

Exploring the Relation between Immigrants and Native workers: New Evidence using Firms, Occupations, and Employment Flows

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Abstract

We evaluate the relationship between immigrant and native employment using the Swedish administrative employer-employee linked LOUISE database. We find that if firms increase employment of immigrant workers by 10 percent, they increase employment of Swedish workers within the same occupation of the immigrants by 2.82 percent, and they increase employment of Swedish workers within other occupations by 0.50 percent. We find that immigrant employment changes outside of the firm have very little effect on the firm's decision to hire Swedish workers. We show that the majority of the Swedish employment increases is due to job-to-job transitions. We also find some evidence that firms increase employment to nonemployment transitions when they hire immigrant workers, which we interpret as possible job displacement occurrences. We interpret these findings as evidence that immigrants are complements with native workers within their occupations and across other occupations.

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1. Introduction

The topic of how many jobs immigrants take from native workers is often discussed during political elections. During his campaign, President Donald Trump stated that US jobs were moved to other countries, and that other jobs were being taken by immigrant workers. Recently, the Australian government passed more strict standards for citizenship due to similar concerns. Some studies explain that these concerns are driven by the assumption that immigrants are cheap substitutes for some domestic workers (Borjas 2003, 2006, Borjas, DiNardo, Freeman, and Katz 1997, Bound, Braga, Golden, and Khanna 2015, Schoeni, R.F., 1997). However, other papers (Butcher and Card 1991, Card 2005, Cortes 2008, Grossman 1982, Pischke and Velling 1994, Pope and Withers 1993) argue that immigrants do not displace native workers, nor is there sufficient evidence that they depress local wages. These results seem to conflict with each other. However, the effects from immigration on domestic workers could stem from several channels with counteracting effects. Due to data limitations, previous studies have been unable to distinguish whether immigrants affect native employment for some or all occupations within a firm, or if they affect employment changes from local spillover effects. In order to provide a complete description of how immigrants affect native employment, one must be able to distinguish between each of these effects.

In this paper we use the rich employer-employee Swedish LOUISE database to investigate how immigrant employment and Swedish employment are related within the firm, occupation, and local labor market. We find that when firms increase immigrant employment by 10 percent, they increase Swedish employment within the immigrants' occupations by 2.81 percent and they increase Swedish employment within other occupations by 0.50 percent. These

results suggest that immigrant employment affects Swedish employment positively, especially within an occupation in a firm. We find little evidence that immigrant employment increases outside of a firm substantially influences a firm's decision to hire Swedish workers. Based on these results, we argue that there is little evidence that, on average, immigrants take employment opportunities away from native workers.

Our primary methodology is to regress employment changes of immigrant on employment changes on native with industry-occupation dummies and previous firm characteristics as controls. With this methodology we control for industry and occupation shocks whose effects vary across time, as well as time invariant firm characteristics. Our goal is to approximate a firm's decision making process of simultaneously selecting how many Swedes and immigrant workers within each occupation they choose to employ or layoff in a given year. Our work closely resembles Kerr, Kerr, and Lincoln 2015A, 2015B, one of the first studies to calculate the employment effects immigrants had on US workers within a firm. We expand their analysis by calculating the native employment effects immigrants have within and across occupations, and we are able to calculate how immigrants outside of the firm can affect a firm's decision to hire native workers. Just like Kerr et al., we show that the sign of any consistent estimate of the employment relation between Swedish employment within one occupation and immigrants in the same or others occupations is determined by the degree of complementarity between the two groups within the same firm. We rule out the possibility that our estimates are driven by plant closings and plant expansions whose employment gains could be driven by aggregate shocks by re-estimating our empirical model using firms that only showed moderate employment gains or losses. We also estimate the employment relations via an IV relation using

immigrant wages as instruments, and we find that our IV estimates are similar to our OLS estimates.

We find that employer changes drive most of the Swedish employment increases associated with immigrant increases. We find that a 10 percent increase in immigrant employment is associated with a 2.18 percent increase in Swedish employer changes (into the firm) within the occupation of the firm the immigrants were hired in, and a 0.60 percent increase in Swedish employer changes within other occupations. In contrast, we find that immigrant changes are not associated with large changes in Swedish nonemployment to employment transitions. These effects are evidence that immigrant employment changes may provide job opportunities for Swedes in the labor market, but more so for employed Swedish workers rather than unemployed Swedes. We also see that immigrant employment increases are associated with a small but significant increase in Swedish employment to nonemployment transitions, suggesting that despite the job opportunity increases for some Swedish workers, other Swedish workers may lose their jobs due to immigrant hires.

We then analyze which firms have the strongest relation between immigrant and Swedish employment, and which immigrant groups have the strongest relation with Swedish employment. We find that immigrants' effects on Swedish employment are larger in private firms relative to public firms within and across occupations, within the same firm. We also find that the immigrants' effects on Swedish employer changes, employment to nonemployment flows, and nonemployment to employment flows are also larger in private firms versus public firms. These results are likely due to private firms having fewer restrictions on hires and separations relative to public firms. We find that immigrants with higher human capital produce larger Swedish

employment effects in all occupations relative to other immigrants, indicating that immigrants with high human capital have stronger complementarities in production with Swedish workers relative to immigrants with low human capital.

Immigrants can produce negative employment effects for native workers if there is little human capital heterogeneity within an occupation (many low-skilled jobs) and if they are a cheaper alternative.¹ There is also evidence that immigrants can produce negative employment effects for native workers in more skilled occupations, such as nursing (Cortes and Pan 2014). However, if there is extensive heterogeneity in the day-to-day activity across workers within an occupation, immigrants can complement native workers, especially if work involves cooperation.² Our positive estimates indicate that immigrants are likely to be complements in production with Swedish workers within a firm, both within and across occupations. Immigrants are less likely to be a cheap alternative for Swedish workers in low-skilled jobs, since there are strict wage-setting regulations for these jobs (Brunk 2009). Our results suggest that immigrant workers have higher degrees of complementarities with Swedish workers within an occupation rather than across occupations. Since many of the occupations in our data require a lot of experience, it is unsurprising to see that employer change effects dominate nonemployment to employment effects, since workers who come from other jobs are usually more experienced than nonemployed workers (Gertler, Huckfeldt, and Trogari 2016, Hahn Hyatt and Janicki 2017). These new employer changes in turn help Swedish workers advance to a higher paying occupation (Krolikowski 2017, Topel and Ward 1992).

¹ For example, for fast-food cooks, there are only a finite amount of reasonable ways to make a burger. Therefore, there is not much variation in human capital.

² An example of this is joint research, where researchers cooperate to produce a product, rather than compete directly against each other.

Immigrant employment outside of a firm can also affect a firm's decision to hire Swedish workers. If there are more nearby immigrants within an occupation (i.e. within a local labor market), there can be competition for a particular job vacancy, which may make Swedish workers more replaceable.³ Furthermore, if it is easy to transition across occupations, then immigrant workers in other occupations may also be competition.⁴ However, immigrants can also produce employment gains in other firms. If immigrants spend more money in the local economy, they could increase employment in other firms; these types of local multiplier effects/employment gains have been documented, albeit not in the context of immigrants and native workers (tradeable-nontradeable sectors - Marchand 2012, Moretti 2004, 2010, Moretti and Thulin 2013). Immigrants can also increase job turnover if there are many of them in an occupation within a local labor market, since previous work has shown that population size can make occupation training less specific across firms (Groen 2006). Furthermore, if immigrants increase production efficiency within one firm, a potential knowledge spillover is created, which may increase employment for all firms (Audretsch and Feldman 2004, Dahl and Pederson 2004, Maliranta, Mohnen and Rouvinen 2009). In our analysis, we see that increases in immigrant presence in other firms have a negligible effect on Swedish employment within a firm, suggesting that either spillovers, multiplier, and competition effects are small, or they cancel each other out.

