Complements or Substitutes?
Task Specialization by Gender and Nativity in Spain[+]

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Abstract

Learning about the impact of immigration on the labor market outcomes of natives is a topic of major concern for immigrant-receiving countries. Using data from Spain –where the immigrant population has risen from 4 percent to 13 percent within a decade, we find that immigration appears to have affected the task specialization of natives without affecting their employment levels. However, the impact of immigration on the relative task supply of natives is twice as large in Spain than in the U.S. with significant differences by gender. Furthermore, while as noted for the U.S., immigrant specialization patterns appear to conform with proficiency in the host country's language, an increase in the share of immigrants has a similar impact on the relative manual task supply of natives regardless of whether immigrants originate from a Spanish-speaking country or not.

Keywords: Immigration, Task Specialization, Gender Segregation, Comparative Advantage.

JEL codes: J15; J24; J61

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1. Introduction

The impact of immigration on the host country's labor market is a topic of major concern for many immigrant-receiving nations. There is a large and growing literature on the consequences of migration on the employment and wages of native workers in the U.S. (see Borjas (1994, 1995, 1999, 2003, 2005), Borjas and Katz (2007), Card (1990, 2001, 2005), Card and Di Nardo (2000), Card and Lewis (2007), Lewis (2003), Ottaviano and Peri (2005, 2006), among others). In general, this literature finds that immigration appears to have small wage effects without affecting the employment rate of natives. As noted by Ottaviano and Peri (2006), this is not surprising given that the effect of immigration depends on the degree of substitution between native and immigrant workers *within* educational groups. If native and immigrant workers of similar educational attainment posses productive skills that lead them to specialize in different occupations, it is reasonable to find a null to small impact of immigration on the employment and wages of natives as immigrants and natives are not competing for the same jobs. In this vein, Peri and Sparber (2009) recently show for the U.S. that less-educated natives adjust to an increase in less-educated immigrant workers by changing their task specialization and upgrading their occupations.

Yet, despite the significant degree of occupational segregation by gender characterizing most economies, the literature has traditionally treated male and female natives as a homogenous group. The gender distinction is particularly important when it comes to economies where female labor force participation (FLFP) has experienced relatively recent increases. That is the case of Spain, where FLFP more than doubled during the last 25 years. As such, women, in part because they have less specific human capital than men given their more recent labor market entry, may respond differently to an immigration shock.

In addition, the argument behind the native responsiveness to the immigrant inflow advanced by the existing literature primarily rests on the comparative advantage of natives in

tasks that require being proficient in the host country language. If that is the case, immigrants who speak the host country language would have, *ceteris paribus*, if any, a smaller impact on the task specialization of natives than immigrants who do not. Yet, to date, we have no evidence of that being the case.

This study focuses on Spain. The new geographic focus allows us to add to the existing literature on various grounds owing to the Spanish labor market idiosyncrasies and, yet, similarity to other European labor markets. *First*, because of the increase in female labor market participation during much of the 1980s and 1990s, the native response to foreign-born workers may differ significantly by gender. *Second*, Spain constitutes an interesting and almost unprecedented case study given the impressive growth of its immigrant population over the past 15 years. In 1991, only 1.2 percent of the Spanish adult population (about 300,000 individuals) was foreign-born. Within a decade, this percentage quadrupled to 4.0 percent (1,370,000 individuals) and, by 2008, it had roughly reached 13 percent (5,200,000 individuals). In fact, since the year 2000, Spain has displayed one of the largest rates of immigration in the world –three to four times as large as the average immigration rate in the U.S. The large magnitude of the immigrant shock may significantly impact the size of the native employment response. *Finally*, almost half of the immigrant stock has Spanish as its native language. This provides us with a unique opportunity to compare their impact on the task specialization of native men and women to that of immigrants for whom Spanish is not their native tongue. If the rationale behind the task specialization of natives in interactive intensive tasks rests on their comparative advantage in Spanish, we should be able to find a null or, at the minimum, lower impact of Spanish speaking immigrants on native workers.

We follow closely the work by Peri and Sparber (2009), who find that immigrants and natives in the U.S. do not seem to compete for the same jobs even within similar age and education categories. They develop a general equilibrium model where immigrants, relative

to natives, have a comparative advantage in manual as opposed to interactive tasks. This comparative advantage causes: (i) immigrants to specialize in jobs that require more manual as opposed to interactive skills and (ii) natives to respond to the lower wages that result from the increased labor supply in such jobs by shifting to occupations with a lower manual to interactive task ratio.

We find that foreign-born workers do not appear to be perfect substitutes of similarly educated native workers, which may help explain the null or small impacts that Spanish immigration appears to have had on native employment and wages.[1] Instead, immigration seems to have altered the task specialization and occupational distribution of natives. However, unlike for the U.S., the impact of immigration on the relative task supply of natives is twice as large in Spain than in the U.S. and there are significant gender differences that emerge at the aggregate level. Furthermore, although immigrants whose mother tongue is Spanish have lower manual to interactive task supplies than their counterparts from non-Spanish speaking regions –just as one would expect according to Peri and Sparber's (2009) model, Latino and non-Latino immigrants appear to have the same impact on the reallocation of natives towards relatively less manual tasks once we take into account other crucial migrant human capital characteristics, such as differences in age and educational attainment. This suggests that, in addition to language proficiency –captured by whether or not they originate from a Spanish-speaking country, other human capital characteristics, such as age (an experience proxy) and educational attainment, are crucial determinants of the ultimate impact of an increase in the share of immigrants on the relative manual task supply of natives.

[1] There are only a few analyses of the impact of immigration on the wages of Spanish natives due to existing data limitations. Yet, in all instances, this literature seems to agree in terms of the small impact that immigration appears to have had on the wages of Spanish natives (see Amuedo-Dorantes and De la Rica (2008), González and Ortega (2010), and Carrasco *et al.* (2008)).

The paper is organized as follows: Section 2 discusses some interesting features of the Spanish labor market to motivate the study and help frame the results. In section 3, we sketch Peri and Sparber's (2009) model and the hypothesis object of analysis. Sections 4, 5 and 6 outline the data and methodology, sections 7 and 8 present the main results and, in section 9, we summarize our main findings.

2. Institutional Framework: Some Features of the Spanish Labor Market

2.1. Female Labor Force Participation and Immigration

Perhaps one of the most important changes experienced by the Spanish labour market since the passage of the 1978 Constitution has been the rapid growth in female labour force participation (FLFP) since the early 1980s. Figure 1 displays the FLFP rates of women aged 25 to 54 over the past 25 years for a variety of nations. During that period of time, FLFP in Spain rose from 32 percent to 75 percent –a remarkable 43 percentage-point increase. To serve as a comparison, in the U.S., FLFP during that time period grew from approximately 62 percent to about 81 percent. Hence, during the past 25 years, the Spanish labor market, just as other European economies like Ireland and the Netherlands, has witnessed a massive entry of women into the workforce. Given the recent nature of this event, women are likely to display a quite distinct work experience and tenure profile from the one exhibited by their male counterparts.

In addition to the impressive growth in FLFP, Spain experienced an extraordinary increase in its immigrant population, particularly in the 21st century. To serve as a reference, between 1995 and the year 2000, the immigrant population rose from 1.5 percent to 2.2 percent; yet, by 2008, the foreign-born population had risen to 13 percent (see Figure 2).[2] Furthermore, using data from the Spanish labor force survey for the 2000-2008 time period

[2] To serve as a comparison, approximately 12.5 percent of the United States' total population were immigrants in 2008, compared to 11.1 percent in 2000 and 7.9 percent in 1990 (please visit the following website for more information: http://www.migrationinformation.org/datahub/state.cfm?ID=US).

under consideration, the figures in Table 1 reveal that an increasingly large fraction of immigrants –accounting for almost half of all interviewed immigrants in 2008– are Latinos for whom Spanish is their native tongue.

The last three columns of Table 1 also display the immigrant distribution by region of origin for the sample of immigrants we work with, *i.e.* recent non-college educated immigrants. As we shall note in what follows, we focus on recent immigrants (*i.e.* those with five or fewer years in Spain) because they are less likely to have yet acquired the language proficiency and other Spanish-specific human capital skills (not exclusively related to language abilities) of natives. Additionally, following Peri and Sparber's (2009) modeling, we restrict out attention to non-college educated immigrants since competition among natives and immigrants is more likely to occur in low-skill jobs. As shown by the last three columns of Table 1, the prevalence of Latino immigrants is also evident in our sample of study.

2.2. Differences in the Occupational Distribution by Gender and Nativity

Despite having significantly decreased over the past decades owing, in part, to the higher educational attainment of women, occupational segregation by gender is still an issue in many European countries, included Spain (Dolado *et al.* 2002, 2003). Already focusing on our sample of study, Figure 3 displays the fraction of non-college educated native men and women employed in each of the 2-digit ISCO88 occupations.[3] It is clear from the graph that occupational segregation by gender is also an important issue in our sample. Evidence from the unequal occupational distribution of native men and native women is the fact that more than 50 percent of native women are employed in personal and sales services (occupations 51, 52 and 91), whereas the share of native men in such occupations does not even reach 15

[3] The International Standard Classification of Occupations (ISCO88) is one of the main international classifications for which International Labor Organization (ILO) is responsible. It is a tool for organizing jobs into a clearly defined set of groups according to the tasks and duties undertaken in the job. It contains 10 mayor occupation groups (1-digit) and 26 groups in the 2-digit classification. We work with 25 groups herein since we lack observations for occupation no. 11: Chief executives, senior officials and legislators. Further information regarding ISCO88 can be obtained from: http://www.ilo.org/public/english/bureau/stat/isco/index.htm.

percent. Similarly, relative to native women, the share of native men in extraction and building trades, precision/handicraft or craft printing trades, driving and mobile plant operations or, overall, working as labourers (occupations 71, 73, 83, and 93) is significantly larger. Approximately 47 percent of native men are employed in such jobs relative to 6 percent of native women.

