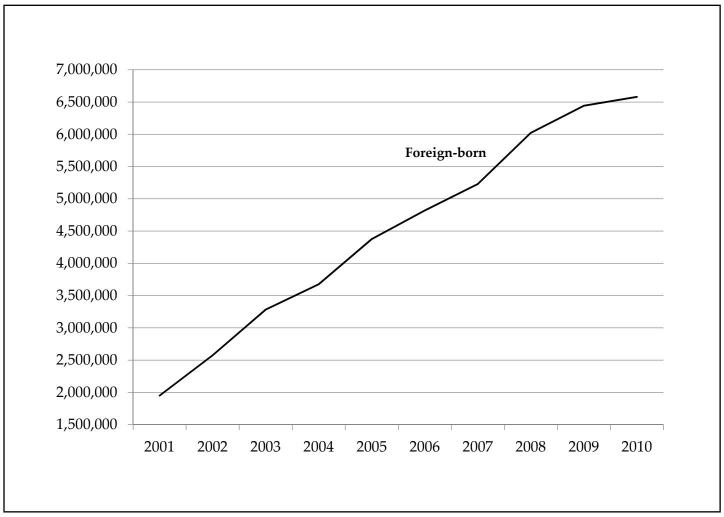
During the period of analysis, 2002 to 2010, sale prices grew an annual average of 7.1% and rental prices grew an average of 3.3% . The average annual population growth during the period was 1.25% while the average immigration ratio was 1.05%. Between January 2001 and January 2010, total population in Spain increased 14.4%, while the total change in foreign-born with respect to initial population was 11.3%. In the most demanding significant results of Table 6, I find an elasticity of housing sale prices with respect to population growth between 1.38 and 2.1 and an elasticity of rental prices of 0.7. Thus, my findings suggest that immigration, via its impact on population growth, caused an average annual growth in sale prices between 1.7 and 2.5% of around 0.9% in rents. This is around half of the total average annual growth of sale prices and around one eighth of the total average annual growth of rental prices. These proportions are quite substantial. The relative importance of immigration on house price growth is even higher if we use the elasticities of prices with respect to the immigration ratio (e.g. long-run impact), as these are larger.

Given the magnitude of the immigration inflows and price increases experienced during the period of analysis described in Section 2.4, these proportions could in fact be quite reasonable. Actually, approximately two thirds of the growth in sale prices and seven eighths of the growth of rental prices would be explained by other factors than immigration, like supply rigidity, speculative demand, empty dwellings, or changes in the cost of construction (taxes, land prices, materials), etc. In conclusion, there is still an important part of the growth of house prices which is not explained by immigration.

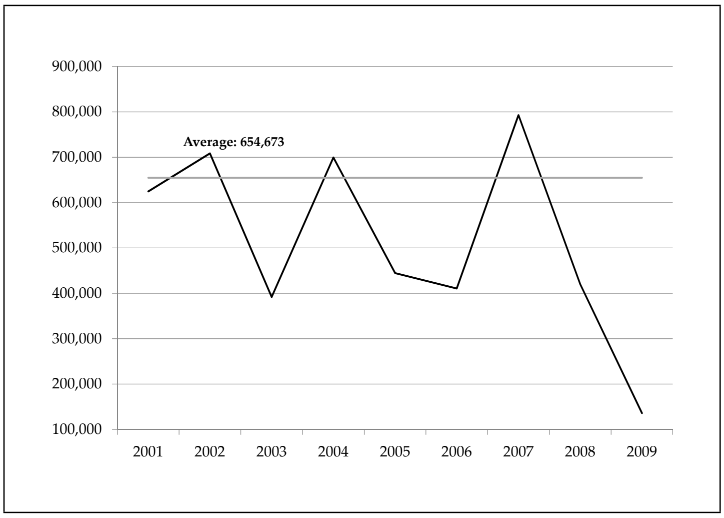
My results highlight the importance of using a theoretical framework to correctly interpret the coefficients. If immigrants causally affect native location decisions, policy makers should take this into account when predicting population changes in different areas. Local demand (of housing, but also of other goods) and labour markets would be differently affected by immigration inflows in the short and in the long run depending on the response of natives and supply. As a consequence, it is essential to take all three channels into account when investigating the local economic effects of increases of foreign-born population. By disentangling the different channels through which immigration affects house prices, in this paper I provide not only the size of the causal effect but also a meaningful economic interpretation of the estimates.

Tables and figures

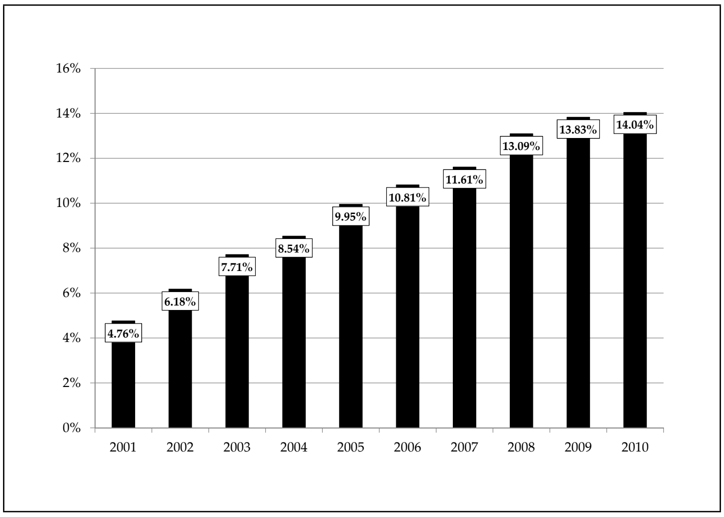
Figure 1: Immigration stocks and inflows 2001-2010