We extend the immigration literature in several ways within this paper. We are able to discern immigrants' effects within their occupation in a firm, as well as their effects on other

³ There is also work documenting how an increase in immigrant population within an occupation can decrease native employment through labor supply decisions, if native workers think they will not be competitive enough with these immigrants (Groen and Rizzo (2007), Orrenius and Zavadny (2013), Pan and Cortez 2015, Peri and Sparber (2011)).

⁴ Although not in the context of immigrants/natives, papers that have looked at the effects of worker competition in a local labor market include Bunel and Tovar (2014), El-Geneidy and Levinson (2006).

jobs within the same firm. We are also able to see how they affect other jobs in other firms. Previous papers in the immigration literature have only been able to calculate local labor market effects or firm effects separately (Doran Gelber and Isen 2014, Kerr, et al 2015A, 2015B). We show these distinctions are important, since there are clear differences in the size of effects by occupation, firm, and local labor market dimensions. We also identify which employment transition type drives the employment changes, which is important, since it highlights which Swedes benefit the most from immigrant hires. We also show how heterogeneous the immigrants' effects on native employment are in Sweden.⁵ Lastly, we work with, to our knowledge, the largest sample of firms and occupations in the immigrant-native worker literature. We work with over ten thousand firms and several hundred occupations, which allows us to provide a more comprehensive analysis of how immigrants affect Swedish employment.

Our results corroborate the findings from previous papers arguing that immigrants produced negligible or positive employment effects more than papers arguing that immigrants produced negative employment effects, although we find evidence from both sets of papers. We find evidence from the employer to nonemployer transitions that firms release some Swedish workers in favor of immigrant workers, but these effects are substantially smaller than the positive employment effects immigrant workers have for other Swedish workers.

The next section describes the conceptual framework of the paper. In section 3 we discuss the data sources used for this analysis, in section 4 we discuss our methodology, in section 5 we discuss our results, and in section 6 we conclude the paper.

⁵ Jaeger (1995) has provided details on the heterogeneity of immigrant workers but not in the context of the Swedish labor market.

2. Conceptual Framework

We provide a conceptual framework to depict our relations of interest. We use a conceptual framework that is similar to the one used in Kerr et al. 2015A. Kerr et al. describe the parameters that govern the employment relationship between immigrants and native workers. We extend their model by incorporating different occupations within the firm, and how immigrant employment outside of the firm affect the firm's decision to hire Swedish workers within an occupation. There are many firms and two occupations, occupations 1 and 2 in the local labor market. All firms are profit maximizers. In this model, a firm f makes output using four types of labor: domestic and immigrant workers within occupations 1 and 2, with the production function, $Q = Q(S_1, S_2, I_1, I_2)$. The S_1 and S_2 terms are Swedish employment levels in occupations 1 and 2, and I_1 and I_2 are immigrant employment levels in occupations 1 and 2. Increases in any argument increase production ($Q_1 > 0, Q_2 > 0, Q_3 > 0, Q_4 > 0$), and exhibit diminishing returns ($Q_{11} < 0, Q_{22} < 0, Q_{33} < 0, Q_{44} < 0$). For brevity, we omit capital in this model.⁶

Firm f 's revenue function, $R(Q, A_f)$ is concave, and is a function of Q and non-labor, exogenous factors, A_f . The A_f term is a function of immigrant employment levels outside of the firm; $A_f = A^f(I_1^{oth}, I_2^{oth}, \rho_f)$, where I_1^{oth} is the number of immigrant workers outside of the firm in occupation 1, I_2^{oth} is the number of immigrant workers outside of the firm in occupation 2, and the term ρ_f is the firm-specific remaining TFP.⁷ We assume the firm cannot control employment in other firms.⁸ A_1^f and A_2^f can be either positive or negative. Immigrants can produce agglomeration effects, which would imply a positive relation between immigrants outside of the

⁶ We look at one-year changes in our empirical models, so we are comfortable assuming that capital is fixed.

⁷ Realistically, this will also be a function of native employment in other firms too. However, for brevity, we focus only on the immigrant levels.

⁸ This assumption relies on the fact that the firm does not have large market power in the labor market.

firm and revenue. However, if they are productive for competing firms, and their production benefits do not spillover to firm f , then firm f 's revenue will decrease. Increases in Q and A_f increase revenue ($R_1 > 0, R_2 > 0$), and R_{12} is also positive. The revenue function is also concave in both of its arguments ($R_{11} < 0, R_{22} < 0$).

Firm f maximizes profits by picking the optimal amount of S_1, S_2, I_1, I_2 (unit is employment counts, assuming hours are the same for all jobs), leading to the following equation:

$$\max_{S_1, S_2, I_1, I_2} R(Q, A_f) - w_{I1}I_1 - w_{I2}I_2 - w_{S1}S_1 - w_{S2}S_2 \quad (1)$$

Without loss of generality, we focus on firm f 's choice of Swedish workers within occupation 1 (as supposed to Swedish workers within occupation 2). The resulting first order condition (FOC) is (assuming no corner solutions):

$$R_1 Q_1 = w_{S1}$$

From the FOC, we are able to derive how I_1, I_2, I_1^{oth} , and I_2^{oth} affect S_1 . A total derivative of the FOC yields the following equation:

$$dS_1 = \theta_{I1}dI_1 + \theta_{I2}dI_2 + \theta_{I1^{oth}}dI_1^{oth} + \theta_{I2^{oth}}dI_2^{oth} + \theta_{S2}dS_2 + \theta_{wS1}dW_{S1}$$

where⁹

$$\theta_{I1} \equiv \frac{[Q_1 Q_3 R_{11} + R_1 Q_{13}]}{-[(Q_1)^2 R_{11} + R_1 Q_{11}]} \quad (2a)$$

$$\theta_{I2} \equiv \frac{[Q_1 Q_4 R_{11} + R_1 Q_{14}]}{-[(Q_1)^2 R_{11} + R_1 Q_{11}]} \quad (2b)$$

⁹ $\theta_{S2} \equiv \frac{[Q_1 Q_2 R_{11} + R_1 Q_{12}]}{-[(Q_1)^2 R_{11} + R_1 Q_{11}]}$. The sign of this will also depend on the cross-partial Q_{12} term. $\theta_{wS1} \equiv \frac{1}{[(Q_1)^2 R_{11} + R_1 Q_{11}]}$, which is unambiguously negative, and consistent with labor demand theory.

$$\theta_{I_01} \equiv \frac{[Q_1 R_{12} A_1^f]}{-[(Q_1)^2 R_{11} + R_1 Q_{11}]} \quad (2c)$$

$$\theta_{I_02} \equiv \frac{[Q_1 R_{12} A_2^f]}{-[(Q_1)^2 R_{11} + R_1 Q_{11}]} \quad (2d)$$

Equation (2a) provides a familiar equation from Kerr et al. In their model, they found that the cross partial term (i.e. in their model $\frac{\partial^2 Q}{\partial L_N \partial L_I}$, where L_I represents immigrant workers and L_N represents native workers), which they interpret as the cross-elasticity between native workers and immigrant workers, governs the sign of the employment relationship between the two. We find a very similar relation as Kerr et al. did. The denominator is positive, since $Q_1 > 0$, $R_{11} < 0$, $R_1 > 0$, $Q_{11} < 0$, and there is a negative sign in front of the term. The first term in the numerator is negative, since $Q_1 > 0$, $Q_3 > 0$, $R_{11} < 0$. The term $R_1 > 0$, so the only term with an ambiguous sign is the cross-partial term Q_{13} , i.e. $(\frac{\partial^2 Q}{\partial S_1 \partial I_1})$, which is very similar to Kerr et al.'s result. If θ_{I_1} is positive, we know that Q_{13} is positive. If it is negative, the sign of Q_{13} may be either positive or negative. The sign of Q_{13} will depend on the degree of complementarity between S_1 and I_1 , with positive values implying complements and negative values implying substitutes. The extent will depend on the other structural parameters.

Equation (2b) tells a similar story, with the cross-partial term $Q_{14} (\frac{\partial^2 Q}{\partial S_1 \partial I_2})$ determining the sign of the coefficient. This sign will depend on the degree of complementarity between occupations 1 and 2, as well as how complementary immigrants are with natives.