As with gender, occupational segregation is also evident by nativity, which helps understand the difference between natives' and immigrants' relative manual task supplies. Figure 4 displays the fraction of natives and immigrants in our sample of study employed in each of the 2-digit ISCO88 occupations. Once more, the figures reveal a clear occupational segregation pattern. Relative to natives, immigrants are heavily concentrated in occupations: 91 (Sales and Services Elementary Operations), 93 (Labourers) and 51 (Personal and Protective Service Workers). Those occupations alone employ more than 50 percent of immigrants in our sample, as opposed to roughly 25 percent of natives.

3. Theoretical Framework

In this section, we sketch the main elements and predictions of the general equilibrium model developed by Peri and Sparber (2009), which we use as reference for our empirical analysis.[4] In their model, immigrants have a comparative advantage in performing manual, as opposed to interactive intensive, tasks owing to their limited language proficiency and their often missing host country specific human capital skills. Specifically, they assume an economy that produces one tradable final consumption good: Y, which only requires a low-skill intermediate input: Y_L.[5] The production of Y_L is carried out by less educated workers and requires a technology that combines two different types of tasks: manual (M) and interactive (I) tasks. Manual tasks can be routine or non-routine in nature. Examples of manual tasks

[4] A summary of Peri and Sparber's (2009) general equilibrium model can be found in Appendix A.
[5] For simplicity, we focus on low-skill goods given that competition among natives and immigrants is more likely to occur in low-skill jobs. Regarding high-skill goods, we are implicitly assuming that they are produced by highly skilled workers.

include body coordination and physical strength, whereas interactive tasks require good communication skills, such as being able to easily converse with other people, being capable of performing team work or supervising the work of others. Finally, less educated natives and immigrants are assumed to differ in their efficiency in manual as opposed to interactive tasks, with immigrants enjoying a comparative advantage in manual tasks over natives owing, in part, to language barriers and lack of host country specific human capital.

Peri and Sparber (2009) solve for the equilibrium provision of relative manual tasks by natives, which is given by:

$$m_n^* = \left(\frac{\beta_L}{1-\beta_L}\right)^{\frac{\alpha\lambda}{(1-\alpha)\lambda+\alpha}} \left[f\overline{(e_m)}_i^{\frac{1}{1-\alpha}} + (1-f)\overline{(e_m)}_n^{\frac{1}{1-\alpha}} \right]^{\frac{-\alpha}{(1-\alpha)\lambda+\alpha}} \left[\overline{(e_m)}_n^{\frac{1}{1-\alpha}} \right]^{\frac{1}{1-\alpha}} \qquad (1)$$

where *f* stands for the share of foreign born and $\overline{(e_m)}$ for the average efficiency in manual, as opposed to interactive, tasks. As mentioned before, it is assumed that $\overline{(e_m)}_i > \overline{(e_m)}_n$ - therefore, immigrants have a comparative advantage in manual, versus interactive, tasks. The supply and demand for relative manual tasks determine the equilibrium compensation for manual, as opposed to interactive, tasks: $(w_m/w_I)^*$. An inflow of immigrants with a comparative advantage in manual tasks shifts the relative supply of manual tasks from immigrants to the right of the one from natives. As a result, the overall relative manual task supply –a weighted average of the native and immigrant relative manual task supplies– also shifts to the right. Given the lower equilibrium compensation for relative manual tasks, natives reduce their relative manual task supply. Therefore, an inflow of immigrants with a comparative advantage in relative manual tasks induces native workers to relocate to occupations with a lower manual to interactive task ratio. That is, from equation (1):

$$\frac{\partial (m)_n^*}{\partial f} < 0 \qquad (2)$$

This is the hypothesis object of analysis in this paper, which, owing to gender differences in their labor supply patterns, we examine separately for native men and women.

4. Data

We use the 2000-2008 Spanish Current Population Survey (*Encuesta de Población Activa*, EPA) for the analysis since it provides the most representative sample of the Spanish workforce during that time period.[6] We define as immigrants individuals with a foreign nationality.[7] We focus our attention on recent immigration inflows as recent immigrants (*i.e.* those with five or fewer years in Spain – around 65 percent of all immigrants in Spain) are less likely to have yet acquired the language proficiency and other Spanish-specific human capital skills (not exclusively related to language abilities) of natives. Additionally, since the vast majority of immigrants are employed in low skill jobs and our intent is to examine native occupational changes that result from an increase in the share of immigrants, our analysis centers on non-college educated workers.

Table 2 presents some descriptive statistics of our sample. Overall, the figures in Table 2 reveal a difference in age (a proxy for experience) by nativity, as well as significant differences in education by both nativity and gender. First, immigrants are, on average, 33 years old as opposed to natives, who are 41 years old on average. As a result, it is not surprising to find that up to 46 percent of immigrants are 30 years of age or younger, relative to just 2 percent of native women or 25 percent of native men. In contrast, about 38 percent of native men and 35 percent of native women are 45 years of age and older relative to just 11 percent of immigrants. Second, native women appear the least educated, with up to 37 percent of them having a primary education or less. In contrast, only 29 percent of working

[6] The Spanish Current Population Survey is the most exhaustive and representative source of data for the Spanish workforce. Every quarter, approximately 60,000 households (more than 200,000 individuals) are interviewed. To ensure the most representative sample of working immigrants possible, the data are weighted using the figures from the latest 2001 Population Census (as opposed to the 1991 Population Census).
[7] Those with a double nationality –less than 4 percent of all immigrants– are excluded from the analysis.

immigrants have that educational attainment. Native men are in-between native women and immigrants, with 31 percent of them having a primary education or less.

5. Measuring Task

To examine whether immigration induces natives to relocate to jobs demanding fewer manual as opposed to interactive or non-manual skills, we rely on information on the job task requirements assembled by Peri and Sparber (2009). In their paper, Peri and Sparber (2009) merged data on job task requirements based on the U.S. Department of Labor's *O*Net* abilities survey[8] with Census occupation classifications to examine task specialization patterns of natives and immigrants in the U.S.[9] They transform the *O*Net* abilities in percentile scores that represent the relative importance of each skill among all U.S. workers in 2000.

Through the development of careful crosswalks with the International Standard Classification of Occupations (ISCO88), the *O*Net* data has been increasingly used by a large number of researchers and institutions outside the U.S.[10] We merge the *O*Net* abilities data to the Spanish labor force survey (*i.e. Encuesta de Población Activa*) by occupation.[11] As previous authors using the *O*Net* dataset with European data,[12] we do so under the

[8] They use version 11.0 of the survey, available at: http://www.onetcenter.org/

[9] The *O*NET* rates the importance of 52 employee abilities –to which we refer to as tasks in this paper– in each occupation in the Standard Occupation Classification (SOC). This information is continually updated by surveying a broad range of workers from each occupation in the U.S.

[10] Please refer to: http://www.onetcenter.org/dl_files/paw/Products_at_Work.pdf for a summary of its many applications outside the U.S.

[11] U.S. 2000 Census codes in the *O*Net* dataset are first matched to the ISCO88 codes using a crosswalk made available by the Center for Longitudinal Studies in the U.K. at: (http://www.cls.ioe.ac.uk/text.asp?section=00010001000500160002). Subsequently, both datasets (the *O*Net* abilities and the Spanish labor force survey) are merged using a crosswalk for the Spanish occupation codes (CNO94) and the ISCO88 classification.

[12] For example, Goos and Manning (2007) use the *Dictionary of Occupational Titles* (DOT) data –the *O*Net*'s predecessor– in their analysis of job polarization in the U.K. More recently, Ortega and Polavieja (2009) use the *O*Net* data to examine native attitudes toward immigration in 25 European countries, including Spain.

assumption that the occupations being examined herein are not that different with regards to their manual as opposed to interactive task content in the U.S. and in Spain.[13]

The scale of measurement for the distinct employee abilities (which we refer to as 'tasks' or 'skills') in the *O*Net* is rather arbitrary. The values range from 1 to 10, but the standard deviation varies to a large extent depending on the task measure under consideration. This problem has also been detected and accounted for Peri and Sparber (2009), who tackle it by converting the arbitrary scale of measurement into percentiles.[14] We follow them and, first, properly weigh each occupation's ability raw scores so as to reflect the importance of that particular ability in the Spanish labor force. This is done using information on the proportion of individuals employed in the occupation in question according to the Spanish Current Population Survey (*Encuesta de Población Activa*, EPA). Subsequently, we convert each weighted ability score into relative ability measures. This is done by dividing each occupation's weighted ability score by the maximum value of that ability in any other occupation. As a result, each ability score ranges between 0 and 1 and is indicative of the relative importance of that particular task in the occupation at hand.

Using the computed ability scores, we construct two measures (one narrower and one more broadly defined) of manual and interactive skills.[15] For comparability reasons, we follow Peri and Sparber (2009) and define first a restricted measure of manual skills that contains the following abilities: "Limb, Hand, and Finger Dexterity", "Body Coordination and Flexibility", and "Strength". The broader measure of manual skills also adds "Sensory and Perception" abilities to the aforementioned skill categories. In contrast, the restrictive

[13] As we shall show, the summary ability measures for each of the occupations seem to conform to expectations on the manual as opposed interactive content of the tasks involved.

[14] Specifically, they assume that the 2000 Census is representative of the U.S. workforce. Then, they re-scale each skill variable so that it equals the percentile score representing the relative importance of that skill among all workers in 2000.

[15] We acknowledge the arbitrary choices that one makes when trying to assign the *O*Net* skill variables into a manual versus interactive task category. Hence, we carry out the analysis using both the narrower and the more extended measures of manual and interactive skills.

measure of interactive skills includes measures of oral and written expression and comprehension, whereas the broader measure adds "Cognitive and Analytical" and "Vocal" abilities. Note that, although closely related to language proficiency, the measures of interactive skills also make reference to cognitive, analytical and vocal abilities that may not be present in Spanish-speaking immigrants.

