The Heterogeneous Labor Market Effects of Immigration*

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Abstract

In this paper I provide estimates of the impact of immigration on native wage and employment levels (rather than on wage inequality, which has been the focus of the literature) by industry. I use variation within 2-digit industries across regions using Austrian panel data from 1986 to 2004 for identification. Using an instrumental variable strategy I find large displacement effects in the service sector and large native employment increases in manufacturing due to immigration. According to my structural estimates this heterogeneous response is explained by large increases in output in manufacturing as immigration reduces the cost of production; while on average demand is far less elastic in service industries. Estimated substitution effects, for a given level of output, are large in both industries. The estimates imply that a 1% increase in the workforce due to immigration (a 10% increase in the number of immigrants) across all industries reduces average native wages by around 0.25% and results in 1.4% of the native labor force changing industry, primarily from services to manufacturing. The fact that the effect of immigration on worker relocation across industries is far larger than its impact on average native wages is a consequence of the heterogeneous impact immigration has across industries.

Keywords: immigration, wages, worker relocation, substitution and scale effect

JEL Classification: J23, J61

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1 Introduction

Over the past two decades there have been renewed large and primarily low-skilled immigration flows to most developed countries. On average among OECD countries the fraction of population that is foreign born went from 5.7% in 1988 to around 11% in 2005 and continues to rise. Such large flows are likely to have significant social and economic consequences for the native-born population. One of the most controversial issues in the debate over immigration is whether and to what degree immigrant workers displace native workers and adversely affect their wages. The economics literature has, however, for the most part not addressed these issues directly, but rather focused on the impact immigration has on wage inequality between different groups of workers.[1] To my knowledge this is the first paper to estimate the effect of immigration on the level of employment and wages of native workers and, moreover, I do so separately by industry. Using a panel dataset for Austria I find that immigration increases the demand for native workers in manufacturing, but displaces native workers in services industries. My estimates of the underlying production functions in these two industries suggests that this differential effect is explained by manufacturing firms rapidly expanding output as immigration reduces their cost of production, while the demand for the output of most service industries is relatively inelastic. The structural estimates imply that a 10% increase in the number of immigrants (equivalent to a 1% increase in the workforce) in Austria results in a 0.25% fall in average native wages and a substantial shift in native labor, around 1.4% of native workers, from service industries to manufacturing.

The approach of this paper adds to the existing literature in a number of important ways. First, by separately identifying both scale and substitution effects arising from an inflow of immigrant labor I am able to identify the impact of immigration on the level of native wages and employment. The substitution effect is that, for a given level of output, an increase in the number of immigrants employed will result in a fall in the demand for native workers (provided the elasticity of substitution between immigrant and native labor is positive). However, an inflow of immigrants will reduce firms' cost of production and so output expands. As the scale of production increases on account of immigration, for a given relative wage, firms will employ more native workers. The magnitude of this scale effect depends on the elasticity of product demand, the more elastic demand is the larger the scale effect. The previous literature has focused on estimating the differential impact of immigration on natives in race/sex groups (Altonji and Card, 1991), different

[1] See Card (2009) for a recent take on the state of this literature in the US. Borjas (2009) is an exception, exploring the implications of factor demand theory for the impact of immigration on native wages.

occupations (Friedberg, 2001 and Card, 2003), and education/experience groups (Borjas, 2003 and 2006, Ottaviano and Peri, 2006, and Borjas, Hanson and Grogger, 2008) or on immigrant versus native wages (LaLonde and Topel, 1991, and Cortes, 2008) and, hence, implicitly or explicitly on estimating the elasticity of substitution between these groups of workers.[2] My approach uses administrative panel data on all Austrian employees in the period 1972 to 2004. I identify the impact of immigration over the period 1986 to 2004, where the number of immigrants as a fraction of the labor force went from 5% to 15%. I use the variation in immigration flows across Austria's nine regions within 2-digit industries, pooled over multiple years, to estimate the impact of immigration on (1) native employment in an industry-region, (2) native wages, and (3) immigrant wages. I use these estimates to derive the scale and substitution effects arising from immigration, as well as the elasticity of labor supply across industries and regions.[3] Estimating these underlying structural parameters of the production functions in each industry then also allows me to answer policy counterfactuals about the differential impact of, for example, issuing work permits in different industries.

Second, I demonstrate how heterogenous the impact of immigration is across industries. Whether immigration is a positive or negative shock to the demand for native labor depends on the difference in the magnitude of the scale effect (the elasticity of demand for labor) and the elasticity of substitution between native and immigrant labor. We would expect, in particular, the elasticity of demand, and hence the scale effect, to vary across industries. In manufacturing, where goods are internationally traded, we would expect a high elasticity of demand; whereas in service industries (such as food and accommodation and retail trade), where output is constrained by local demand, we would expect a low elasticity of demand. This is exactly what I find. In the period 1986 to 2004 the increase in the supply of immigrant labor results in a negative shock to the demand for native labor in service industries, the IV estimates suggest that around 0.6 native workers are displaced by the arrival of one immigrant and there is modest and not statistically significant fall in average native wages. In contrast, in manufacturing the arrival of one immigrant results on average in the employment of 1.3 additional natives and a small and not statistically significant increase in average wages. The heterogenous impact of immigration can mainly be explained by a very high elasticity of labor demand in manufacturing and a low elasticity in services, with point estimates of 17 and 1.4 respectively. Note that in all industries immigration results in a substantial fall in the average immigrant wage, with an elasticity

[2]Card (1990) is an exception, estimating the total effect of immigration on native wages and employment.

[3]The elasticity of labor supply plays an important role since it determines to what degree shocks to the demand of native labor result in changes in wages or employment across industry-regions.

of -0.09 in services and -0.22 in manufacturing. A consequence of this heterogeneity is that the average wage effects of immigration are likely to be small as compared to the effect on native worker relocation across industries. Heterogeneous effects of immigration across industries imply that native workers will relocate until wages equalize, with the amount of relocation depending on both the degree of heterogeneity across industries and the magnitude of the immigration shock.

Third, the empirical approach in this paper addresses the two major challenges identified in the literature in estimating the impact of immigration on native labor market outcomes. First, immigrants do not choose their locations randomly. Unobserved economic factors that attract immigrants are likely to also affect native worker outcomes. Second, labor and capital are mobile and may respond to immigration by relocating across units of observation. The two main approaches in the literature address these challenges differently. The local labor market approach, first due to Grossman (1982), uses the geographic variation in immigration flows to identify the local impact of immigration. In this approach, following Altonji and Card (1991) and Card (2001), it is possible to instrument for the current distribution of immigration flows by using the historical distribution of immigrants across local labor markets. However, Borjas, Freeman and Katz (1996) and Borjas (2003, 2006) are critical of the local labor market approach arguing that it fails to take account of offsetting capital and native labor mobility across local labor markets, which will tend to attenuate the wage effects of immigration.[4] Instead they use variation over time at the national level, where native labor supply can be thought of as inelastic, in the relative supply of different types of labor. The disadvantage of this approach is that it maintains the assumption that the composition of immigration flows is exogenous, for example, that changes in the return to education do not affect the educational composition of immigrant flows. The fact that, using US data, papers using variation across local labor markets have tended to find small effects of immigration and those using the time series methodology have tended to find larger effects suggests that reconciling these approaches is important. My identification strategy combines the strengths of each of these approaches. First, identification is across regions within 2-digit industries, so that I am able to instrument for the distribution of the inflow of immigrants. Second, I explicitly model and estimate the response of natives to immigration and so am able to account for this effect when estimating the elasticities of derived demand.

The rest of the paper is organized as follows. Section 2 outlines a basic model with

[4] Card and DiNardo (2000), Card (2001, 2005) and Card and Lewis (2007) find that there is near to no offsetting native labor mobility across US cities in response to immigration shocks. Borjas (2006) and Cortes (2008) find large, but not perfectly, offsetting displacement effects.

which to understand the impact of immigration. The data and descriptive statistics on immigration to Austria are presented in Section 3. Section 4 describes the instrument, presents estimates of the impact of immigration on native wages and employment, as well as immigrant wages. I then us these estimates to identify scale and substitution effects arising from immigration and discuss the implications for average wages and worker relocation across industries. Section 5 concludes.

2 Framework: Substitution and Scale Effects

To understand the labor market impact of immigration the existing literature has focused on estimating the elasticity of substitution between types of labor. However, the elasticity of substitution is only informative about the impact of immigration on relative wages. In general the impact of a shifting the supply of immigrant labor on the wage level of native workers will depend on both the elasticity of substitution and the elasticity of product demand (both a substitution and scale effect). The existing literature has followed Card (2001) by controlling for the scale effect by including year fixed effects; however, to my knowledge, the scale effect has not been explicitly estimated. In this section I provide a model that makes explicit the role of scale and substitution effects. I also explicitly model the location decisions of native workers as a discrete choice model, from which I derive aggregate elasticities of labor supply; and the choices of consumers from which I derive the elasticity of product demand in an industry.

2.1 Setup

2.1.1 Firms

Consider an economy with S competitive industries in R regions producing final goods Y, sold at prices p and produced using a two-level nested-CES aggregation of native labor N, immigrant labor I and capital K.

$$\begin{aligned} Y_{rs} &= F^{Y}\left(Q_{rs}, K_{rs}\right) \\ &= F^{Y}\left(F^{Q}\left(N_{rs}, I_{rs}\right), K_{rs}\right) \end{aligned} \tag{1}$$

with σ_{in} as the elasticity of substitution between native and immigrant labor and σ_{qk} as the elasticity of substitution between labor and capital. Note that as $\sigma_{in} \rightarrow \infty$ native and immigrant labor become perfect substitutes. I assume constant returns to scale at the level of each nest. Note that since each nest only contains two inputs I have implicitly assumed that all elasticities of substitution are non-negative (since factor demands are homogenous of degree zero in factor prices). Intuitively, if the wage of immigrant labor falls all else equal more immigrant labor will be employed (the own-price elasticity of factor demand is always negative), and since output is assumed constant less native labor will have to be employed.

