Immigration, Family Responsibilities and the Labor Supply of Skilled Native Women

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Abstract: We investigate the effect of female immigration on the labor supply of skilled native women using data on Spain's large recent immigration wave. We adopt a spatial correlations approach and instrument for current immigration using ethnic networks. We find that female immigration increases the local availability of household services and reduces their price. It also increases the labor supply of skilled native women with family responsibilities, by allowing them to return to work earlier after childbirth, and to continue working while caring for elderly dependents. Our estimates suggest that immigration accounts for about one third of the large increase in the employment rate of college-educated women with family responsibilities over the last decade.

Keywords: Immigration, Labor supply, Fertility, Retirement, Household services

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1. Introduction

There is a large literature addressing the effects of immigration on the host country's labor market. Most studies focus on the direct effects of immigration on the wages and employment opportunities of natives with the *same* skill level. However, immigration may also affect the labor market decisions of natives with *different* skills through general-equilibrium effects. One such effect may arise if immigration increases the local supply of market-provided services that are close substitutes with housework (such as cleaning, cooking or child and elderly care). As a result, women that can afford to purchase these services may be able to shift time from housework toward market work.

As pointed out by Kremer and Watt (2006), this particular channel through which immigration can affect the labor market of the receiving economy may be quantitatively important. Through a calibration exercise, they estimate that taking this form of skill complementarity into account implies that the immigration surplus in the US may be more than 10 times larger than previously thought. In turn, Cortes and Tessada (2010) provide empirical evidence that supports this mechanism. Their estimates indicate that low-skilled immigration has led to a significant increase in the labor supply of highly skilled women in the US. This link between immigration and native female labor supply is present in other countries as well. Cortes and Pan (2009) show that educated women with young children in Hong Kong were able to increase their labor market participation in recent decades thanks to an increased supply of foreign domestic workers.

In this paper, we empirically analyze the effect of female immigration on the labor supply of skilled native women in Spain over the last decade, with an emphasis on the response by women with large family responsibilities. The responsibilities we have in mind include caring for young

children and elderly dependents. The former has already received some attention in the literature (Cortes and Pan 2009). However, the latter has not been considered prior to our study, and we argue that it is particularly relevant for Europe, where fertility rates are low but the population is aging rapidly due to large increases in life expectancy.

Our paper contributes to the literature on the potential benefits of immigration to natives. We focus on the case of a Southern-European country, Spain, which has experienced a very large wave of immigration over the last decade. The foreign-born share in the working-age population increased from 3% in 1999 to 15% in 2008 (Population Registry). In addition, there are reasons to believe that immigration may have a larger effect on the labor supply of women with family responsibilities in Spain than in the US or in northern European countries. As common in several Mediterranean countries and in Latin America, Spain is still characterized by geographically close family networks and a family-based provision of care for children and elderly dependents (Esping-Andersen, 1990). As a result, Spanish females suffer a larger burden on their time than women in countries where the government plays a larger role (e.g. Scandinavian countries) or there is a larger supply of market-provided care (e.g. retirement homes in the US). This may account for Spain's relatively low female employment rates.[1]

Our paper incorporates three methodological innovations. First, we focus on female immigration as our main explanatory variable, as opposed to total immigration flows. The reason is that employment in household services has been dramatically affected by female immigration. In 2008, 49% of recent immigrant women were employed as housekeepers or home-providers of

[1] Despite large progress in recent decades, female employment in Spain remains lower than in the US and most Western European countries. In 2008, the female employment rate was 59% in Spain, compared with 64.5% in the EU-27 and 72% in the US. The gender gap in employment is also among the highest in industrialized countries (21% in Spain, 18% in the EU-27 and 10% in the US). See also De Laat and Sevilla-Sanz (2011).

child or elderly care. In the same year, roughly half of the recorded employment in household services was accounted for by female immigrants, compared to only 12% in 1999.

Secondly, we pay particular attention to the response of women whose labor supply is more heavily constrained by family responsibilities. In the data we are able to identify two types of family situations that impose a burden on women's time: the presence of young children, and elderly dependents (typically parents or in-laws). To the best of our knowledge, we are the first to study the effects of immigration on the labor supply of women with elderly care responsibilities, which fills an important gap in the literature.

Third, we show the benefits of using registry data in the analysis. These benefits are twofold. First, the availability of population registry data to measure immigrant concentration makes it feasible to conduct the analysis using the relatively small quarterly household surveys.[2] This has important implications for policy-making as it allows researchers to analyze the effects of an immigration episode with just a few years of data, as opposed to having to rely on Census data that, in most countries, become available only every ten years. Second, it allows us to measure regional immigrant concentration accurately, including undocumented immigrants. The reason is that registration in the Spanish Local Population Registry is required in order to have access to public healthcare and education, but also to be eligible in the event of an amnesty. The process of registration does not require proof of legal residence and the data are confidential (that is, cannot be used to expel undocumented migrants). The latter feature is crucial in our analysis, given that a substantial share of employment in household services is informal.

Our analysis proceeds in three steps. First, we build a simple model of labor supply. The model shows that, under certain assumptions, a reduction in the price of household services leads

[2] Aydemir and Borjas (2006) argue that estimates of regional immigrant concentration based on 5% Census samples (let alone the much smaller Labor Force Survey) may be very noisy, inducing substantial attenuation bias.

to an increase in the labor supply of skilled native women with family responsibilities, relative to other skilled native women. Second, we analyze empirically the effects of female immigration on the household services sector, in terms of size (employment) and prices (wages). We define "household services" to include nannies (in-house childcare), housekeepers and in-house personal care workers. Third, we examine the effects of female immigration on the labor supply of skilled native women. We focus on highly educated women. Because of their high earnings potential, these women can afford to purchase household services. In contrast, low-educated women tend to earn lower wages, which makes it unprofitable for them to hire someone to help at home in order to increase their own labor supply.

Methodologically, we follow a spatial correlations approach. Our identification strategy is based on correlating changes in immigrant concentration at the regional level with changes in the labor supply of skilled native women in the same region. More specifically, we are interested in the effects of immigration on the labor supply of college-educated native women in general, and on the subset of these women with large family responsibilities arising from child and elderly care. While there are potentially multiple channels through which unskilled immigration can affect the labor supply of skilled workers, we believe that the effects operating through the price of household services will be most cleanly identified by changes in the *relative* labor supply of skilled women with and without family responsibilities. In our model it is only skilled women with family responsibilities who purchase household services. The rest of skilled women do not change their time allocation in response to changes in the local supply of household services. Our identification approach differs from the tests already in the literature and rests on the assumption

that immigration does not have a direct impact on family responsibilities *in the short run*.[3] As we show later on, this assumption is supported in the case of Spain.

Crucial to the spatial correlations approach is the fact that there has been large variation in immigration rates across Spanish regions. Over the course of the last decade, immigration has generated large regional differences in the foreign-born share, which ranges from below 4% in some regions to almost 25% in others in 2008. In order to provide a causal interpretation for our estimates, we adopt an instrumental variables approach based on ethnic networks (Card 2001).

Our analysis produces several interesting findings. First, we find that recent female immigration into a region affected the cost and availability of market-provided household services in the region. We find evidence of a positive effect on employment in household services, and a negative impact on average wages in the sector. Second, we also find that immigration led to an increase in the labor supply of college-educated women with family responsibilities, relative to equally skilled women without these responsibilities, along the extensive margin. Specifically, our results suggest that immigration allowed women to return to work sooner after childbirth, and to continue working while caring for elderly relatives. These effects are both statistically significant and quantitatively important, and operate mainly through the extensive margin of labor supply.

Our results are also related to some recent work on job polarization. Manning (2004) and Mazzolari and Ragusa (2007) argue that the increase in the demand for low-wage occupations over the last two decades is driven by a surge in the demand for non-tradeable, household

[3] Cortes and Tessada (2010) focused on the effects on the labor supply of all highly skilled women. More similar to our approach, Cortes and Pan (2009) focused on the gap in participation rates between women with children below age 5 and mothers of older children. Hock and Furtado (2009) and Furtado and Hock (2010) argue that immigration has reduced the trade-off between fertility and work in the US. We discuss in more detail the role of immigration on family responsibilities in Spain. For now we note that the latter studies use decennial data while we use annual data.

services by high-wage earners. Our results provide evidence of a demand for household services that responds to price changes driven by immigration.

The remainder of the paper is organized as follows. Section 2 discusses the two family arrangements that we argue may represent a burden on women's time. Section 3 presents a time-use decision model. Section 4 describes the empirical strategy and Section 5 introduces the datasets, presents some descriptive statistics, and explains the construction of the main variables. The results are discussed in Sections 6 through 8. Section 9 concludes.

2. Family Responsibilities

The unequal gender distribution of tasks within the household imposes a burden on women's labor supply. This is particularly the case in countries where families are important providers of care for children and the elderly, as in Spain as well as most Mediterranean countries.

To illustrate this point, Table 1 presents data on labor force participation (top panel) and time use (bottom panel) by gender and education. First, we note that participation rates are much lower for women than for men. In 2005-2008, 41% of all working-age women were out of the labor force, compared with only 13% of men. The majority of these women (62%) reported that family responsibilities were the main reason for not participating in the labor market, versus only 4% of men.[4] Second, college-educated women display much higher labor market participation (only 11% were out of the labor market). However, even for educated women, family responsibilities were the main reason for being out of the labor force.

Next, we consider two situations ("family responsibilities") that may affect the labor market participation of skilled women. It is well known that maternity and child rearing influence women's labor supply decisions. This can be seen clearly in our data. In column 5, the non-

[4] Table 1 refers to the period 2005-2008 because the classification of "reasons for being out of the labor force" in the Spanish Labor Force Survey changed in 2005.

participation rate of college-educated women with young children (age 7 or below) is only slightly higher than for female college graduates in general. However, 76% of these women reported that family responsibilities were the main reason to exit the labor force.[5] Scrolling down the column (in panel B) we can see that the employment rates of college-educated mothers were lower (77% versus 80% among all college-graduates in 2002) and they spent almost two extra hours per day doing housework (6.1 versus 4.4 hours a day).

The second family responsibility that we consider is having an elderly dependent in the household, which has been shown to affect the labor supply decisions of women (Crespo and Mira 2009, Ettner 1995).[6] The frequency of this event is increasing rapidly as a result of a large reduction in mortality among the elderly in Spain.[7] The last two columns in Table 1 present data on participation and time use for college-educated women with elderly dependents (separately for male and female). Non-participation rates are only slightly higher for educated women with elderly dependents (12-13% compared with 11% for all college-educated females). Note that there are marked differences between male and female elderly dependents. To start, 44% of college-educated women with a male elderly dependent (typically, her father or her father in-law) report that family responsibilities are the main reason for having exited the labor force, compared with a lower 39% among those with a female elderly dependent. There are much larger differences in (2002) employment rates, as seen in the bottom panel. The employment rate among college-educated women with a male elderly dependent was 66%, compared with 83% for those with a female elderly dependent, and 80% for all college-educated women. We also find a small

[5] Note that one out of three college-graduate women in our data had children younger than eight.
[6] This is particularly so in countries such as Spain, where families play a key role in caring for the sick and the elderly. For instance, the percentage of institutionalized elderly in Spain is 2.9%, compared with 4.3% in the United States and 7.9% in Sweden (Jacobzone, 1999).
[7] Only 5% of female college-graduates had an elderly person living in their household. This grossly underestimates the number of these women that devote part of their time to providing elderly care. Often elderly parents or in-laws live outside the household but in close proximity. Unfortunately, we cannot identify these situations in our data.