(a) Foreign-born stocks

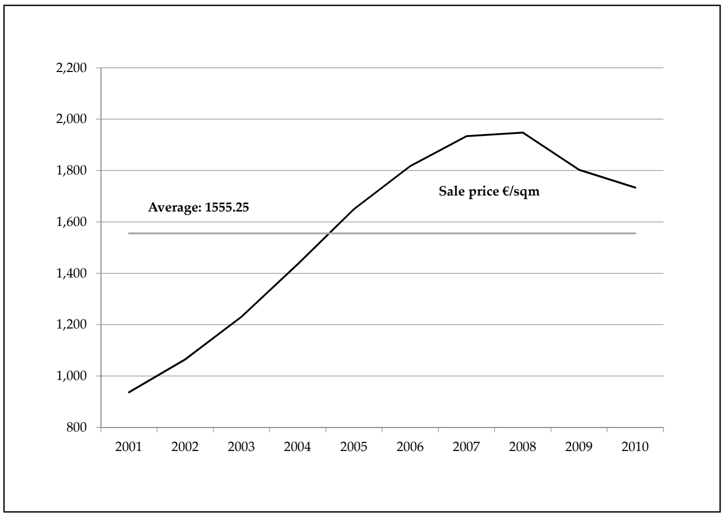


(b) Foreign-born changes

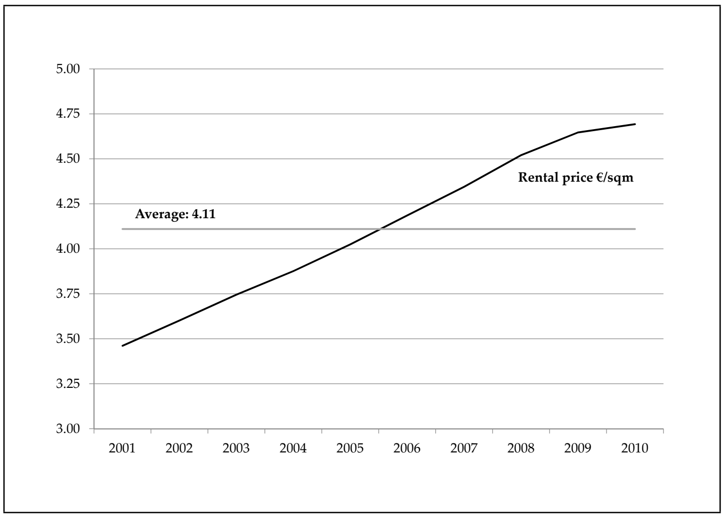


(c) Percentage of foreign-born over population

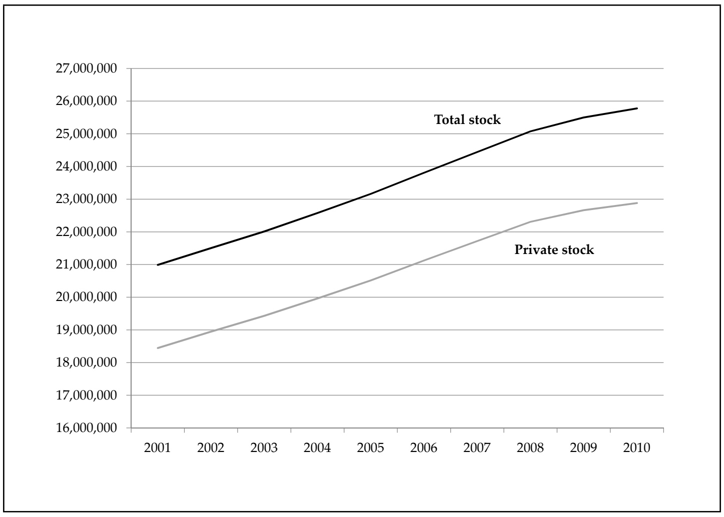
Figure 2: House price growth and dwelling construction 2001-2010



(a) Growth of sale prices



(b) Growth of rental prices



(c) Growth of dwelling stocks

Table 1: Summary statistics

Variables	*Time period*	*Mean*	*Std. Dev.*	*Min*	*Max*
Change of log rental prices (per sq m)	2002/2010	0.0333	0.0152	-0.0053	0.0831
Change of log house prices (per sq m) - IVIE	2002/2010	0.0715	0.0849	-0.1437	0.2765
Change of log house prices (per sq m) - Housing Dpt average	2002/2010	0.0638	0.0798	-0.1437	0.2542
Change of log house prices (per sq m) - Housing Dpt 2nd quarter	2002/2010	0.0654	0.0845	-0.1682	0.3192
Inflow of population in t-1 over population beginning of t-1	2001/2009	0.0125	0.0127	-0.0100	0.0612
Inflow of immigrants in t-1 over population beginning of t-1	2001/2009	0.0105	0.0083	-0.0054	0.0456
Inflow of natives in t-1 over population beginning of t-1	2001/2009	0.0021	0.0065	-0.0168	0.0313
Inflow of population in t-1 over population beginning of t-1 (working-age)	2001/2009	0.0091	0.0100	-0.0083	0.0500
Inflow of immigrants in t-1 over population beginning of t-1 (working-age)	2001/2009	0.0080	0.0068	-0.0062	0.0398
Inflow of natives in t-1 over population beginning of t-1 (working-age)	2001/2009	0.0011	0.0049	-0.0091	0.0244
Log of the surface of natural parks (in sq kms)	Time-invariant	11.0181	1.1307	8.5007	12.6216
Coast dummy	Time-invariant	0.4400	0.4967	0	1
Length of coastline (in kms)	Time-invariant	156.8200	281.9197	0	1428
Log of hours of average temperature (January)	Time-invariant	1.9595	0.4622	1.0784	2.9025
Log of mm of rain precipitation (January)	Time-invariant	3.7124	0.5833	2.7770	5.3642
Log of number of retails shops	2000	9.4060	0.7777	7.7450	11.5112
Log of number of restaurants and bars	2000	8.1272	0.9006	5.6971	10.3467
Importance of tourism sector - comparative index	2000	19.9704	32.0277	1.2700	163.2900
Log of the number of doctors	2000	7.5119	1.0929	3.3322	10.2324
Percentage of rented properties over total	2001	0.1027	0.0363	0.0578	0.2116
Percentage of empty homes over total	2001	0.1485	0.0243	0.0846	0.1913
Share of developable land (Corine)	2000	0.8556	0.0732	0.4652	0.9609
Regulatory index (land use plans)	1999	0.5650	0.2736	0.0927	1
Change of log of GDP	2000/2008	0.0685	0.0231	-0.0087	0.1365
Change of log of unemployment rate	2000/2008	-0.0049	0.0244	-0.1343	0.0954
Change of log of number of credit establishments	2000/2008	0.0110	0.0277	-0.0728	0.0972
Change of percentage of savings banks	2000/2008	0.0090	0.0104	-0.0465	0.0494
Log of change of stock of private dwellings	2000/2008	0.0261	0.0121	0.0067	0.0935

Table 2: Residential density in Spain 2001-2010

Year	**Population**	**Housing stock**	**Stock over population**
2001	40,972,359	20,988,378	0.512
2002	41,692,558	21,504,402	0.516
2003	42,573,670	22,010,730	0.517
2004	43,055,014	22,573,867	0.524
2005	43,967,766	23,160,019	0.527
2006	44,566,232	23,808,108	0.534
2007	45,054,694	24,443,903	0.543
2008	46,008,985	25,076,820	0.545
2009	46,593,673	25,504,442	0.547
2010	46,864,418	25,783,555	0.550

Source: Department of Housing

Table 3: Long-run estimates – OLS/FE results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change log rental prices							
Immigration ratio (t-1)	0.346***	0.303**	0.418***	0.389***	0.366***	0.331**	0.284**
	(0.129)	(0.128)	(0.128)	(0.118)	(0.113)	(0.130)	(0.117)
Change log sale prices							
Immigration ratio (t-1)	0.588**	0.720**	0.882***	1.007***	1.101***	0.624**	1.184***
	(0.280)	(0.307)	(0.322)	(0.331)	(0.314)	(0.242)	(0.405)
Observations	450	450	450	450	450	450	450
Region dummies		NUTS2	NUTS2	NUTS2	NUTS2	NUTS2	NUTS3
Geography/Amenities			✔	✔	✔	✔	
Supply controls				✔	✔	✔	
Time-varying controls					✔	✔	✔
Region trends						NUTS2	

Notes: The dependent variable is the change of log province house rental prices (top panel) and sale prices (bottom panel), between t/t-1. t=2002/2010. Significance levels: * $p<0.05$, ** $p<0.01$, *** $p<0.001$. All specifications include year dummies. Clustered (province) standard errors in parenthesis. NUTS2 corresponds to regions (CCAA) and NUTS3 corresponds to provinces. Geography/Amenities province controls include coast dummy, log hours of sunshine, log rain precipitation, log surface of natural parks, log number of retails shops in 2000, log number of restaurants and bars in 2000, log number of doctors in 2000 and index of the importance of the tourism sector in 2000. Supply (time-invariant) controls include proportion of rented properties in 2001, proportion of empty houses in 2001, share of developable land in 2000 and regulatory index in 1999. Time-varying controls include change log GDP, change log number of credit establishments and change of percentage of saving banks.