2.1.2 Consumers

I assume that there are two types of consumers: domestic, d, and foreign, f, of mass M_d and M_f respectively. They have a utility function represented by

$$U = \left(\sum_s C_s^{\frac{\alpha_s - 1}{\alpha_s}} \right)^{\frac{\alpha_s}{\alpha_s - 1}}$$

where C_s is consumption of the output of industry s, which in turn is an index of consumption of goods produced domestically $C_{s,h}$ or abroad $C_{s,o}$

$$C_s = \left(b_g C_{s,h}^{\frac{\alpha_f - 1}{\alpha_f}} + (1 - b_g) C_{s,o}^{\frac{\alpha_f - 1}{\alpha_f}} \right)^{\frac{\alpha_f}{\alpha_f - 1}}, \quad g = \{d, f\}$$

where b_g is a consumer type specific weight for the consumption of foreign or domestic goods. Domestic consumption is an aggregate of varieties produced in the regions of the country

$$C_{s,h} = \left(\sum_r c_{rs}^{\frac{\alpha_r - 1}{\alpha_r}} \right)^{\frac{\alpha_r}{\alpha_r - 1}}$$

The goods are substitutes and all the elasticities of substitution are greater than one, i.e. $\alpha_s > 1$, $\alpha_f > 1$ and $\alpha_r > 1$. Moreover, I make the usual assumption that varieties within a country are more substitutable for each other than varieties produced in different countries, which in turn are more substitutable than products from different industries, i.e. $\alpha_s \leq \alpha_f \leq \alpha_r$. Note that the parameters α_f, α_r and b_g could potentially vary by industry.

As was originally shown by Dixit and Stiglitz (1977) the demand for the output of a sectors (in a particular region) is given by

$$Y_{rs} = Y_s \left(\frac{p_{rs}}{P_{s,h}} \right)^{-\alpha_r} \tag{2}$$

where

$$
\begin{aligned}
Y_s &= \left(M_d b_d^{\alpha_f} + M_f b_f^{\alpha_f}\right) C_s \left(\frac{P_{s,h}}{P_s}\right)^{-\alpha_f} \\
P_{s,h} &= \left(\sum_r p_{rs}^{1-\alpha_r}\right)^{\frac{1}{1-\alpha_r}}
\end{aligned}
$$

The elasticity of demand is

$$
\frac{d\ln Y_{rs}}{d\ln p_{rs}} = \psi = -\alpha_r + \left(\alpha_r + \frac{d\ln Y_{s,h}}{d\ln P_{s,h}}\right)\frac{d\ln P_{s,h}}{d\ln p_{rs}}
$$

which if $\frac{d\ln P_{s,h}}{d\ln p_{rs}} = 0$ implies that $\frac{d\ln Y_{rs}}{d\ln p_{rs}} = -\alpha_r$.

2.1.3 Native Workers

Native workers of a certain type have a choice of industry and region within which to work, where for every worker it is possible to choose any combination of industry $s \in S$ and region $r \in R$. I assume that the utility of worker j in industry s and region r can be expressed as

$$
U_{jrs} = \ln a_j + \ln a_{rs} + \ln a_{jrs} + \ln w_{rs} + \varepsilon_{js} + \varepsilon_{jr} + \varepsilon_{jrs}
$$

In what follows I suppress the j subscript wherever possible. I further assume that $var\left(\varepsilon_s\right) = 0$. Thus

$$
U_{rs} = \ln a + \ln a_{rs} + \ln w_{rs} + \varepsilon_r + \varepsilon_{rs} \tag{3}
$$

where I assume that ε_r and ε_{rs} are independent for all industries and regions in workers' choice sets, ε_{rs} is independent and identically Gumbel (Extreme Value Type I) distributed with a scale parameter μ^s, and ε_s is distributed so that $\max_r U_{rs}$ is Gumbel distributed with a scale parameter μ^r (where these scale parameters are inversely related to the variance of the error term).[5] Thus the workers' discrete choice problem takes the form of a two-level nested logit, where workers can be thought of as first choosing a region and then an industry to work in. This formulation of the representative worker's choice problem results in an elasticity of labor supply to an industry-region, ϕ_n, with respect to a change in the wage given by:

$$
\frac{d\ln N_{rs}}{d\ln w_{rs}} = \phi_n = \mu^s\left(1 - P\left(s|r\right)\right) + \mu^r P\left(s|r\right)\left(1 - P\left(r\right)\right) \tag{4}
$$

[5] My formulation of the workers' discrete choice problem follows Ben-Akiva and Lerman (1985).

where $P(s|r)$ is the probability that a worker in region r chooses industry s and $P(r)$ is the unconditional probability of a worker choosing to work in region r (see Appendix A.2 for a derivation). The elasticity of labor supply contains two terms: the first pertaining to the response of workers in other industries within the same region, and the second to the response of workers from other regions to a change in the wage. The magnitude of each of these terms (and hence of the elasticity of labor supply) is inversely proportional to the variance of the error terms. Intuitively, a lower variance means that there are proportionally more workers over a given interval who respond to a marginal change in the wage. The nested logit assumption imposes the restriction that all the cross-elasticities within the same nest, i.e. within the same region across different industries, are the same. It does, however, allow the cross-elasticity across nests to differ from that within a nest. The order of the nesting implies that the elasticity of labor supply is higher across industries (with error term ε_r) than across regions (with error term $\varepsilon_r + \varepsilon_{rs}$).

2.2 Effects of Immigration

The model delivers a number of important results. The effect of immigration on the wage w_n and employment N of native workers in an industry-region is given by

$$\frac{d\ln w_n}{d\ln I} = \frac{s_i\left(\eta - \sigma_{in}\right)}{\sigma_{in}\eta + \phi_n\left(s_i\eta + s_n\sigma_{in}\right)} \tag{5}$$

$$\frac{d\ln N}{d\ln I} = \phi_n \frac{d\ln w_n}{d\ln I} \tag{6}$$

where ϕ_n is the elasticity of native labor supply, η is the elasticity of demand for labor and s_i is the share of immigrant labor in total labor output. See Appendix A.1 for a derivation of the expressions for the labor supply elasticities and the inverse derived demand elasticities and Hicks (1963) and Allen (1938) for more general proofs of these results. The effect of immigration on wages and, since labor supply is upward sloping $\phi_n > 0$, on employment of natives is positive when $\eta > \sigma_{in}$. The intuition for this result is that the inflow of immigrants is an increase in the labor supply of immigrant labor (for a given wage), reducing the cost of immigrant labor and hence resulting in two countervailing effects: (1) the substitution effect, where for a given level of output firms will substitute immigrant for native labor; and (2) the scale effect, where the fall in the cost of production results in output expanding and hence, for a given relative wage, firms will employ more native workers.

The expression for the elasticity of labor demand is

$$-\frac{d\ln Q}{d\ln w_q} = \eta = \frac{\sigma_{qk}\psi + \phi_k\left(s_q\psi + s_k\sigma_{qk}\right)}{\phi_k + s_k\psi + s_q\sigma_{qk}} \tag{7}$$

The scale effect is always positive (or at least non-negative) and is increasing in the elasticity of demand for the final product ψ, the elasticity of substitution between labor and capital σ_{qk} and elasticity of supply of capital ϕ_k.

The degree to which the demand shock to native labor caused by immigration, whether positive or negative, expresses itself in a change in wages or employment depends on the elasticity of labor supply. The larger the elasticity of labor supply the more the wage effect of immigration is attenuated $\frac{d}{d\phi_n}\left(\frac{d\ln w_n}{d\ln I}\right) < 0$ and the employment effect is amplified $\frac{d}{d\phi_n}\left(\frac{d\ln N}{d\ln I}\right) > 0$.

The effect of immigration on immigrant wages is always negative

$$\frac{d\ln w_i}{d\ln I} = -\frac{\phi_n + s_n\eta + s_i\sigma_{in}}{\sigma_{in}\eta + \phi_n\left(s_i\eta + s_n\sigma_{in}\right)} < 0$$

and the effect on total labor output is always positive

$$\frac{d\ln Q}{d\ln I} = \frac{s_i\eta\left(\sigma_{in} + \phi_n\right)}{\sigma_{in}\eta + \phi_n\left(s_i\eta + s_n\sigma_{in}\right)} > 0 \tag{8}$$

See Appendix B for some further results pertaining to the impact of immigration on average wages (averaged across natives and immigrants), and on wage inequality between native and immigrant labor.

3 Data

3.1 Dataset

The analysis in this paper uses a dataset containing social security records for all individuals employed in Austria between the years 1972 and 2005, with the exception that I observe tenured public sector employees only starting in 1988 (or in some cases 1995). The observations are specific to a match between an employee and employer in a certain year (so continuous employment relations are truncated into separate observations ending on December 31 and starting on January 1 of a year). Observations contain information on income and days worked, as well as the type of employment. Also recorded for individuals are their gender, nationality, date of birth, and location of residence. For the employer I observe their 4-digit industrial classification and location. I also observe spells of unemployment, maternity (or paternity) leave and, only for women, live births. There is some top-coding of income, which in no year affects more than 9% of employees; income is not observed for tenured public sector employees. There is also some bottom-coding of incomes, which in no year affects more than 8% of employees. Until 1997 only an individual's latest nationality and location of residence is observed. Education records are obtained from data provided by the Austrian Employment Service (AMS) and only exist for individuals who are unemployed at some point during their career. Apprenticeships during the period 1972 to 2005 are observed directly in the data. I impute education for everyone else.[6] I distinguish between low skilled (those with at most compulsory schooling), medium skilled (those having completed apprenticeships or vocational training) and high skilled (completed *Matura* or tertiary education). Notice that these definitions are very different than the ones employed in the US. Since I have longitudinal information on workers I can construct actual experience and actual tenure variables. Work experience prior to 1972 is imputed using the information on education and average employment rates for men and women in prior years. Observed income is nominal (in euros) and per day worked.