Equations (2c) and (2d) describe how immigrant employment in occupations 1 and 2 outside of the firm affect Swedish employment within occupation 1. The denominator terms in

equations (2c) and (2d) are the same as the denominator terms in equations (2a) and (2b). Q_1 and R_{12} are positive by assumption, so the signs of (2c) and (2d) will be determined by A_1^f and A_2^f , respectively.

3. Data Sources

We use the LOUISE register to obtain the entire population of workers in Sweden aged 16-64. The LOUISE register shows which workers are immigrants and when they immigrated to Sweden. LOUISE gives us where the immigrant immigrated from, which is sometimes the country itself, and at other times is one of several countries. We define immigrants as those born outside of Sweden, and we define Swedes as those born in Sweden.¹⁰ We are able to link this database to an employer-employee register containing all employed and self-employed workers in Sweden. We attribute one employer to each worker within a year by selecting the employer associated with the most earnings for that worker within that year. We then match each person-plant-year combination with wages and occupational codes from the Wage Structure Statistics. The Wage Structure Statistics is an annual survey that collects establishment information for the Swedish National Mediation Office. This survey collects information on monthly wage rates and occupation for each employee who worked at least one hour during the measuring month.¹¹ LOUISE uses the Swedish Standard Classification of Occupations (SSYK) to classify its occupations, which is based on the International Standard Classification of Occupations (ISCO).¹² The Wage Structure Statistics surveys a sample of private sector employers. The

¹⁰ There is literature that distinguishes the employment outcomes between those born in Sweden to immigrant parents and those born in Sweden to native parents. We omit this portion for this version.

¹¹ This is either October or November of the calendar year.

¹² Åslund, Hensvik, and Skans (2014) use the SSYK, and argue that it most closely resembles the worker's day-to-day task.

survey covers all private sector firms with 500 or more employees, while a random sample is collected for firms with fewer than 500 employees. The sampling is stratified based on a cross-classification of industry and establishment size, resulting in roughly 50 percent of private sector workers in Sweden being included in the survey. This survey includes all public sector (federal, county council, and municipality level) establishments. Utilizing these datasets, we construct the number of Swedes and immigrants within each firm. We are also able to construct the average Swedish monthly wage within each firm from these datasets.¹³

We construct employer flows, nonemployment to employment flows, and employment to nonemployment flows from the panel structure of the employer-employee database. We are able to construct these outcomes because we are able to observe a Swedish worker's work history at each firm. We define an employer flow/employer change for a worker as working in one firm during year $t-1$, and working in another firm during year t . We define a nonemployment to employment flow as not working at any firm during one year and working at a firm during the next year. We define an employment to nonemployment flow as working at a firm during one year and not working at any firm during the next year.¹⁴ The LOUISE also contains demographic characteristics such as age, education, and gender.

4. Methodology

4.1 Distinguishing between Firm, Occupation, and Local Labor Market Effects

We collapse our microdata to the firm-occupation-year level in an unbalanced panel data

¹³ For more information on the LOUISE database and its construction, consult (Karimi, Hotz, and Johansson 2016).

¹⁴ Our definition of employer transitions, nonemployment to employment flows, and employment to nonemployment flows mimic those done in Hyatt and McEntarfer 2012, Hyatt and Spletzer 2013A, Hyatt and Spletzer 2014, and Mukoyama 2014.

set to estimate our main empirical equation:

$$\Delta Y_{fot} = \beta_0 + \gamma_{od} + \gamma_t + \beta_1 \Delta FO_{fot} + \beta_2 \Delta FNO_{fot} + \beta_3 \Delta ONF_{fot} + \beta_4 \Delta LL_{fot} + \varepsilon_{fot} \quad (3)$$

The primary dependent variable is the one-year log change in employed Swedes, within firm f , occupation o , and year t (from year $t - 1$ to year t). γ_{od} are dummies for each occupation-industry combination that control for time-varying effects associated with occupation-industry heterogeneity (since this is a first differenced model). γ_t are year dummies. We restrict the sample to firms that had at least 25 employees during year $t - 1$, since small firms may capture large percentage increases with small level effects and some small firms may only hire immigrants without considering Swedish worker employment. By eliminating these firms, we remove roughly ninety percent of firms and twenty percent of workers. Therefore, the results in our paper should be interpreted as the effects for workers within medium or large firms.

Equation (3) is the specification that emulates our conceptual framework. With no endogeneity problem due to sorting, the coefficients on ΔFO_{fot} , ΔFNO_{fot} , ΔONF_{fot} , and ΔLL_{fot} will represent θ_{I1} , θ_{I2} , θ_{Io1} , and θ_{Io2} in the theoretical framework. The ΔFO_{fot} term is the yearly log change in the number of immigrants within firm f and occupation o . The empirical specification is log-linear, so the coefficient β_1 measures the Swedish employment percentage change within a firm-occupation due to a 1 percent increase in immigrant employment within the same firm-occupation (i.e. θ_{I1}). The ΔFNO_{fot} term is the yearly log change in the number of immigrants within firm f but not in occupation o . The coefficient for this regressor, β_2 , measures the Swedish employment percentage change within a firm-occupation due to a 1

percent increase in immigrant employment within the same firm but other occupations (i.e. θ_{I2}). The ΔONF_{fot} term is the yearly log change in the number of immigrants within occupation o and the same municipality of the observation but not in firm f . The coefficient for this regressor, β_3 , measures the Swedish employment percentage change within a firm-occupation due to a 1 percent increase in immigrant workers within the same occupation but other firms (i.e. θ_{I01}). The ΔLL_{fot} term is the yearly log change in the number of immigrant workers within the municipality but not in the same occupation o or firm f . This regressor is included to measure any local spillover effect that other immigrants may have on the firm's decisions to employ Swedes, and its effects are captured by β_4 (i.e. θ_{I02}). Since this is a one-year difference, these results should be interpreted as short run effects.

Our conceptual framework includes the changes in the number of Swedes in other occupations on the right hand side (dS_2), and this term can be correlated with immigrant employment and with Swedish employment in occupation o and firm f . We control for the one-year log change in the number of Swedes within other occupations within the firm ($\Delta SWOT_{fot}$), and the coefficient on this covariate is equivalent to θ_{S2} .

Our conceptual framework also includes changes in wages for Swedes within firm f and occupation o . Immigrants may choose to search more intensely at firm-occupations who pay Swedes more, because they may be able to get a similarly high paying job.¹⁵ As changes in Swedish wages may reflect changes in firm productivity, which, if correlated with immigrant hires/layoffs, will bias our estimates. We therefore control for the changes in Swedish wages

¹⁵ In the US, these immigrants can also search more intensely if they feel they can gain a competitive advantage. This is less likely to be the case in Sweden, since the income inequality is much smaller.

within firm f and occupation o . We do this by including the firm-occupation's average one-year log change of Swedish wages one, two, and three years prior to the observation (i.e. we include ΔW_{fot-1} , ΔW_{fot-2} , and ΔW_{fot-3} as three separate regressors).

Immigrants may search more intensely at firms or firm-occupations that have initially high levels of immigrants, since immigrants may feel that these firms are better at accommodating any cultural differences, or they may feel more comfortable working with other immigrants. If these firms are also growing, then these decisions will be correlated with both ΔFO_{fot} and ΔFNO_{fot} , and also with our outcome. We therefore include one, two, and three year lags of each of all of our covariates of interest to control for any initial increase/decrease in the immigrant employment population in any of these dimensions (i.e. $\Delta FO_{fot-1}, \Delta FO_{fot-2}, \Delta FO_{fot-3}; \Delta FNO_{fot-1}, \Delta FNO_{fot-2}, \Delta FNO_{fot-3}; \Delta ONF_{fot-1}, \Delta ONF_{fot-2}, \Delta ONF_{fot-3}; \Delta LL_{fot-1}, \Delta LL_{fot-2}, \Delta LL_{fot-3}$ are included as covariates). In addition we include the levels of total employment together with one, two, and three year lags of the one-year log change in total employment for that firm (i.e. $FS_{ft} \equiv F_{ft} + Y_{ft}; \Delta FS_{ft-1}, \Delta FS_{ft-2}$, and ΔFS_{ft-3} are included as covariates). We acknowledge that the lagged terms are not in our conceptual framework. However, in order to properly control for sorting, we need to include them in our empirical specification.