(0.4) difference in daily hours of housework between the two groups.[8] These findings are consistent with the evidence in Del Boca et al (2005) for Italy, who find that grandmothers play an important role in the labor supply of women with children.

These figures suggest that having young children or an elderly dependent at home are events that impose an additional burden on the time allocation of (college-educated) women. These women have a relatively high earnings potential, given their high education level. As a result, they are potential users of household services and may want to increase their labor supply in response to a reduction in the price of these services. The model in the next section analyzes this time-use problem.

3. A simple time-use model

As we show later on, an inflow of immigrant women into a regional economy leads to a reduction in the price of household services in the region. The model here focuses on the effects of a reduction in the price of household services on the time-use of skilled women. The goal is to derive a testable prediction that will be carried out in the following sections.

We consider a time-use problem in the tradition of Gronau (1977), where an individual allocates time between three competing uses: market work, home production and leisure. We follow closely the setup in Cortes and Tessada (2010), which includes the option of purchasing household services as an alternative to using one's own time for home production. More specifically, an individual maximizes a utility function of the form: $u(y) + \phi(l)$, where y is consumption and l is leisure, operating under a budget constraint, a time constraint and a home production constraint.

[8] None of our datasets contains information on the time devoted to elderly care or on the health status of the members of the household. We can thus only identify potential care givers. For instance, we define as elderly dependent anyone 65 or older (other than the husband) that lives in the household. This may account for the small differences in time devoted to housework associated with elderly dependents, according to our definition.

Respectively,

(1) $y + px = wn + I$

(2) $n + l + h = 1$

(3) $x + \phi f(h) = R$.

Consider the budget constraint (1). The left-hand side is the total expenditure on consumption good y (numeraire) and in household services x (at price p). The right-hand side is total income, which is the sum of labor income (n hours of work times hourly wage w) and wealth I. Equation (2) is the time constraint: one unit of time can be used for market work (n), leisure (l) or home production (h). Obviously, we restrict all quantities to be non-negative.

Equation (3) states that home production can be undertaken either through one's own time h (delivering $\phi f(h)$ units of home output) or by purchasing household services in the market (x). Note that there is a required non-negative level of home production R, which we interpret as family responsibilities.[9] These responsibilities do not generate utility but impose a constraint on resource allocation.

Departing from Cortes and Tessada (2010), we assume that all individuals face the same wage rate but there is heterogeneity in the burden imposed by family responsibilities. In particular, some individuals have family responsibilities that need to be fulfilled ($R>0$) while others do not ($R=0$).[10] These care-giving services (e.g. child or elderly care) can be bought in the market (x) or produced using one's own time (h). Naturally, individuals without family responsibilities will not purchase any of these household services and will not devote any time to home production, that is, $x = h = 0$. Their time will be divided solely between market work (n)

[9] We assume that functions ϕ, u, and f are increasing and strictly concave. As a result, all constraints will be binding.

[10] Our analysis of heterogeneity in family responsibilities pre-dates the discussion in the latest version of Cortes and Tessada (2010). More importantly, our Proposition 1 below makes an empirical prediction that is distinct from theirs, although it is obviously consistent with their discussion since we use their same setup.

and leisure (h). Clearly, assuming that some individuals face no family responsibilities is unrealistic. However, this assumption greatly simplifies the analysis and ties the model presented here more closely to the empirical specifications, which feature a discrete indicator variable for individuals with family responsibilities.

We are interested in the comparative statics of a change in the price of household services and, in particular, on the differential response of individuals with and without family responsibilities. Let us start by examining the optimality conditions associated with the time-use problem of individuals *with* family responsibilities ($R>0$). First, the time devoted to home production is determined by equating the value of the marginal product of home production (where p is the price of household services) to its opportunity cost (given by the wage rate):

$$(4) \qquad p\alpha f'(h^*) = w.$$

We denote the optimal home production time by $h^*(w,p)$, which is decreasing in w and increasing in p. Second, the demand for household services is given by

$$(5) \qquad x^*(w,p,R) = R - \alpha f(h^*).$$

Finally, consumption and labor supply, (y^*, n^*), are pinned down by the following two equations:

$$(6a) \qquad w = MRS(1 - h^* - n\ ,\ y)$$

$$(7a) \qquad y = wn + I - px^*.$$

Equation (6a) equates the marginal rate of substitution between leisure and consumption to the real wage (w), and equation (7a) is the budget constraint after plugging in the optimal expenditure in household services.[11] As shown by Cortes and Tessada (2010), when w is high enough relative to p, market work hours (n) and purchases of household services (x) are both positive. Intuitively, individuals with a high wage have a high opportunity cost of time. For them it pays off to hire someone (at rate p) and supply their own time to the market (at w>p).

[11] $MRS(l,y) = \phi'(l)/u'(y)$.

We now turn to the optimal time use for individuals *without* family responsibilities (*R=0*). Trivially, for these individuals $h^* = x^* = 0$ and the amount of work and consumption are given by the solution to the following system of equations:

(6b) $w = MRS(1 - n, y)$

(7b) $y = wn + I$.

We note that the time allocation for these individuals is not a function of the price of household services.[12] The proposition below summarizes the effects of a reduction in the price of household services on the time-use allocation of individuals with and without family responsibilities.

Proposition 1. *As a result of a reduction in the price of household services (p),*

i) The time use of individuals without family responsibilities is unaffected.

ii) Individuals with family responsibilities reduce the time devoted to home production (h) and increase their purchases of household services (x*).*

iii) If home production is highly productive (high α), a reduction in p leads to an increase in the labor supply of women with family responsibilities.

Proof. In appendix.

The first statement in the Proposition follows trivially from the fact that individuals without family responsibilities never devote any resources to family responsibilities. Statement ii) is also straightforward. Equation (4) implies that a reduction in the price of household services, *p*, leads to a reduction in the time devoted to home production and, thus, an increase in the purchases of domestic services.

Regarding the third item in the Proposition, in general, the effect of a reduction in the price of household services on labor supply depends on parameters due to the usual opposing income and

[12] Recall that the home-produced good does not deliver utility.

substitution effects.[13] The intuition behind our sufficient condition is the following. When the home production technology is highly effective, the bulk of family responsibilities is satisfied by means of one's own time, rather than by purchasing household services. As a result, a reduction in the price of these services has a negligible income effect. Therefore, a marginal reduction in the price of household services leads to a reduction in housework, an increase in the purchases of market-provided household services, and a larger supply of labor to the market.[14]

Our focus is the time-use of highly skilled individuals. Nevertheless, two points are worth noting regarding the time use of less skilled individuals. First, low-wage individuals with family responsibilities will tend to devote their own time to home production. It does not pay off to pay someone else p units of the numeraire in order to earn w when these two prices are similar. Furthermore, in our application the reduction in the price of household services is triggered by immigration. Low-wage native individuals are likely to face greater labor market competition as a result of large recent immigration flows. This effect of immigration on their wage earnings will be confounded with the effect of cheaper household services. For very low-wage natives, the former is likely to dominate since these individuals will most likely not employ household service workers.

In conclusion, this section has shown that a reduction in the price of household services will (under some conditions) lead to an increase in the labor supply (to the market) of highly skilled individuals with large family responsibilities. In the model, the time use of highly skilled individuals without family responsibilities remains unaffected. Therefore, the key implication of this simple model is that a reduction in the price of household services will lead to an increase in

[13] For very high values of α we will reach a corner solution where $\alpha f(h)=R$ and $x = 0$. Clearly, in this case reductions in p will not have any effects on time use decisions.

[14] On the basis that leisure is not an inferior good, Cortes and Tessada (2010) stress that a reduction in the price of household services is likely to lead to a reduction in the labor supply of women with family responsibilities. We note that the sufficient condition in the third item of our Proposition allows for an arbitrary income-elasticity for leisure.

the labor supply of skilled women with family responsibilities, relative to skilled women without responsibilities.

4. Empirical Strategy

Methodologically, we adopt a spatial correlation approach, where changes in the labor supply of skilled native females with female immigration rates across Spanish regions. We use instrumental variables to identify the causal effect.

Our main explanatory variable is a measure of immigrant concentration at the regional level. Specifically, we use the number of females with foreign nationality residing in the region at the beginning of the year, normalized by the working-age female population in the region. For short, we refer to this variable as the Female Immigrant Share (*FIS*).[15] Our decision to use the FIS (built using Registry data) as the main explanatory variable in the analysis is based on three reasons. First, we are confident that this variable accurately reflects the size of the immigrant population, including undocumented workers. This feature is important in our analysis, since the household services sector contains al high rate of informal employment. Second, we focus on female immigrants because the overwhelming majority (95%) of workers in this sector are women. Third, we note that our female immigrant share does not distinguish immigrants by educational attainment. The reason is that years since arrival appears to be more tied to employment in household services than (low) educational attainment. In particular, our data show that half of all female recent immigrants are employed in household services.[16]

[15] Due to data limitations, it is infeasible to use the price of household services as the main explanatory variable. We can only build a noisy estimate of the price for a limited number of years. Moreover, measurement error problems are likely to be amplified by the high degree of informal employment in this sector.

[16] Bertoli et al (2010) show that the average wages of recently arrived Ecuadorians in Spain with and without a college degree are extremely similar. Wage differences within this group only arise across occupations.

Our empirical analysis proceeds in two steps. First, we examine the connection between female immigration and the household services sector (section 4.1). Second, we estimate the effects of immigration on the labor supply of skilled native women (section 4.2).[17] After discussing our main specifications, section 4.3 describes our instrumental-variable approach.

4.1. Immigration and household services

Our first goal is to establish a link between female immigration flows into a region and the price and availability of household services in that region. In particular, we are interested in the effects on the size (measured by employment) of the sector as well as the average wage received by household service workers.

We estimate the following empirical models:

$$EHS_{r,t} = \lambda_t + \phi_r + \beta_e FIS_{r,t} + \varepsilon_{r,t} \quad (8)$$

$$WHS_{r,t} = \lambda_t + \phi_r + \beta_w FIS_{r,t} + \varepsilon_{r,t}\,. \quad (9)$$

The dependent variables are, respectively, region *r*'s total employment in household services in year *t*, normalized by the working-age female population in the region (*EHS*) and the average hourly wage (in logs) in the household services sector (*WHS*). In both equations, the main explanatory variable (*FIS*) is the female immigrant share in the region at the beginning of the year. The specification includes year (λ_t) and region (ϕ_r) fixed effects. Accordingly, identification is based on within-region changes over time in the household services sector and the annual female immigration rate.