Table 3 displays the restrictive manual and interactive task summary measures for each of the 2-digit ISCO88 level occupations under consideration. It allows us to gauge the suitability of the *O*Net* abilities data in describing the manual to interactive task content of the Spanish occupations considered in this analysis. As it would be expected, high skill occupations have a greater content of interactive tasks and a smaller content of manual tasks than low skill occupations. In contrast, low skill occupations display, on average, a greater content of manual, as compared to interactive, tasks than the high skill occupations. Overall, the figures in Table 3 suggest that the manual to interactive task requirements of U.S. workers are sensible in describing the expected task content, based on their skill level, of the Spanish occupations being examined. Additionally, the figures in Table 3 provide evidence of how, as assumed by the theoretical model, immigrants opt for jobs characterized by a greater manual to interactive task content possibly due to their comparative advantage in manual as opposed to interactive tasks requiring communication skills. Further evidence of this pattern is displayed by Figure 5, which provides a scatter plot of the average manual to interactive task supplies of immigrants and natives at the regional level in 2005.[16] The vast majority of dots lay below the 45-degree line, thus suggesting that, for the most part, the average manual to interactive task supply of immigrants exceeds that of natives as suggested by the individual level data summarized in Table 3.

[16] We use 2005 because it is somewhere in the middle of the time period being examined. However, similar results are available from the authors for the remaining years in our sample.

Lastly, just as Figure 5 does for immigrants and natives, Figure 6 suggests that the occupational segregation by gender observed earlier on in Figure 3 does result in distinct relative manual task supplies for native men and women. All the dots, which represent the average manual to interactive task supplies of native men and women at the regional level in 2005, lay below the 45-degree line. Therefore, on average, the manual to interactive task supply of native men exceeds that of native women.

6. Methodology

Thus far, we have provided preliminary evidence of the distinct occupation choices of native men and native women, as well as of natives and immigrants. We have also shown that natives and immigrants differ with regards to their relative manual supplies, with immigrants displaying a greater supply of relative manual tasks than natives. We now proceed to testing whether less educated native men and women have changed their occupational distribution, relocating to jobs characterized by a lower manual to interactive task ratio, as the shares of similarly skilled foreign-born workers rises. To test this hypothesis, we collapse our data into region-time cells using data from 52 Spanish provinces from 9 years, *i.e.* from 2000-2008.[17] This type of analysis assumes that labor markets are local, as opposed to national, in scope.[18] In the case of Spain, where internal mobility has been shown to be rather low (see, for example, Bentolila and Dolado 1991, and Bover and

[17] As opposed to the U.S., Spain has a recent immigration history that justifies the use of annual data. The latter is likely to capture a different short-run dynamics than the one captured through the use of decennial data in Peri and Sparber (2009).

[18] There are basically two main approaches to examining the labor market impact of immigration on natives. One is the so-called cross-sectional, inter-area or spatial correlation approach, which is the one we use herein. It exploits the fact that immigrants concentrate in certain regions and relies on regional variation to identify the impact of immigration on various native labor market outcomes. The second approach is the so-called national approach. Proponents of this approach have argued that, if natives migrate in response to high immigration, it becomes very difficult for spatially based research to detect any immigration impact on natives. Therefore, instead of slicing the labor market by region, they do it by skill groups and rely on variation across skill groups to identify the impact of immigration on natives. While this approach addresses the criticism that immigration may lead to the out-migration of natives, it assumes that immigrants and natives are perfect substitutes within skill groups. This assumption may be clearly violated if immigrants tend to downgrade in the host country and compete with natives of different skill groups. For that reason, as noted by Dustmann, Glitz, and Frattini (2008), the discussion is still open as to which approach works best.

Velilla 1999), this is a reasonable assumption.[19] In particular, we log-linearize equation (1) and obtain the following linear specification:

$$\ln\left(\frac{M}{I}\right)_{n,pt} = \eta_n (Share\_foreign)_{pt} + X_{pt}\beta + \alpha_p + \delta_t + \varepsilon_{pt} \qquad (3)$$

The vector δ_t represents year fixed-effects intended to account for common time-varying technological parameters captured by the term: $\left(\frac{\alpha\lambda}{(1-\alpha)\lambda+\alpha}\right)\ln\left(\frac{\beta_L}{1-\beta_L}\right)$ in equation (1). The vector α_p contains region (in our case: province) fixed-effects that account for variations in unobserved population characteristics included in the following term from equation (1): $\left(\frac{1}{1-\alpha}\right)\ln\left[\overline{(e_m)}_n^{\frac{1}{1-\alpha}}\right]$. In addition to accounting for variations in unobserved population characteristics with the region fixed-effects, we include the vector X_{pt}, which contains information on the average workers' personal characteristics of each cell (*i.e.* four age group dummies and a secondary-education dummy) to avoid potential spurious correlations between the immigration shock and the provision of manual to interactive tasks by natives.[20] Our key regressor is the share of foreign-born, measured as the ratio of immigrants to natives in each cell, corresponds to the term: $\left(\frac{-\alpha}{(1-\alpha)\lambda+\alpha}\right)\ln\left[f\overline{(e_m)}_i^{\frac{1}{1-\alpha}} + (1-f)\overline{(e_m)}_n^{\frac{1}{1-\alpha}}\right]$ in equation (1). If natives specialize in occupations requiring fewer manual, as opposed to interactive, tasks as the share of foreign-born workers increases, the coefficient η_n should be negative and

[19] Native interregional mobility in Spain is very low. To serve as an example, it is worth noting that in 2006, a year in between the time period examined in this paper, a report from the Spanish Employment Institute (*i.e.* "INEM Employment Observatory" (2006)) noted that 78 percent of Spanish citizens live in the same province in which they were born.

[20] Results are qualitatively the same to those derived from: (a) regressing each individual's task supply on a set of age and education dummies to compute the predicted task supply, (b) subtracting the predicted task supply from the individual's observed task supply to get the "cleaned" residuals, and (c) using the "cleaned" residuals to compute the manual and interactive task supply measures employed in the final regression analysis (see Peri and Sparber 2009). We prefer this other method because it relies on the same exact manual and interactive skill measures already displayed in Table 3.

statistically different from zero. Finally, the specification in equation (3) includes a non-correlated zero-mean disturbance term (ε_{pt}).

To address any potential endogeneity between the relative supply of manual tasks by less educated natives and the supply shock, we follow the literature and use information on the settlement of previous immigrants as instruments. The underlying assumption for this instrument choice is that settlement patterns of previous immigrants are a main determinant of immigrants' location choices (*e.g.* Card 2001, Cortes 2006, Lewis 2003, Ottaviano and Peri 2006, Peri 2006, Saiz 2003, Dustman *et al.* (2008) among other ones, for similar strategies). This is also true in Spain (Sandell 2008).[21] We use information on the change in the ratio of immigrants to natives four years earlier in each of the regions to instrument for the share of low-educated foreign-born workers. Our instrument is constructed using data from the population registers –the most representative source of information on the immigrant population in Spain given that, after registering, immigrants have access to medical care and other public services regardless of their immigration status.[22] As we show at the bottom of each of the tables displaying the regression results, the F-test indicates that it is strongly correlated to the share of recent foreign-born workers.[23] Our instrument is valid under the assumption that shocks are not too persistent. We thus check the validity of this assumption using Wooldridge's (2002) test for autocorrelation in panel data.[24] In all instances, we are unable to reject the null hypothesis of no first-order autocorrelation.[25] The lack of even first-order serial correlation suggests that shocks are not persistent.[26]

[21] Using data on immigrants from the Spanish population registers, Sandell (2008) shows that networks play a crucial role in the location choices of immigrants.
[22] Immigrants are not inquired about their legal status.
[23] Specifically, regardless of whether we use the narrower or broader task measure as our dependent variable, the first stage regressions always yield a coefficient that is statistically significant at the 1 percent level.
[24] The test is implemented using the procedure developed by Drukker (2003) for Stata.
[25] For example, for our entire sample of natives, the F-test statistics is equal to 16.850 with a p-value=0.000. Hence, we cannot reject the null hypothesis of no first-order autocorrelation. Similar results are obtained for other sub-samples and are available from the authors.
[26] We also performed the analysis using the ratio of immigrants to natives four years earlier in each of the regions as our instrument. Our findings proved robust to the use of this other instrument. Likewise, we carried

Finally, it is worth noting that a potential problem in this type of analysis is the usage of some lagged measure of the immigrant share as instrument when measurement error is correlated over time (Aydemir and Borjas 2006). This is due to the fact that the immigrant population can, at times, account for a small number of observations. As a result, measures of regional immigrant concentration may suffer from measurement error due to the small sample sizes. Instrumental variable methods account for this measurement problem as long as the measurement error in the instrument is uncorrelated with the measurement error in the regressor of interest. We avoid this problem using the lagged immigrant concentration from the population registers, which as noted earlier, effectively serves as an immigrant population census. Additionally, its measurement error, if any, is independent from that in the labor force survey.

7. Immigration and the Relative Task Supply of Native Men and Women

Table 4 displays the results from estimating equation (3) for all natives, native men and native women using the narrower and broader measures of the manual to interactive task content that differ in their inclusion of tasks requiring sensory and perception abilities. All regressions include the overall share of foreign-born workers as our key regressor.[27] Finally, the two columns of Table 4 display the results from estimating equation (3) by OLS and by

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out the analysis using both instruments (the level *and* the change in the level of the ration of immigrants to natives four years earlier in each of the regions) so as to be able to perform over-identification tests and gauge the exogeneity of our instruments from an econometric standpoint. Results from such tests confirmed that, conditional on the other instrument being valid, each instrument could be considered exogenous. Furthermore, our findings remained unchanged. However, owing to the high correlation of the two instruments, only one of them was significantly correlated to the share of foreign-born workers in the first stage regressions when used jointly. Therefore, we decided to use the instrument that appeared to be most highly correlated with the endogenous regressor when used independently, *i.e.* the change in the ratio of immigrants to natives four years earlier in each of the regions. Results from all the alternative analyses described herein are available from the authors.

[27] We also experimented with: (1) using the share of either male or of female foreign-born workers, and (2) using the shares of male and of female foreign-born workers as key regressors. However, to the extent that both foreign-born men and women impact native workers, strategy (1) results in serious omitted variable biases. In turn, due to the very high correlation between foreign-born male and female workers, strategy (2) yields unreliable estimates.

instrumental variable (IV) regressions using the change in the ratio of immigrants to natives four periods earlier in each of the regions being examined.