Table 4: Long-run estimates – IV results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change log rental prices							
Immigration ratio (t-1)	0.665**	0.924**	0.974**	0.998***	1.010**	1.113**	0.151
	(0.291)	(0.387)	(0.393)	(0.384)	(0.414)	(0.469)	(0.472)
Change log sale prices							
Immigration ratio (t-1)	-0.322	0.803	2.131***	2.223***	2.430***	2.199***	3.035***
	(0.766)	(0.505)	(0.700)	(0.630)	(0.685)	(0.670)	(0.997)
Observations	450	450	450	450	450	450	450
Region dummies		NUTS2	NUTS2	NUTS2	NUTS2	NUTS2	NUTS3
Geography/Amenities			✔	✔	✔	✔	
Supply controls				✔	✔	✔	
Time-varying controls					✔	✔	✔
Region trends						NUTS2	
Test weak identification	19.01	26.51	24.50	28.36	25.94	28.24	14.70

Notes: The dependent variable is the change of log province house rental prices (top panel) and sale prices (bottom panel), between t/t-1. t=2002/2010. Significance levels: * $p<0.05$, ** $p<0.01$, *** $p<0.001$. All specifications include year dummies. Clustered (province) standard errors in parenthesis. NUTS2 corresponds to regions (CCAA) and NUTS3 corresponds to provinces. Geography/Amenities province controls include coast dummy, log hours of sunshine, log rain precipitation, log surface of natural parks, log number of retails shops in 2000, log number of restaurants and bars in 2000, log number of doctors in 2000 and index of the importance of the tourism sector in 2000. Supply (time-invariant) controls include proportion of rented properties in 2001, proportion of empty houses in 2001, share of developable land in 2000 and regulatory index in 1999. Time-varying controls include change log GDP, change log number of credit establishments and change of percentage of saving banks. The weak identification test corresponds to the F-stat Kleibergen-Paap. In all cases it is above the Stock-Yogo critical values.

Table 5: Native mobility test – OLS and IV results

	(1)	(2)	(3)	(4)	(5)	(6)
Native ratio						
Immigration ratio (t)	0.335***	0.349***	0.182***	0.593***	0.599***	0.454***
	(0.053)	(0.065)	(0.038)	(0.175)	(0.201)	(0.112)
Observations	450	450	450	450	450	450
Region dummies	NUTS2	NUTS2	NUTS2	NUTS3	NUTS2	NUTS3
Geography/Amenities	✔	✔		✔	✔	
Supply controls	✔	✔		✔	✔	
Time-varying controls	✔	✔	✔	✔	✔	✔
Region trends		NUTS2			NUTS2	
Test weak identification				25.94	28.24	14.70

Notes: The dependent variable is the native immigration ratio between t/t-1. t=2001/2009. Significance levels: * $p<0.05$, ** $p<0.01$, *** $p<0.001$. All specifications include year dummies. Clustered (province) standard errors in parenthesis. NUTS2 corresponds to regions (CCAA) and NUTS3 corresponds to provinces. Geography/Amenities province controls include coast dummy, log hours of sunshine, log rain precipitation, log surface of natural parks, log number of retails shops in 2000, log number of restaurants and bars in 2000, log number of doctors in 2000 and index of the importance of the tourism sector in 2000. Supply (time-invariant) controls include proportion of rented properties in 2001, proportion of empty houses in 2001, share of developable land in 2000 and regulatory index in 1999. Time-varying controls include change log GDP, change log number of credit establishments and change of percentage of saving banks. The weak identification test corresponds to the F-stat Kleibergen-Paap. In all cases it is above the Stock-Yogo critical values.

Table 6: Short-run estimates – IV results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change log rental prices							
Population growth (t-1)	0.429**	0.584**	0.570***	0.613***	0.634**	0.696**	0.104
	(0.170)	(0.233)	(0.218)	(0.227)	(0.250)	(0.291)	(0.323)
Change log sale prices							
Population growth (t-1)	-0.208	0.508	1.248***	1.365***	1.525***	1.375***	2.088***
	(0.505)	(0.317)	(0.388)	(0.359)	(0.383)	(0.354)	(0.602)
Observations	450	450	450	450	450	450	450
Region dummies		NUTS2	NUTS2	NUTS2	NUTS2	NUTS2	NUTS3
Geography/Amenities			✔	✔	✔	✔	
Supply controls				✔	✔	✔	
Time-varying controls					✔	✔	✔
Region trends						NUTS2	
Test weak identification	24.96	24.00	30.12	32.73	32.46	30.63	26.75

Notes: The dependent variable is the change of log province house rental prices (top panel) and sale prices (bottom panel), between t/t-1. t=2002/2010. Significance levels: * p<0.05, ** p<0.01, *** p<0.001. All specifications include year dummies. Clustered (province) standard errors in parenthesis. NUTS2 corresponds to regions (CCAA) and NUTS3 corresponds to provinces. Geography/Amenities province controls include coast dummy, log hours of sunshine, log rain precipitation, log surface of natural parks, log number of retails shops in 2000, log number of restaurants and bars in 2000, log number of doctors in 2000 and index of the importance of the tourism sector in 2000. Supply (time-invariant) controls include proportion of rented properties in 2001, proportion of empty houses in 2001, share of developable land in 2000 and regulatory index in 1999. Time-varying controls include change log GDP, change log number of credit establishments and change of percentage of saving banks. The weak identification test corresponds to the F-stat Kleibergen-Paap. In all cases it is above the Stock-Yogo critical values.