The unit of observation for most of the empirical work in this paper is a 2-digit industry in one of Austria's nine regions. I use the NACE economic activities classification scheme of the European Union. The exception is construction (itself a 2-digit industry), in which I use the 3-digit classification. I also combine agriculture with forestry and fishing to create a single industry. For around 16% of observations I have no information on the industry they work in (this is a problem only for the self-employed) and consequently I exclude them from the analysis. I exclude the public sector and non-for-profit industries from most of the analysis, reducing the sample size by 19%. I also exclude those industries that do not employ at least 20 foreigners in the period 1972 to 1979, accounting for 8% of native observations. Finally, since identification is (in large part) across regions I only include industries that on average employ at least 20 workers per year in at least six of the nine regions. This restriction reduces the sample size by 13%.

[6] For 35%of native and 29% of foreign observations education needs to be imputed. I impute education for individuals using a multinomial logit. The explanatory variables are gender, cohort, as well as income, 2-digit industry, region and type of employment at various stages of a worker's career, and, where available, a proxy for years of schooling. The within sample fraction of correctly imputed education levels for natives is 59%, and 53% for foreign workers. For natives the fraction that has to be imputed is 40%, 23% and 56% for low, medium and high skilled education groups respectively. The corresponding within sample fraction correctly imputed is 68%, 44% and 63% respectively.

3.2 Background

3.2.1 Immigration

During the 1970s until 1988 the percentage of employees in Austria who are foreign nationals was stable at around 4.5%. Then from 1988 onwards the number of foreign workers more than doubled in four years. From around 4.9% of those employed (180,000 individuals) in 1988 to around 10.5% (421,000 individuals) in 1992; after which it continues rising to around 15% (see Figure 1, note that the figure depicts the faction foreign within the sample I use for analysis which is somewhat higher than the figures quoted here).[7] Up until 1989 most foreigners in Austria were from Yugoslavia, with a sizeable fraction from Turkey and an increasing number from developed countries. Following 1989 there was an increase in foreigners from all countries, but in particular Eastern Europe (see Figure 2).

Legally employed immigrants typically initially only have a temporary work permit (*Beschäftigungsbewilligung*) valid for at least one year which ties them to a specific employer, or are seasonal workers who are allowed to be continuously employed for at most nine months and for at most 12 out of every 14 months. After one year of employment immigrants can apply for an *Arbeitserlaubnis* which allows them unrestricted access to employment within a region (*Bundesland*) of Austria. Finally, in general after five years of employment, or for second generation immigrants at completion of compulsory schooling, immigrants receive a permanent work permit (*Befreiungsschein*) that allows them unrestricted access to the labor market, as well as allowing their family to join them and work in Austria. Major changes in legislation occurred in 1997 (reducing immigration quotas, especially for family members) and in 2005. Since 1994 nationals of EU-15 countries have unrestricted access to the Austrian labor market. Quotas are decided upon by the Ministry for Industry and Labor (*BMWA*) and implemented by the Austrian Employment Service (*AMS*). In 2000, for example, 146,774 new work permits were issues, of which 78,008 were temporary (of which 38,589 were for seasonal work), 10,349 received an *Arbeitserlaubnis* and 44,369 were permanent work permits (Nowotny, 2007).

The fraction foreign in total employment increases rapidly in all industries over this period, 1986 to 2004, from 5.8% to 12.9% in manufacturing and 4.8% to 16.1% in services. Table 1 shows full-time equivalent employment of natives and immigrants in each of the

[7] Note that an individual's nationality and not country of birth is recorded. Also nationality is available in the data only since 1997 on account of the way the Social Security Administration makes the data available. So it is not possible to directly observe an individual's nationality prior to 1997. This is a problem since throughout the 1980s and 1990s annually around 2-3% of foreigners living in Austria became Austrian citizens, according to data from the Austrian Forum for Migration Studies. Commonly foreigners can acquire the Austrian citizenship after having lived in Austria for 10 years, or at least 5 years if married to an Austrian citizen.

two-digit industries used in the analysis for the years 1987 and 2004. The share of the wage bill accruing to foreigners is somewhat lower since immigrants make between 15% to 20% less than natives on average. The fraction of low-skilled workers is much higher among foreigners than natives in Austria, as is the fraction employed in blue collar jobs, the fraction female is lower. See Table 2 for more details.

3.2.2 Labor Market

From 1972 onwards the Austrian labor market was characterized by a steady growth in employment. Male labor market participation rates declined in the 1970s from 85% and have since stabilized at around 80%. Meanwhile, female labor market participation steadily increased, from under 50% in the early 1970s to over 65% now. Austria has had low unemployment rates over the last 40 years; using ILO definitions unemployment was under 2% in the 1970s, 3-4% in the 1980s and somewhat over 4% since then. The unemployment rate of foreign nationals in Austria is higher than that of Austrians and increased from 5.5% in 1986 to 7.4% in 1992 and then continued trending upwards to 10% in 2004.[8] Labor market participation rates at the time of the 2001 census were 87% for men and 65% for women, somewhat higher than for Austrians. The participation rate varies substantially by country of origin and among men is lowest for those from EU and EFTA countries (78%) and among women among those from Turkey and Africa (around 56%). The informal economy accounts for less than 10% of GDP in Austria and somewhat more of employment. Immigrants probably have a somewhat higher propensity to be employed illegally than Austrians, with estimates varying from 10% to 20% of total employment.[9] According to the Austrian Forum for Migration Research the fraction of immigrants among the self-employed (who I exclude from the analysis) is 5.4% in 1988 and increases to 9.0% in 1992 and continues to increase slowly to nearly 11%, somewhat slower than the overall share of the number of immigrants.

The OECD Employment Outlook (2004) ranks Austria in the middle of OECD countries in terms of employment protection, with substantially higher protection than in the US, Canada or the UK, and less protection than Germany, France, Spain or Sweden. Notice periods for continuous employment relationships, i.e. not short or fixed term contracts, for white collar workers (*Angestellte*) start at 6 weeks and increase with uninterrupted tenure at a firm. For blue collar workers notice periods are agreed at an industry

[8] Nowotny (2007) using the Austrian, rather than ILO, definition of unemployment. Under Austrian definitions the unemployment rate is always higher, currently around 2 percentage points, than under ILO definitions.

[9] Jandl (2007) and IOM (2005). In the early 1990s there was a form of amnesty for a lot of illegally employed foreign nationals, there has been no such amnesty since (Nowotny, 2007).

level as part of the collective bargaining process. They vary from 1 day in construction, to up to 5 months for high skilled blue collar workers (*Facharbeiter*) in parts of manufacturing.[10] Severance pay, starting at two months salary, for all workers is only available after 3 years of uninterrupted tenure at a firm and not available if the separation is due to a voluntary quit by the worker.[11]

Austria has a complex collective bargaining system covering 95% of employees in 2002. Currently around 450 separate wage agreements (*Kollektivverträge*) are reached by employer and employees representatives at the national level every year. These agreements typically specify minimum wages and minimum wage increases for employees by industry, occupation, skill level, and seniority. Agreements can be binding or merely recommended best-practice, and provide the framework within which actual wages are set. Detailed information on collective bargained minimum wages is only available for part of the economy, broadly corresponding to the manufacturing sector and for firms with 10 or more employees. In the 1980s actual wages were on average around 30% above the minimum mandated by collective bargaining, and only around 10% of employees were actually paid that minimum. Since then there has been a narrowing of this gap, and currently it is around 20%. In a number of industries there are also agreed minimum wage growth rates of actual wages; these are typically somewhat smaller than the increases in the minimum wage and set above the rate of inflation, but below the rate of nominal growth.[12]

4 Wage and Employment Effects of Immigration

The identification strategies in this paper rely on inter-regional variation in the inflow (over time) of immigrants into an industry. Below I discuss in detail the instrument I will use to deal with the potential endogeneity of the distribution of immigrants across regions within an industry. I also check for the existence of pre-existing trends and conduct a falsification exercise. I then proceed to provide OLS and linear IV estimates of the impact of immigration on native worker displacement and wages. Finally, I use these results to estimate the structural parameters of the model outlined in the Section 2, which I then use to infer the effects of various counterfactuals.

[10] The definition of a white collar worker is defined by law (*Angestelltengesetz*) and includes all salespersons and office workers (including secretaries and receptionists). Everyone else is a blue collar worker unless otherwise agreed, either by collective bargaining or at a firm or on an individual basis.

[11] Severance pay legislation was revised substantially for all employment relationships beginning January 1, 2003. I describe the earlier system.

[12] Pollan (2001, 2005)

4.1 Instrument

The inflow of immigrants may be correlated with unobserved shocks to the demand for labor in a region. If immigrants are more likely to go to regions that are experiencing positive shocks to the demand for native and immigrant labor, then the OLS estimate of the effect of immigration on native employment and wages is upward biased. It is equally possible that immigrant inflows are affected by the availability of jobs in an industry. A plausible way in which the supply-side may matter is that declining industries may make a special effort to attract immigrant labor. For example, as described, many immigrants require a work permit to legally work in Austria; one way that declining industries may respond is by exerting political pressure that more work permits be issued for immigrants working in their industry. In that instance there is a negative correlation between the inflow of immigrants and shocks to the wages and employment of native labor and the OLS estimates would be downward biased.[13] The possibility of biased OLS estimates makes it important to instrument for the inflow of immigrants to an industry-region.

I instrument for the distribution of the inflow of immigrants using the pattern of foreign employment in the 1970s. The underlying idea is that one of the primary determinants of an immigrants' destination choice is a social network that helps them settle in a foreign country, as well as helping them find a job.[14] I use a long baseline period, 1972 to 1979, so as to minimize the effect of short-term employment fluctuations and measurement error, which given that the number of foreigners in some industry-region cells is small could lead to a weak first stage. The social networks justification for the use of this instrument suggests that I distinguish between foreigners by nationality. Sample size considerations lead me to put foreigners in Austria into six categories: former Yugoslavia, Turkey, Eastern Europe, developed countries, Germany and Switzerland (since nationals of those two countries are likely to speak German), and immigrants from the rest of the world.