What are the key findings? The first result worth highlighting is the negative impact that an increase in the share of foreign-born workers has on the manual to interactive task content of the occupations held by natives. This is true regardless of the task measure being used and the methodology employed. Note, however, that the OLS estimates are likely to be biased. After all, immigrants are more likely to locate in more dynamic regions offering better employment prospects and we are most likely unable to fully capture that labor demand effect through the inclusion of region fixed-effects.[28] Once we take into consideration the endogeneity of our key regressor, we find that a one standard deviation increase in the share of foreign-born workers lowers the relative manual task supply of native workers anywhere between 1.5 to 1.7 percent depending on the relative task measure being used.[29] Because of the distinct institutional frameworks and sizes of the immigrant shocks, cross-country comparison may not be that relevant. Nevertheless, we briefly relate our estimates to those found for the U.S. According to Peri and Sparber (2009), a one percentage-point increase in the foreign-born share of less educated workers increases the relative supply of interactive versus manual tasks among natives by 0.37 percent. Note, however, that a one standard deviation increase in the share of foreign-born workers in Spain is approximately equal to a 2 percentage-point increase. Hence, the impact of a one percentage-point increase in the share of less educated foreign-born workers on the relative task supplies of native workers in Spain is approximately twice the estimated impact of a similar increase in the U.S.

[28] Specifically, if we are omitting information on an "increase in labor demand" in certain sectors, such as construction, the OLS estimates should be upward biased. After all, the correlation between that omitted variable and the "share of foreign-born" should be positive. Likewise, the correlation between an ongoing "increase in labor demand" in a sector like construction –characterized by a high intensity of manual tasks– and the "manual to interactive task specialization of natives" should also be positive, as natives may also respond to the emerging employment opportunities in that sector. Hence, the sign of the bias should be positive (Wooldridge 2003, pp. 92).

[29] The standard deviation of the share of foreign-born workers is 0.022 or, approximately, 2 percentage points.

A second finding worth noting from the IV results in Table 4 is the greater impact that the share of foreign-born workers has on native women as opposed to native-men. The difference is statistically significant at a 5 percent level, regardless of the task measure being used as the dependent variable.[30] In particular, a one standard deviation increase in the share of foreign-born workers lowers the relative manual task supply of native men anywhere between 1.1 and 1.3 percent, depending on the relative task measure being used. In contrast, these figures range between 2.4 and 2.7 percent in the case of native women. The fact that immigration has a larger impact on the task specialization of native women is not surprising when we consider that native women, in part owing to their recent entry into the labor market, may have accumulated less occupation-specific human capital than men. As such, it is less costly for them than for their native male counterparts to respond to an increase in the share of foreign-born by reallocating their task supply to jobs with a lower content of manual-to-interactive tasks. Also worth noting is the fact that the difference between the OLS and the IV estimates is significantly larger for native women than for native men. Perhaps, omitted variable biases, such as the one emerging from a confounding labor demand shock, may have been significantly stronger among native women than among native men. After all, women may have been more likely to join the labor ranks during the past economic boom –a period of high labor demand– than men, who were probably more likely to already be at work.[31]

In sum, the results from Table 4 indicate that an increase in the share of foreign-born workers induces natives –and native women to a larger extent than native men– to reduce

[30] Using the restricted measure, the Chi-square (1) = 4.21 and Prob > Chi-square = 0.0401. Using the broader measure, the Chi-square (1) = 4.25 and the Prob > Chi-square = 0.0392.

[31] As a result, the correlation between an ongoing "increase in labor demand" and the "manual to interactive task specialization of natives" may have been larger for native women than for native men.

their relative manual task supply by relocating to occupations with a lower manual to interactive task content than those held by immigrants.[32]

8. The Role of Language Proficiency in Explaining Immigrant Specialization

Thus far, we have shown that the increase in the share of foreign-born workers appears to have affected the task specialization of natives with significant differences by gender. In all instances, the rationale behind the impact of immigrants on the employment patterns of natives rests on the comparative advantage of the former in manual as opposed to interactive tasks owing, in part, to their limited language proficiency. Under this rationale, immigrants from non-Spanish speaking regions should have more of a comparative advantage in relative manual tasks than immigrants from Latin American countries where Spanish is the official language. Accordingly, we would expect immigrants from non-Spanish speaking regions to have a higher manual to interactive task ratio than their counterparts originating from countries where Spanish is the native tongue and, in turn, induce a greater reduction in the manual to interactive task ratio of natives.

Because approximately half of immigrants in Spain are from Latin America, we can assess whether, as hypothesized above, the impact of an increase in the share of Spanish-speaking immigrants –as captured by the share of Latino immigrants– on the relative task supply of natives is any different from the impact on an increase in the share of immigrants from non-Spanish speaking regions.[33] In this manner, we are able to evaluate the premise that the impact of immigrants on the employment patterns of natives rests at least partially on language barriers.

[32] One might also wonder whether immigration, in addition to inducing a relocation of natives towards jobs with a lower relative manual task content, has changed the employment levels of natives. We look at whether that has been the case and find that the share of immigrants does not appear to have impacted the employment levels of native men or women. These results are available from the authors upon request.

[33] Ideally, one would want to have detailed information on the migrant's language proficiency and compare immigrants from the same origin so as to control for country-specific heterogeneity, but we lack information on language proficiency in our data.

Before proceeding with the regression analysis, we first compare the average manual to interactive task supplies of Latino and non-Latino immigrants and assess if, indeed, Latino immigrants exhibit lower relative manual task supplies than non-Latino immigrants. According to the figures in Table 5, which displays the average relative manual task supplies of various groups of workers, the relative manual task supply of immigrants is, on average, significantly larger than that of natives. Furthermore, as we would expect, relative manual task supply of non-Latino immigrants is, on average, significantly larger than the relative manual task supply of Latino immigrants.[34]

Further evidence of the higher relative manual task supply of non-Latino (as opposed to Latino) immigrants can be inferred from Figure 7, which provides a scatter plot of the average manual to interactive task supplies of Latino and non-Latino immigrants at the regional level in 2005.[35] The vast majority of dots lay below the 45-degree line, suggesting that, for the most part, the average manual to interactive task supply of non-Latino immigrants exceeds that of Latino immigrants as shown by the individual level data summarized in Table 5.

In sum, the descriptive statistics in Table 5 and Figure 7 indicate that, on average, non-Latino immigrants have higher relative manual task supplies than Latino immigrants. This finding certainly hints on the possibility that both groups of immigrants might differ, *ceteris paribus*, with regards to their impact on the relative task supply of natives. Note, however, that the relative manual task supply of Latino and non-Latino immigrants summarized in Table 5 and Figure 7 might correspond to individuals who, in addition to their proficiency in Spanish –captured by their origin, also differ with respect to other crucial human capital characteristics possibly affecting their ultimate impact on native employment patterns. In this regard, it is worth noting that non-Latino immigrants are, on average, less

[34] Both sets of differences are statistically significant at the 5 percent level.
[35] Similar results are obtained using other years in the sample period under consideration.

educated and approximately 5 years older than their Latino counterparts. Therefore, we turn to the regression-based analysis to gauge if, once we account for such differences in age and educational attainment, these two groups of immigrant workers have a differential impact on the relative task supply of natives.

Table 6 displays the results from examining if Spanish-speaking immigrants from Latin America and non-Spanish speaking immigrants from elsewhere have a differential impact on the relative task supply of natives.[36] Because the shares of Latino and non-Latino immigrants are highly collinear,[37] including both of them in the same regression raises a problem of multicollinearity. As the standard textbook would predict, their standard errors significantly rise, undermining the statistical significance of both shares. An alternative approach in the presence of multicollinearity consists of including one of the shares (for instance, the share of Latino immigrants) along with the difference between the two shares (*e.g.* the difference between the non-Latino and the Latino immigrant shares) and testing whether the coefficient on the difference between the two shares is statistically different from zero. That is, to estimate:[38]

$$\ln\left(\frac{M}{I}\right)_{n,pt} = \eta(Sharefb_{Non-Latinos} - Sharefb_{Latinos})_{pt} + \lambda(Sharefb_{Latinos})_{pt} + X_{pt}\beta + \alpha_p + \delta_t + \varepsilon_{pt} \quad (4)$$

and test whether η is statistically different from zero.

Results from such an analysis are displayed in Table 6. The first two columns of Table 6, which correspond to model specification (1), estimate equation (3) using the share of Latino immigrants as the share of foreign-born workers. The figures are, thus, intended to

[36] All Latin Americans in our sample originate from Spanish speaking countries.
[37] Their correlation is above 0.5.
[38] Indeed, suppose we have the following two equations: (1) $Y = bx + u\,, (x = lat/native)$ and (2) $Y = cz + v, (z = nolat/native)$, where: $Corr\,(u, v) = d$. Hence: $v = du + e$ and equation (2) can be rewritten as: $Y = cz + (du + e)$. Since: $u = Y - bx$, we can further rewrite equation (2) as: $Y = cz + d(Y - bx) + e$. Adding and subtracting "cx" in the right hand side, we obtain that: $Y(1 - d) = c(z - x) + x(c - db) + e$ or, alternatively: $Y = a_0(z - x) + a_1 x + e$.

inform on the impact of an increase in the share of Latino immigrants on the relative task supply of natives using OLS and IV methods, correspondingly. The next two columns in Table 6 (corresponding to model specification (2)) do something similar to the first two columns of Table 6, but now using the share of non-Latino immigrant workers instead. The last 4 columns of Table 6 show the estimated coefficients for the share of Latino immigrants and the difference between the non-Latino and Latino immigrant shares –both of which are included in specification (3) according to equation (4) above– using OLS and IV methods, respectively.[39]

According to the figures in the last column of Table 6, which displays the estimated coefficients for the difference in the two immigrant shares using IV methods, Latino and non-Latino immigrants do not have a differential impact on the relative manual task supply of natives. Rather, both immigrant shares reduce the relative task supply of natives similarly. As such, the analysis suggests that, although language proficiency may be one of the most important factors driving immigrants' specialization in manual tasks, Latino and non-Latino immigrants also differ with regards to other important demographic characteristics crucial in determining what their impact on the relative manual supply of natives is. The fact that lack of language proficiency does not result in a differential impact of the share of immigrants on native specialization patterns is an important finding. It suggests that, while important in shaping their comparative advantage in relative manual tasks, language proficiency is just one more human capital factor determining the ultimate impact of immigrants on the relative manual supply of natives.