Table 7: Short-run estimates with supply – OLS and IV results

	(1)	(2)	(3)	(4)	(5)	(6)
Change log rental prices						
Population growth (t-1)	0.629**	0.696**	0.787**	0.716*	0.694*	0.675*
	(0.295)	(0.291)	(0.374)	(0.416)	(0.355)	(0.379)
Log change housing stock (t-2)			-0.111	-0.084	-0.026	-0.044
			(0.127)	(0.139)	(0.122)	(0.125)
Change log sale prices						
Population growth (t-1)	1.301***	1.375***	1.614***	1.573**	1.633***	1.441**
	(0.399)	(0.354)	(0.594)	(0.721)	(0.601)	(0.659)
Log change housing stock (t-2)			-0.290	-0.261	-0.139	-0.135
			(0.442)	(0.456)	(0.475)	(0.477)
Observations	450	450	450	450	450	450
NUTS2 FE and trends	✔	✔	✔	✔	✔	✔
Geography/Amenities	✔	✔	✔	✔	✔	✔
Supply controls		✔	✔		✔	
Time-varying controls	✔	✔	✔	✔	✔	✔
Time-varying supply			✔	✔	✔	✔
Weak identification immigration	32.29	30.63	21.05	15.47	11.44	12.55
Weak identification supply					40.87	43.42

Notes: The dependent variable is the change of log province house rental prices (top panel) and sale prices (bottom panel), between t/t-1. t=2002/2010. Significance levels: * $p<0.05$, ** $p<0.01$, *** $p<0.001$. All specifications include year dummies. Clustered (province) standard errors in parenthesis. NUTS2 corresponds to regions (CCAA) and NUTS3 corresponds to provinces. Housing stock corresponds refers to total private housing units in the province in year *t*. Geography/Amenities province controls include coast dummy, log hours of sunshine, log rain precipitation, log surface of natural parks, log number of retails shops in 2000, log number of restaurants and bars in 2000, log number of doctors in 2000 and index of the importance of the tourism sector in 2000. Supply (time-invariant) controls include proportion of rented properties in 2001, proportion of empty houses in 2001, share of developable land in 2000 and regulatory index in 1999. Time-varying controls include change log GDP, change log number of credit establishments and change of percentage of saving banks. The weak identification test corresponds to the F-stat Kleibergen-Paap. In all cases it is above the Stock-Yogo critical values.

Table 8: Short-run estimates with supply – Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change log rental prices							
Population growth (t-1)	0.964**	0.710***	0.878**	0.734**	0.623**		
	(0.386)	[0.267]	[0.358]	[0.323]	[0.265]		
Change log sale prices							
Population growth (t-1)	1.905***	0.578	1.012**	0.956**	1.125***	1.713***	1.409***
	(0.494)	[0.772]	[0.397]	[0.406]	[0.357]	[0.549]	[0.399]
Test	WAP	Contemp	PR11	PR2	2IVs	HD2ndQ	HDAver
Observations	450	400/450	450	450	400	450	450
NUTS2 FE and trends	✔	✔	✔	✔	✔	✔	✔
All controls	✔	✔	✔	✔	✔	✔	✔
Test weak identification	34.74	28.98	13.04	17.04	16.38	30.63	30.63
Hansen test					0.54		

Notes: The dependent variable is the change of log province house rental prices (top panel) and sale prices (bottom panel), between t/t-1. t=2002/2010. Significance levels: * p<0.05, ** p<0.01, *** p<0.001. All specifications include year dummies. Clustered (province) standard errors in parenthesis. NUTS2 corresponds to regions (CCAA) and NUTS3 corresponds to provinces. Geography/Amenities province controls include coast dummy, log hours of sunshine, log rain precipitation, log surface of natural parks, log number of retails shops in 2000, log number of restaurants and bars in 2000, log number of doctors in 2000 and index of the importance of the tourism sector in 2000. Supply (time-invariant) controls include proportion of rented properties in 2001, proportion of empty houses in 2001, share of developable land in 2000 and regulatory index in 1999. Time-varying controls include change log GDP, change log number of credit establishments and change of percentage of saving banks. The weak identification test corresponds to the F-stat Kleibergen-Paap. In all cases it is above the Stock-Yogo critical values.

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Appendix

A.1 Data sources

The spatial unit of analysis is the province (NUTS3). I exclude Ceuta and Melilla because of their particular history and lack of data.

I use data on total, foreign-born and native population from the Spanish population municipality registers (yearly). The number of residents in a municipality is registered by the city councils in an administrative register called the Municipal Register (*Padrón Municipal*). An annual record of the municipal register, dated on the 1st January of each year, is obtained from its updates. This dataset provides precise information on the population figures, on a yearly basis. It is also more accurate than other population sources because it collects the total number of foreign-born residents even if they are illegal immigrants[33]. Immigrants are identified using foreign-born population (by country of birth), not nationality. The figures are dates at the beginning of the natural year (1st of January).

Even if this data is available since 1996, I focus on the period 2001-2010 for several reasons. First, Fernández-Huertas et al. (2009) and Bertoli et al. (2011) recommend the use of population data coming from the population registers (*Padrón*) from 2001 because its reliability improves after that year. Secondly, it is after 2001 that the stock of foreign-born starts increasing significantly. It could be the case that most entries started in 2001 or that the stocks started to be correctly measured after that year. To mitigate measurement error I then focus on 2001-2010 for the main analysis. Thirdly, the rental prices data is only available from 2001 so focusing on this time period allows us to compare the rental and sale prices results over the same time period. Finally, using the housing boom and bust allows adoption of a demanding estimation strategy as there is more variance in the house price growth data.

House price data comes from Uriel-Jiménez et al. (2009), published by the Valencian Institute of Economic Research (henceforth IVIE) jointly with the BBVA Foundation (FBBVA). The database covers the period 1990-2007 and the IVIE prices are calculated using the original data from the (previously) Spanish Housing Department (*Ministerio de Vivienda*). The Housing Department official data provides the average price per square meter on dwellings sales in the private sector. It is provided every quarter for all the provinces. The IVIE dataset of house prices is constructed by weighting the official prices provided by the Housing Department to take into account the location of the dwelling and when it was built. As the IVIE data is only available until 2007, the dataset was expanded until 2010 by applying the provincial price growth rates from the Housing Department official data series. Data on rental prices comes from the Housing Department and the National Institute of Statistics (*INE*). I combine data from the National Observatory of Rented Properties (*Observatorio Estatal de la Vivienda en Alquiler*) and the consumer price indices (CPI provinces - rents component) to calculate the average rental price per square meter of the each province, from 2001 to 2010.

I also use time-invariant province characteristics in the specifications without province fixed effects. These include: geographical characteristics (a dummy if the province is located

[33] However, it has two disadvantages. For confidentiality issues, data availability on the characteristics of the population is limited (only age, gender and nationality). In addition, the immigration figures may be overestimated because immigrants have to actively cancel their register when they move out of the country (if they move within the country their new register cancels out the old one). For this reason, it is a good source to study the effect of immigration inflows but not so good for outflows.

on the coast, the length of the coastline and the surface if the national parks – obtained from the National Geographical Institute); weather conditions (average rainfall and average temperature in January – obtained from the National Agency of Meteorology) and initial province attributes in 2000 (number of retails shops, number of restaurants and bars, relative weight of the tourism sector – obtained from *La Caixa* Spanish Economic Yearbook (*La Caixa Anuario Económico de España*) –; and number of doctors – obtained from the National Institute of Statistics).

The share of developable land in 2000 is obtained combining "developable" categories from the EU Corinne 2000 land cover data. Total area and total developable area[34] were calculated using GIS and raster maps of land use year for 2000, provided by the *Corine* Land Cover data project (European Environment Agency). The proxy for land regulation, defined as the share of municipalities in the province which had specific land use regulatory plans in 1999 (*Planes Generales de Ordenamiento Urbanístico*) is obtained from the Urban Areas Digital Atlas *"Atlas Digital de las Areas Urbanas"*, published by the (previously known as) Spanish Housing Department (*Ministerio de Vivienda*). The data on housing stocks was also obtained from this Department. I also control for the share of rental properties and the share of empty houses in 2001, from the 2001 Housing Census (*Censo de Población y Viviendas*). The percentage of rented properties over total occupied properties and the proportion of empty homes are obtained from 2001 Census data from the Spanish National Statistical Institute (INE).