Our primary outcome of interest is employment, but we also look at nonemployment to employment transitions, employment to nonemployment transitions, employer changes, and temporary employer changes. We use the first two transitions to evaluate the extent to which Swedish workers can gain or lose employment based on immigrant hires. We use employer changes to evaluate whether immigrants provide more jobs for Swedish workers to advance to a

possible better job match. Finally, we use temporary employer changes, which are defined as employer changes where the worker stays at that firm for only one year, to see whether these newly created jobs induced by immigrant hires are good matches for Swedish workers.¹⁶ Our RHS variables do not change when we use different outcomes.

4.2 Discussion of Identification – Variation Sources

Our goal is to determine whether immigrants are substitutes or complements for native workers by using the firm’s joint employment determination process, as shown in our conceptual framework. If our estimates of interest are not biased, we produce policy relevant estimates. We are using a first differenced model with industry-occupation dummies, so we are comparing firms that have immigrant employment changes to firms that do not have immigrant employment within the same industry-occupation combination. We can rule out aggregate industry or aggregate occupation shocks if these shocks have the same effect for all firms within these dimensions. For example, if both immigrants and native workers are displaced due to a negative trade shock that affects all firms within an industry, then this effect will be captured by our dummies. Also, if some firms hire more immigrants and Swedes because they are more technologically advanced than other firms within an industry, and the difference in technological advancement is constant across time, then these effects will be controlled for with first differencing. Any threat to identification will involve shocks that affect that affect firms with immigrant employment changes more than firms without immigrant employment changes, within an industry-occupation combination. Furthermore these shocks must have time-varying effects on Swedish employment, since time-invariant effects from firm heterogeneity is

¹⁶ Our definition mimics the “short duration jobs” in Hyatt and Spletzer (2013B). They use quarter while we use year, which implies that some of the jobs we label as temporary last longer than theirs.

controlled for by first differencing the model.

The most concerning examples for our identification strategy are firms that rapidly expand or contract within an industry-occupation combination. Although we control for previous firm growth in the empirical model, it is still possible that our estimates are still affected if these firms produce substantially higher estimates that do not reflect our parameters of interest. If a firm with a high number of immigrant and Swedish workers closes, that will induce a high correlation statistic, implying that OLS will be biased upwards, and it will not necessarily be due to complementarities in production, but rather the result of a large negative firm-specific demand shock through the TFP that affects both groups. Similarly, any firm that rapidly expands will also produce higher correlation statistics, which may be the result of large positive firm-specific shocks through the TFP that affects both groups. Rather than resort to IV strategies to handle these issues, we re-estimate equation (3) on three mutually exclusive and exhaustive sets of firms: firms that had at least a thirty percent contraction in employment from three years to one year prior to the observation, firms that had at least a thirty percent expansion in employment during these years, and firms that did not experience either type of expansion or contraction during that time. Each threshold corresponds to roughly ten percent of the original sample. The estimates using the first two samples should be higher than our baseline estimates, but if the estimates using the third sample are similar to our baseline estimates, then we can be more confident that our baseline estimates are not driven by large firm contractions/expansions.

Another factor that may cause an artificially high positive estimate is the possibility that we are simply capturing transitions across firms within an organization that spans multiple locations. If an organization transfers immigrant and native workers from one of their firms in

Stockholm to another firm in Gothenberg, then there will be two observations in the data with immigrants and native employment changes moving in the same direction, causing an upward bias in OLS estimates. We therefore perform another sensitivity run where we restrict to organizations that have multiple firms, and at least one of their firms has a large contraction or expansion (30 percent or more). By doing so, we restrict the sample to organizations that are likely to have had transfers across firms. This sample of firms may also contain merges across firms and acquisitions of one firm by another.

The final concern we address is that our empirical specification could simply reflect joint hiring decisions that do not reflect complementarities in production, and that our estimates only reflect how one group increased/decreased in proportion relative to another in the data. We therefore perform a placebo test, by using the same specification in equation 3, but for two groups that should have very little complementarities in production. For the outcome, we use the one-year log change in Swedish women who are older than fifty years old, and we use the one-year log change in Swedish men under twenty-four years old within the firm-occupation, firm-other occupation, occupation-other firm, and other occupations-other firm combinations. These two groups exhibit variation in employment across time, and if our empirical model simply reflects proportion changes without complementarities, we should see a large positive correlation between the two groups. However, the two groups are typically not considered complements or substitutes in production, so if the specification is correct, it should produce either zero or very small effects in magnitude.

Many studies have regressed native employment changes on immigrant wage changes to measure the complementarity between the two groups, with a prior assumption of the production

function's form (Ottaviano and Peri 2012). We cannot use this method for our data, since any one-year change in the average wage within a firm-occupation can be due to wage changes of immigrant workers who stay in the firm-occupation, and can be due to immigrant workers who join/leave the firm-occupation across years. Since workers change jobs and occupations at a high rate between two years, we cannot be sure that any measured wage change is not a result of a composition effect.

4.3 Additional Specifications – Immigrant Heterogeneity

We also explore which immigrants produce the largest effects for Swedish employment. We look at several different factors through the following empirical specification:

$$\Delta Y_{fot} = \beta_0 + \gamma_{od} + \gamma_t + \sum_g \{ \beta_1^g \Delta FO_{fot}^g + \beta_2^g \Delta FNO_{fot}^g + \beta_3^g \Delta ONF_{fot}^g + \beta_4^g \Delta LL_{fot}^g \} + u_{fot} \quad (4)$$

We now separate immigrants into different mutually exclusive and exhaustive groups. The β_1^g coefficient represents the percent increase in Swedish employment when there is a 1 percent increase in the number of immigrants belonging to group g within the same firm and occupation as the observation. We again include the same wage terms as we did in equation (3), the 1, 2, 3 year lags of firm size changes, and the 1, 2, 3 year lags of each covariate of interest (i.e.

$$\Delta FO_{fot-1}^g, \Delta FO_{fot-2}^g, \Delta FO_{fot-3}^g; \Delta FNO_{fot-1}^g, \Delta FNO_{fot-2}^g, \Delta FNO_{fot-3}^g; \Delta ONF_{fot-1}^g, \Delta ONF_{fot-2}^g, \Delta ONF_{fot-3}^g; \Delta LL_{fot-1}^g, \Delta LL_{fot-2}^g, \Delta LL_{fot-3}^g).$$

We perform three separate regressions to analyze three sources of heterogeneity: 1)

differing estimates by how long the immigrant stayed in Sweden prior to the observation year, 2) differing estimates by immigrant nationality, 3) differing estimates by human capital level. We use two different groups for the first comparison. We use immigrants who arrived in Sweden within two years of the observation as one group, and immigrants who arrived in Sweden more than two years prior to the observation as another group. We use five different groups for the second comparison. The first group, which we refer to as “ESC”, consists of immigrants from the US, Canada, UK, Ireland, and the Oceanic countries.¹⁷ The second group, which we refer to as “FIN”, consists of immigrants from Finland. The third group, which we refer to as “DIN”, consists of immigrants from Denmark, Iceland, and Norway. The fourth group, which we refer to as “OEU”, consists of immigrants from the other European countries. The fifth group, which we refer to as “OTH”, consists of immigrants from the remaining countries in the world. We use two different groups for the third analysis: immigrants with high human capital and immigrants with low human capital. We approximate immigrants with high human capital by first taking the entire population of nonemployed and employed workers from 2000 to 2010 (i.e. immigrants and Swedes). We then run the following probit model for each person i :¹⁸

$$Pr(emp_i = 1) = \Phi(\gamma_t + \theta X_i + \varepsilon_i) \quad (5)$$

Where γ_t is once again a set of year dummies, and X_i are a vector of covariates that consists of: age, age squared, completing more than a high school education, gender, country of origin, work experience in years, work experience squared, and whether the person immigrated to Sweden

¹⁷ Ideally, we would separate Australia and New Zealand from the remaining Oceanic countries, but unfortunately data limitations prevent us from doing so. However, these two consist of roughly 70% of the population across all Oceanic countries.