Our coefficients of interest, β_e and β_w, indicate to what extent immigration flows are associated with changes in employment and average wages in the household services sector. Note

[17] We do not have clear predictions on the effect of immigration on the labor supply of low-skilled natives. As we argue below, immigration will affect the price of household services and possibly other low skilled occupations. Thus, immigration increases the degree of labor market competition faced by low skilled natives, potentially depressing their wages. This mechanism is not present in our time-use problem, which assumes (skilled) wages to be independent of the price of household services.

that β_e will be zero if either no immigrant becomes employed in household services, or if immigrants fully displace natives working in that sector. A positive coefficient implies that female immigration is associated with a net increase in the size of the household services sector. Naturally, if immigration did not affect the size of the sector we would not expect changes in wages either ($\beta_w = 0$).

4.2. Immigration and the labor supply of skilled women

We next analyze the effects of immigration on the labor supply of skilled native women. Building on Proposition 1, our main testable hypothesis is that immigration will lead to increases in the labor supply of skilled women with family responsibilities, relative to skilled women without.

We estimate the following individual labor supply model:

$$y_{irt} = \lambda_t + \mu_r + \alpha D_{irt} + \beta FIS_{rt} + \gamma D_{irt} FIS_{rt} + X'_{irt}\Lambda + \varepsilon_{irt}. \quad (10)$$

The dependent variable (y) is a measure of labor supply (employment or hours) for highly skilled individual i located in region r in year t. The right-hand side contains year (λ_t) and region (ϕ_r) fixed-effects, a dummy variable (D) that takes value one when the individual has any of the family responsibilities identified in Section 2, the female immigrant share (FIS) at the beginning of the year, an interaction of this variable with the dummy for family responsibilities ($D*FIS$) and, finally, a vector of individual controls (X), such as age, marital status, number of children in the household, and so on.[18] We allow the disturbance term to be correlated across individuals (and over time) in the same region.

We expect α to be negative, since family responsibilities impose a burden on women's time, which is likely to constrain their labor supply.[19] Based on Proposition 1, we expect the coefficient

[18] In the empirical analysis we also allow the effect of immigration to vary by type of family responsibility.
[19] Family responsibilities are likely to be endogenous to labor supply decisions. Since we do not instrument for D, our estimates of α cannot be given a causal interpretation.

on the female immigrant share (β) to be zero, since the time use of women without family responsibilities should not be affected by changes in the price of household services (driven by female immigration). However, there are other reasons to believe that β may be negative (if immigrants compete in the labor market with natives) or positive (if natives and immigrants are complementary factors in production).

Estimation of β is the main goal in Cortes and Tessada (2010). However, our main interest is on coefficient γ, the differential effect on the labor supply of skilled women with family responsibilities, relative to women without. On the basis of Proposition 1 and the link from immigration to the price of household services, we expect a positive value of γ.[20]

Identification is based on correlating changes in (female) immigration rates across Spanish regions with the gap between the labor supply of skilled women with and without family responsibilities. Presumably, besides through the price of child and elderly care, other channels by which female immigration can affect the time use of skilled native females (e.g. labor market competition or complementarities in production) will affect both groups of skilled women similarly.

4.3. The instrument

Clearly, OLS estimates of equation (10) are likely to suffer from an endogeneity problem. If immigrants move to regions where *skilled* natives are increasing their labor supply for reasons other

[20] Despite the potential endogeneity of family responsibilities, we argue that our IV estimate of coefficient γ is unbiased. The implicit assumption is that the immigration episode did not affect the child and elderly care decisions of skilled native women in the short run. While there is evidence for the US that immigration increased fertility among skilled women (Furtado and Hock, 2010), we do not find causal effects of immigration on family responsibilities in the Spanish data. Table A1 in the Appendix regresses the indicator for the presence of family responsibilities on the female immigration share and a set of controls (region and year fixed effects, age, age square and marital status). While the OLS estimates are positive and statistically significant, the effect vanishes once the endogeneity of immigration is controlled for using ethnic networks. Since our analysis is based on annual data, these findings imply that immigration does not have short-run effects on child or elderly care decisions.

than immigration, then the OLS estimate will be biased upwards. However, it is also possible that recent immigrants and highly skilled natives are attracted to different regions (e.g. due to skill-specific regional labor demand shocks), which would lead to a downward bias.

Following Cortes and Tessada (2010), we account for the potential endogeneity of migrants' location choices using an instrumental variables approach. Specifically, we build a version of the widely used ethnic networks instrument à la Card (2001). This instrument exploits the fact that recent immigrants tend to locate in regions with large communities of previous immigrants from the same country of origin. More formally, consider the following predictor for the size of the immigrant population in a region r in a given year t:

$$Z_{r,t} = \sum_{c} Z_{c,r,t} = \sum_{c} \left(\frac{FB_{r,c,t_0}}{FB_{c,t_0}} \right) FB_{c,t} \tag{11}$$

for $t_0<t$. The term in brackets denotes the share of the foreign-born population from country of origin c living in Spain's region r in some base year t_0. As discussed below, the base year in our analysis is 1991. $FB_{c,t}$ is the total size of the population from country c residing in Spain in year t. We include both men and women, since our definition of networks is based purely on ethnicity, not gender.

Our main explanatory variable is the female immigrant share (*FIS*), defined as the number of foreign females in a region in a given year, relative to the 1991 female working-age population. We prefer to normalize stock variables using the 1991 population, as opposed to the current population in the region, because it is more plausibly exogenous to current labor market conditions. Consequently, we shall instrument it with the predicted share of immigrants (*ZS*), defined as the predicted immigrant population (*Z*), relative to the 1991 working-age population.

Our empirical models include region (and year) fixed effects. Thus, effectively, the instrument is used to predict regional *changes* in the immigrant population by using past *time-invariant*

regional data interacted with the current change in the Spain-wide foreign-born population.

The instrumental variables approach based on ethnic networks has been widely used in countries such as the US, with a long history of immigration. The immigration episode in Spain started timidly during the second half of the 1980s and accelerated over the 1990s. Thus we employ data from the 1991 Census to compute the distribution of immigrants by country of origin across Spanish provinces in that year, and then predict the distributions over our period of analysis. Our exogeneity assumption is that regional shocks to the demand for female *skilled* labor between 1999 and 2008 are uncorrelated with immigrant location patterns prior to 1991. Section 6.1 provides a detailed discussion on the validity of the instrument for our specific application.

5. Data

5.1. Sources and Definitions

We exploit the regional variation in migration densities across the 52 Spanish regions. We combine data from four different sources: the Labor Force Survey (1999-2008), the Household Budget Survey (1999-2005), the Local Population Registry (1999-2008), and the 1991 Decennial Census.

Our main data source is the Labor Force Survey (LFS or "Encuesta de Población Activa"). This survey interviews about 60,000 households on a quarterly basis and is essentially standardized with the labor force surveys in other European countries. We use the second quarter interviews for each year between 1999 and 2008.[21] We use the LFS to calculate the share of (female) workers employed in household services by region and year, the dependent variable in equation (8). The Labor Force Survey, however, does not provide information on wages or earnings. Therefore, in order to construct the dependent variable in the wage equation (9)

[21] We use only the second quarter in order to minimize seasonality effects.

(average hourly wages in household services by region and year), we combine data on hours worked by household service workers from the LFS with information on expenditure on household services from the Household Budget Survey (HBS).[22] The average hourly wage of household service workers is constructed as total expenditure on household services in a region and year, divided by total hours worked by household service workers in the same region and year.[23]

We also use the LFS data to build our two measures of individual labor supply (a binary employment indicator and a continuous variable of weekly hours worked) in equation (10), the vector of individual characteristics (age, gender, education, marital status, and number and ages of children in the household), and to construct our indicators for women with family responsibilities.

We define three indicator (or dummy) variables for the following situations. The first indicator identifies women with children younger than 8.[24] The second indicator (elderly dependents) takes a value of one for women that live in households where there is an individual aged 65 or older. Typically, this is the woman's parents or parents-in-law. As discussed earlier, this definition is somewhat limited. We do not know whether the woman is providing care services for this elderly co-resident. Likewise, we do not know if women are caring for other elderly relatives that live in different households. Finally, a grandparent in the household may help women cope with other family responsibilities, instead of imposing a burden, and this may be more pronounced for female elderly co-residents. Thus, we analyze separately the case of

[22] Other data sets that do have information on wages (the Earnings Structure Survey, the Continuous Sample of Working Lives) exclude the household services sectors, thus our indirect approach for estimating wages in the sector.
[23] The HBS does not report the 52 regions, but it contains information at a higher level of regional aggregation (18 regional units). The wage analysis is aggregated accordingly.
[24] The specific age cut for the children is somewhat arbitrary, thus we have explored different alternative ages between 0 and 16.

male and female elderly relatives in the household. Finally, we build a third, joint indicator (family responsibilities) that takes a value of one if any of the previous two indicators is one.

Our third source of data is the 1991 Spanish Decennial Census. We use the Census in the construction of the instrument (*Z*) and thus take 1991 as the base year. We compute the proportion of immigrants that lived in each Spanish region in 1991, separately by country of origin.

Finally, we use data from the Local Population Registry ("Padron Continuo") to construct immigration rates. The Registry is collected by municipalities and published annually since 1996. We use these data in the construction of our instrument (*Z*) and our main explanatory variable, the female immigrant share (*FIS*).

5.2. Measurement error

As pointed out by Aydemir and Borjas (2006), the spatial correlations approach is likely to suffer, in practice, from substantial attenuation bias due to measurement error in the main explanatory variable (some measure of regional immigrant concentration). Their warning is highly relevant in our analysis, since our main data source is the relatively small (compared with the Census) quarterly Labor Force Survey.[25] In addition, our focus on the household services sector requires a measure of the immigrant population that accurately accounts for undocumented migrants.

Fortunately, we can get around this data limitation thanks to the Population Registry. The whole population, rather than a sample, is in the Registry. Thus we can argue that our main explanatory variable, the female immigration share (*FIS*), is virtually free of measurement error. To construct this variable, we use women with foreign nationality and include all education levels

[25] Conducting our analysis using solely Census data would require waiting for several years until the 2011 Census data becomes available. Clearly, policy-makers need more timely analysis to inform their pressing policy decisions.

(since no education data is available in the Registry). We define immigration based on nationality rather than country of birth, which provides a better measure of recent immigration.[26]

For comparison purposes, we construct two alternative measures of immigrant concentration using the Labor Force Survey. First, following the approach in Cortes and Tessada (2010), we compute the female unskilled share (*FUS*) in each region and year, including both natives and immigrants. Low-skill workers are defined as those having at most a high-school degree. As discussed earlier, educational attainment is very loosely correlated with occupation in the case of recent immigrants in Spain. Thus we only use this measure as a robustness check. Second, to investigate the effect of measurement error in the immigrant concentration variable, we also build the female immigrant share using the Labor Force Survey (*FISS*). As expected, for some regions in the early years in our sample period, the number of observations is quite low.

5.3. Descriptive statistics

Our identification strategy exploits the variation in immigrant concentration across regions. Fortunately, the size of immigration flows over the last decade differed a great deal across Spanish regions. Figure 1 plots the regional distribution of immigrants in 2008 (as a fraction of the working-age population). The Mediterranean coast, Madrid and the islands were the main host regions. The foreign-born share in many of these areas (e.g. Alicante, the Balearic Islands and Girona) increased from around 5% in 1999 to more than 20% in 2008. In contrast, in the South and West immigration rates were fairly low, with foreign-born shares in 2008 well below 5%.