As time-varying controls I use the number of credit establishments in a given province and the share of saving banks (to control for credit availability), the growth of GDP and the growth of the unemployment rate. Data on the number of banks comes from the La Caixa Spanish Economic Yearbook, which collects data at the municipality and the province level for several socioeconomic indicators. Data on the growth of GDP comes from the Regional Economic Accounts of the National Institute of Economics. The province unemployment rate was calculated using the IVIE data on human capital (*Estimación de las Series de Capital Humano 1964-2010*) and it is defined as the ratio of unemployed over working-age population.

Finally, I calculated the stock of (private) dwellings in the different years combining data from the Spanish Housing Department. Data on the housing stock is available from 2001. Using the entry and exit flows, I calculated a rate of depreciation and I updated the stock of the dwellings combining the depreciation rate and construction of dwellings data. I focus on private dwellings, but the results in section 3.4 are unchanged when using total dwellings.

A.2 Further details on the construction of the instrument

A.2.1 Gravity estimations

In order for the instrument to be valid, both terms in expression (6) have to orthogonal to local shocks related to immigration inflows and house price growth. Local shocks have a dir-

[34] The categories included in developable land are: Green urban areas, Non-irrigated arable land, Permanently irrigated land, Rice fields, Vineyards Fruit trees and berry plantations, Olive groves, Pastures, Annual crops associated with permanent crops, Complex cultivation patterns, Land principally occupied by agriculture, Agro-forestry areas, Broad-leaved forest, Coniferous forest, Mixed forest, Natural grasslands, Moors and heartland, Sclerophyllous vegetation and Burnt areas.

ect impact on total immigration inflows to Spain as these depend on national shocks which are just a combination of local shocks. For this reason, instead of directly using national inflows by nationality in (6), I construct a prediction based on factors that are plausibly exogenous to local shocks. Following Saiz (2007) and Ortega & Peri (2012), I use a gravity-type model that only contains push-factors from origin to predict the total inflow from nationality n to Spain in a given year t to predict total inflows[35] by nationality in a given year. The estimated equation is:

$$\ln\left(FBinflow_{from\_n\_to\_Spain,t}\right) = \rho' \ln\left(ECON_{n,t-1}\right) + \omega' \ln\left(GEO_n\right) + \gamma_g + \lambda_t + \xi_{n,t} \quad \text{(A.1)}$$

where $ECON_{n,t-1}$ is a matrix of (lagged) time-varying economic conditions of the sending country (log of gross domestic output in real terms, log of total population, percentage of urban population, percentage of internet users, an index of globalisation and dummy of belonging to the EU27). GEO_n is a matrix of time-invariant geographic characteristics of the sending country (log of distance to Spain, log of area, number of cities, latitude and longitude and dummies for common language, common border and common colonial past with Spain). I include year dummies λ_t and country-group dummies γ_g (the groups appearing in table A.1). I can alternatively include country dummies, which drops the time-invariant variables. I estimate a similar model using foreign-born stocks on the left hand side (in this case the economic variables are lagged two years because population is measure on the 1^{st} of January).

I use data from the World Bank World Development Indicators (for the economic variables) and from the *Centre d'Études Prospectives et d'Informations Internationales - CEPII* (for the geographical variables). Data is available for 109 of the 119 countries of table A.1, which represent more than 99% of the inflows into Spain for the period. Results for different specifications are showed in table A.2, for the total national inflows (columns 1-3) and for the national foreign-born stocks (columns 4-6). The specifications include country and country-group dummies alternatively, and the two first columns include year dummies while the last two do not include them. All the models have high predictive power.

From the results in Table A.2 I recover the predicted inflows to and predicted stocks of foreign-born in Spain from nationality n for every year 2001-2010. I use the prediction from estimates from column 1 for the construction of the instrument, and I use the rest of the specifications estimates for the robustness check. These are combined with the share by province in 1991 in a similar manner as in (6). The imputed predicted foreign-born inflow for each nationality n to each province i at time t becomes:

$$imp\_pred\_FBinflow^n_{i,t} = \left(pred\_FBinflow^n_{Spain,t}\right) * share^n_{i,1991} \quad \text{(A.2)}$$

The total imputed predicted inflow to each province i at time t is defined as the sum of (A.2) across nationalities:

$$imp\_pred\_FBinflow_{i,t} = \sum_n^N \left(imp\_pred\_FBinflow^n_{i,t}\right) \quad \text{(A.3)}$$

I use the lagged (A.3) in the construction of instrument (10).

[35] And equivalently for imputed predicted stocks.

A.2.2 Prediction for native location

I use past census data to predict the numbers of natives residing in province i in year t. Total natives in a province are the sum of those born and residing there and those who were born somewhere else in Spain and have moved there. I use an strategy that follows the same intuition as the shift-share immigration instrument. In contrast to the immigrants prediction, in this case we need to predict both magnitudes, i.e. stayers and movers. Therefore, we need to define a historical share and a time-varying shift for both types of natives. Instead of countries, the origin-destination geographical units are now the Spanish provinces. I use the province of birth of the native in the same way as the nationality in the case of foreign-born. The strength of the instrument is now based on the historical (im)mobility persistence of different Spanish locations (for stayers) and the "ethnic" networks (for movers). Some regions have historically had larger mobility propensities (Galicia), and some bilateral internal migration flows are based on historical location patterns (for example Galicians in Madrid or Andalusians in Cataluña).

A person born in a given province b can either stay where she was born (stayers) or can move and reside in a different province $i \neq b$ (movers). R is the total number of provinces in Spain in which natives can locate. For consistency, I use native location patterns from census 1991 as base year. I define the share of stayers in province i as the proportion of natives born and living in a province over all the natives born in the province (regardless of where they reside) in 1991. In this case, the province of birth and residence is the same, i.e $i = b$. The stayers share is defined as follows:

$$share^{b}_{i(i=b),1991} = \frac{natives^{b}_{i=b,1991}}{\sum_{i}^{R} natives^{b}_{i,1991}} \tag{A.4}$$

Share (A.4) is multiplied by the total natives that are living in the same province where they were born in year t. This gives the predicted number of stayers in a given province i year t.