Formally, the instruments for the inflow of immigrants to a certain 2-digit industry s and region r at time t are given by

$$\Delta I_{rst}(IV) = \sum_{nationality} \frac{nationality_{rs,72-9}}{nationality_{s,72-9}} * \Delta nationality_{st} \tag{9}$$

The first stage is highly significant in all industries, apart from Food and Accommodation, and the correlation coefficient between the actual and instrumented inflow of immigrant

[13] This is what Friedberg (2001) finds when examining the distribution of Russian arrivals in Israel after the end of the Cold War.

[14] See Card (2001), Card and Lewis (2007) and Cortes (2008) for how this instrument works for the US. Munshi (2003) provides a detailed analysis of such networks for Mexicans in the US.

labor to an industry-region averaged over the period 1986 to 2004 is 0.5 (see Table 3).[15]

4.2 Pre-Existing Trends and Falsification

For the instrument to be valid it has to be uncorrelated with other unobserved factors that may affect native (and immigrant) labor market outcomes during the period 1986 to 2004. All the main specifications in this paper are in growth rates and control for 2-digit industry by year effects, so much of the identification comes from the within 2-digit industry across regions variation in immigration flows. Hence, the biggest threat to the validity of the instrument is that there are long-term region specific trends in the growth rate of native employment or native wages that are correlated with the fraction of immigrants in that region (within each industry). Fortunately, the data lends itself to subjecting the instrument to a falsification exercise. During the period 1980 to 1985 there is near to no net immigration to Austria (see Figure 1) or any particular 1-digit industry. Hence, it is possible to test whether during this period the historical distribution of immigrants (and hence the instrument) is correlated with native labor market outcomes in this pre-period. The results suggests that the instrument is correlated with region-specific trends in native employment in manufacturing, see Table 4. This correlation is negative in all 1-digit industries, foreigners seem to be disproportionately employed in regions where an industry is in decline. This means that the instrumental variable estimates of the impact of immigration on native wages and employment may be downward biased on account of long-term demand trends. To deal with the potential bias arising from long-term region-specific trends I include region by 1-digit industry fixed effects in all subsequent specifications.

4.3 Reduced-Form Estimates: Immigration, Wages and Employment

The model of the previous section assumes that there is an exogenous shock to the supply of immigrants. Instrumenting for the inflow of immigrants is meant to ensure exogeneity, however, it remains to be shown that immigration can be thought of as a shock to the

[15] An issue the instrument does not deal with is the fact that those immigrants who are affected by the instrument (sometimes referred to as the "compliers") may be different from the average immigrant. In this case, the instrument will disproportionately affect those immigrants for whom social networks are important for location decisions. Such immigrants may of course be systematically different from those whose locations decisions are determined primarily by demand shocks. Hence, I am at best estimating the effect of immigration flows for those immigrants whose location decisions are affected by the instrument (commonly referred to as a local average treatment effect).

supply of immigrant labor. If that is true then the wages of immigrants should fall in response to an inflow of new immigrants, which in practice does not have to be true. For example, LaLonde and Topel, 1991, find that new immigrants affect cohorts of previous immigrants differentially and so the average effect of immigration on immigrant wages could be positive, in which case the model of the previous section is clearly misspecified. I regress the (instrumented) inflow of immigrants ($\Delta \ln I$) into an industry-region (rs) in a given year (t) on the change in wages of foreign nationals ($\Delta \ln w_{i,rst}$)

$$\Delta \ln w_{i,rst} = \beta_1 \Delta \ln I_{rst} + \delta_{st} + \delta_r + \varepsilon_{1,rst} \tag{10}$$

The specification includes 2-digit industry by year fixed effects (δ_{st}) and region fixed effects (δ_r). My main specifications are regressions of log changes on log changes since these best correspond to the theory in the previous section. In all specifications observations are weighted by employment in each industry-region cell. Identification of the effect of immigration is from the within 2-digit industry variation in immigration flows across regions, pooled over years and conditional on region-specific long-term trends. No other covariates are included. Reassuringly in all 1-digit industries both the OLS and IV estimates are negative (see Table 5). The IV estimates suggest an elasticity of immigrant wages to immigration flows of -0.22 in manufacturing and -0.09 in the service industry.

I proceed to estimate the impact of immigration on native employment growth ($\Delta \ln N$) and native wage growth ($\Delta \ln w_n$)

$$\Delta \ln N_{rst} = \beta_2 \Delta \ln I_{rst} + \delta_{st} + \delta_r + \varepsilon_{2,rst} \tag{11}$$

$$\Delta \ln w_{n,rst} = \beta_3 \Delta \ln I_{rst} + \delta_{st} + \delta_r + \varepsilon_{3,rst} \tag{12}$$

I present the results, pooled by 1-digit industry, in Tables 6 and 7. In the data (OLS estimates) immigration is positively correlated with native employment growth, suggesting that there are common reasons why immigrants and natives move to a certain industry-region. However, the correlation with wages is not uniformly positive, suggesting that the data is generated by a combination of shocks to both demand and supply (hence wage and employment changes are uncorrelated).

The IV estimates reveal that the effect of immigration is highly heterogeneous across industries. Notably, the estimates suggest that immigration is a positive demand shock for native labor in manufacturing, the point estimates of the elasticity of native employment with respect to immigration at the industry-region level is 0.15. The wage effects of immigration in manufacturing are near zero. However, immigration can be thought of as a negative demand shock for native labor in the service industries (defined as trade services, food and accommodation and business services), with an elasticity of -0.069 for employment and -0.023 for wages (though the wage effect is not statistically significant). Since on average the fraction of immigrants in total employment is around 11% in manufacturing and 12% in services, the estimated elasticities translate into large changes in native employment. An exogenous inflow of one immigrant results in the employment of nearly 1.4 additional native worker in manufacturing. In contrast, in services an additional immigrant displaces 0.58 native workers.

Since the magnitude of the effect of immigration on native wages is small we can conclude that the elasticity of labor supply across industry-regions is high. The point estimates suggest that on average the elasticity of labor supply is substantially larger in manufacturing (around 19) than in services (around 3). The magnitude of the elasticity of labor supply will depend on the level of aggregation at which the impact of immigration is measured (in my case a 2-digit industry in a region), the length of time over which the impact is measured (in my case a single year) and institutional features, such as centralized wage-bargaining, that constrains wage-setting behavior. An important consequence of the high elasticity of labor supply is that the sign of the demand shock (positive or negative) to native labor due to immigration is more easily discernible in the data on employment than in wages. Further, if the effect of immigration and the elasticity of labor supply are both heterogenous it is difficult to interpret estimates at an aggregate level. That may, for example, explain why the effects of immigration on wages and employment in business services, which is a highly heterogeneous industry, go in the opposite direction.

The differences between the OLS and IV estimates provides evidence on the factors that determine the location decisions of immigrants. Notice that the bias in the OLS estimates is not uniform across industries. In services the OLS estimates are consistently more positive than IV estimates, which means that demand shocks are an important determinant of immigrant location decisions. In manufacturing the OLS estimates are barely biased, and demand and supply shocks seem to offset each other when it comes to determining immigrant location decisions. Similarly, the OLS estimates of the impact of immigration on immigrant wages are less negative than the IV estimates,which suggests that immigrant location decisions respond to demand shocks and/or that the type of immigrant affected by the instrument has a more detrimental effect on the wage of existing immigrants than those of the average immigrant. To check whether long-run region specific trends in demand are important I also run the same regressions without region-specific fixed effects. The point estimates are not substantially affected by the exclusion of region fixed effects.

Throughout this paper I am thinking of changes in (instrumented) immigration flows as shocks to the supply of immigrant labor, and hence as shocks to the demand for other types of (native) labor. This approach differs somewhat from the dominant approaches in the literature, as exemplified by Card (2001) and Borjas (2003), which view immigration as shocks to factor proportions, as measured by education, experience or occupation. The main reason for doing so is practical, my data on worker education and foreign worker experience is limited, and so it does not seem sensible to rely on an approach that emphasizes changes in factor proportions. Recall that the education categories I use do not correspond to those used in the US since Austria's education system is very different. Moreover, there are a number of reasons, including measurement error, why workers across education groups are more similar than we might wish. Nevertheless, it is surprising that the effect of immigration on the wages and employment of low-skilled natives is very similar to that of higher-skilled natives (see Table 8). It seems as though in Austria educational attainment, at least the way I am able to measure it, is not a very salient feature for understanding wage differentials (see Blau and Kahn, 1996, and Leuven, Oosterbeek and van Ophem, 2004 for further discussion of this issue for countries other than the US). For this reason I will not differentiate between natives by education in the remainder of this paper, though all the models in this paper are easily extended to allow for differential effects by education. Similarly, the instrumental variable estimates do not show a statistically significant differential impact of immigration on male versus female native workers. There is some evidence though that blue collar workers do better than white collar workers, which is surprising since immigrants are predominantly blue collar. What is striking is that throughout the OLS estimates suggest that immigration is positively correlated with the relative outcomes of the factors which immigrants disproportionately bring to the labor market, that is low skilled, male and blue collar as compared to high skilled, female and white collar. This suggests that the distribution of immigrant flows responds to differential factor returns rather than vice-versa.

An advantage of the instrumental variable approach is that it helps deal with measurement problems. For example, there are large numbers of illegally employed, and hence unobserved, immigrant and native workers resulting in both attenuation bias (if illegal and legal immigration flows are uncorrelated) and more complicated biases (if they are correlated) in the OLS estimates. Similarly, the educational attainment and experience of immigrants is not likely to be constant within an industry-year causing biased OLS estimates. But for the instrumental variable estimates it is only necessary that these compositional effects are uncorrelated with the initial distribution of immigrants.