¹⁸ A person can appear multiple times, since we are looking at every year from 2000 to 2010.

within the past two years.¹⁹ We then calculate the predicted value for each person, and classify immigrants with a predicted value above 0.75 (the median predicted value in our data for immigrants) as having high human capital, and those with a predicted value below 0.75 as having low human capital.

We cluster all standard errors at the firm-occupation level for equations (3) and (4).²⁰

5. Results

5.1 Summary Statistics

Table 1 shows the five most common occupations, industries, and workplace municipalities for immigrant and Swedish workers. The first panel shows that the assistant nurses/hospital ward assistant and home-based personal care occupations are the two most common occupations for both Swedish and immigrant workers. We also see that child care is the fourth most common occupation for both worker groups. We can therefore reasonably assume there is a large enough overlap of occupations across employed Swedish and immigrant workers to ensure the two groups are comparable. We also see that social work activities, human health activities and primary education are three out of the top four industries for both workers groups, which again suggests that the two groups can be compared. Finally, Swedish and immigrant workers share four out of the top five workplace municipalities, although the top five municipalities account for almost 40% of immigrant workers, while only 26% of the Swedish

¹⁹ This way of determining high human capital/people likely to work is similar to the method done in Beudry and Lewis (2014).

²⁰ We also perform separate standard error calculations by the Huber-White method (Eicker, Fridhelm 1967, Huber 1967, White 1980) and the Bell and McCafferey (2002) method; the results do not change by a significant amount.

workers.²¹

The employed immigrants are likely to have high human capital, as evidenced by comparing the wage distributions between immigrant and Swedish workers in Table 2. We see that on average Swedish workers have a monthly wage of 29,107 Kronor (equivalent to roughly 3,300 US dollars) and immigrant workers have a monthly wage of 27,014 Kronor (equivalent to roughly 3,067 US dollars), a 7.5% difference.²² This is evidence that immigrant workers have comparable human capital levels with Swedish workers, although it could also reflect the possibility that immigrant workers are a highly selective group of immigrants.²³

Table 3 presents the most common origin nations for immigrants in our sample. Finnish workers are the most common immigrants in Sweden, accounting for almost 14% of the immigrant population within the data. We see that, within the top 10, with the exception of Finland, immigrants are not from neighboring or Western European countries but are from Eastern Europe, Africa, and the Middle East. There is substantial evidence (Arai and Vilhelmsson 2004, Carlsson and Rooth 2007, Ekberg and Rooth 2003) that immigrants from some countries will have higher barriers to employment relative to others, which we discuss in more detail when discussing the results from equation (4).

5.2 Baseline results: firm and spillover?

We first explore whether immigrants' employment effects on Swedish worker are

²¹ The fact that immigrants are more clustered is a pattern that has also been found among immigrant groups in other countries (Pamuk 2004, Allen and Turner 2005).

²² We also see a 7.4% difference when comparing the median (25,912 Kronor for Swedish workers relative to 24,059 for immigrant workers), so the difference in means is not necessarily due to outliers.

²³ Butcher and Dinardo (2002) have also documented that native workers and employed immigrants have comparable human capital levels.

stronger within a firm or outside of a firm, without focusing on occupation. This specification is not our main relation of interest, but it will be useful before evaluating whether there are different effects across occupations. We run the following specification on a firm-year level dataset:

$$\Delta Y_{ft} = \beta_0 + \gamma_d + \gamma_t + \beta_f \Delta F_{ft} + \beta_l \Delta L_{ft} + k(w_{ft}) + l(PS_{ft}) + v_{ft},$$

where the dependent variable ΔY_{ft} is the one year log change in Swedish employment within firm f and year t . The term γ_t are again year dummies and γ_d are industry dummies that control for any industry effects. We do not control for occupation in this equation, and we cluster the standard errors at the firm level for this equation. Our main covariates of interest from this equation are ΔF_{ft} and ΔL_{ft} , which are the one-year log change in immigrant employment within firm f and the one-year log change in immigrant employment within the local labor market not including the firm, respectively. The coefficients β_f and β_l , will show the Swedish employment percent change associated with a one percent increase in immigrant employment within the firm (F_{ft}) and immigrant employment outside of the firm (L_{ft}), respectively. The $k(w_f)$ term controls for the average wages of Swedish workers within firm f . This term consists of the firm's average one-year log change of Swedish wages one, two, and three years prior to the observation (i.e. ΔW_{ft-1} , ΔW_{ft-2} , and ΔW_{ft-3} as three separate regressors). The $l(PS_{ft})$ term consists of one, two, and three year lags of both ΔF_{ft} and ΔL_{ft} (ΔF_{ft-1} , ΔF_{ft-2} , ΔF_{ft-3} and ΔL_{ft-1} , ΔL_{ft-2} , ΔL_{ft-3} are included as covariates), and it includes the one, two, and three year lags of the one-year log change in the firm total employment (i.e. ΔFS_{ft-1} , ΔFS_{ft-2} , and ΔFS_{ft-3} , just like in equation 3).

Table 4 shows the estimates from this specification. We see that when firms increase immigrant employment by 10 percent, we see a 4.92 percent increase in Swedish employment within the same firm. We see that the coefficient on the ΔL_{ft} variable is insignificant. These estimates are comparable to the OLS point estimates found in Kerr et al., who also analyze immigrants' effects on native employment in the US. The same increase in immigrant employment outside of the firm has insignificant effects on Swedish employment within the same firm.

5.3 Baseline results: Firm, occupation and spillover?

Table 5 shows the estimates from equation (3), our main specification. The largest estimate is the change in the number of immigrants within the same firm and occupation. Columns (1) and (2) show that when firms increase immigrant employment within an occupation, they increase Swedish employment within the same occupation by 2.82 percent, and they increase Swedish employment within other occupations by 0.5 percent. Column (3) shows that the same increase in immigrant employment in other firms and the same occupation is associated with a small but significant positive effect of 0.23 percent for Swedish workers in a firm within that occupation. Column (4) shows that the same increase in immigrant employment in other firms and other occupations is associated with a small but significant negative effect of 0.22 percent for Swedish employment. This last estimate suggests that immigrants may cause small congestion/competition effects from other occupations in the local labor market.

In Table 6 we test whether our Table 5 results were driven primarily by large firm shutdowns and expansions that could drive a high correlation statistic between immigrants and native workers. Panel 1 shows that firms that expanded employment by thirty percent or more had a higher immigrant firm-occupation estimate (0.313; 0.031 more) but a slightly lower

immigrant firm-other occupations estimate (0.043; 0.007 less). Panel 2 shows that firms that contracted employment by thirty percent or more also had a higher immigrant firm-occupation estimate (0.370; 0.088 more) and a slightly higher immigrant firm-other occupations estimate (0.053; 0.003 more). Panel 3 shows the results when we remove the firms from Panels 1 and 2 from our original sample. We see that the estimates in Panel 3 are very similar to the estimates in Table 5 (0.266, 0.049, 0.024, and -0.014, all significant except for the last estimate, compared to 0.282, 0.050, 0.023, -0.022, all significant), so we are confident our baseline estimates are not due to spurious correlations from large plant closings or plant expansions.

In Table 7 we show that there is no evidence that transitions across firms within an organization drive our positive results. The estimates for firms that we expect to have high transitions across firms within an organization are actually lower than the other firms, when comparing Panels 1 and 2. Therefore, we do not anticipate transitions across firms in an organization/merges/acquisitions to be a problem for our analysis.