[39] Since the population register allows us to distinguish immigrants according to their origins, our instruments are the changes in the ratio of Latino and non-Latino immigrants to natives four years earlier in each of the regions. As we show at the bottom of Table 6, the F-tests indicate that they are both strongly correlated to the share of recent Latino and non-Latino foreign-born workers being instrumented.

9. Summary and Conclusions

Previous immigration studies have long discussed a puzzling result, *i.e.* the fact that immigration appears to have very small wage effects and no employment effects on natives. Yet, if native and immigrant workers of similar educational attainment posses productive skills that lead them to specialize in different occupations, it is reasonable to find a null to small impact of immigration on the employment and wages of natives as immigrants and natives are not competing for the same jobs. Focusing on Spain, we examine whether immigration has induced native workers to specialize in occupations that differ from those held by immigrants in their content of manual to interactive tasks. Because of its idiosyncratic characteristics –including the recent increases in female labor force participation, the rapid growth of its immigrant population and the composition of its immigrant stock, Spain offers an interesting case study and, potentially, an example of what may happen in other European economies with similar FLFP and immigration trends.

Using data from the 2000 through 2008 Spanish Current Population Survey (*Encuestas de Población Activa* (EPA)), we first provide some descriptive evidence of the distinct occupation choices of native men and native women, as well of natives and immigrants. Subsequently, we also present descriptive evidence of the greater relative manual task supply of immigrants relative to natives. These figures suggest that foreign-born workers are not perfect substitutes of similarly educated native workers, which may help explain the null or small impacts of immigration on native employment and wages. Therefore, we then proceed to assess the impact of immigration on the relative task supply of Spanish natives. We find that immigration appears to have affected the task specialization of natives, inducing them to relocate to jobs with a lower content of manual to interactive tasks. Possibly due to the impressive growth in its immigrant population during the past two decades, the impacts found are twice the impact of immigration on the relocation of natives in

the U.S. Specifically, a one standard deviation increase in the share of foreign-born workers lowers the relative manual task supply of native men anywhere between 1.1 and 1.3 percent, depending on the relative task measure being used. For native women, these figures range between 2.4 and 2.7 percent. Perhaps owing to their recent entry in the workforce, immigrants induce greater job relocation on the part of native women than on the part of their native male counterparts.

Because a large fraction of immigrants have Spanish as their native tongue, we are also able to explore the differential impact that immigrants with Spanish as their native tongue may have on the relocation of natives. Latino immigrants, owing to their proficiency in Spanish, have lower manual to interactive task supplies than non-Latino immigrants, just as we would expect due to the comparative advantage of Latino immigrants on interactive tasks when compared to non-Latino immigrants. Yet, once we also take into account other differences between these two immigrant groups, such as their age and educational attainment, the impact of non-Latino immigrants on the relative manual supply of natives is not any different from that of Latino immigrants. As such, while important in shaping their comparative advantages in relative manual tasks and, in turn, their manual to interactive task ratios, language proficiency is just one more factor explaining the ultimate impact that immigrants have on the relative task supply of natives.

Overall, our findings have important labor market implications. First, they help us understand the apparent negligible impact of immigration on native wages and employment levels in Spain. Second, they suggest that, via adjustments in natives' task specialization and occupational upgrading, immigration may help increase job mobility, which could positively contribute to labor market efficiency by improving the quality of job matches (Raphael and Riker 1999). This is particularly important in a country like Spain, where job mobility, particularly among workers with open-ended or permanent work contracts who account for

approximately 70 percent of the workforce, is highly constrained by geographic mobility (García Pérez and Rebollo Sanz 2005). Third, they emphasize the importance of accounting for gender differences in the impact of immigration on natives' labor market outcomes, even more so in migrant-receiving economies experiencing relatively recent increases in female labor force participation. Finally, while important in shaping their comparative advantage in manual tasks and their relative manual task supplies as predicted by the theory, language proficiency is just another human capital related factor explaining the ultimate impact of an increase in the share of foreign-born on the employment patterns of natives.

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Appendix
Equilibrium provision of M/I tasks supplied by natives (Peri and Sparber (2009)

We assume the economy produces one tradable final consumption good: Y, which only requires a low skilled intermediate input: Y_L. The production of Y_L is carried out by less educated workers and requires a technology that combines two different types of tasks: manual (M) and interactive (I) tasks. Both tasks are combined to produce Y_L according to the following CES production function:

$$Y_L = [\beta_L M^{\frac{\lambda-1}{\lambda}} + (1-\beta_L) I^{\frac{\lambda-1}{\lambda}}]^{\frac{\lambda}{\lambda-1}} \qquad (1)$$

where β_L measures the productivity of manual versus interactive tasks in the production of Y_L and λ captures the elasticity of substitution between manual (M) and interactive (I) tasks. Profit maximization in a competitive market then yields the following relative demand function for manual versus interactive tasks:

$$\frac{M}{I} = m = \left(\frac{\beta_L}{1-\beta_L}\right)^{\lambda} (w_m)^{-\lambda} \qquad (2)$$

where w_m is the relative compensation for manual versus interactive tasks.

The model assumes that less educated natives and immigrants differ in their comparative advantage in manual versus interactive tasks. If we denote by e_{mi} and e_{mn} as the efficiency in manual relative to interactive tasks of native and immigrant workers, respectively, the stated assumption implies that: $\bar{e}_{mi} > \bar{e}_{mn}$, where the subscripts i and n refer to immigrants and natives, respectively.

The optimal relative supply of manual versus interactive tasks, η_{mj}, is directly related to the relative task compensation in manual versus interactive tasks, (w_m), and to the worker relative efficiency in performing manual versus interactive tasks (e_{mj})[40]:

$$\eta_m = w_m^{\frac{\alpha}{1-\alpha}} \left(e_{mj}\right)^{\frac{1}{1-\alpha}} \qquad (3)$$

In order to find the equilibrium relative provision of manual to interactive tasks, we need to aggregate equation (3) across all workers to obtain the market relative supply of manual relative to interactive tasks and solve for the aggregate equilibrium provision of manual versus interactive tasks:

$$m^* = \left(\frac{\beta_L}{1-\beta_L}\right)^{\frac{\alpha\lambda}{(1-\alpha)\lambda+\alpha}} (\overline{e_m})^{\frac{\lambda}{(1-\alpha)\lambda+\alpha}} \qquad (4)$$

[40] This relative supply is the result of the maximization process of a representative individual who must allocate his time among manual and interactive tasks so as to maximize his/her labor income.

However, given that immigrants are more efficient in providing manual relative to interactive tasks than natives we must account for a different optimal provision between immigrants and natives. To do so, we first rewrite the aggregate supply of manual versus interactive tasks in this economy as a weighted average of the relative supply by natives and immigrants of both tasks, where the weight is the share of interactive tasks provided by immigrants (which is a monotonic transformation of the foreign-born share of low-educated workers, $L_i/(L_N+L_i)$) :

$$m = \left(\frac{M}{I}\right) = \left(\frac{M_i + M_n}{I_i + I_n}\right) = f\left(\frac{M}{I}\right)_i + (1-f)\left(\frac{M}{I}\right)_n = fm_i + (1-f)m_n \qquad (5)$$

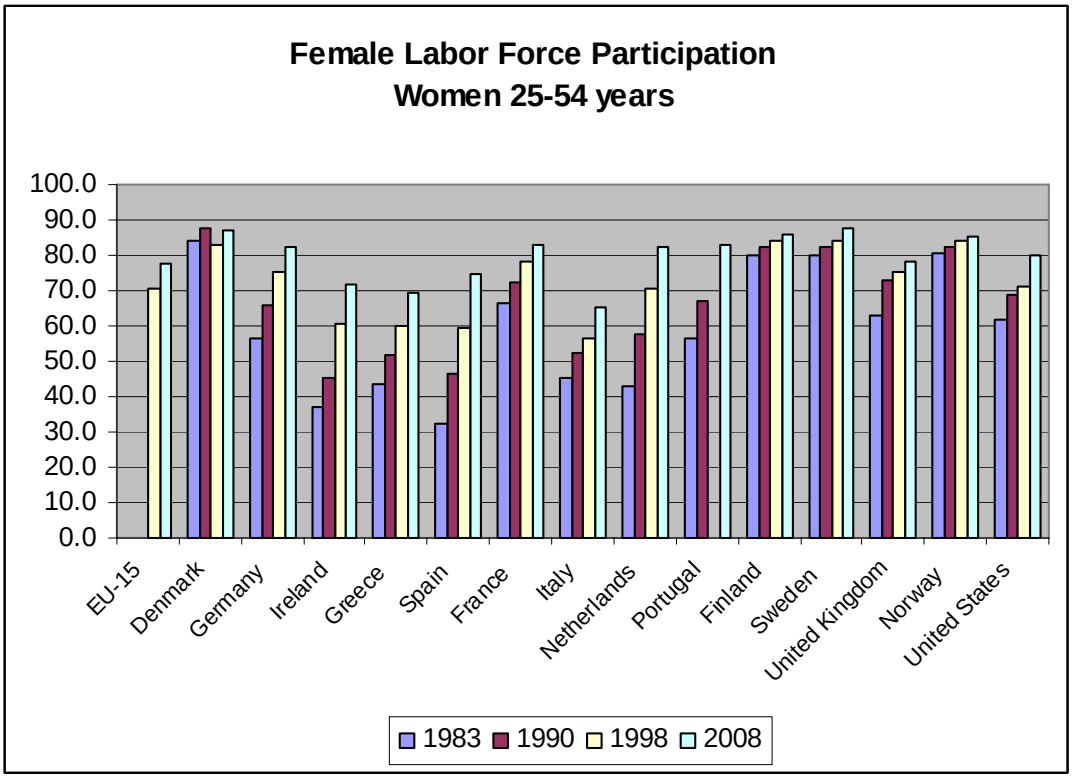
The average relative efficiency of all low educated workers in performing manual versus interactive tasks, $\overline{e_m}$, can also be rewritten as a weighted average of natives and immigrants' relative efficiency in manual and interactive tasks as follows:

$$\overline{e_m} = \left[f\left(\overline{e_m}\right)_i^{\frac{1}{1-\alpha}} + (1-f)\left(\overline{e_m}\right)_n^{\frac{1}{1-\alpha}} \right]^{(1-\alpha)} \qquad (6)$$