There are however a number of other confounding factors that bias the estimates of the employment and wage effects of immigration. First, immigration to an industry-region may, for example, significantly increase the demand for the output of that industry-region, which would result in an upward bias of the estimates (specifically, the estimated elasticity of product demand will be upward biased, since I would be confusing shifts in demand with the elasticity of demand). However, even if workers spend all of their income in the same region (recall that the returns to capital can accrue to investors from all over the world) only a very small fraction would be ultimately be spent on the output of the industry they are actually employed in, so this bias is likely to be small.

Further, immigration may cause changes in both the "quality" of native workers, as well as the quantity. If immigrants were better substitutes for low than high ability (as measured by units of human capital) natives then I would be overestimating the wage and underestimating the employment effects of immigration. This is a concern that can potentially be addressed using the panel aspect of the data.

Finally, once I turn to the structural estimates I am going to be assuming that immigration causes native workers to change employers solely on account of changes in the wage. However, there may be non-pecuniary reasons why natives may or may not wish to work with immigrants which will bias my structural estimates. This is because, as well as changing the demand for native labor, immigration also changes the supply of native labor for a given wage.

4.4 Structural Estimates and Implications

4.4.1 Model Identification

The share of the total wage bill that goes to native and immigrant labor, s_n and s_i respectively, is observed directly in the data. On average over the period 1986 to 2004 the share of immigrant is labor 9.7% in manufacturing and 10.3% in services. It is somewhat less than the average number of immigrants as a fraction of the workforce (which is 11.2% in manufacturing and 12.2% in services) since on average wages of immigrants are 16.1% and 18.5% lower than that of natives in manufacturing and services respectively. Further, I restrict all the elasticities of native labor supply to be the same across industry-regions. In the absence of information on the capital stock employed in each industry-region in each year I do not decompose the scale effect (the elasticity of labor demand) into its various components. That leaves three unknown parameters ψ, σ_{in} and ϕ_n.

There are three linearly independent estimating equations I described above, $\frac{d\ln w_n}{d\ln I}$, $\frac{d\ln N}{d\ln I}$ and $\frac{d\ln w_i}{d\ln I}$, that I will use to identify these parameters. As long as the reduced-form estimates are unbiased they can be used to derive the structural parameters of the derived demand elasticities. I estimate the structural parameters as follows. The labor supply elasticity is simply the effect of immigration on native employment divide by the effect on native wages, see regressions (11) and (12).

$$\phi_n = \frac{d\ln N}{d\ln I} / \frac{d\ln w_n}{d\ln I} = \beta_2/\beta_3$$

In the same way the elasticity of substitution between native and immigrant labor σ_{in} can be estimated

$$\sigma_{in} = \frac{d\ln\left(I/N\right)}{d\ln\left(w_n/w_i\right)} = \frac{1-\beta_2}{\beta_3-\beta_1}$$

where the coefficients are from regressions (11), (12) and (10)). Finally, I use the expression for $\frac{d\ln N}{d\ln I}$ to find the elasticity of labor demand:

$$\eta = \frac{\sigma_{in}\left(s_i + s_n \frac{d\ln N}{d\ln I}\right)}{s_i\left(1-\frac{d\ln N}{d\ln I}\right) - \sigma_{in}\frac{d\ln w_n}{d\ln I}}$$

Note that given the assumed nested structure of the production function I am able to derive the elasticity of labor demand independent of any assumptions about how capital and labor are combined to produce final output.[16]

The strategy described relies on the assumption that the elasticity of labor supply is identical across industry-regions and over time. Maintaining that assumption and using the average $P\left(s|r\right)$ and $P\left(r\right)$ as observed in the data, it is possible to identify the scale parameters of the native workers' discrete choice problem (μ^s and μ^r). To identify these I use the expression for the ratio of new hires to an industry-region that originate in the same region $H\left(s'|r\right)$ and from other regions $H\left(r'\right)$ (using equations (18) and (19) in Appendix A.2)

$$\frac{H\left(s'|r\right)}{H\left(r'\right)} = \frac{\mu^s\left(1-P\left(s|r\right)\right)}{\mu^r\left(1-P\left(r\right)\right)} - \left(1-P\left(s|r\right)\right) \tag{13}$$

4.4.2 Estimates

The parameter estimates for manufacturing, the service sector are summarized in Table 9. The point estimate of the elasticity of substitution between immigrants and natives is 3.7 in manufacturing and 15.9 in the service sector. These estimates are in line with other studies: Cortes (2008) finds an elasticity of substitution between native and immigrant

[16] Equation (8) could be used to find the elasticity of product demand for a given supply elasticity of capital

$$\psi = \frac{\phi_k\left(\eta - s_k\sigma_{qk}\right) + s_q\sigma_{qk}\eta}{\phi_k s_q + \sigma_{qk} - s_k\eta}$$

(or vice versa).

labor of around 4 and Manacorda, Manning and Wadsworth (2007) of around 6 using UK data.[17]

I find an elasticity of labor demand at the industry-region level of 17 in manufacturing and 1.4 in services, and thus in manufacturing the scale effect is larger than the substitution effect and vice versa in services.[18] I have not found any estimates directly comparable to these, indeed this paper is the first paper to estimate scale effects arising from an inflow of immigrants. However, if we are willing to assume that capital is perfectly elastically supplied and combined with the labor aggregate in a Cobb-Douglas production function, then a back of the envelope calculation suggests that the elasticity of product demand in manufacturing at the 2-digit industry by region level is 34. In comparison Broda and Weinstein (2006) find that for US trade averaged across products the elasticity of substitution between goods, which in this context can be thought of as comparable to my elasticity of product demand, is 7. Broda, Greenfield and Weinstein (2006) provide estimates separately by country and the mean elasticity of substitution estimate for 3-digit manufacturing industries in Austria is around 15 (the distribution is right skewed, when excluding the top and bottom 5% of the estimates the mean is around 5).

In neither industry can we reject the hypothesis that labor is perfectly elastically supplied, though the point estimate is higher in manufacturing. As discussed in the previous section, on account of the high elasticity of labor supply across industry-regions the effect of immigration on the demand for native labor does not show up in changes in wages at the industry-region level, but rather in changes in employment. In services immigrants displace native workers and in manufacturing they increase the demand for native labor.

[17] Note that within education groups, and hence using different variation from the one used in this paper, Card (2009) suggests that this elasticity of substitution is around 20 in the US; while, Borjas, Hanson and Grogger (2008) conclude that perfect substitutability between immigrant and native labor can not be rejected.

[18] It is interesting to note that, in this context, I can evaluate the validity of Marshall's third law of derived demand: "The demand for anything is likely to be less elastic, the less important is the part played by the cost of that thing in the total cost of some other thing, in the production of which it is employed." (Bronfennbrenner, 1961, p. 8, quoting A. C. Pigou). As Hicks (1932) and Allen (1938) pointed out this is only true if the elasticity of demand for the output being produced is larger than the elasticity of substitution, i.e. if the ability of consumers to substitute between goods is greater than producers ability to substitute between inputs. I find Marshall's third law to be true in manufacturing, but false in services (at least as pertains to the effects of an inflow of immigrants).

4.4.3 Implications for Average Wages and Worker Relocation

We are now in a position to use the estimates of the structural parameters to draw inferences about any number of possible immigration scenarios. I will focus on the effects of a proportional increase in the number of immigrants in every industry-region of Austria. There are some issues in going from region level parameter estimates to those at the national level. I discuss these in Appendix C. Also, to simplify matters I assume that manufacturing and services are the only two industries, that labor is perfectly elastically supplied to each industry (an assumption that is not rejected by the data even at an annual frequency), so that wages equalize across industries, and that labor is supplied perfectly inelastically in aggregate. This allows us to conclude the following.

First, to calculate the impact of immigration on native wages notice that the aggregate shift in the demand for native labor is simply the weighted sum of the shift in demand in each industry on account of the immigrant inflow. In particular, the aggregate change in demand, ΔD, is given by

$$\Delta D = \sum_j \frac{s_{i,j}\left(\eta_j^A - \sigma_{in,j}\right)}{\sigma_{in}\eta_j^A}$$

where industry j is either manufacturing or services. Given that in aggregate labor is inelastically supplied to the labor market this shift in demand is also equal to the change in average native wages. I find that the elasticity of native wages with respect to immigration is -0.025, i.e. a 10% increase in immigrant labor, equivalent to 1% of the labor force, would decrease average native wages by 0.25%.

One of the main results of the paper of course is that the industry which immigrants determines whether they increase or decrease the demand for native labor. If all immigrants joined manufacturing industries, then average native wages in the economy would increase by 0.20%; while if they exclusively joined the service sector then average native wages would fall by 0.43%. Clearly, from the perspective of the welfare of natives it matters hugely where immigrants work.

We can also calculate how many native workers relocate across industries on account of immigration. The total differential of native wages in an industry is given by

$$d\ln w_n = \frac{\partial \ln w_n}{\partial \ln N} d\ln N + \frac{\partial \ln w_n}{\partial \ln I} d\ln I$$

where $\frac{\partial \ln w_n}{\partial \ln N} = -\left(\frac{s_i}{\sigma_{in}} + \frac{s_n}{\eta}\right)$ and $\frac{\partial \ln w_n}{\partial \ln I} = s_i\left(\frac{1}{\sigma_{in}} - \frac{1}{\eta}\right)$. Assuming that the aggregate labor supply elasticity is equal to zero we can calculate how many native workers must have moved so that wages equalize across industries.[19] I find that the elasticity of native worker relocation across industries with respect to an inflow of immigrants is 0.14. The implication is that a 10% increase in immigrant labor, equivalent to a 1% increase in the labor force, will result in 1.4% of native workers relocating from the service sector to manufacturing. This would imply a reduction in native employment in services by around 1.9% and an increase in manufacturing by around 4.7%.