We also test whether our empirical specification produces large positive results when we compare other worker groups with each other. In Appendix Table 1, instead of using the one-year log change of Swedish workers as the outcome, we use the one-year log change of Swedish female workers above fifty years old. We use the one-year log change of Swedish male workers less than twenty-four years old within the same firm-occupation, in firm-other occupations, the same occupations-other firms, and other occupations-other firms as our covariates of interest. The two groups should not have strong complementarities in production, so we should not see high estimates when we use the same functional form for these two. We see the estimates are substantially smaller. We see a small 0.5 percent increase in employment for women over fifty

from a 10 percent increase in men younger than twenty-four years old within the firm-occupation, and a 0.07 percent decrease in other occupations; the first effect is less than one-fifth of the effect in Table 5, and the second effect is negative instead of positive. We are therefore confident that our empirical specification does not unintentionally induce a positive relation between the outcome and explanatory variables when looking at the firm level.

Most of the previous studies were not able to distinguish between the effects of firm decisions and local labor market effects. We show that this distinction is important, and that previous studies' estimates more likely reflected complementarities in production rather than local multiplier effects or other local spillover effects. We also highlight the importance of distinguishing between any effect within an occupation and outside the occupation, which has also been shown to be an important distinction for workers with stable jobs (Kambourov and Manovskii 2009, Pavan 2011). Our results highlight that immigrants and native workers are complements in production not just within an occupation, but across occupations (albeit less so across occupations).

Tables 8 and 9 provide the results when we use different employment transition outcomes. Columns (1)-(4) in the "Employer Changes" Panel of Table 8 show the results when using changes in employer changes as the dependent variable. Columns (1) and (2) show that when firms increase immigrant employment by 10 percent, they increase Swedish employer changes into the immigrants' occupations by 2.18 percent and they increase Swedish employer changes into other occupations by 0.6 percent. Columns (3) and (4) show that immigrant employment changes outside of the firm have some positive impact on changes in employer changes (0.17 percent within an occupation, 0.41 percent outside of the occupation), but not

nearly as large as the immigrants' effects within the firm. Column (1) of Appendix Table 2 shows that the Swedes who transitioned (from other firms) to firms that increased immigrant employment experienced a 3.6-7.3% earnings increase.²⁴

The "Temporary Employer Changes" panel in Table 8 shows the equivalent statistics using the one-year log difference in temporary employer changes as the dependent variable. We see that a large portion of the Swedish workers who join a firm from immigrant hires do not remain with the firm one year after. Columns (1) and (2) in this panel show that a 10 percent increase in immigrant employment within an occupation of a firm is associated with a 1.51 percent increase in this outcome within that occupation, and a 0.32 percent increase in this outcome within other occupations. Columns (3) and (4) show that immigrant changes outside of the firm have little impact on this outcome. Column (3) of Appendix Table 2 shows that more than 40% of workers who change employers leave their job after one year, so the result that many Swedish workers leave the jobs created by immigrant workers after one year is high but not surprising.

The "Nonemployment to Employment Flows" panel in Table 9 provides the results when the one-year log change of nonemployment to employment flows is used as the dependent variable. Columns (1) and (2) in this panel show that if immigrant employment increases in a firm by 10%, there is a 0.48% increase in Swedish employment from the nonemployment pool within that occupation, and a 0.07% increase in Swedish employment from the nonemployment pool outside of the occupation. This outcome is barely affected by immigrant employment changes outside of the firm, as shown in columns (3) and (4). Immigrant employment increases

²⁴ Column (2) of Appendix Table 2 also shows that the job stayers get a small increase when there is an increase in immigrant employment. These growth rates are very similar to the pay increases experienced by other job stayers.

may affect employer changes more than flows out of non-employment because several occupations in our analysis requires workers to have a high level of human capital. Given that workers who transition from one job to another usually have higher levels of human capital relative to workers who transition out of non-employment, it is not surprising to see these results.

Columns (1)-(4) of the “Employment to Nonemployment Flows” panel in Table 9 provide the results when using employment to non-employment changes as the dependent variable. Here we see evidence of displacement caused by immigrant employment, although these effects are small. We see that a 10 percent increase in immigrant employment within a firm causes a 0.26 percent increase in Swedish transitions to nonemployment from that occupation (column (1)), although the other effects are either insignificant or less than 0.05 percent. We further investigate which Swedes were more likely to be displaced due to immigrant workers by using the one-year log change in the Swedish employment to nonemployment transitions by age as the outcome in equation (3). We provide these results in Appendix Table 3. We see that the displacement effects are slightly larger for the Swedish workers under 30 (0.13% increase in transitions to nonemployment from a 10% increase in immigrants) and over 40 (0.12% increase from a 10% increase in immigrants), relative to the Swedish workers between 30 and 40 (0.08% increase from a 10% increase in immigrants) when comparing the “Same Firm, Occupation” coefficients across the three panels in Appendix Table 3. The youngest workers may represent workers who have the least amount of human capital, while the oldest workers might have the highest amount of rent.

Appendix Table 4 shows that the Swedes who transitioned from non-employment to employment concurrent with immigrant employment increases were paid 88.8%-93.8% of their

peers' income within their firm-occupation combination (column (1)), while they were paid roughly 83.6%-89.6% of their peers' income within their firm (column(2)). These results suggest that the Swedes who transition out of non-employment due to immigrant employment have less human capital than their peers. Columns (3) and (4) of Appendix Table 4 shows that the Swedes who went into nonemployment were paid roughly equal to their peers within their original firm-occupation and firm. It is unclear whether the workers who transitioned into nonemployment have less human capital than their peers, given that they were paid the same. It is possible that they have less human capital, and were overpaid, which would increase the odds that a firm let them go in favor of immigrants.²⁵

5.4 Private Firms vs Public Firms

Table 10 shows how private firms select Swedish and immigrant employment. We calculate these estimates by restricting the data to private firms and then by using equation (3). When comparing the estimates from Panel 1 of Table 10 with Table 5, we see the estimates using private firms are higher than the estimates using all firms. When private firms increase immigrant employment by 10 percent, they increase Swedish employment by 4.35 percent within the immigrants' occupations and 0.67 percent outside of the immigrants' occupations, both of which are higher than the equivalent Table 5 estimates. We again see very small effects from immigrant employment changes outside of the firm. We also observe that the employer transition effects are also higher in private firms. When we compare panel 2 of Table 10 with panel 1 of Table 8, we see that the same increase in immigrant employment within private firms is associated with a 3.07 percent increase in Swedish employer changes within the immigrants'

²⁵ Appendix Table 4 also shows in Columns (5) and (6) that the employer change entrants were paid roughly the same as their peers within both the firm-occupation and the firm.

occupations and a 0.69 percent increase in Swedish employer changes for other occupations. We also see larger nonemployment to employment and employment to nonemployment effects within private firms, as can be seen when comparing Panels 3 and 4 of Table 10 with Panels 1 and 2 of Table 9. The same increase in immigrant employment in private firms is associated with a 0.75/0.53 percent increase in Swedish nonemployment to employment/employment to nonemployment flows within the immigrants' occupations and very small increases in Swedish nonemployment to employment/employment to nonemployment flows outside of the immigrants' occupations. These results reflect the fact that private firms have fewer restrictions on hiring and firing relative to public firms.

5.5 Immigrant Heterogeneity

Table 11 shows whether immigrants who immigrated to Sweden within two years of the observation year produce higher or lower Swedish employment estimates relative to immigrants who immigrated to Sweden more than two years prior to the observation year. Columns (1)-(8) show the output from equation (4) when we use these two as the immigrant groups; the first four columns show the Swedish employment effects from the first immigrant group and columns (5)-(8) show the Swedish employment effects from the second immigrant group. When comparing columns (1) and (2) with column (5) and (6), we see that hiring immigrants who recently immigrated to Sweden produce a substantially smaller estimate (1.14 percent within the occupation and 0.1 percent in other occupations) relative to other immigrants (2.83 percent within the occupation and 0.50 percent in other occupations). We again see very little effect on Swedish employment when immigrant increases occur outside of the firm for both immigrant groups.