We need to obtain an expression for the optimal supply of manual to interactive tasks by natives as a function of the relative efficiency in performing tasks by each group. With that purpose, we make use of equation (5) and obtain the optimal supply of tasks provided by all native workers:

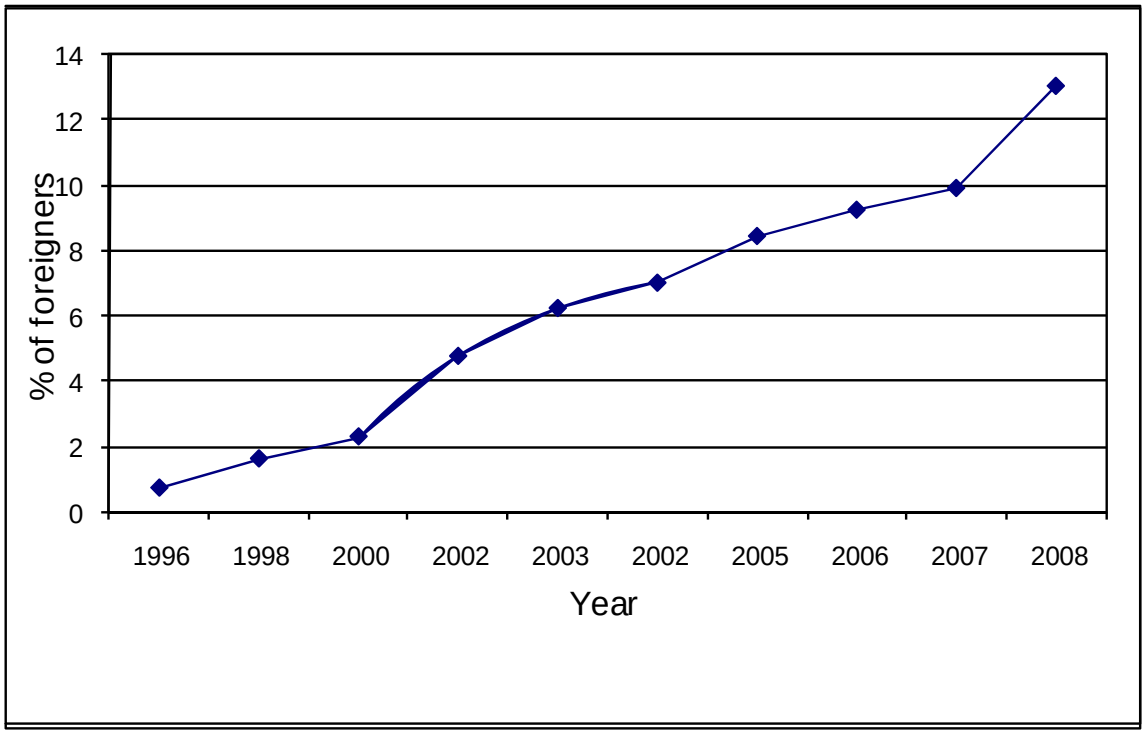
$$m_n^* = \left(\frac{\beta_L}{1-\beta_L}\right)^{\frac{\alpha\lambda}{(1-\alpha)\lambda+\alpha}} \left[f\left(\overline{e_m}\right)_i^{\frac{1}{1-\alpha}} + (1-f)\left(\overline{e_m}\right)_n^{\frac{1}{1-\alpha}} \right]^{\frac{-\alpha}{(1-\alpha)\lambda+\alpha}} \left[\left(\overline{e_m}\right)_n^{\frac{1}{1-\alpha}} \right]^{\frac{1}{1-\alpha}} \qquad (7)$$

Figure 1



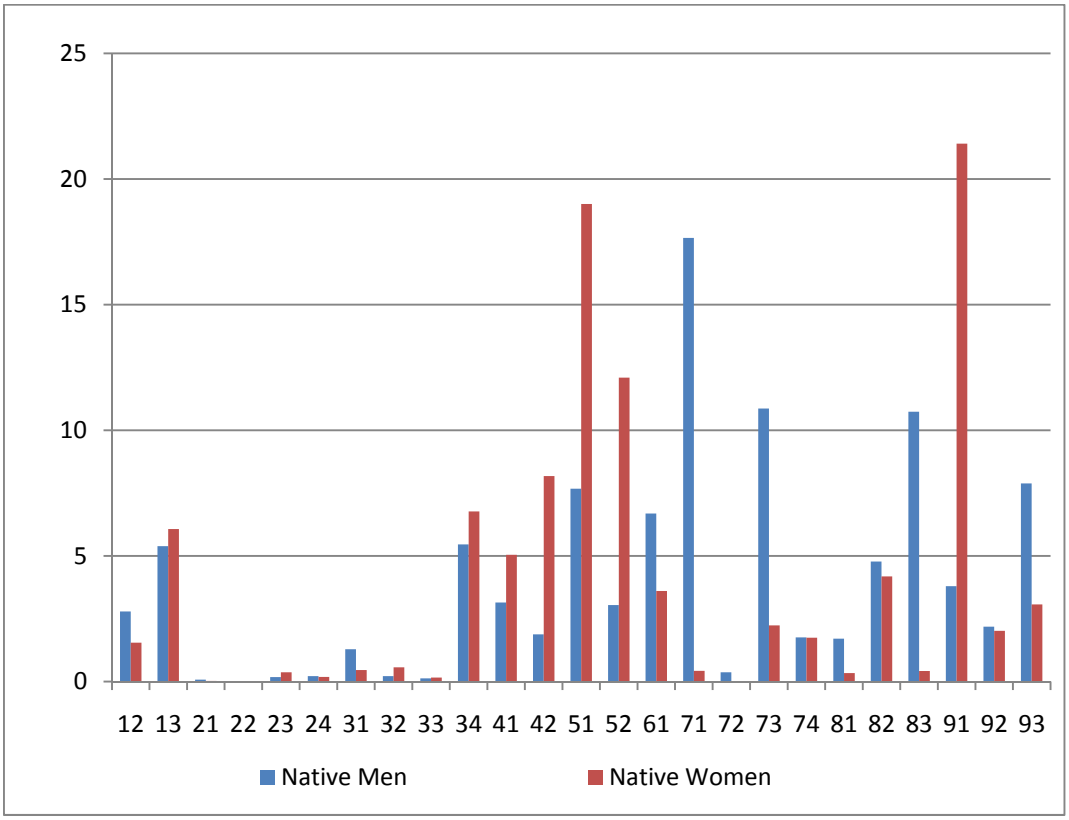
Source: OECD Labor Market Statistics

Figure 2
Share of Foreign-Born in Spain



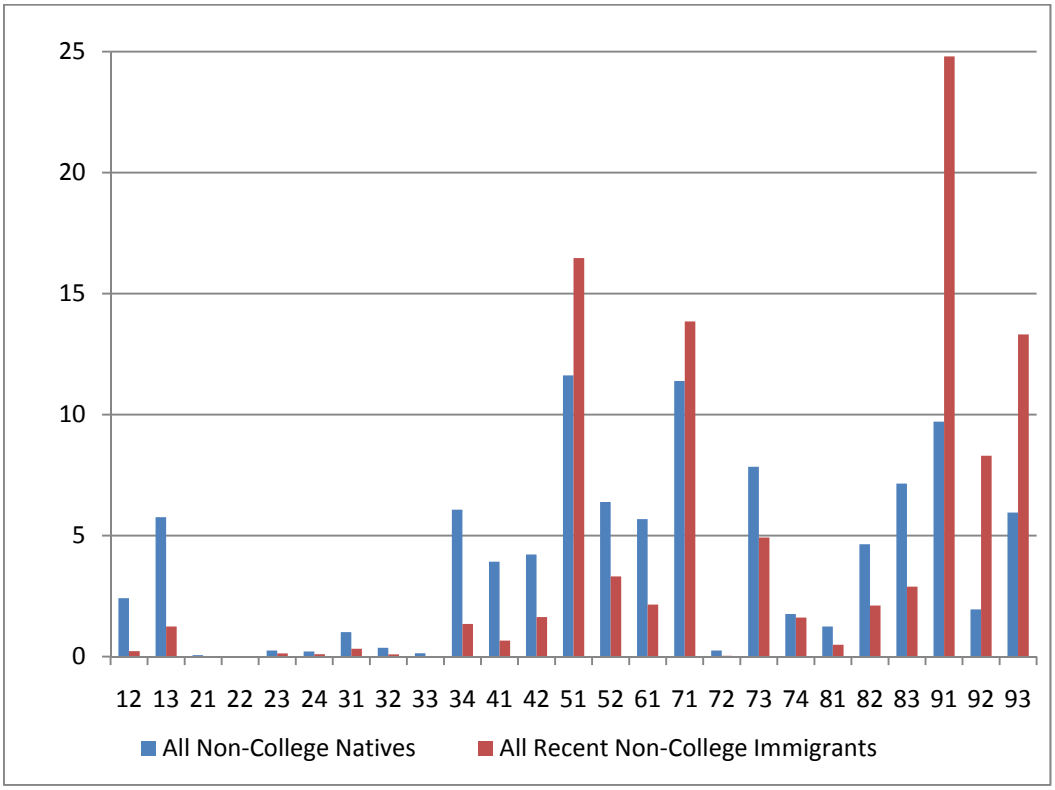
Source: Spanish Population Register (*Padrón Municipal,* Spanish Institute of Statistics, INE)

Figure 3
Occupational Distribution of Native Men and Native Women
Non-College Educated Workers (2000-2008)



Note: The 2-digit ISCO88 codes represent the following occupations:
12. Corporate Managers;
13. Managers of Small Enterprises;
21. Physics, Mathematics and Engineering Professionals;
22. Life Science and Health Professionals;
23. Teaching Professionals;
24. Other Professionals;
31. Physical and Engineering Science Associated Professionals;
32. Life Science and Health Associated Professionals;
33. Teaching Associated Professionals;
34. Other Associated Professionals;
41. Office Clerks;
42. Customer Services Clerks;
51. Personal and Protective Service Workers;
52. Models, Sales People and Demonstrators;
61. Skilled Agriculture and Fishery Workers;
71. Extraction and Building Trades Workers;
72. Metal, Machinery and Related Trade Workers;
73. Precision, Handicraft, Craft Printing and Related Trades;
74. Other Craft and Related Trade Workers;
81. Stationary Plant and Related operators;
82. Machine Operators and Assemblers;
83. Drivers and Mobile Plant Operations;
91. Sales and Services Elementary Operations;
92. Agricultural and Fishery Laborers;
93. Laborers in Mining, Construction, Manufacturing and Transportation.