Further, using the total differential of immigrant wages,[20] I calculate that the elasticity of average immigrant wages, taking into account the response of natives, with respect to immigration is -0.058, so that a 10% increase in the number of immigrants decreases average immigrant wages by 0.59%. This average decrease in immigrant wages is composed of a 1.59% fall in manufacturing and only 0.18% in services. The reason the impact of immigration on immigrant wages is relatively modest is that native labor movements boost demand for immigrants in both industries, thereby partially off-setting the large and negative partial effect of immigrants on their own wages.

Finally, we can estimate the elasticity of average wages with respect to an immigration induced increase in the labor force. Note that the demand for goods is always downward-sloping in the model outlined in Section 2. With domestic and foreign goods as imperfect substitutes and labor mobile across industries, even in the long-run with perfectly mobile capital, as immigrants expand the production of domestic goods their price, and hence average wages, will have to fall. In addition, when capital is not perfectly mobile this will put further downward pressure on average wages. My estimated aggregate wage elasticity is -0.28. In other words, a 10% increase in immigrants, increasing the total labor force by 1%, would decrease wages averaged across natives and immigrants by 0.28%.

[19] If there are only two industries the flow of workers across these industries, dN, is given by

$$\frac{dN}{N_1+N_2} = \frac{\left(\frac{\partial \ln w_{n,2}}{\partial \ln I_2} - \frac{\partial \ln w_{n,1}}{\partial \ln I_1}\right)}{\left(\frac{N_1+N_2}{N_1}\frac{\partial \ln w_{n,1}}{\partial \ln N_1} - \frac{N_1+N_2}{N_2}\frac{\partial \ln w_{n,2}}{\partial \ln N_2}\right)} d\ln I$$

[20] The total differential of immigrant wages in an industry is given by

$$d\ln w_i = \frac{\partial \ln w_i}{\partial \ln I} d\ln I + \frac{\partial \ln w_i}{\partial \ln N} d\ln N$$

where $\frac{\partial \ln w_i}{\partial \ln I} = -\left(\frac{s_n}{\sigma_{in}} + \frac{s_i}{\eta}\right)$ and $\frac{\partial \ln w_i}{\partial \ln N} = s_n\left(\frac{1}{\sigma_{in}} - \frac{1}{\eta}\right)$.

5 Conclusions

There is a large literature on the impact of immigration on inequality between different types of native labor. This paper contributes to the immigration literature by estimating the impact on wage and employment levels. The effect of immigration on inequality depends on the elasticity of substitution, which is defined for a given level of output, between types of labor. The impact on wage levels also depends on the degree to which output expands as immigration reduces the cost of production. The magnitude of this scale effect depends on the elasticity of product demand, with the effect of immigration on the demand for native labor depending on the difference in the magnitude of scale and substitution effects. An important insight of the paper is that the scale effect will vary considerably by industry, since the elasticity of product depend will vary, and so immigration is likely to have a highly heterogenous effect depending on what industry immigrants join. The more the scale of output can expand, and the lower the elasticity of substitution, the more immigration will benefit native labor. This insight has implications for policy, for example, for the decision to what industries to issue work permits. A further consequence of the heterogeneous impact of immigration on the demand for native labor is that even if average wage effects are small immigration is likely to induce large amounts of relocation between industries, from those industries where immigrants displace native workers to those where they increase the demand for natives.

Given the evidence on the heterogeneity of scale effects across industries it would be important to identify what observable industry or worker characteristics can explain these differences. The tradeability of final output is an obvious example. Similarly, the magnitude of the elasticity of substitution will depend on industry characteristics and, as the literature using US data has found, on the characteristics of native and immigrants workers. In this paper I abstract from these issues and measure some kind of average response, but further work is likely to uncover other reasons for which responses to immigration are heterogeneous across types of workers.

The paper also contributes to the debate on how to best empirically identify the impact of immigration. The approach the paper takes is to use an instrumental variable strategy to deal with the endogeneity of immigrant location decisions. This is the approach the local labor markets literature takes and is open to the criticism that natives will decide to move across units of observation in response to immigration, thereby attenuating the measured impact of immigration. I deal with this concern by explicitly modeling the response of natives to immigration and accounting for this effect when estimating scale and substitution effects. My methodology thereby addresses the drawbacks of both the local labor markets and the time series approach, which does not allow for the instrumenting of the distribution of immigration flows, to identifying the impact of immigration.

The paper's focus is on native workers and, with the help of the instrumental variables strategy, I abstract from how immigrants behave. A complete analysis of the issue would have to consider how, in the long-term, immigrants are integrated into the national labor market. That issue goes beyond the scope of this paper, but is likely to be important in thinking about the long-term effects of immigration.

Appendix A

In this appendix I derive the factor demand elasticities and elasticities of labor supply for the model in Section 2. I suppress industry and region subscripts.

A.1 Elasticities of derived demand

Firms maximize profits subject to equations (1) and (2). Taking the derivative of the first-order conditions with respect to a change in the number of immigrants:

$$\frac{d\ln w_i}{d\ln I} = \frac{d\ln Q}{d\ln I}\left(\frac{1}{\sigma_{in}} - \frac{1}{\eta}\right) - \frac{1}{\sigma_{in}} \tag{14}$$

$$\frac{d\ln w_n}{d\ln I} - \frac{d\ln w_i}{d\ln I} = \frac{1}{\sigma_{in}}\left(1 - \frac{d\ln N}{d\ln w_n}\frac{d\ln w_n}{d\ln I}\right) \tag{15}$$

Eliminating $\frac{d\ln w_i}{d\ln I}$ using (14) and (15)

$$\frac{d\ln Q}{d\ln I} = \frac{d\ln w_n}{d\ln I}\frac{\eta\left(\sigma_{in} + \phi_n\right)}{\left(\eta - \sigma_{in}\right)} \tag{16}$$

Then I differentiate the production function and use the fact that with constant returns to scale $s_i = \frac{w_i I}{w_q Q} = \frac{w_i}{w_q}\frac{I}{Q} = \frac{F_I I}{Q}$ and $s_n = \frac{w_n N}{w_q Q} = \frac{F_N N}{w_q Q}$

$$\begin{aligned}\frac{dQ}{dI} &= F_I + F_N\frac{dN}{dw_n}\frac{dw_n}{dI} \\ \frac{d\ln Q}{d\ln I} &= s_i + s_n\phi_n\frac{d\ln w_n}{d\ln I}\end{aligned} \tag{17}$$

I eliminate $\frac{d\ln Q}{d\ln I}$ using (16) and (17) to find the expression for $\frac{d\ln w_n}{d\ln I}$, see equation (5). Then substitute into (16) to find the expression for $\frac{d\ln Q}{d\ln I}$ (8). Finally, substituting this expression into (14) to obtain $\frac{d\ln w_i}{d\ln I}$ as a function of the exogenous parameters.

A.2 Native worker labor supply

A worker chooses an industry and a region in which to work following (3). Hence, the marginal probability that a worker chooses region r is given by the probability that

$$P\left(r\right) = \Pr\left[\varepsilon_r + \max_s\left(\ln\alpha_{rs} + \ln w_{rs} + \varepsilon_{rs}\right) \geq \varepsilon_{r'} + \max_s\left(\ln\alpha_{r's} + \ln w_{r's} + \varepsilon_{r's}\right), \quad \forall r' \in R, r' \neq r\right]$$

Since ε_{rs} is Gumbel distributed with parameter μ^s the term $\max_s (\ln \alpha_{rs} + \ln w_{rs} + \varepsilon_{rs})$ is also Gumbel distributed and can be written as $\tilde{\alpha}_r + \tilde{\varepsilon}_r$ where

$$\begin{aligned} J_r &= \left(\sum_s (\alpha_{rs} w_{rs})^{\mu^s} \right)^{1/\mu^s} \\ \tilde{\varepsilon}_r &= \max_s (\ln \alpha_{rs} + \ln w_{rs} + \varepsilon_{rs}) - \tilde{\alpha}_r \end{aligned}$$

and $\tilde{\varepsilon}_r$ is Gumbel distributed with scale parameter μ^s. The combined disturbance $\varepsilon_r + \tilde{\varepsilon}_r$ is, as assumed, independent and identically Gumbel distributed with scale parameter μ^r for all $r \in R$, therefore

$$P(r) = \frac{e^{\mu^r \ln J_r}}{\sum_{r' \in R} e^{\mu^r \ln J_{r'}}} = \frac{J_r^{\mu^r}}{\sum_{r'} J_{r'}^{\mu^r}}$$

The conditional choice probability of choosing industry s having decided on region r is

$$P(s|r) = \Pr \left[\ln \alpha_{rs} + \ln w_{rs} + \varepsilon_{rs} \geq \ln \alpha_{rs'} + \ln w_{rs'} + \varepsilon_{rs'}, \quad \forall s' \in S, s' \neq s | r \text{ chosen} \right]$$

The components attributable to the industry cancel, so

$$P(s|r) = \frac{e^{\mu^s \ln \alpha_{rs} w_{rs}}}{\sum_{s'} e^{\mu^s \ln a_{rs'} w_{rs'}}} = \frac{(\alpha_{rs} w_{rs})^{\mu^s}}{\sum_{s'} (a_{rs'} w_{rs'})^{\mu^s}}$$

and the joint probability is

$$P(r,s) = P(s|r) P(r) = \frac{(\alpha_{rs} w_{rs})^{\mu^s}}{\sum_{s'} (a_{rs'} w_{rs'})^{\mu^s}} \frac{J_r^{\mu^r}}{\sum_{r'} J_{r'}^{\mu^r}}$$

Assuming $\bar{N}$ homogeneous workers the labor supply to a given industry and region is $N_{rs} = \bar{N} P_\tau (r, s)$. The elasticity of the labor supply to an industry-region with respect to a change in the wage is found by taking the derivative with respect to w_{rs} and is given by (4). Further, the cross-elasticity of labor supply with respect to a change in the wage of an industry in a different region is

$$\begin{aligned} \frac{d \ln P(r', s)}{d \ln w_{rs}} &= \frac{d \ln P(r')}{d \ln J_r} \frac{d \ln J_r}{d \ln w_{rs}} \\ &= -\mu^r P(r) P(s|r) = -\mu^r P(s, r) \end{aligned} \tag{18}$$

The cross-elasticity of labor supply with respect to a change in the wage of an industry in the same region is

$$\begin{aligned}\frac{d\ln P(r,s')}{d\ln w_{rs}} &= \frac{d\ln P\left(s'|r\right)}{d\ln w_{rs}}+\frac{d\ln P\left(r\right)}{d\ln J_r}\frac{d\ln J_r}{d\ln w_{rs}}\\ &= -\mu^s P\left(s|r\right)+\mu^r P\left(s|r\right)\left(1-P\left(r\right)\right)\end{aligned} \tag{19}$$

Combining (18) and (19) yields the expression for the ratio of within region to outside of region hires (13).