The immigrants who immigrated to Sweden more than two years ago are more likely to have more work experience within Sweden relative to immigrants who arrived more recently. Therefore, they will have more general, occupation-specific, and firm-specific human capital, and thus are more likely to be able to work with Swedish workers. The immigrants who arrived more than two years ago also had more time to adapt with the language and to Swedish culture, which may also contribute to them being able to work with Swedes better than recent immigrants.²⁶ To test whether cultural differences can explain the differences in Swedish employment effects between recent immigrants and other immigrants, we analyze the effects by nationality origin. Some countries are closer to Sweden in culture relative to others, and immigrants from these countries should produce higher employment effects as a result.

Table 12 shows the estimates from equation (4) when we use immigrant nationality as groups. We see in column (1) that a 10 percent increase in immigrant employment from ESC, FIN, DIN, OEU, and OTH country groups in a firm corresponds with an increase in Swedish employment within their occupation by 1.92, 2.58, 2.21, 2.12, and 1.92 percent, respectively. Column (2) shows that the same increase also corresponds with a 0.12, 0.39, 0.22, 0.21, and 0.25 percent increase in Swedish employment for other occupations within the firm. We see variation in Swedish employment effects for immigrant changes outside of the firm. Column (3) shows that the same increase in immigrant employment in FIN, DIN, OEU, and OTH country groups outside of the firm leads to a 0.15, 0.12, 0.05, and 0.11 percent increase in Swedish employment within a firm's occupation (ESC is insignificant). For immigrant changes in other firms and other occupations, we see mixed results: ESC and DIN immigrants produce insignificant estimates,

²⁶ The costs of adapting to a country with a different culture have been examined in several papers including Dinesen (2012).

FIN immigrants produce a 0.2 percent increase in Swedish employment, while OEU and OTH immigrants produce negative estimates of 0.18 and 0.17, respectively (again, for a 10 percent increase). It is very likely that selection into immigrating into Sweden and selection into employment vary by nationality, which could cause the difference in estimates across nation groups to be smaller than the true differences. This selection could be brought about by differences in migration costs, opportunities in their home country vs. country of immigration, and the relative variance of earnings between the two countries (Borjas 1987, 1994, 1999, Roy 1951). These differences can also be due to differences in human capital prior to immigration, or to discrimination.²⁷

Table 13 shows the results when we combine immigrant nationality, age, gender, education, experience, and recent immigrant status to determine immigrants with high or low human capital status based on the predicted values from equation (5).²⁸ The first four columns show the effects from low-human capital immigrants, and columns (5)-(8) show the estimates from high human capital immigrants. When comparing columns (1) and (2) with columns (5) and (6), we see high human capital immigrants have larger estimates (2.81 percent within the occupation and 0.50 percent in other occupations) relative to low human capital immigrants (1.23 percent within the occupation and 0.08 percent in other occupations) within a firm. We again see very little effect on Swedish employment when immigrant employment increases occur outside of the firm.

5.6 IV Estimation

²⁷ For example, immigrants from the DIN and FIN groups are the closest in proximity to Sweden, but they face the smallest migration costs, which means other immigrants would have to have higher rewards to compensate for the higher migration costs to arrive there.

²⁸ Appendix Table 5 shows the distribution of predicted probabilities from equation (5).

A potential concern with our analysis is that even after controlling for industry-occupation trends and previous firm growth, the hiring of immigrants could be correlated with changes in (unobservable) hiring shocks that affect Swedish employment even after adding the lagged controls. An upward trend in both shocks and immigration hiring would bias our OLS estimates upward. Since our data is at the firm-occupation-year level, we are primarily concerned with the endogeneity of immigrant firm-occupation and immigrant firm-other occupation variables, since most firms have very little control over the employment decisions of other firms. We therefore instrument both variables with the one-year lag of the average wage within each of those categories (i.e. the average immigrant lagged wage within the firm-occupation and the average immigrant lagged wage within the firm and other occupations).²⁹ These instruments are valid if each firm is a price taker, which is not a valid assumption for firms with big market power in the labor market (Fakhfakh and FitzRoy 2006). We therefore use firms who employ less than twenty percent of the population within the firm's industry and local labor market to approximate firms who will be price takers in the labor market.³⁰ We show in Appendix Table 6 the OLS (Panel 1) and IV results (Panel 2) using this sample. When comparing Panel 1 of Appendix Table 6 with Table 5, we see that most of the OLS estimates in the new firm sample are statistically significantly different from the OLS estimates in our original sample. The effect of immigrant employment changes within the same firm-occupation estimate is lower, the same firm-other occupation estimate is higher, and the effects outside of the firm are larger in

²⁹ We use the one, two, and three year lagged difference as instruments.

³⁰ We provide an appendix detailing why each instrument is valid. These instruments are relevant. A 1% increase in the mean immigrant wages within the occupation reduced the hiring of immigrants in that occupation by .81% (significant at the 1% level), and a 1% increase in mean wages of immigrants in other occupations reduced the hiring of immigrants in those other occupations by 0.20% (significant at the 1% level). We also note that in order for our selection on observables approach to be consistent with this model, we would have to ignore the simultaneous nature of our theoretical model.

magnitude. We therefore cannot assume that the following IV results can be extrapolated or compared against the results in Tables 5-13.³¹

We find some differences between the IV and OLS estimates. A 10 percent increase in immigrant employment now leads to a 1.20 percent increase in Swedish employment within the immigrants' occupation (lower than the 2.27 percent increase in OLS for this firm sample) and a 1.37 percent increase in Swedish employment outside of the occupation (higher than the 0.6 percent increase in OLS). We note that although the firm-other occupations IV estimate is higher than the firm-occupation estimate, the two estimates are not significantly different from each other at the 5 percent level. We also see that the effects outside of the firm are larger than the OLS estimates; within the occupation, a 10 percent increase in immigrant employment outside of the firm leads to a 0.87 percent increase in Swedish employment, and outside of the occupation, the same increase leads to a 0.92 percent decrease in Swedish employment.

6. Conclusion

We present evidence that immigrants are not substitutes for Swedish workers. We find that employed immigrants typically increase job opportunities for Swedish workers rather than replace them for employment. We find that distinguishing between the firm's role and the local labor market effects is important. We also show that, within a firm, it is important to distinguish between the immigrant's occupation and other occupations in order to provide an accurate depiction of which jobs are positively affected the most.

We show that most of the positive employment effects are a result of new jobs available

³¹ We note that several studies that implemented an IV strategy for immigrant effects of native workers usually use a Bartik (1991) index. However, this index is not useful in our setting with an interest of within firm effects.

for Swedes who were already employed, and we document that these employer transitions are associated with income gains. One possible consequence of this result is that income dispersion could rise. If some Swedes have a higher chance of increasing their income relative to other Swedes through job changes, then there could be an increase in income dispersion. We do not explore this topic in this paper; we leave it for possible future work.

When we explore immigrant worker heterogeneity, we find that our effects are driven mostly by immigrants who have high human capital. As a result, we recommend that policy makers focus on attracting immigrants with high human capital into their countries in order to help their native workers advance in their careers.

There are several possible extensions from our results. Papers that have analyzed the employment effects from immigrant networks have almost exclusively analyze how these networks affect immigrant employment (Hellerstein McInerney and Neumark 2010), but they do not discuss how they could also affect native employment outside of the immigrants' ethnicity. If these workers complement each other in production, it is possible that native workers can also benefit from immigrant networks. Since Hellerstein Kutzbach and Neumark 2014 have shown that there are positive network effects across different ethnicities within native workers, it is very likely immigrant networks can produce positive employment effects for native workers.

Another possible extension of this paper is evaluating whether there are any long term implications from these immigrant hires. Cortes (2008) analyzes their effects on local prices, and an interesting follow up would be to see whether similar results hold in the Swedish labor markets.