Figure 4
Occupational Distribution of Natives and Recent Immigrants
Non-College Educated Workers (2000-2008)



Note: The 2-digit ISCO88 codes represent the following occupations:
12. Corporate Managers;
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23. Teaching Professionals;
24. Other Professionals;
31. Physical and Engineering Science Associated Professionals;
32. Life Science and Health Associated Professionals;
33. Teaching Associated Professionals;
34. Other Associated Professionals;
41. Office Clerks;
42. Customer Services Clerks;
51. Personal and Protective Service Workers;
52. Models, Sales People and Demonstrators;
61. Skilled Agriculture and Fishery Workers;
71. Extraction and Building Trades Workers;
72. Metal, Machinery and Related Trade Workers;
73. Precision, Handicraft, Craft Printing and Related Trades;
74. Other Craft and Related Trade Workers;
81. Stationary Plant and Related operators;
82. Machine Operators and Assemblers;
83. Drivers and Mobile Plant Operations;
91. Sales and Services Elementary Operations;
92. Agricultural and Fishery Laborers;
93. Laborers in Mining, Construction, Manufacturing and Transportation.

Figure 5
Scatter Plot of the Manual to Interactive Task Intensity of Immigrants versus Natives
Non-college educated workers, 2005

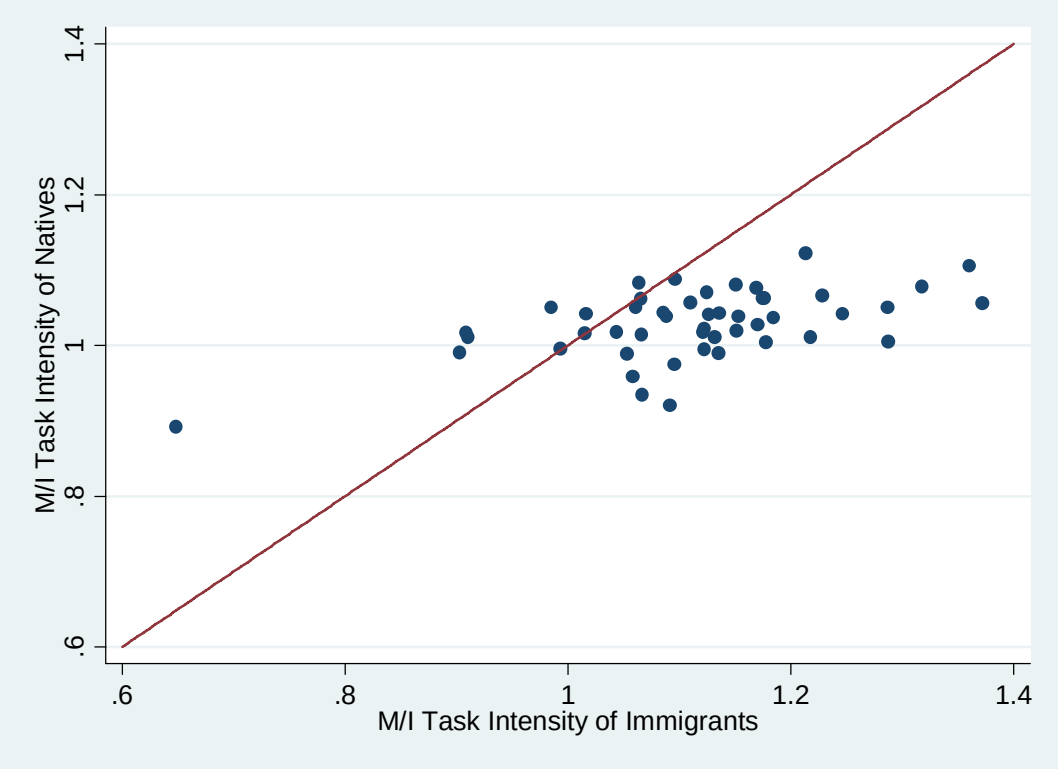

Figure 6
Scatter Plot of the Manual to Interactive Task Intensity of Female vs. Male Natives
Non-college educated workers, 2005

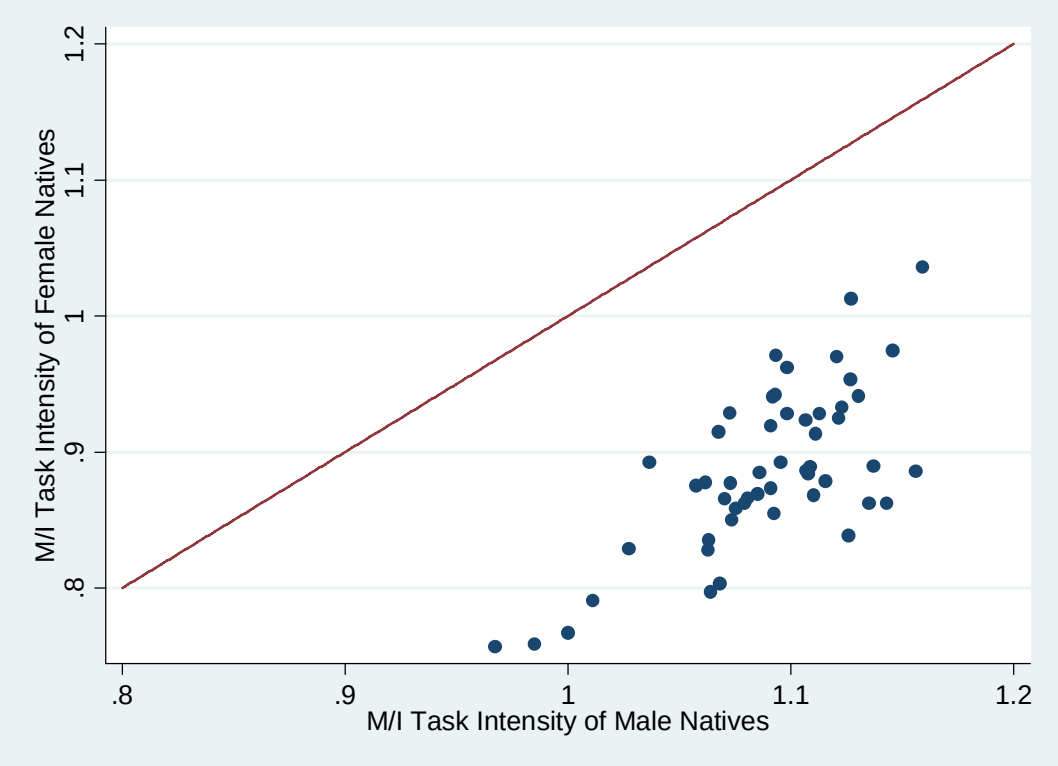

Figure 7
Scatter Plot of the Manual to Interactive Task Intensity of Latino vs. Non-Latino Immigrants
Non-college educated workers, 2005

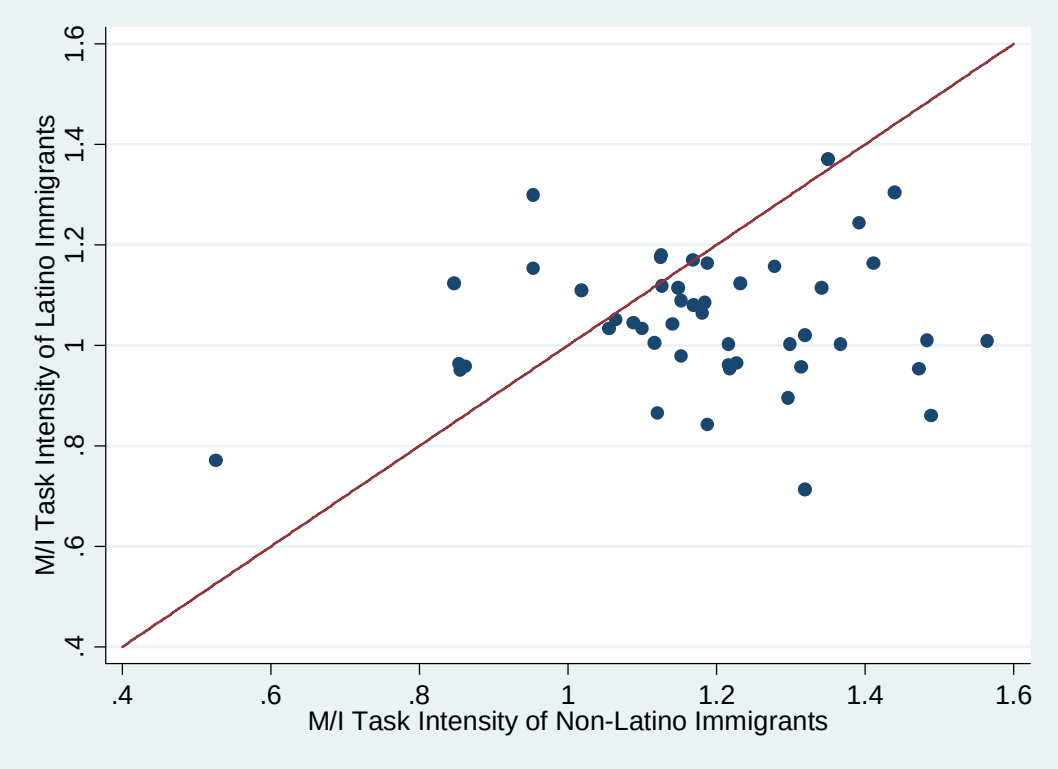

Table 1
Immigrant Distribution by Region of Origin (%)

	All Immigrants			Recent Non-College Immigrants		
Origin	**2000-2008**	**2000**	**2008**	**2000-2008**	**2000**	**2008**
Latin America	46.4	31.04	47.11	55.6	44.6	51.50
Africa	16.3	22.84	14.56	13.0	22.7	11.38
EU15	11.9	31.72	8.59	4.19	16.84	3.06
Europe other than EU15	21.4	7.12	25.75	24.66	9.89	31.34
Other	4.0	7.28	3.99	2.55	8.58	2.72

Source: Employed immigrants between 16 and 65 years of age in the Spanish Labor Force Survey, 2000-2008.