[26] After a few years of residence, many immigrants become naturalized. At the same time, we have shown that the fraction of female immigrants employed in household services declines rapidly with years of residence in Spain. Thus, a measure of recent immigration seems more appropriate than the stock of foreign-born females.

Data from the Labor Force Survey indicates that recent immigrants were on average younger, less educated, and more heavily concentrated in low-earnings occupations than natives. In 2008, immigrants were, on average, 5 years younger than natives, and had slightly lower levels of education (85% had at most a high-school degree, compared with 82% of natives). Despite the very small difference in this measure of educational attainment, immigrants were disproportionately employed in low-earnings occupations (83% compared with 33% of natives). In particular, a large number of recent female immigrants held household service jobs. Fuelled by immigration, this sector expanded vigorously. As a share of total employment, it increased from 3% in 1999 to 4.4% in 2008. According to the Family Budget Survey, the percentage of households reporting positive expenditures on household services increased from 6% in 1999 to 9% in 2005.

Table 2 (bottom panel) summarizes our main explanatory variables, that is, our measures of female immigrant concentration. Our main variable is the Registry-based female immigrant share (*FIS*). For the average region, this share increased from 2.6% to 17.9% between 1999 and 2008.[27] The row below reports the analog variable computed using the Labor Force Survey (*FISS*), with very similar mean values. The share of unskilled females (*FUS*) also increased over the period, from 90% to 96%. Finally, the last row of the bottom panel reports the average predicted share of foreign-born individuals (*Z*), which increased by 16 percentage points between 1999 (4.5%) and 2008 (21.1%).

The top panel of Table 2 presents summary statistics regarding the labor supply of native women across education groups, distinguishing by type of family responsibility. We focus on the last two columns, which report on women with a college degree. Several points are worth noting.

[27] Note that all the measures of female immigrant concentration, FIS; FUS and FISS are normalized using the 1991 female working-age population.

First, there was remarkable skill upgrading among Spanish women between 1999 and 2008. Over this period, the share of women with a university degree doubled (from 4.6% to 9.3%). Second, roughly 40% of college-graduate women face at least one family responsibility. Having young children at home is the most common one, affecting 38% of skilled women in 1999 and 33% in 2008. In comparison, the group of all women (in age group 25-64) is characterized by a lower share of mothers of young children and a higher frequency of elderly dependents, reflecting the lower average age among more educated women.

Third, the employment rates of college-educated women increased by 8 percentage points, from 79% to 87%. In the same period the employment rates of all women increased by 17 percentage points, from 38% to 55%. These large increases reflect the strong economy of this period. The employment rates of skilled women with young children also increased substantially during the period, by 10 percentage points.

We next turn to work hours. Clearly, college-graduate women work more hours on average than women as a whole (31.4 versus 19.2 in 2008, respectively).[28] We also note that family responsibilities are associated with lower hours of market work. Moreover, between 1999 and 2008, the average weekly hours of work increased by 3 hours for college-educated women as a whole (from 28.5 to 31.4) and by roughly the same amount for those with young children (from 26.5 to 29.4). In contrast, the employment rate and average hours of work among skilled women with female elderly dependents fell slightly. Finally, note that both the employment rates and work hours of college graduate women are considerably higher for those with a female versus a male elderly relative in the household.

6. Instrument validity

[28] Our computation of the average hours of work includes women with zero hours of work. Thus changes in participation rates also affect average hours.

We follow an instrumental variables approach in order to provide a causal interpretation of the associations modeled by equations (8) through (10). Following Card (2001), we aim at exploiting the influence of ethnic networks established in the past on the location choices of current immigrant arrivals from the same country of origin. The validity of this instrument has been argued extensively in applications involving US data. It is less clear that ethnic networks are helpful in predicting actual immigration flows in countries with a shorter history of immigration.[29] However, according to the Spanish National Immigrant Survey, over 80% of immigrants in Spain in 2007 reported that they had a local contact (a friend or relative) that they could go to upon arrival in Spain. This suggests that the first location upon arrival in Spain was, at least in part, driven by networks of friends and relatives from one's country of origin. Next, we discuss the exogeneity and relevance of the instrument in the context of our application.

6.1. Exogeneity

Instrumental variables estimation of equation (10) will be consistent provided that the geographical location patterns of the 1991 stock of immigrants are uncorrelated with region-specific shocks that affect the labor supply of skilled native women between 1999 and 2008. Note that the typical analysis of the labor market effects of immigration using the ethnic networks instrument relies on a stronger assumption. Namely, it assumes that shocks to the labor demand for, say, unskilled labor in the past are uncorrelated with recent shocks to the demand for that same type of labor. Our assumption would only be violated if the regions that received positive aggregate economic shocks in the mid 1980s also received systematically high (or low) shocks to female skilled labor supply over the period 1999-2008.

[29] Gonzalez and Ortega (2009) are the first to build a version of the ethnic networks instrument using Spanish data. Unlike here, their predictor does not use Population Registry data, it disaggregates immigration flows by education, and it covers only the period 2001-2006.

We provide two pieces of evidence that support our exogeneity assumption. First, it is informative to compare the current location choices of the two groups that have a relatively long history of immigration into Spain, namely, Latin Americans and Moroccans. The predictive power of the instrument is primarily based on the networks of these two groups.[30] We compute each region's share of the total Moroccan population and the analogous Latino share using the Population Registry in 2008. Figure A1 in the Appendix reports these values. Note first that the Latino and Moroccan shares are positively correlated. This is not surprising since large provinces have larger shares of all immigrant groups. The correlation coefficient is 0.84, but drops to 0.44 when we exclude the four largest provinces. The figure also reveals important differences in the distribution of the two ethnic groups. For instance, in 2008 Madrid hosted 12.3% of all Moroccans and 25.7% of all Latinos. Finally, these differences have a clear geographic interpretation. Excepting Barcelona and Madrid, all other provinces with an over-representation of Moroccans lie along the Mediterranean coast.[31]

These observations have two important implications. Firstly, the geographic distribution of immigrants differs by country of origin, which suggests that current local economic conditions are not the only determinant of migrants' location. There is room for other variables, such as ethnic networks. Secondly, at least for the case of Moroccans, proximity to the country of origin seems to be a key determinant of current location. To the extent that earlier Moroccans also took this into account, distance is another reason that can account for the predictive power of the 1991 shares by country of origin that is not related to current local economic conditions.

[30] Grouping Latin American countries together is done partly because of casual evidence that ethnic networks often spill over from one country of origin to others that share a common language and culture, and partly because of the coarse partition of countries in the 1991 Census.
[31] Murcia (7.9%), Malaga (5.5%), Almeria (5%) and so on.

Our second piece of evidence is based on the main determinants of the 1991 geographical distribution of immigrants. We next show that the relative size (in terms of GDP) and the sector composition of each region in 1991 can account for much of the variation in the distribution of immigrants at that time, while they do not appear to be correlated with the 1999-2008 increase in the regional demand for female skilled labor. This evidence supports the exogeneity assumption required for the consistent estimation of (10) using the ethnic networks instrument.

Let us start by analyzing the determinants of the cross-sectional distribution of immigrants in 1991. We estimate a cross-sectional regression where the dependent variable is the foreign-born share in 1991 at the regional level. The right-hand side variables are the economic size of the region (measured as the regional share in the national GDP) and its sector composition (value added in the primary sector and in tourism plus retail over total value added at the regional level). The results are presented in Table A2 in the Appendix (column 1). Clearly, the relative economic size and the share of services (tourism and retails) over GDP are both highly significant determinants of the foreign-born share. Together these variables account for an 89% of the total variation in the data.

We next examine whether these 1991 variables are correlated with the recent evolution of the labor supply of skilled women. In doing so, we estimate the previous cross-sectional regression, but replacing the dependent variable by the increase in the regional employment-population ratio of college-graduate females between 1999 and 2008. Column 2 in Table A2 presents the results. None of the explanatory variables are now statistically significant, and the associated R^2 is very low. In conclusion, the main determinants of the 1991 location of immigrants do not appear to be correlated with recent changes in the labor supply of college educated women. Of course, we cannot rule out that other determinants of the past location of immigrants may be correlated with

current changes in the demand for skilled female labor. However, on the basis of the high goodness of fit of the first regression (column 1, Table A2) this seems unlikely.

6.2. Relevance

Having argued that it is reasonable to assume that the cross-sectional distribution of immigrants in 1991 is uncorrelated with shocks to the labor demand for skilled females over the last decade, we now turn to examining the relevance of our instrument.

Table 3 reports the OLS estimates of a set of regressions where the dependent variables are different measures of the size of female immigration flows: the female immigrant share (*FIS*), the share of unskilled females (*FUS*) and the female immigrant share built using survey data (FISS). The right-hand-side of the regressions contains our ethnic networks instrument (*ZS*), along with province and year fixed-effects, and a set of demographic controls. Let us focus first on the top panel, where the instrument is based on Population Registry data (and the 1991 Census). The first column presents our main specification, where the female immigrant share has also been built using the Population Registry. The coefficient associated with *ZS* is 0.288, positive and highly significant. The associated t and F statistics are, respectively, 8.1 and 65.5, which allow us to clearly reject the null of weak instruments.[32] The partial R^2 is 16%. In words, a predicted increase in the immigrant population of 100 individuals in a given province between one year and the next is associated with an actual increase of almost 30 foreign females. There are at least two reasons that can account for a coefficient lower than one. First, even if networks accounted perfectly for each immigrant's first location in Spain, local labor demand shocks taking place later in time may induce some relocation. Second, as time goes by, some foreign-born individuals will become Spanish citizens and, therefore, will stop being counted as foreigners. Columns 2 and 3 report on

[32] The critical value, as reported by Stock and Yogo (2005), is 16.4.

the ability of the instrument to predict the female unskilled share (*FUS*) and the female immigrant share built using survey data in place of the population registry (*FISS*). In both cases, the main coefficient of interest ranges between 0.2 and 0.3, and remains highly significant, even though the partial R^2 falls substantially.

The benefits from using Population Registry data are illustrated in the bottom panel of Table 3. Absent the registry data, we would have had to build our instrument and the immigrant concentration variables using the quarterly Labor Force Survey (and the 1991 Census). Consider the last column in the panel, where both the dependent and the main explanatory variable in this first-stage regression are based on the Labor Force Survey. The point estimate is 0.256, similar in size to our preferred estimate (0.288) but much less precisely estimated. The F-statistic is now only 22.37, compared with 65.61 earlier, and the partial R^2 has dropped by half. The F-statistics are even lower in columns 1 and 2, where they fall below the threshold that allows us to reject the null of weak instruments. In conclusion, the availability of even limited population registry data turns out to be very helpful. It allows for a strong first-stage, and relatively small standard errors in the final IV estimates of the parameters of interest.[33]

7. Immigration and household services

In this section we examine the effects of (female) immigration on the household services sector. We expect migration inflows into a region to increase the availability of household services and to reduce its price (wage). Given its non-traded nature, inter-regional trade cannot help accommodate the changes in the local supply. Thus standard models predict an adjustment via prices and wages.