The share of movers is calculated differently. For a given province of birth b there are 49 potential province destinations where the mover can reside. I therefore need to calculate further 49 shares which represent the proportion of movers residing in a specific province i over the total number of movers originating from province b. The movers share is defined as proportion of natives born in b but residing in i over all the natives born in b but residing somewhere else:

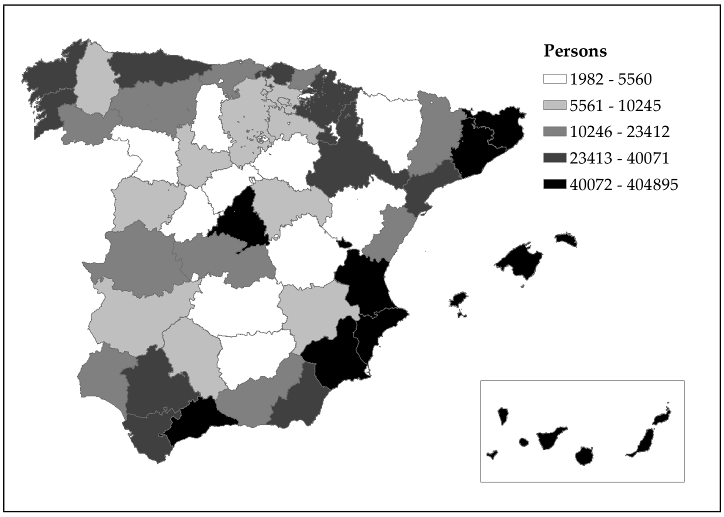
$$share^{b}_{i(i\neq b),1991} = \frac{natives^{b}_{i\neq b,1991}}{\sum_{i\neq b}^{R} natives^{b}_{r,1991}} \tag{A.5}$$

Share (A.5) is multiplied by the total number of natives living outside the province they were born in year t (subtracting the natives living in the province for which we want to calculate the prediction, similarly to the case of the foreign-born prediction). This predicts the number of natives born in b living in province i (where $i \neq b$) in year t. For a given province of birth, there are 49 movers predictions.

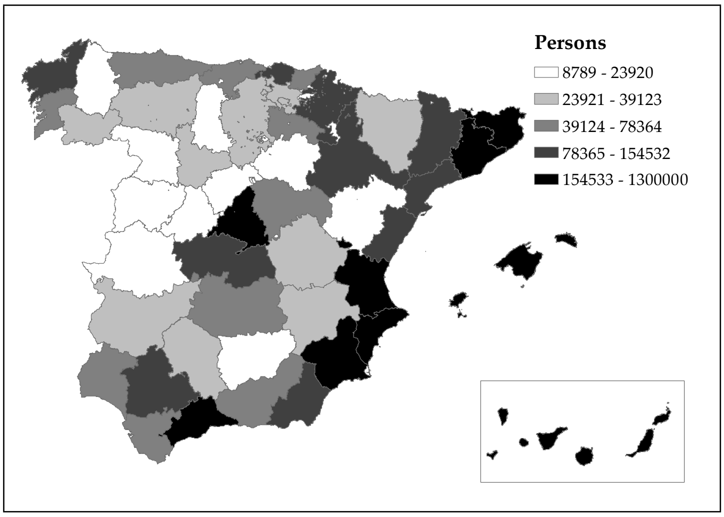
To obtain the number of natives living in each province i at time t, I sum the prediction for stayers and the 49 predictions for each potential province of residence (movers) in each year. This gives $imp\_natives_{i,t}$ which is used in the construction of (A.3).

A.3 Additional tables and figures

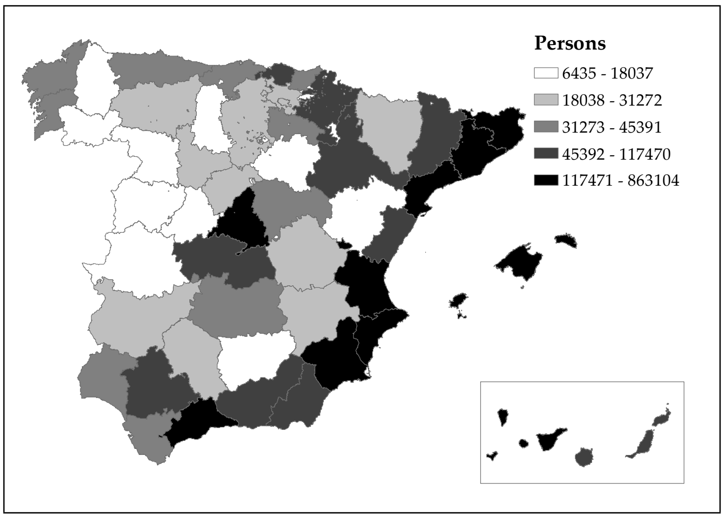
Figure A.1: Spatial distribution of foreign-born stocks



(a) Foreign-born stock in 2001

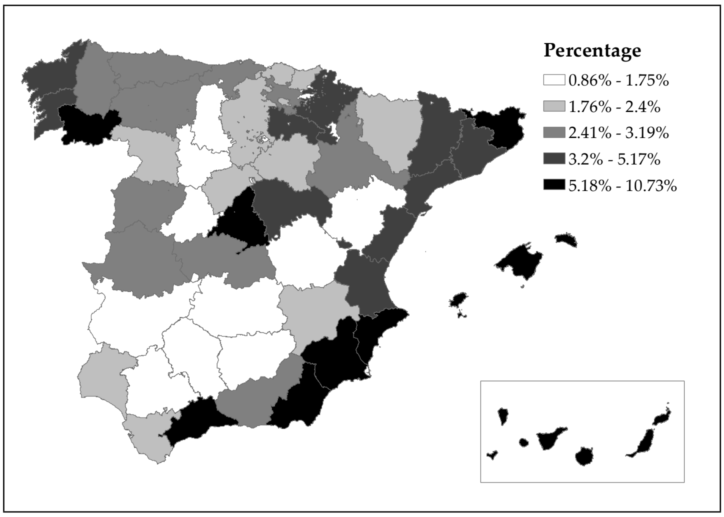


(b) Foreign-born stock in 2010

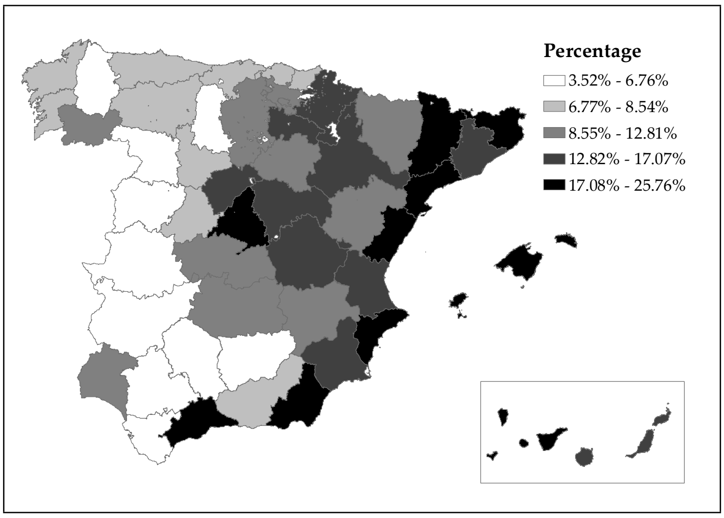


(c) Change in foreign-born stock between 2001-2010

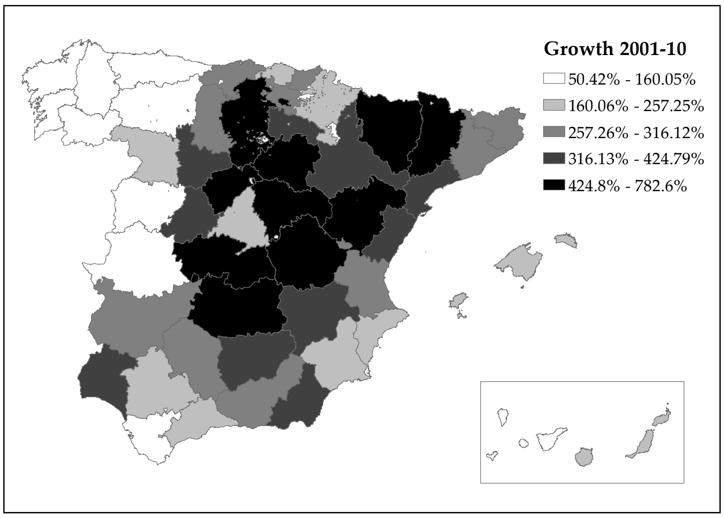
Figure A.2: Spatial distribution of share and growth of foreign-born