Appendix B

There is an interesting dichotomy in a CES framework between the parameters that determine the response of the average wage level to immigration and those that determine the effect of immigration on inequality between groups. Broadly speaking the scale effect determines the effect on average wages and the substitution effect between relative wages of immigrants and natives. The total effect on native wages is just the sum of these two effects.

Borjas (2009) has an extensive discussion of this issue. His results can easily be verified in the context of the model in Section 2. Assuming an elasticity of labor supply equal to zero, equations (5) and (10) imply that the average wage effect is given by

$$s_n \frac{d \ln w_n}{d \ln I} + s_i \frac{d \ln w_i}{d \ln I} = -s_i \frac{1}{\eta}$$

and the aggregate wage elasticity is equal to $-\frac{1}{\eta}$. Hence, for example, in a small open economy where domestically produced goods are perfect substitutes for foreign goods i.e. demand for output is perfectly elastic, and capital is perfectly elastically supplied the average wage effect of immigration should be equal to zero. In the short-run, however, where capital is fixed the aggregate wage elasticity is equal to the negative of the capital share, $-\frac{1}{\eta} = -s_k$.

Where my assumption of imperfect substitutability of immigrant and native labor matters is that it allows immigrant and native wages to diverge. Indeed, the effect of immigration on inequality between groups, when native labor is inelastically supplied, depends solely on the elasticity of substitution

$$\frac{d \ln w_n}{d \ln I} - \frac{d \ln w_i}{d \ln I} = -\frac{1}{\sigma_{in}}$$

The wage elasticity of native wages, scaled by the fraction of immigrants in the labor force, is the sum of these two effects:

$$\frac{1}{s_i} \frac{d \ln w_n}{d \ln I} = \frac{1}{\sigma_{in}} - \frac{1}{\eta}$$

Appendix C

There are two major issues in going from region level parameter estimates to those at the national level: (1) immigrants are also consumers and so immigration results in a shift (for a given price) in the demand for goods and services produced in Austria, and (2) the elasticity of demand for Austrian products is likely to be lower than for those produced in an individual industry-region.

To help me illustrate these issues take an immigration shock that is of the same magnitude in all industry-regions. Using the equations in Section 2.1.2 and the fact that prices are homogeneous of degree one, the difference in the impact of immigration on output in an industry at the aggregate national level $\frac{d\ln Y_{sh}}{d\ln I_{sh}}$ and regional level $\frac{d\ln Y_{sr}}{d\ln I_{sr}}$ is

$$\frac{d\ln Y_{sh}}{d\ln I_{sh}} - \frac{d\ln Y_{sr}}{d\ln I_{sr}} = \frac{M_d b_d^{\alpha_f}}{M_d b_d^{\alpha_f} + M_f b_f^{\alpha_f}} - (\alpha_r - \alpha_f)\left(-\frac{d\ln p_{sr}}{d\ln I_{sr}}\right) \tag{20}$$

where $\frac{M_d b_d^{\alpha_f}}{M_d b_d^{\alpha_f} + M_f b_f^{\alpha_f}}$ is the domestic share of consumption of domestic products.[21] The first term of this expression reflects the increase in aggregate demand for domestic goods as a consequence of immigration, the second term reflects potentially different elasticities of product demand at the region and country level (typically we assume that $\alpha_r \geq \alpha_f$). If we can assume that capital is perfectly elastically supplied and that $(\alpha_r - \alpha_f)\left(-\frac{d\ln p_{sr}}{d\ln I_{sr}}\right)$ is small enough to be negligible, then from equations (7) and (20) it follows that the aggregate elasticity of labor demand with respect to an aggregate immigration shock is

$$\eta^A = \eta + s_q \frac{M_d b_d^{\alpha_f}}{M_d b_d^{\alpha_f} + M_f b_f^{\alpha_f}}$$

A related issue is that the estimated elasticity of labor supply is across industry-regions. However, if the inflow of immigrants into all regions is of equal magnitude then workers will not change jobs across region within an industry, but only across industries within a region. The within region across industry elasticity is

$$\frac{d\ln N_s}{d\ln w_s} = \mu^s \left(1 - P\left(s|r\right)\right)$$

[21] Exports accounted for around 24% of GDP in 1976 and 58% of GDP in 2006. They started growing particularly quickly after 1995 when Austria joined the EU. Data on the relevant variable, what fraction of domestic output is domestically consumed, is surprisingly difficult to obtain. For the type of services included in my sample (primarily food and accommodation and retail and wholesale trade) presumably close to all of output is domestically consumed. In manufacturing, in contrast, most output is likely to be exported.

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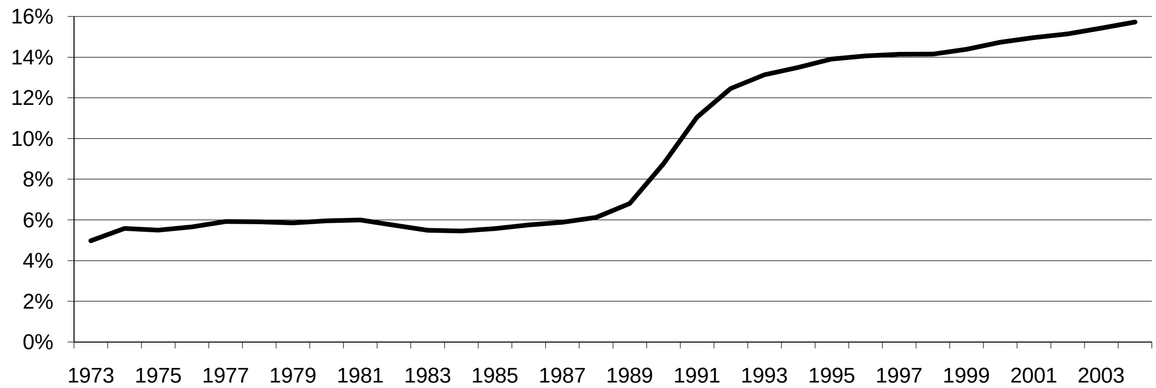

Figure 1: Fraction of foreigners in total employment

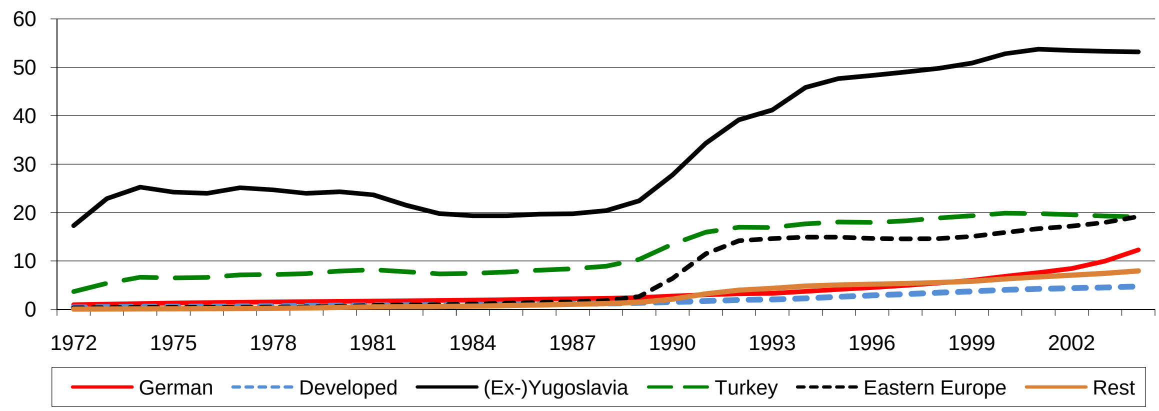

Figure 2: Foreigners by origin (in millions of days worked)

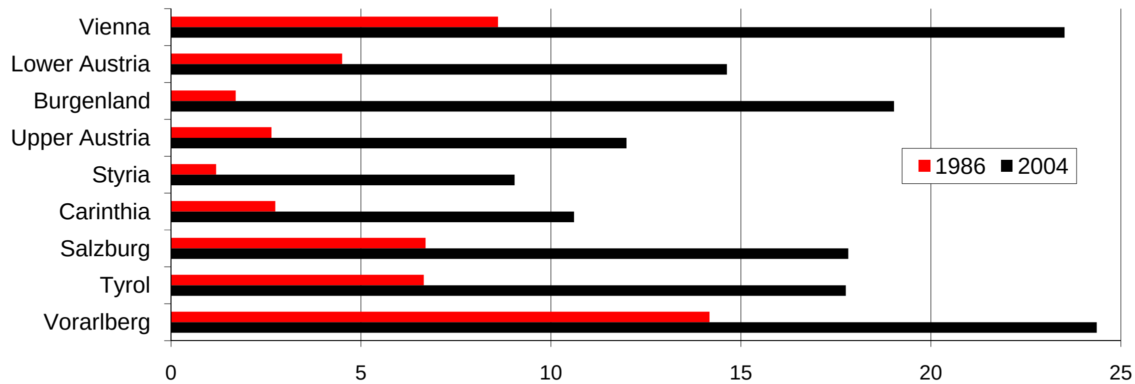

Figure 3: Fraction foreign employment (by region in 1986 and 2004)