[33] In our main IV regressions the vector of instruments includes *ZS* and *ZS*D*, in addition to the year and province fixed effects and the set of demographic controls. The results of the first-stage regression for our main specifications are reported in table A3.

In order to test these hypotheses, we estimate the regional aggregate regressions (8) and (9). In the former, the dependent variable is employment in household services relative to total employment. In the latter, it is the log of the average hourly wage for household service workers in the region. In both cases, the right hand side contains region and year fixed effects, together with the female immigrant share (*FIS*).[34]

Table 4 reports the OLS and IV estimates. The top panel reports the estimates of the employment regression. The OLS results for our preferred specification, which uses the Registry-based female immigrant share (*FIS*), show that the arrival of 100 female immigrants into a region is associated with an increase in the number of household service workers equal to about 14. However, it could well be that immigrants are drawn to regions with increasing demand for service workers. If this is the case, then our OLS estimates will overestimate the impact of immigration. The second column reports the IV estimates. As expected, the coefficient is now smaller, but it remains positive and strongly significant. An inflow of 100 female immigrants into a region leads to an increase in the number of workers in household service occupations equal to about 9.[35]

Let us now turn to the average wage regressions, reported in the bottom panel of Table 4. According to our data, the average hourly wage for household service workers in the period 1999-2005 was 4 euros, with a standard deviation of 2. The OLS results suggest that a 1 percentage point increase in the female immigration rate in the region is associated with household service wages that are 3.2% lower. However, if immigrants are attracted to regions

[34] As explained earlier, data limitations require the use of larger regions in the wage regression. Instead of 52 regions we use the 18 aggregate regional units ("autonomous communities") and can only use data for years 1999-2005, delivering a total of 126 observations. In comparison, the employment regression has 520 region-year observations.

[35] Our results are unaffected by the use of alternative measures of immigrant concentration (available upon request from the authors). Note that the exogeneity assumption required for the validity of our instrument in these regressions is that the 1991 geographical distributions of immigrants is uncorrelated with annual shocks to the demand for household service workers at the regional level over 1999-2008.

with increasing (household service) wages, the OLS coefficient may underestimate the actual wage effect. The second column thus reports the IV coefficient, which indeed points to a larger effect. The IV results suggest that a 1 percentage point increase in the share of female immigrants in the region leads to a significant 5.9% decline in household service wages. This effect is very large, but we should be cautious in its interpretation given the large associated standard errors.

Previous studies have not found significant effects of immigration on native wages in Spain (Carrasco et al. 2008, Gonzalez and Ortega 2010). However, household services were always excluded from the analysis in those studies, for data availability reasons (the main sources of wage data do not include this sector).[36]

Overall, the results in this section provide clear evidence that female immigration into a region leads to an increase in employment in the household services sector and to a decline in the average hourly wage of household service workers, though the latter effect has been estimated with a limited degree of precision.

8. The labor supply of skilled women

Unfortunately, we lack precise estimates of the price of household services for the whole period at the disaggregated regional level. Our approach is then to estimate a reduced-form regression, where the main explanatory variable is the share of female immigrants in a region and year. The justification for this regression was provided in the previous section, where we established a link between female immigration into a region and the supply (and price) of household services in that region. We are relatively confident in providing a structural interpretation for the estimates from our reduced-form regression. The reason is twofold. First,

[36] A report from the Spanish President's Economic Bureau (2006) reports average annual growth of wages in household services for 1988-1997 and 1998-2004 at 10% and -1.7%, respectively. The source of the data used for these calculations is unspecified.

we focus on skilled native women, who most likely do not face labor market competition from recent female immigrants. As we noted earlier, the occupational distribution of the two groups differs sharply. Second, we focus on the differential effect of female immigration on the labor supply of skilled women with family responsibilities, relative to skilled women in the same region that do not have such responsibilities. Any other channel through which immigration affects all skilled native women, regardless of their family situation, will thus not confound our results.

Let us then turn to the estimation of the labor supply model in equation (10), shown here again:

$$(10) \qquad y_{irt} = \lambda_t + \mu_r + \alpha D_{irt} + \beta FIS_{rt} + \gamma D_{irt} FIS_{rt} + X'_{irt}\Lambda + \varepsilon_{irt}.$$

For now, the "family responsibilities" dummy (D) takes a value of one for all women with children younger than 8 or living with an elderly dependent. We consider two measures of labor supply: a dummy for being employed and the number of weekly hours worked (including the zeros). Table 5 presents the OLS and IV estimates. The top panel estimates the models on the sample of college-graduate native women. For comparison, the middle and bottom panels use increasingly larger samples: native women with at least a high-school degree, and all women, respectively.

Let us focus on the main sample, native women with a college degree.[37] First, the coefficient of the family responsibilities dummy (α) is negative and highly significant, as expected. The point estimates indicate that family responsibilities are associated with lower employment rates (about 5 percentage points) and fewer hours worked (about 2 per week).

[37] Table A3 reports the first-stage regression. As shown by the t-statistics, the female immigration share, *FIS*, is highly partially correlated with the predicted immigration share, *ZS*, while *FIS*D* is highly partially correlated with the interaction term *ZS*D*. Thus, the rank condition for 2SLS is satisfied (Wooldridge 2002). The Cragg-Donald statistic associated with these regressions are around 6, which allows us to reject the null of weak instruments (critical value 4.58 for a 15% maximal IV size, Stock and Yogo 2005).

Second, we do not find any significant effect of immigration on the labor supply of skilled women without family responsibilities, that is, we cannot reject the null hypothesis of $\beta=0$. This is consistent with the predictions of our theoretical model. Note, however, that as we include increasingly less educated women in the sample (middle and bottom panels), the IV point estimate for β becomes negative and highly significant for the employment regression. Our interpretation is that recent female immigration put downward pressure on the employment rates of middle and low educated women through greater competition in the labor market.

We now focus on γ, the coefficient associated to the interaction between the family responsibilities indicator and the female immigrant share. This is our main coefficient of interest, capturing the *differential* effect of an increase in the female immigrant concentration on the labor supply of skilled women with family responsibilities, relative to skilled women without such responsibilities in the same region. Both in OLS and IV we find a positive and significant effect on employment.[38] According to the IV estimate, a 10 percentage point increase in the share of foreign females in the region leads to an increase of 2.56 percentage points in the employment rate of college educated women with family responsibilities, relative to other college educated women in the same region. Interestingly, the point estimate for γ falls rapidly as we enlarge the sample by including high school graduates (middle panel) and high-school dropouts (bottom panel). In our view this reflects the fact that relatively few less skilled women are able to afford household services.

Since the female immigration rate in the average region increased by 15 percentage points between 1999 and 2008, the increase in employment that can be attributed to the immigration inflow equals about 3 percentage points. In comparison, the employment rate of college educated

[38] Note that the IV estimate is slightly above the OLS one, suggesting a negative correlation between the labor market shocks for college educated natives and (low-skilled) foreign females.

women with family responsibilities experienced and overall increase of 10 percentage points in this period. Thus immigration accounts for almost a third of the large increase in employment rates for skilled Spanish women caring for children and elderly over the last decade.

Regarding hours worked, the coefficient on the interaction (γ) is also positive, both in OLS and IV, although we cannot reject the null of no effect. At face value, the point estimate implies that a 10 percentage-point increase in the female immigrant share leads to an increase in weekly hours worked of 0.25 (15 minutes). The failure to detect this small effect on hours may be due to the relatively small sample size. When we enlarge the sample by including women with at least a high-school degree (middle panel), the IV point estimate of γ is now practically identical to the analogous estimate under the more stringent definition of skilled worker (2.88), and significant at the 95% confidence level. As expected, the coefficient turns negative and insignificant once we include all education levels (third panel). In sum, we find partial evidence for a labor supply response along the intensive margin for skilled women with family responsibilities. However, the effect appears to be rather small.

For comparison with previous studies, we re-estimate the empirical models in Table 5 with the share of low-skilled females (*FUS*) as main explanatory variable, which includes both natives and immigrants. Cortes and Tessada (2010) use this explanatory variable to account for the potential increase in competition among low-skilled workers that results from the immigration inflow. The results are presented in Table A4 in the Appendix. Our previous conclusions remain mostly unaffected. However, two points are worth mentioning. First, the share of low-skilled females increased by 6 percentage points over the period. Thus the predicted effects of the immigration inflow are slightly smaller under this alternative specification. Second, the point

estimates are less precisely estimated, probably due to the larger measurement error in the immigrant share obtained from the Labor Force Survey.

We also check the robustness of our main IV estimates by allowing regions to experience different shocks over time based on their 1991 values of several key variables. Namely, we include in the regression a set of additional controls, interacting a set of regional characteristics in 1991 (share of women with a college degree, employment rate of college-educated women, share of value added in agriculture, and share of value added in services) with a linear time trend. The results are reported in Table A5. None of the additional controls is significant and our main coefficients of interest remain practically unchanged and significant.

As an interesting comparison, we also estimate the models in Table 5 for the analogous samples of men.[39] We expect to find smaller effects for men since their labor supply is less constrained by family responsibilities (Table 1). Similar effects to those found for women would suggest that mechanisms other than the effect of immigration on the household services sector are responsible for our results. As it turns out, we cannot reject the null of no effect on the employment and hours of men for any of the three samples (neither in OLS or in IV). The interaction with family responsibilities is never significant and the sign is actually negative for the sample of college-graduate men. Thus increases in the local supply of female immigrants have effects that are specific to native women.

A final concern regarding our estimation results is the potential bias due to endogenous internal migration. Regions are not closed economies and natives may respond to the immigration supply shock by moving to other areas with less competition or cheaper household services. Note that the first explanation is not relevant in our study since we focus only on high skilled workers. Moreover previous studies have not found evidence of large natives' migration responses to

[39] The full table with the results for men is available upon request.

immigration (Card, 2001). The magnitude of this response is expected to be even smaller in Spain where internal immigration rates, in particular interregional ones, are relatively low in comparison with those in other developed countries (Bentolila, 2001). Accordingly, the potential bias in our estimation results arising through this channel is likely to be negligible.

In sum, we find significant and sizeable effects of immigration on the labor supply of college-graduate native women, operating mostly along the extensive margin. Our interpretation is that cheaper household services induced high-productivity women to re-optimize their time use, reducing their housework and increasing their market labor supply.

In the remainder of the section we estimate labor supply models analogous to (10), separately for mothers of young children and women with elderly dependents.

8.1. Young children

To investigate the labor market response of mothers with young children, we restrict the sample to college-educated women younger than 45. We depart slightly from the specification in (10) by including two indicators for the presence of young children (younger than 4 years old and between 4 and 7 years old).

The estimation results are presented in Table 6, both for OLS and IV. First, we note that the coefficients associated with the children dummies are negative. In particular, according to our IV estimates, having a child younger than 4 is associated with a probability of employment almost 4 percentage points lower, compared with only 2 points for children aged 5 to 8. Second, the coefficient on the female immigrant share is never significantly different from zero. Third, the coefficient on the interaction between the immigrant share and the dummy for children younger than 8 years old is positive and highly significant. Additionally, the point estimates we obtain are very similar to those in Table 5. A 10 percentage point increase in the female immigrant share

leads to an increase in the employment rate of skilled women (younger than 45) with children equal to 2.2 percentage points, relative to comparable women without children younger than 8. This is perhaps not too surprising given that having young children is the responsibility with the highest frequency in our sample.