Table 2
Non-college Educated Natives and Immigrants

Variables	All Natives	Native Men	Native Women	All Immigrants
Average Age	40.52	40.72	40.3	32.86
Distribution by age categories (%):				
<30 years	24.79	24.5	25.33	46.46
31-35 years	11.13	11.2	11.01	18.42
36-40 years	12.98	12.8	13..4	14.13
41-45 years	14.10	13.7	14.8	9.99
>45 years	37.00	37.9	35.4	10.99
Percentage Female (%)	35.7			44.7
Education (%):				
Primary or Less	29.33	31.05	37.4	28.51
Secondary	70.67	68.95	73.76	71.49
N	399,744	256,973	14,277	11,441

Notes: Non-college educated and working individuals between 16 and 65 years of age from the 2000 through 2008 Spanish Labor Force Surveys. Immigrants include only those with, at most, five years of residence in Spain, *i.e.* recent immigrants.

Table 3
Manual and Interactive Tasks Intensity of Each ISCO88-2digit Occupation

Occupations (2-digit ISCO88 code)	Manual	Interactive	Ratio Manual/ Interactive
12. Corporate Managers	0.49	0.99	0.49
13. Managers of Small Enterprises	0.49	0.95	0.52
21. Physics, Mathematics and Engineering Professionals	0.47	0.93	0.51
22. Life Science and Health Professionals	0.57	0.96	0.59
23. Teaching Professionals	0.54	0.94	0.58
24. Other Professionals	0.47	0.98	0.48
31. Physical and Engineering Science Associated Professionals	0.67	0.87	0.77
32. Life Science and Health Associated Professionals	0.67	0.91	0.73
33. Teaching Associated Professionals	0.48	0.85	0.56
34. Other Associated Professionals	0.48	0.94	0.51
41. Office Clerks	0.53	0.87	0.61
42. Customer Services Clerks	0.53	0.89	0.59
51. Personal and Protective Service Workers	0.71	0.84	0.85
52. Models, Sales People and Demonstrators	0.66	0.78	0.84
61. Skilled Agriculture and Fishery Workers	0.86	0.72	1.19
71. Extraction and Building Trades Workers	0.87	0.66	1.31
72. Metal, Machinery and Related Trade Workers	0.86	0.69	1.24
73. Precision, Handicraft, Craft Printing and Related Trades	0.81	0.62	1.29
74. Other Craft and Related Trade Workers	0.80	0.59	1.35
81. Stationary Plant and Related operators	0.86	0.69	1.25
82. Machine Operators and Assemblers	0.81	0.65	1.25
83. Drivers and Mobile Plant Operations	0.86	0.73	1.18
91. Sales and Services Elementary Operations	0.70	0.73	0.95
92. Agricultural and Fishery Labourers	0.91	0.58	1.56
93. Labourers in Mining, Construction, Manufacturing and Transportation	0.86	0.58	1.48

Notes: Non-college educated and working individuals between 16 and 65 years of age from the 2000 through 2008 Spanish Labor Force Surveys. Immigrants include only those with, at most, five years of residence in Spain, *i.e.* recent immigrants.

Table 4
Impact of the Share of Foreign-Born on the Relative Supply of Manual Tasks of Non-college Educated Natives

	OLS	IV
All Natives		
Restricted Task Measure	-0.335***	-0.756***
	(0.091)	(0.179)
Broad Task Measure	-0.295***	-0.684***
	(0.079)	(0.161)
Native Men		
Restricted Task Measure	-0.336***	-0.575***
	(0.124)	(0.185)
Broad Task Measure	-0.349***	-0.518***
	(0.125)	(0.166)
Native Women		
Restricted Task Measure	-0.399***	-1.221***
	(0.108)	(0.312)
Broad Task Measure	-0.359***	-1.106***
	(0.101)	(0.283)

Notes: The unit of observation is the (region, year) cell. We have 52 regions (provinces) and 9 years of data (2000 through 2008). The coefficients reported are the estimated impact of the share of foreign born on the relative manual task supply of different groups of natives. A description of the restricted and broad task measures used to measure the relative manual task supply of natives is provided in section 5 in the paper. The joint F-statistic in the IV regressions is equal to 37.08 with Prob > F = 0.000. *** stands for statistically significant at 1% level.

Table 5
Average Relative Manual Task Supply of Non-college Educated Workers

	Natives			Latino Immigrants			Non-Latino Immigrants		
	All	**Men**	**Women**	**All**	**Men**	**Women**	**All**	**Men**	**Women**
Restricted Task Measure	1.005	1.081	0.870	1.069	1.215	0.933	1.071	1.281	0.978
	(0.320)	(0.322)	(0.268)	(0.289)	(0.296)	(0.202)	(0.290)	(0.258)	(0.235)
Broad Task Measure	1.008	1.080	0.878	1.057	1.194	0.929	1.152	1.255	0.972
	(0.292	(0.291)	(0.243)	(0.265)	(0.269)	(0.186)	(0.267)	(0.236)	(0.218)
N	399744	256973	142771	7165	3477	3688	5076	3229	1847

Notes: Non-college educated and working individuals between 16 and 65 years of age from the 2000 through 2008 Spanish Labor Force Surveys. Immigrants include only those with, at most, five years of residence in Spain, *i.e.* recent immigrants. A description of the restricted and broad task measures used to measure the relative manual task supply of natives is provided in section 5 in the paper.

Table 6
Impact of the Share of Foreign-Born on the Relative Supply of Manual Tasks of Natives by Ethnic Origin of the Foreign-Born
Dependent Variable: Ln (M/I) for Non-College Natives

Model Specification:	**(1)**		**(2)**		**(3)**			
Independent Variable(s):	**Share of Latino Immigrants**		**Share of Non-Latino Immigrants**		**Share of Latino Immigrants**	**Difference in Shares**	**Share of Latino Immigrants**	**Difference in Shares**
Estimation Method:	**OLS**	**IV**	**OLS**	**IV**	**OLS**		**IV**	
All Natives								
Restricted Task Measure	-0.429***	-1.712***	-0.403***	-1.287***	-0.668***	-0.309***	-1.110**	1.185
	(0.132)	(0.502)	(0.168)	(0.311)	(0.181)	(0.138)	(0.579)	(2.520)
Broad Task Measure	-0.374***	-1.545***	-0.357***	-1.163***	-0.588***	-0.277***	-0.960***	1.186
	(0.113)	(0.453)	(0.145)	(0.272)	(0.157)	(0.120)	(0.467)	(2.333)
Native Men								
Restricted Task Measure	-0.482***	-1.278***	-0.355***	-0.965***	-0.666***	-0.238***	-0.756	2.125
	(0.192)	(0.458)	(0.166)	(0.329)	(0.237)	(0.121)	(0.776)	(3.259)
Broad Task Measure	-0.422***	-1.146***	-0.310***	-0.867***	-0.585***	-0.209***	-0.650	1.726
	(0.169)	(0.413)	(0.144)	(0.294)	(0.209)	(0.104)	(0.647)	(2.720)
Native Women								
Restricted Task Measure	-0.437***	-2.851***	-0.556***	-2.164***	-0.803***	-0.486***	-2.138***	-0.843
	(0.147)	(0.907)	(0.261)	(0.531)	(0.226)	(0.265)	(0.537)	(2.273)
Broad Task Measure	-0.387***	-2.579***	-0.506***	-1.959***	-0.723***	-0.445*	-1.859***	-0.999
	(0.141)	(0.821)	(0.235)	(0.484)	(0.211)	(0.239)	(0.485)	(1.959)

Notes: *** stands for statistically significant at 1% level, ** at 5 percent level and * at 10 percent level. The unit of observation is the (region, year) cell. The unit of observation is the (region, year) cell. We have 52 regions (provinces) and 9 years of data (2000 through 2008). The coefficients reported are the estimated impact of the share of foreign born on the relative manual task supply of different groups of natives. A description of the restricted and broad task measures used to measure the relative manual task supply of natives is provided in section 5 in the paper. Additionally:

- **Model specification (1)** estimates equation (3) using the share of Latino immigrants as our key regressor.
- **Model specification (2)** estimates equation (3) using the share of non-Latino immigrants as our key regressor.
- **Model specification (3)** estimates equation (4) using both the share of Latino immigrants and the difference between the share of non-Latino and Latino immigrants as key regressors. A test of the equality of the impacts of the Latino and non-Latino immigrant shares on the relative task supply of natives corresponds to testing whether the coefficient on the difference between the two shares is statistically different from zero.

The joint F-statistic in the IV regressions are the following: **Model Specification (1)**:16.65 with Prob>F = 0.000; **Model Specification (2)**: 29.46 with Prob>F = 0.000; **Model Specification (3)**: For the Share of Latino Immigrants: 19.53 with Prob>F = 0.000. For the Difference in Shares: 6.48 with Prob>F = 0.000.