Table 1: Full-time Equivalent Employment by 2-Digit Industry

	Native Employment		Foreign Employment	
	1987	2004	1987	2004
Agriculture and forestry	24456	21108	2146	8834
Manufacturing				
Wearing apparel	33014	8000	2551	1798
Leather and leather products	10503	3932	682	1200
Chemicals and chemical products	34437	28627	1330	2916
Rubber and plastic products	21508	20175	2092	4721
Other non-metallic mineral products	29319	24556	1358	3439
Fabricated metal products	56860	58032	4663	10827
Machinery and equipment	58058	58012	2346	5781
Electrical machinery and apparatus	18430	16916	1270	1556
Construction				
General construction	119916	101027	10241	26574
Installation	37091	45974	1083	6702
Building completion	24158	29195	1041	7837
Services				
Sale and maintenance of motor vehicles	50567	61860	1602	6874
Wholesale trade	171413	177323	6265	19750
Retail trade	175484	228229	4848	26324
Hotels	41237	43441	5742	19659
Restaurants and bars	52107	77585	5952	32279
Land transport	56814	77602	2999	17726
Other business activities	76840	201835	5225	44793
Other service activities	24416	30141	1479	5186

Table 2: Summary Statistics

	Manufacturing		Services		All Industries	
	1986	2004	1986	2004	1986	2004
Fraction Foreign (in)	5.8	12.9	4.8	16.1	5.3	16.2
Share Foreign (in %)	5.2	11.0	4.0	13.7	4.6	13.7
Relative Wage Foreign (in %)	-11.2	-17.7	-19.7	-19.4	-15.1	-20.1
Fraction Low Skilled (in %)						
Foreign	78.4	66.8	75.6	67.8	77.3	67.6
Native	36.2	23.4	30.0	27.9	32.3	26.8
Fraction Blue Collar (in %)						
Foreign	84.1	77.1	78.4	71.5	82.0	75.0
Native	62.8	53.9	46.2	42.2	54.3	47.2
Fraction Female (in %)						
Foreign	28.5	25.1	43.8	46.5	31.2	36.4
Native	35.4	26.7	50.1	54.1	40.2	44.5
Average Age (in years)						
Foreign	35.6	36.8	33.8	33.5	35.1	34.6
Native	32.9	35.8	31.6	34.6	32.3	35.0

Table 3: Actual Immigration on Predicted Immigration (by 1-digit industry)

Dependent variable: Log Change in Immigrant Employment							
	Manufacturing	All Services	Construction	Retail Trade	Food and Acc.	Bus. Services	All Industries
Instrument	0.328***	0.282***	0.275***	0.319***	0.237	0.377***	0.301***
	(0.057)	(0.082)	(0.078)	(0.079)	(0.157)	(0.065)	(0.04)
Partial R-squared	0.25	0.14	0.20	0.24	0.18	0.28	0.21
No. Observations	1296	1290	486	648	324	324	3234

* significant at 10%, ** significant at 5%, *** significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each 1-digit industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.

Table 4: Correlation of Instrument with Changes in Native Wages and Employment in Pre-period (1981-85), by 1-digit industry

Dependent variable: Change in Native Employment / Log Change in Native Wages / Log Change in Immigrant Wages							
	Manufacturing	All Services	Construction	Retail Trade	Food and Acc.	Bus. Services	All Industries
			Foreign Wages				
Instrument	-0.049***	-0.001	-0.007	-0.04	-0.01	0.006	-0.001
	(0.012)	(0.004)	(0.009)	(0.038)	(0.006)	(0.008)	(0.004)
Partial R-squared	0.000	0.000	0.010	0.000	0.000	0.000	0.000
No. Observations	360	360	135	180	90	90	900
			Native Employment				
Instrument	-0.036***	-0.04	-0.024	-0.042***	-0.045	-0.017	-0.036***
	(0.012)	(0.032)	(0.021)	(0.011)	(0.028)	(0.02)	(0.015)
Partial R-squared	0.040	0.010	0.010	0.120	0.030	0.010	0.010
No. Observations	360	360	135	180	90	90	900
			Native Wages				
Instrument	-0.001	0.007	-0.016	0.001	-0.003	-0.001	0.001***
	(0.003)	(0.005)	(0.009)	(0.005)	(0.006)	(0.003)	(0.003)
Partial R-squared	0.000	0.010	0.030	0.000	0.000	0.000	0.000
No. Observations	360	360	135	180	90	90	900

* significant at 10%, ** significant at 5%, *** significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell and estimates are robust to heteroscedasticity. I cluster on 2-digit industry by region and all regressions include 2-digit industry by year fixed effects.

Table 5: Impact of Immigration on Changes in Immigrant Wages (by 1-digit industry)

Dependent variable: Log Change in Immigrant Wages								
	All Services		Manufacturing		Construction		All Industries	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Δ Log Foreign Emp.	-0.065**	-0.09***	-0.075***	-0.218***	-0.043***	-0.046*	-0.067***	-0.107***
	(0.032)	(0.027)	(0.012)	(0.076)	(0.014)	(0.027)	(0.015)	(0.025)
Partial R-squared	0.05		0.09		0.08		0.07	
No. Observations	1296	1296	1296	1290	486	486	3240	3234
	Retail Trade		Food and Acc.		Bus. Services			
	OLS	IV	OLS	IV	OLS	IV		
Δ Log Foreign Emp.	-0.026	-0.089***	-0.009	-0.172	-0.158***	-0.089		
	(0.035)	(0.032)	(0.014)	(0.127)	(0.056)	(0.059)		
Partial R-squared	0.03		0.07		0.12			
No. Observations	648	648	324	324	324	324		

* significant at 10%, ** significant at 5%, *** significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each 1-digit industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.

Table 6: Impact of Immigration on Changes in Native Employment (by 1-digit industry)

Dependent variable: Log Change in Native Employment								
	All Services		Manufacturing		Construction		All Industries	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Δ Log Foreign Emp.	0.125***	-0.069*	0.158***	0.152***	0.043***	0.037	0.121***	0.019
	(0.042)	(0.041)	(0.022)	(0.074)	(0.011)	(0.027)	(0.022)	(0.024)
Partial R-squared	0.2		0.22		0.33		0.2	
No. Observations	1296	1296	1296	1290	486	486	3240	3234
	Retail Trade		Food and Acc.		Bus. Services			
	OLS	IV	OLS	IV	OLS	IV		
Δ Log Foreign Emp.	0.132*	-0.098***	0.03	-0.391	0.146***	0.072		
	(0.073)	(0.048)	(0.02)	(0.275)	(0.044)	(0.059)		
Partial R-squared	0.22		0.09		0.2			
No. Observations	648	648	324	324	324	324		

* significant at 10%, ** significant at 5%, *** significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each 1-digit industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.

Table 7: Impact of Immigration on Changes in Native Wages (by 1-digit industry)

Dependent variable: Log Change in Native Wages								
	All Services		Manufacturing		Construction		All Industries	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Δ Log Foreign Emp.	0.003	-0.023	0.008	0.008	0.008*	-0.002	0.006	-0.011
	(0.014)	(0.018)	(0.006)	(0.013)	(0.005)	(0.008)	(0.007)	(0.009)
Partial R-squared	0.04		0.01		0.07		0.04	
No. Observations	1296	1296	1296	1290	486	486	3240	3234
	Retail Trade		Food and Acc.		Bus. Services			
	OLS	IV	OLS	IV	OLS	IV		
Δ Log Foreign Emp.	0.02	-0.005	0.014	-0.144	-0.035*	-0.04		
	(0.019)	(0.014)	(0.01)	(0.092)	(0.019)	(0.049)		
Partial R-squared	0.08		0.02		0.05			
No. Observations	648	648	324	324	324	324		

* significant at 10%, ** significant at 5%, *** significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each 1-digit industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.

Table 8: Differential Impact of Immigration on Changes in Native Employment

Dependent variable:	Difference High to Low Education Workers			
	All Services		Manufacturing	
	OLS	IV	OLS	IV
Δ Log Foreign Emp.	-0.042***	0.007	-0.057***	-0.042
	(0.015)	(0.03)	(0.011)	(0.031)
Partial R-squared	0.61	0.6	0.34	0.34
No. Observations	1296	1296	1296	1290
Dependent Variable:	Difference Female to Male Workers			
	All Services		Manufacturing	
	OLS	IV	OLS	IV
Δ Log Foreign Emp.	-0.073***	0.055	0.004	0.036
	(0.027)	(0.04)	(0.019)	(0.05)
Partial R-squared	0.42	0.37	0.24	0.23
No. Observations	1296	1296	1296	1290
Dependent Variable:	Difference White Collar to Blue Collar Workers			
	All Services		Manufacturing	
	OLS	IV	OLS	IV
Δ Log Foreign Emp.	-0.103***	0.032	-0.062***	-0.078**
	(0.023)	(0.043)	(0.012)	(0.033)
Partial R-squared	0.5	0.46	0.34	0.34
No. Observations	1296	1296	1296	1290

* significant at 10%, ** significant at 5%, *** significant at 1%. Unit of analysis is a 2-digit industry in a region in a year. Observations are weighted by the number of employees in each cell. All regressions include 2-digit industry by year fixed effects and region fixed effects for each 1-digit industry. Standard errors are clustered on 2-digit industry by region cells and are robust to heteroscedasticity.

Table 9: Structural Parameter Estimates

	All Services	Manufacturing
Elasticity of Substitution (σ_{in})	15.9**	3.7***
	(7.2)	(1.2)
Elasticity of Labor Demand (η)	1.4	17.0*
	(1.2)	(10.2)
Elasticity of Labor Supply (ϕ_n)	3.0	18.8
	(2.8)	(30.3)
Hire (s'|r) / Hire (r')	2.9	2.1
Immigrant labor share (s_i)	0.10	0.10
Native labor share (s_n)	0.90	0.90

* significant at 10%, ** significant at 5%, *** significant at 1%. Standard errors were calculated using the delta method.