For robustness, we re-estimated the model including yearly indicators for the age of the youngest child as well as their interaction with the female immigration rate.[40] This alternative specification suggests that the bulk of the effect comes from the labor supply response of mothers with children younger than 1, suggesting that the lower wages of foreign domestic workers allow skilled women to return to work earlier after childbirth.

8.2. Elderly dependents

We next analyze the effect of female immigration on the labor supply of women cohabiting with an elderly relative (most often one of the parents of parents-in-law).[41] Though middle-aged women are more likely to lie in this category, we do not have strong arguments to restrict the sample to a particular age range and thus we consider the whole sample of college-educated women. We estimate the regressions separately including indicators for male and female elderly dependents, respectively.

The first result is that neither the female immigrant share, nor the interaction with elderly dependent, is significant in any of the specifications where the elderly dependent is a female.[42] Thus we conclude that immigration did not affect the labor supply of skilled native women with female elderly dependents. This is consistent with elderly women on average helping with

[40] These results are available upon request.
[41] Some of the elderly men are husbands. We also estimate analogous regressions excluding the husbands from the definition of elderly dependents, with very similar results.
[42] These results are available upon request.

household chores more than imposing a burden on the working-age female head of household, and could also be related to better health compared with men in the same age range.

Table 7 displays the main estimation results for college-graduate women with male elderly dependents. First, the coefficient associated with the indicator for a male elderly dependent is negative, large (in absolute value), and highly significant. In fact it is more than twice as large as the analogous coefficient in the specification for young children. Having a male elderly dependent is associated with a lower employment probability (17 percentage points) as well as lower working hours (6.5 hours per week). Second, the coefficient on the female immigrant share is again not statistically significant.

We now turn to the main coefficient of interest, the interaction term between the male elderly dummy and the female immigrant share. We find a significant and positive IV estimate for employment as well as hours worked. The point estimates are considerably larger than the estimated effects for mothers but the standard errors are also substantially higher, particularly for hours worked. Taken at face value, the IV point estimates suggest that a 10 percentage-point increase in the share of foreign females in the region increases the probability of employment by 6.8 percentage points and weekly hours worked by 2 hours for college-educated women living with male elderly relatives, compared to equally educated women without this responsibility.

9. Conclusions

Our results provide evidence that female immigration increases the labor supply of skilled women with family responsibilities, relative to other skilled women. We show that immigration into a region leads to higher employment and lower wages in the household services sector. Thus, our interpretation is that female immigration leads to cheaper household services, which in turn

allows skilled women with family responsibilities to purchase more of these services and increase their labor supply.

Furthermore, we have shown a differential response for skilled women with family responsibilities, relative to skilled women without such responsibilities in the same region. This supports our interpretation that the main channel through which female immigration affected the time use of skilled females was through household services. Second, our results suggest that the main effects operated through changes on the extensive margin of labor supply. We find that immigration allowed skilled women to reconcile their family responsibilities and their careers. These women were able to go back to work earlier after childbirth, and continue working (possibly by postponing retirement) when caring for elderly dependents.

The results indicate that the effect of immigration was also quantitatively important. According to our estimates, recent female immigration flows were responsible for an increase in 3 percentage points in the employment rate of skilled women with family responsibilities over the period 1999-2008. This is a large effect, compared with the 8 percentage-point increase in the employment rate of college-educated women or the 10 percentage-point increase for the subset of women with young children.

Our results are largely consistent, but not identical to those in Cortes and Tessada (2010). They find that low-skilled immigration into the US between 1980 and 2000 increased the labor supply of highly skilled native women along the intensive margin (hours worked), with no effects on their employment rate. This may be due to the more flexible work schedules in the US compared to Spain. Cortes and Tessada (2010) do not analyze the effects on women with elderly dependents, which is probably much more relevant in Europe than in the US. Neither do they consider a potentially differential effect for women with family responsibilities along the extensive margin, which is our main result. Our findings are also consistent with those for Hong

Kong in Cortes and Pan (2009), who show that the arrival of foreign domestic workers between 1976 and 2006 played a crucial role in eliminating the gap in labor force participation rates between mothers of younger and older children.

Several countries have already introduced special visa programs for foreign caregivers (Canada, Israel or Hong Kong). The main goal in these programs has been to help skilled native women with young children balance their careers and their family responsibilities. Our results suggest an even larger scope for these programs on the grounds of the positive effect on the employment rates of women caring for elderly relatives. This result is particularly relevant in Europe, where fertility rates are low and the population is aging rapidly.

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Table 1: Family responsibilities and labor supply

Education level	All levels		College Graduates [1]		College Graduates (1)		
Gender	Women	Men	Women	Men	Women		
Family Responsibility					Children[2]	Male elderly[3]	Female elderly[3]
Panel A: Labor Force Survey, 2005-2008 merged							
% Out of the Labor Force	41	13	11	5	12	13	12
Reasons:							
Family Responsibilities	62	4	52	7	76	44	39
Retired	3	35	9	34	0	20	21
Other reasons [4]	35	61	39	59	24	36	40
Observations	139,686	124,771	12,262	12,646	4,001	192	457
Panel B: Time Use Survey, 2002							
% Employed [5]	46	.	80	.	77	66	83
Daily hours household work	5.6	.	4.44	.	6.15	4.6	4.22
Observations	12,845	.	1,938	.	571	94	109

Sources: For panel A, 2nd quarter LFS 2005-2008 merged. For panel B, 2002 Time Use Survey 2002.
Sample: individuals age 25-64.
(1) College graduates are those with a four-year college degree or higher education.
(2) Children are defined as less than 8 years old.
(3) Elderly dependents are individuals 65 and older co-habiting with the respondent (other than the husband).
(4) "Other reasons" includes: studying, discouraged, disabled or other reasons not specified.
(5) Employed over working-age population.

Table 2: Mean values in 1999 and 2008 for main variables

Education level	All levels		HS Graduates and Above		College Graduates [1]	
Year	1999	2008	1999	2008	1999	2008
Frequency						
Over all women	100	100	22.55	44.59	4.63	9.28
Over women with same education						
Children	20.78	19.49	33.31	27.69	37.69	32.97
Male elderly	9.20	8.74	3.33	4.32	2.40	3.03
Female elderly	5.22	5.70	3.76	4.87	3.20	3.39
% Employed						
Over women with same education	37.98	55.23	66.9	74.38	79.05	87.11
Over women with same education and FR [2]						
Children [3]	42.96	61.91	63.48	73.24	74.82	85.36
Male elderly [4]	19.28	29.18	47.70	53.32	60	63.37
Female elderly	38.55	50.73	73.76	69.53	83.33	81.42
Average hours worked in market						
Over women with same education	13.81	19.16	24.55	26.42	28.47	31.43
Over women with same education and FR						
Children	15.22	20.69	22.89	24.83	26.5	29.42
Male elderly	7.37	10.07	17.12	18.53	20.38	22.48
Female elderly	14.75	18.30	27.25	25.21	29.73	29
Observations	40,499	35,374	9,132	15,760	1,876	3,264
Main explanatory variables						
Female Immigrant Share (FIS) [5]	0.026	0.179				
Female Immigrant Share Survey Data (FISS) [6]	0.024	0.174				
Female Unskilled Share (FUS) [7]	0.902	0.961				
Instrument, Predicted Immigrant Share (ZS) [8]	0.045	0.211				
Observations	52	52				

Sources: 2nd quarter LFS 1999-2008. Sample: Individuals age 25-64. (1) College graduates are those with a four-year college degree or higher education. (2) Family Responsibility. (3) Children are defined as less than 8 years old. (4) Elderly dependents are individuals 65 and older co-habiting with the respondent. (5) FIS is the number of foreign females over the 1991 female working-age population. Population registry and 1991 Census. (6) FISS is the number of foreign females (from the LFS) over the 1991 female working-age population. LFS and 1991 Census. (7) FUS is the number of women with at most a high-school degree (native or immigrant) over the 1991 female working-age population. LFS and 1991 Census. (8) ZS is the predicted number of immigrants (both genders) over the 1991 working-age population (both genders). Population Registry and 1991 Census.

Table 3: Instrument relevance

Dependent variable:	[1] Female Immigrant Share (FIS)	[2] Female Unskilled Share (FUS)	[3] Female Immigrant Share Survey (FISS)
ZS (Population Registry) (1)	0.288***	0.297***	0.205***
t-stat (2)	8.1	9.07	5.35
F-stat (3)	65.61	82.26	28.62
Partial R2	0.16	0.1	0.07
ZS (Labor Force Survey)	0.251***	0.183***	0.256***
t-stat	3.99	3.77	4.73
F-stat	15.92	14.21	22.37
Partial R2	0.08	0.03	0.08

Note:
(1) ZS stands for predicted stock of immigrants as a share of the 1991 working-age population.
(2) All specifications include province and year fixed effects, age, age squared, marital status and the presence of children in several age brackets. Standard errors clustered by province. Three asterisks indicate significant at 99% confidence level.
(3) Threshold value for the test of weak instruments is 16.38 (Stock and Yogo 2005).

Table 4: Immigration and the household services sector

Dependent Variable: Employment in household services over total employment[1]

	OLS	IV
Female immigrant share (FIS)	0.144***	0.086***
	[0.011]	[0.021]
Observations	520	520
R-squared	0.81	0.798

Dependent Variable: Average log hourly wage household service workers [1], [2]

	OLS	IV
Female immigrant share (FIS)	-3.22***	-5.87***
	[0.889]	[2.17]
Observations	126	126
R-squared	0.597	0.562

Sources: Dependent variable in top panel A constructed from the Labor Force Survey (1999-2008) at the regional level (52 regions). Dependent variable in bottom panel constructed from the Labor Force Survey (hours worked) and the Household Budget Survey (expenditure) for the period 1999-2005, at a higher level of regional aggregation (18 regional units).
(1) Top regression includes region and year dummies. Bottom regression includes aggregate regions and year dummies. Both regressions are weighted using the 1991 female population. Standard errors are reported in brackets. One asterisk indicates significance at the 90% confidence level, two indicate 95% and three indicate 99%.
(2) Average hourly wage for household service workers in an aggregate region and year is constructed as total expenditure on household services divided by total hours worked by household service workers in the aggregate region.