(a) Share foreign-born over population in 2001

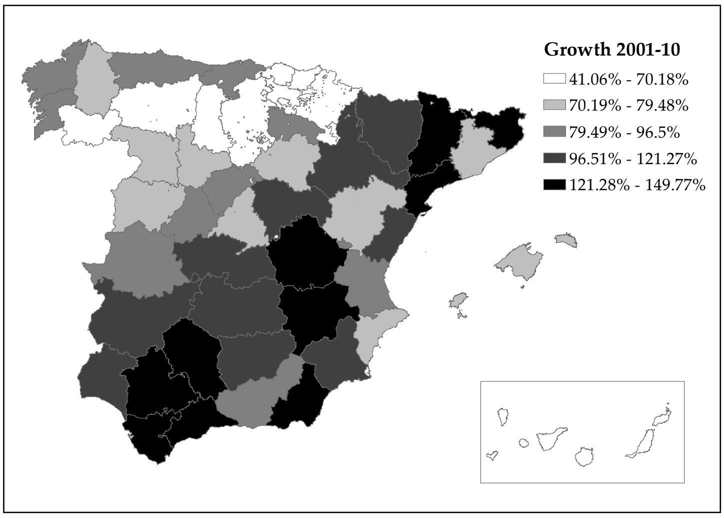


(b) Share foreign-born over population in 2010

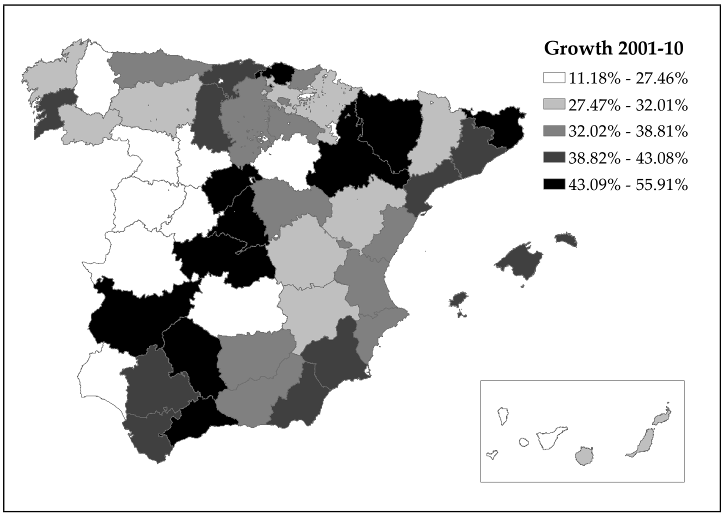


(c) Growth foreign-born stocks between 2001-2010

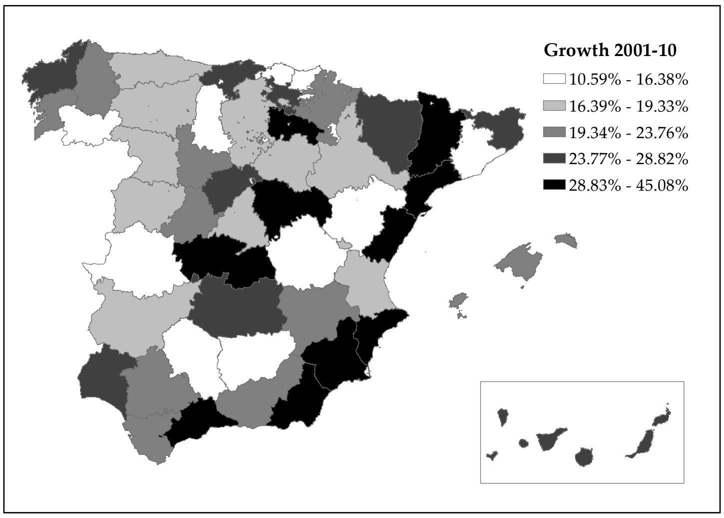
Figure A.3: Spatial distribution of growth in prices and construction



(a) Growth of sale prices 2001-2010



(b) Growth of rental prices 2001-2010



(c) Growth of housing stock 2001-2010

Table A.1: List of countries of birth by nationality groups

COUNTRY	NATIONALITY GROUP	COUNTRY	NATIONALITY GROUP
France	United Kingdom, France & Germany	Cote d'Ivoire	Rest of Africa
United Kingdom	United Kingdom, France & Germany	Egypt	Rest of Africa
Germany	United Kingdom, France & Germany	Ethiopia	Rest of Africa
Austria	Rest of EU15, Norway & Switzerland	Guinea-Bissau	Rest of Africa
Belgium	Rest of EU15, Norway & Switzerland	Equatorial Guinea	Rest of Africa
Denmark	Rest of EU15, Norway & Switzerland	Kenya	Rest of Africa
Finland	Rest of EU15, Norway & Switzerland	Liberia	Rest of Africa
Greece	Rest of EU15, Norway & Switzerland	South Africa	Rest of Africa
Ireland	Rest of EU15, Norway & Switzerland	Sierra Leone	Rest of Africa
Italy	Rest of EU15, Norway & Switzerland	Togo	Rest of Africa
Luxembourg	Rest of EU15, Norway & Switzerland	Zaire	Rest of Africa
Norway	Rest of EU15, Norway & Switzerland	Africa other	Rest of Africa
Netherlands	Rest of EU15, Norway & Switzerland	Canada	United States & Canada
Portugal	Rest of EU15, Norway & Switzerland	United States of America	United States & Canada
Sweden	Rest of EU15, Norway & Switzerland	Mexico	Latin & Central America
Switzerland	Rest of EU15, Norway & Switzerland	Costa Rica	Latin & Central America
Bulgaria	Rumania, Bulgaria, Pol& & Hungary	Cuba	Latin & Central America
Hungary	Rumania, Bulgaria, Pol& & Hungary	Dominica	Latin & Central America
Poland	Rumania, Bulgaria, Pol& & Hungary	El Salvador	Latin & Central America
Romania	Rumania, Bulgaria, Pol& & Hungary	Guatemala	Latin & Central America
Cyprus	Rest of EU27	Honduras	Latin & Central America
Malta	Rest of EU27	Nicaragua	Latin & Central America
Latvia	Rest of EU27	Panama	Latin & Central America
Estonia	Rest of EU27	Dominican Republic	Latin & Central America
Lithuania	Rest of EU27	Argentina	Latin & Central America
Czech Republic	Rest of EU27	Bolivia	Latin & Central America
Slovakia	Rest of EU27	Brazil	Latin & Central America
Slovenia	Rest of EU27	Colombia	Latin & Central America
Iceland	Rest of Europe	Chile	Latin & Central America
Liechtenstein	Rest of Europe	Ecuador	Latin & Central America
Andorra	Rest of Europe	Paraguay	Latin & Central America
Europe other	Rest of Europe	Peru	Latin & Central America
Albania	Balkans, USSR & Turkey	Uruguay	Latin & Central America
Ukraine	Balkans, USSR & Turkey	Venezuela	Latin & Central America
Moldova	Balkans, USSR & Turkey	America other	Latin & Central America
Belarus	Balkans, USSR & Turkey	Bangladesh	Philippines, China & Indo-continent
Georgia	Balkans, USSR & Turkey	China	Philippines, China & Indo-continent
Bosnia Herzegovina	Balkans, USSR & Turkey	Philippines	Philippines, China & Indo-continent
Croatia	Balkans, USSR & Turkey	India	Philippines, China & Indo-continent
Armenia	Balkans, USSR & Turkey	Pakistan	Philippines, China & Indo-continent
Russia	Balkans, USSR & Turkey	Saudi Arabia	Rest of Asia
Serbia & Montenegro	Balkans, USSR & Turkey	Indonesia	Rest of Asia
Macedonia	Balkans, USSR & Turkey	Iraq	Rest of Asia
Turkey	Balkans, USSR & Turkey	Iran	Rest of Asia
Gambia	Sub-Saharan Africa	Israel	Rest of Asia
Ghana	Sub-Saharan Africa	Japan	Rest of Asia
Guinea	Sub-Saharan Africa	Jordan	Rest of Asia
Mali	Sub-Saharan Africa	Lebanon	Rest of Asia
Nigeria	Sub-Saharan Africa	Nepal	Rest of Asia
Senegal	Sub-Saharan Africa	South Korea	Rest of Asia
Algeria	North Africa	Syria	Rest of Asia
Morocco	North Africa	Thailand	Rest of Asia
Mauritania	North Africa	Vietnam	Rest of Asia
Tunisia	North Africa	Kazakhstan	Rest of Asia
Burkina Faso	Rest of Africa	Asia other	Rest of Asia
Angola	Rest of Africa	Australia	Oceania
Benin	Rest of Africa	New Zealand	Oceania
Cape Verde	Rest of Africa	Oceania other	Oceania
Cameroon	Rest of Africa	Stateless	Stateless
Congo	Rest of Africa		