Table 5: Immigration and the labor supply of native women

Dependent variable: Estimation method:	Employed(1) OLS [1]	Hours worked(2) OLS [2]	Employed IV [3]	Hours worked IV [4]
COLLEGE GRAD. AND ABOVE				
Dummy for Family Responsibilities (*D*)	-0.049** [0.013]	-2.156** [0.499]	-0.054** [0.013]	-2.305** [0.531]
Female Immigrant Share (*FIS*)	-0.055 [0.075]	-1.596 [3.841]	-0.119 [0.149]	-1.012 [7.348]
Interaction (*FIS* x *D*)	0.167** [0.060]	1.115 [2.433]	0.214** [0.064]	2.488 [2.644]
Observations	25,529	25,272	25,529	25,272
HIGH SCHOOL GRAD. AND ABOVE				
Dummy for Family Responsibilities (*D*)	-0.039** [0.007]	-1.631** [0.256]	-0.053*** [0.006]	-2.166*** [0.252]
Female Immigrant Share (*FIS*)	-0.081 [0.062]	-1.765 [2.410]	-0.256** [0.129]	-5.039 [3.607]
Interaction (*FIS* x *D*)	0.103** [0.031]	0.162 [1.250]	0.147*** [0.032]	2.888** [1.415]
Observations	128,953	127,919	128,953	127,919
ALL EDUCATION LEVELS				
Dummy for Family Responsibilities (*D*)	-0.013** [0.004]	-0.338 [0.195]	-0.019** [0.004]	-0.642** [0.196]
Female Immigrant Share (*FIS*)	0.039 [0.049]	3.984* [1.735]	-0.229* [0.102]	-5.492 [2.891]
Interaction (*FIS* x *D*)	-0.074** [0.024]	-4.901** [1.224]	-0.019 [0.024]	-1.613 [1.098]
Observations	362,613	360,222	362,613	360,222

Note: Each set of estimates comes from a different regression. All regressions include region and year fixed effects, age, age squared, marital status and the presence of children in several age brackets. D is the indicator for family responsibilities that takes value 1 in the presence of children younger than 8 or male elderly dependent (65 and older). Standard errors clustered by region are reported in brackets. One asterisk indicates significance at the 90% confidence level, two indicate 95% and three indicate 99%.

(1) Dependent variable is a dummy for being employed.

(2) Dependent variable is the (unconditional) weekly hours worked. Non-employed individuals have zero hours worked.

Table 6: Immigration and the labor supply of skilled women with young children.
Sample: College graduates, younger than 45

Dependent variable: Estimation method:	Employed OLS [1]	Hours worked OLS [2]	Employed IV [3]	Hours worked IV [4]
COLLEGE GRAD. AND ABOVE				
Dummy for child younger than 4	-0.036*** [0.012]	-1.945*** [0.439]	-0.039*** [0.011]	-2.042*** [0.444]
Dummy for child between 4 and 7	-0.021 [0.015]	-0.980* [0.500]	-0.025* [0.015]	-1.091** [0.516]
Female Immigrant Share (*FIS*)	-0.077 [0.112]	-4.639 [5.560]	-0.312 [0.250]	-9.717 [12.03]
Interaction (*FIS* x *D_child*) (1)	0.150** [0.066]	2.025 [2.447]	0.220** [0.098]	4.281 [3.961]
Observations	17,116	16,971	17,116	16,971

Note: Each column corresponds to a different regression. All estimates include region and year fixed effects, age, age squared, marital status and the presence of children in several age brackets. Standard errors clustered by region are reported in brackets. One asterisk indicates significance at the 90% confidence level, two indicate 95% and three indicate 99%.

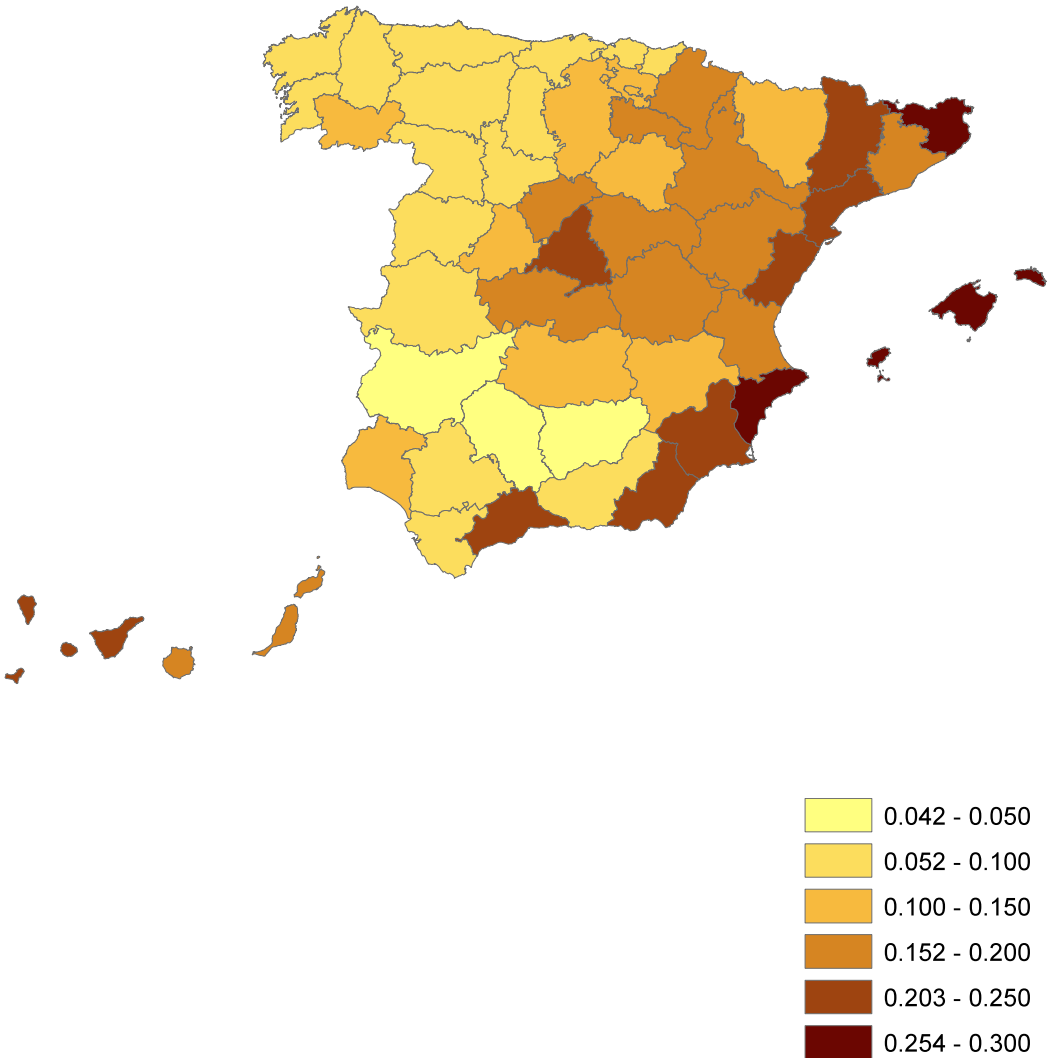
(1) *D_child* takes a value of one if there is a child younger than 8 in the household.

Table 7: Immigration and the labor supply of skilled women with male elderly dependents
Sample: College graduates, all ages

Dependent variable: Estimation method:	Employed OLS [1]	Hours worked OLS [2]	Employed IV [3]	Hours worked IV [4]
COLLEGE GRAD. AND ABOVE				
Dummy for *male elderly dependent (D_eld)*	-0.143** [0.030]	-5.648** [1.137]	-0.175** [0.031]	-6.511** [1.225]
Female immigrant share (*FIS*)	-0.017 [0.077]	-1.792 [3.971]	-0.102 [0.148]	-1.49 [7.624]
Interaction (*FIS x D_eld*)	0.419* [0.178]	13.58* [6.602]	0.682** [0.162]	20.79** [7.465]
Observations	25,529	25,272	25,529	25,272

Note: Each column corresponds to a different regression. All regressions include region and year fixed effects, age, age squared, marital status and the presence of children in several age brackets. Standard errors clustered by region are reported in brackets. One asterisk indicates significance at the 90% confidence level, two indicate 95% and three indicate 99%.

Figure 1. Foreign-born share in the working-age population by region, 2008



Appendix

Proof Proposition 1. Statement i) is obvious. The first-order conditions associated to the problem of individuals without family responsibilities do not depend on p, the price of household services. Statement ii) is equivalent to showing that h^* and x^* are, respectively, increasing and decreasing functions in p for individuals with family responsibilities. For these individuals, their first-order conditions imply:

$$w = p\alpha f'(h) \quad \text{and} \quad x = R - \alpha f(h).$$

It follows from strict concavity of f that the optimal time devoted to home production is a function $h^*(p\alpha,w)$, increasing in $p\alpha$ and decreasing in w. Moreover, the optimal purchases of household services are given by $x^*(R,p\alpha,w) = R - \alpha f(h^*)$, which is decreasing in p for any $\alpha>0$.

Let us now turn to statement iii). Implicit differentiation of the first-order conditions for individuals with family responsibilities leads to the following expression:

$$\left(-\frac{dn^*}{dp}\right) = \frac{dh^*}{dp} - \frac{wu'' x^*}{\phi''+w^2u''}$$

We already established that the first term on the right-hand side is positive. Under our assumptions (strictly concave u and ϕ), the second term is also positive. As a result, the sign of the right-hand side depends on parameters.

We next provide a sufficient condition for x^* to be close to zero. As a result, the monotonicity of h^* as a function of p is inherited by n^*. We proceed in four steps. First, let H be implicitly defined by $R = \alpha f(H)$, that is, the time devoted to home production that fulfills the required family responsibilities. Obviously, in this case the purchases of household services are zero. Second, recall that we derived earlier the following demand functions $h^*(p\alpha,w)$ and $x^*(R,p\alpha,w)$. Third, given p and w, observe that there exists α' such that $h^*(\alpha' p,w)=H$ and $x^*(R,\alpha' p,w)=0$. Fourth, for values of α close enough (from below) to α',

$$\left(-\frac{dn^*}{dp}\right) \cong \frac{dh^*}{dp} > 0.$$

That is, the supply of work hours to the market is locally monotonically increasing. QED

Example: Suppose $f(x) = \phi(x) = u(x) = x^{0.5}$. Then

$$\left(-\frac{dn^*}{dp}\right) = \frac{1}{1+w}\left(\frac{\alpha^2 p}{w}\left(\frac{1}{2}+\frac{1}{w}\right) - \frac{R}{w}\right).$$

It is easy to check that the expression is positive if and only if $\alpha^2 > \dfrac{R}{p\left(\frac{1}{2}+\frac{1}{w}\right)}$.

Table A1: Exogeneity of Family Responsibilities

Dep. Var.	Family Responsibilities[1]	Elderly Dependents[2]	Young Children[3]
OLS			
Female Immigrant share (*FIS*)	0.270 [0.087]**	0.021 [0.036]	0.253 [0.089]**
IV			
Female Immigrant share (*FIS*)	0.135 [0.236]	0.069 [0.093]	0.064 [0.221]
Observations	25,529	25,529	25,529

Note: Each set of estimates comes from a different regression. In all cases the sample is the set of women with a college degree. All regressions include region and year fixed effects, age, age squared and marital status. Standard errors clustered by region are reported in brackets. One asterisk indicates significance at the 90% confidence level, two indicate 95% and three indicate 99%.

(1) The dependent variable is an indicator for family responsibilities that take value 1 in the presence of children younger than 8, retired husband, or male elderly dependent (65 and older).

(2) The dependent variable is a dummy for the presence of retired husband or male elderly dependent (65 and older).

(3) The dependent variable is a dummy for the presence of children younger than 8.

Table A2: Exogeneity instrument (Supporting regressions)

Dependent variable	FB share 1991 (1) [1]	Ch. Employment Skilled Females (2) [2]
Share GDP 1991 (3)	0.890***	0.356
	[0.065]	[0.675]
Share Primary 1991 (4)	-0.024	-0.068
	[0.042]	[0.431]
Share services 1991 (5)	0.098***	-0.203
	[0.020]	[0.207]
R^2	0.89	0.02
Observations	50	50

Note: 50 regions. Ceuta and Melilla excluded due to lack of data.
(1) Dependent variable is the foreign-born share in 1991 (stock of foreign-born over working-age population).
(2) Dependent variable is the change in the employment rate of college educated women between 1999 and 2008.
(3) Regional GDP over Spain's GDP in 1991.
(4) Value added in primary sector over total value added in the region in 1991.
(5) Value added in services over total value added in the region in 1991.

Table A3: First-stage regressions for Tables 5, 6 and 7.

	All Family Responsibilities[1]		Elderly Dependents[2]		Young Children[3]	
Dep.Var.	*FIS*	*FIS*D_all*	*FIS*	*FIS*D_elderly*	*FIS*	*FIS*D_child*
ZS	0.288***	-0.096***	0.288***	-0.004***	0.286***	-0.136***
	[0.082]	[0.019]	[0.036]	[0.002]	[0.035]	[0.016]
ZS x D	0.001	0.530***	0.019*	0.554***	0.001	0.568***
	[0.005]	[0.086]	[0.011]	[0.087]	[0.004]	[0.039]
Obs.	25,529	25,529	25,529	25,529	25,529	25,529

Notes: Each set of estimates is from a different regression. In all cases the sample is the set of women with a college degree. All regressions include region and year fixed effects, age, age squared, marital status and the presence of children in several age brackets. Standard errors are clustered by province. One asterisk indicates significance at the 90% confidence level, two indicate 95% and three indicate 99%.
(1) The family responsibilities variable (*D_all*) is an indicator for the presence of children younger than 8 or a male elderly dependent (65 and older) in the household.
(2) *D_child* is an indicator for the presence of children younger than 8 in the household.
(3) *D_elderly* is a dummy for the presence of a male elderly dependent (65 or older) in the household.

Table A4: Immigration and the labor supply of native women

Dependent variable: Estimation method:	Employed(1) OLS [1]	Hours worked(2) OLS [2]	Employed IV [3]	Hours worked IV [4]
COLLEGE GRAD. AND ABOVE				
Dummy for Family Responsibilities (*D*)	-0.098* [0.037]	-4.352** [1.295]	-0.273* [0.112]	-4.851 [3.317]
Female Unskilled Share (*FUS*)	0.016 [0.057]	-1.070 [2.576]	-0.132 [0.150]	-1.176 [7.132]
Interaction (*FUS* x *D*)	0.073 [0.037]	2.548 [1.272]	0.266* [0.121]	3.097 [3.558]
Observations	25,529	25,272	25,529	25,272
HIGH SCHOOL GRAD. AND ABOVE				
Dummy for Family Responsibilities (*D*)	-0.003 [0.022]	-1.616 [0.825]	-0.192** [0.059]	-4.829* [1.905]
Female Unskilled Share (*FUS*)(3)	-0.057 [0.051]	-2.238 [1.837]	-0.248* [0.120]	-4.861 [3.483]
Interaction (*FUS* x *D*)	0.001 [0.021]	0.001 [0.770]	0.178** [0.064]	3.516 [2.058]
Observations	128,953	127,919	128,953	127,919
ALL EDUCATION LEVELS				
Dummy for Family Responsibilities (*D*)	0.031* [0.015]	1.568* [0.751]	-0.008 [0.027]	0.908 [1.216]
Female Unskilled Share (*FUS*)	-0.053 [0.040]	-0.38 [1.317]	-0.22* [0.086]	-5.188* [2.377]
Interaction (*FUS* x *D*)	-0.055** [0.015]	-2.562** [0.776]	-0.012 [0.029]	-1.845 [1.301]
Observations	362,613	360,222	362,613	360,222

Note: Each set of estimates corresponds to a different regression. All regressions include region and year fixed effects, age, age squared, marital status and the presence of children in several age brackets. D is the indicator for family responsibilities that takes value 1 in the presence of children younger than 8, retired husband, or male elderly dependent (65 and older). Standard errors clustered by region are reported in brackets. One asterisk indicates significance at the 90% confidence level, two indicate 95% and three indicate 99%.

(1) Dependent variable is a dummy for being employed.

(2) Dependent variable is the (unconditional) weekly hours worked. Non-employed individuals have zero hours worked.

(3) FUS is the number of women with at most a high-school degree (native or immigrant) over the 1991 female working-age population.

Table A5: Immigration and the labor supply of native women. Additional Controls 1991

Dependent variable: Estimation method:	Employed(1) OLS [1]	Hours worked(2) OLS [2]	Employed IV [3]	Hours worked IV [4]
COLLEGE GRAD. AND ABOVE				
Dummy for Family Responsibilities (*D*)	-0.050*** [0.013]	-2.159*** [0.502]	-0.054*** [0.013]	-2.318*** [0.530]
Female Immigrant Share (*FIS*)	0.042 [0.086]	-1.206 [4.655]	0.449 [0.551]	20.27 [29.06]
Interaction (*FIS* x *D*)	0.169*** [0.057]	1.172 [2.439]	0.208*** [0.062]	2.449 [2.617]
year x share of women with a college degree in 1991	0.057 [0.044]	-0.452 [1.913]	0.101 [0.094]	1.882 [4.250]
year x employment rate of college educated women in 1991	-0.027 [0.019]	0.010 [0.937]	-0.060 [0.040]	-1.677 [1.921]
year x share of value added in primary sector over total value added in the region in 1991	-0.003 [0.028]	-0.794 [1.366]	0.005 [0.041]	-0.372 [1.982]
year x share of value added in services over total value added in the region in 1991	-0.013 [0.012]	-0.504 [0.605]	-0.031 [0.030]	-1.460 [1.545]
Observations	25,529	25,272	25,529	25,272

Note: Each set of estimates comes from a different regression. All regressions include region and year fixed effects, age, age squared, marital status and the presence of children in several age brackets. D is the indicator for family responsibilities that takes value 1 in the presence of children younger than 8, retired husband, or male elderly dependent (65 and older). Standard errors clustered by region are reported in brackets. One asterisk indicates significance at the 90% confidence level, two indicate 95% and three indicate 99%.

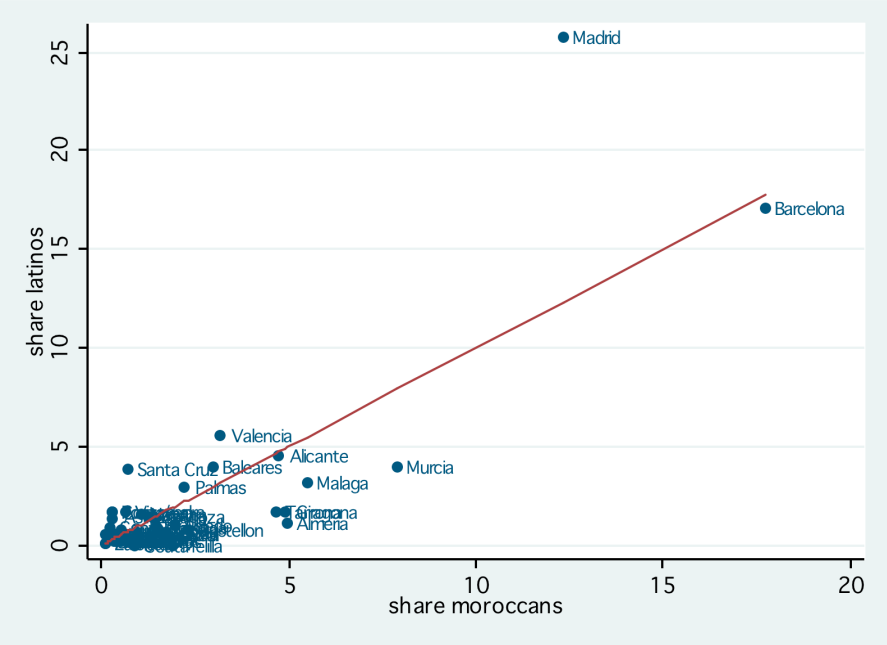
(1) Dependent variable is a dummy for being employed.

(2) Dependent variable is the (unconditional) weekly hours worked. Non-employed individuals have zero hours worked.

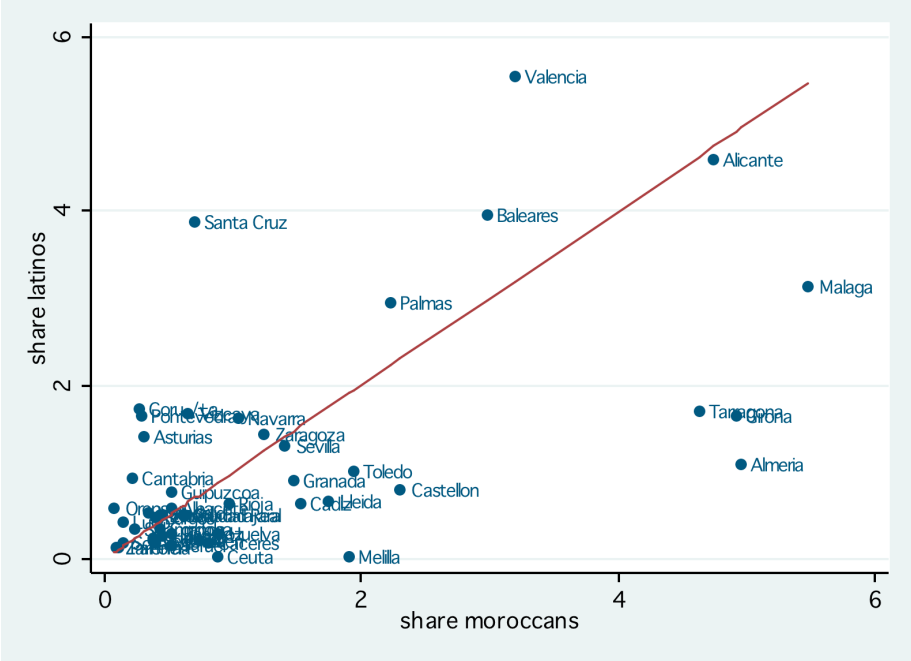
The additional controls are the following variables constructed for 1991 interacted with a linear time trend: share of women with a college degree, employment rate of college educated women, share of value added in primary sector over total value added in the region, share of value added in services over total value added in the region.

Figure A1: Share of immigrants by region in 2008.

a) All regions (52 observations).



b) Excluding largest regions (48 observations).



Notes: The figures include a 45 degree line. The 2008 share of Moroccans is defined as the number of Moroccans in region *r* over the total number of Moroccans in Spain, times one hundred. The 2008 share of Latinos is defined likewise.