Table A.2: Gravity equations immigrant inflow and stock by country

	(1)	(2)	(3)	(4)	(5)	(6)
Log number of immigrants from country n to/in Spain in t						
	INFLOW			STOCK		
Log of GDP in billions in	-1.386***	-1.093**	-0.520***	-0.275	0.864**	-0.207
constant dollars in t-1/t-2	[0.467]	[0.434]	[0.185]	[0.252]	[0.433]	[0.146]
Log of total population	-1.603	1.987	0.890***	-4.644***	0.816	0.675***
in 1000s in t-1/t-2	[1.441]	[1.231]	[0.229]	[1.203]	[1.299]	[0.191]
Percentage of urban	0.876	3.521	3.355***	-3.328	6.141	3.596***
population in t-1/t-2	[4.429]	[4.194]	[0.824]	[3.315]	[4.155]	[0.725]
Percentage of internet	-1.934***	-0.576	-0.061	-2.021***	0.112	-0.377
users in t-1/t-2	[0.431]	[0.452]	[0.453]	[0.554]	[0.288]	[0.316]
Globalisation index	0.015	0.083***	-0.011	0.018	0.097***	-0.014
in t-2/t-3	[0.017]	[0.017]	[0.014]	[0.013]	[0.019]	[0.012]
Dummy if country belongs	1.044***	0.935***	0.464*	0.464*	0.693**	0.263
to the EU	[0.176]	[0.210]	[0.260]	[0.235]	[0.269]	[0.268]
Log of distance between			-1.794***			-1.631***
country and Spain			[0.436]			[0.392]
Log of country area in			0.311***			0.190*
square kilometres			[0.104]			[0.108]
Number of cities in the			-0.308***			-0.333***
country in Henderson data			[0.050]			[0.047]
Latitude			0.002			-0.001
in degrees			[0.007]			[0.007]
Longitude			0.026***			0.020***
in degrees			[0.008]			[0.007]
Dummy if country official			2.246***			1.905***
language is Spanish			[0.619]			[0.646]
Dummy if country is			-0.413			-0.148
contiguous to Spain			[0.544]			[0.548]
Dummy if country was a			-0.285			-0.133
colony of Spanish Empire			[0.543]			[0.585]
Model	PR1	PR11	PR2	PR1	PR11	PR2
Observations	1142	1142	1142	1308	1308	1308
Adjusted R^2	0.872	0.818	0.648	0.951	0.922	0.745
Year dummies	✔		✔	✔		✔
Fixed effects	Country	Country	Group	Country	Country	Group

Notes: Clustered (country) standard errors in brackets. t=1998/2009. The number of countries in the sample is 109. Note that sometimes country inflows are zero so the number of observations in columns 1-3 is smaller than in columns 4-6. EU membership dummy changes over time as new countries join the Union. Group refers to nationality groups as defined in Table A.1. The economic explanatory variables are lagged one or two periods depending on the variable used on the LHS (inflow or stocks). The globalisation index is lagged one additional period due to data restrictions. Significance levels: * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table A.3: Effects on housing construction - long and short-run estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change log private dwellings stock							
Immigration ratio (t-1)	0.791	1.428**	1.626**	1.425**	1.410**	1.376**	1.327*
	(0.590)	(0.671)	(0.795)	(0.667)	(0.694)	(0.677)	(0.784)
Test weak identification	19.01	26.51	24.50	28.36	25.94	28.24	14.70
Population ratio (t-1)	0.510	0.902**	0.953**	0.875**	0.885**	0.861**	0.912*
	(0.343)	(0.427)	(0.427)	(0.374)	(0.403)	(0.395)	(0.494)
Test weak identification	24.96	24.00	30.12	32.73	32.46	30.63	26.75
Observations	450	450	450	450	450	450	450
Region dummies		NUTS2	NUTS2	NUTS2	NUTS2	NUTS2	NUTS3
Geography/Amenities			✔	✔	✔	✔	
Supply controls				✔	✔	✔	
Time-varying controls					✔	✔	✔
Region trends						NUTS2	

Notes: The dependent variable is the change of log private dwellings stock between t/t-1 (both panels). t=2002/2010. Significance levels: * p<0.05, ** p<0.01, *** p<0.001. All specifications include year dummies. Clustered (province) standard errors in parenthesis. NUTS2 corresponds to regions (CCAA) and NUTS3 corresponds to provinces. Geography/Amenities province controls include coast dummy, log hours of sunshine, log rain precipitation, log surface of natural parks, log number of retails shops in 2000, log number of restaurants and bars in 2000, log number of doctors in 2000 and index importance tourism sector in 2000. Supply (time-invariant) controls include proportion of rented properties in 2001, proportion of empty houses in 2001, share of developable land in 2000 and regulatory index in 1999. Time-varying controls include change log GDP, change log number of credit establishments and change of percentage of saving banks.

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