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Table 1: Occupation, Industry, and Workplace Municipality Information for Swedish and Immigrant Workers			
Swedish Workers		Immigrant Workers	
Occupation	Percent	Occupation	Percent
Assistant nurses and hospital ward assistants	6.28	Assistant nurses and hospital ward assistants	8.10
Home-based personal care and related workers	4.34	Home-based personal care and related workers	7.87
Pre-primary education teaching associate professionals	3.26	Helpers and cleaners in offices, hotels and other establishments	5.44
Child-care workers	3.05	Child-care workers	3.67
Primary education teaching professionals	2.98	Medical Doctors	3.07
Industry	Percent	Industry	Percent
Social work activities	7.25	Social work activities	9.18
Human health activities	6.58	Restaurants	7.64
Primary Education	6.39	Human health activities	6.22
Administration of the State; economic and social policy of the community	3.67	Primary Education	5.32
Other retail sale of new goods in specialized stores	3.28	Industrial Cleaning	4.21
Municipality	Percent	Municipality	Percent
Stockholm	12.67	Stockholm	20.30
Göteborg	6.65	Göteborg	9.25
Malmö	3.31	Malmö	5.52
Uppsala	2.05	Uppsala	2.35
Linköping	1.71	Solna	2.23

Note: All workers from 2000 to 2010 are used. For workers who appeared in multiple years, we take the last recorded occupation/industry/workplace municipality. The Swedish Standard Classification of Occupations (SSYK) is used for the occupation. The Swedish Standard Industrial Classification (SNI) is used for the industry.

$$(20500-19140)/20500= 6.6341 \times 10^{-2}$$

$$(22700-21170)/22700= 6.7401 \times 10^{-2}$$

$$(25912-24059)/25912= 7.1511 \times 10^{-2}$$

$$(31143-28419)/31143= 8.7467 \times 10^{-2}$$

$$(40750-37435)/40750= 8.1350 \times 10^{-2}$$

Percentile	Swedish Workers	Immigrant Workers	Difference percent
10	20,500	19,140	6.63
25	22,700	21,170	6.74
50	25,912	24,059	7.15
75	31,143	28,419	8.75
90	40,750	37,435	8.13
Mean	29,107 (\$3,300)	27,014 (\$3,067)	7.19
Number of people	1.898 Million	0.277 Million	

Note: All workers from 2000 to 2010 are used. For workers who appeared in multiple years, we take the last recorded monthly wage.

Immigrant Nation	Percent
Finland	13.91
Croatia, Macedonia, Slovenia	7.20
Iraq	6.44
North Africa, Israel, Saudi Arabia/Syria/Yemen/Jordan/Qatar/Palestine/Tunisia	5.43
Poland & Danzig	5.29
Iran	4.93
Bosnia and Herzegovina	4.58
Other Eastern Europe	4.57
Burma, Philippines, Singapore, Malaysia, Thailand, Vietnam, Laos, Indonesia	4.36

Afghanistan, India, Bangladesh, Brunei, Mongolia, Nepal, Oman, Pakistan, Sri Lanka	4.15
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Note: We use every calendar year from 2000 to 2010, inclusive. All workers who were born outside of Sweden are used.

Table 4: Immigrant Effects on Swedish Employment Within and Outside of Firm	
(1)	(2)
Same Firm	Same Local Labor Market, Different Firms
0.492*** (0.007)	0.020 (0.016)
Number of firm-year records: 114,808	

Note: We use the years 2000 to 2010, inclusive. We collapse the microdata to the firm-year combination. We then first difference the empirical model across years. The outcome is the one-year log change in the number of Swedes employed in a firm at a given year. Therefore, for firm f and year 2003, the outcome is the difference from 2002 to 2003 in the log of Swedes employed in that firm. “Same Firm” is the one-year log change in the number of immigrants employed within the same firm as the observation. “Same Local Labor Market, Different Firms” is the one-year log change in the number of immigrants employed within the same local labor market but in other firms. Industry dummies and year dummies are included. *** represents significance at the 1 percent level; ** represents significance at the 5 percent level; * represents significance at the 10 percent level.

Table 5: Immigrant Effects on Swedish Employment by Firm, Occupation, and Local Labor Market			
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)
0.282*** (0.004)	0.050*** (0.002)	0.023*** (0.002)	-0.022*** (0.008)
Number of firm-occupation-year records: 588,267			

Note: We use the years 2000 to 2010, inclusive. We collapse the microdata to the firm-occupation-year combination. We then first difference the empirical model across years. The outcome is the one-year log change in the number of Swedes employed in a firm-occupation at a given year. Therefore, for firm f , occupation o , and year 2003, the outcome is the difference from 2002 to 2003 in the log of Swedes employed in that firm-occupation. “Same Firm, Occupation” is the one-year log change in the number of immigrants employed within the same firm and occupation as the observation. “Same Firm, Different Occupation” is the one-year log change in the number of immigrants employed within the same firm, but in the other occupations from that observation. “Same Occupation, Different Firm” is the one-year log change in the number of immigrants employed in the same occupation, but in other firms within the same local labor market from that observation. “Same Local Labor Market” is the one-year log change in the number of immigrants employed within the same local labor market but in other firms and other occupations. Occupation-industry interaction dummies and year dummies are included.

Table 6: Effects by Firm's Employment Growth			
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)
Panel 1: More than 30% increase in firm employment			
0.313*** (0.014)	0.043*** (0.006)	0.011 (0.007)	-0.017 (0.023)
Number of firm-occupation-year records: 39,780			
Panel 2: More than 30% decrease in firm employment			
0.370*** (0.017)	0.053*** (0.008)	0.024*** (0.009)	-0.014 (0.026)
Number of firm-occupation-year records: 28,714			
Panel 3: All other firms			
0.266*** (0.004)	0.049*** (0.002)	0.024*** (0.002)	-0.019** (0.009)
Number of firm-occupation-year records: 519,773			

Note: In the first panel, we restrict to firms that had a thirty percent increase in its firm employment totals from three years prior to the observation to one year prior to the observation. In the second panel, we restrict to firms that had a thirty percent decrease in its firm employment totals from three years prior to the observation to one year prior to the observation. In the third panel, we restrict to firms that were not in either of the previous two samples. The outcome and empirical specifications are identical in all three panels. The empirical specification is the same as it was in Table 5.

Table 7: Effects by Plant Close/Merge Evidence			
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)
Panel 1: Only Firms with Plant Close/Merger Evidence			
0.265*** (0.004)	0.050*** (0.002)	0.025*** (0.002)	-0.023*** (0.009)
Number of firm-occupation-year records: 511,346			
Panel 2: Only Firms without Plant Close/Merger Evidence			
0.361*** (0.012)	0.048*** (0.005)	0.008** (0.004)	-0.001 (0.021)
Number of firm-occupation-year records: 76,921			

Note: In the first panel, we restrict to firms that at least one other plant in their organization that had at least a 30 percent contraction in employment or at least a 30 percent increase in employment. In the second panel, we restrict to the other firms in our sample. The empirical specification is the same as it was in Table 5.

Table 8: Immigrant Effects on Swedish Employer Changes			
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)
Panel 1: Employer Changes			
0.218*** (0.004)	0.060*** (0.003)	0.017*** (0.002)	0.041*** (0.012)
Panel 2: Temporary Employer Changes			
0.151*** (0.004)	0.032*** (0.002)	0.007*** (0.002)	0.002 (0.008)
Number of firm-occupation-year records: 588,267			

Note: The regressors we use in Table 8 are identical to the ones we used in Table 5. The outcome in the “Employer Changes” panel is the one-year log change in the number of Swedes that had an employer change into that firm-occupation combination at a given year. The outcome in the “Temporary Employer Changes” panel is the one-year log change in the number of Swedes that had a temporary employer change into that firm-occupation combination at a given year. A temporary employer change is when a worker transitions across employers during consecutive years, and then transitions out of the firm the following year. For example, for 2003, a temporary employer change is when a worker moves from company A to company B from 2002 to 2003, and then transitions out of company B by 2004.

Table 9: Changes in Swedish Flows; Into and Out of Employment			
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)
Panel 1: Nonemployment to Employment Flows			
0.048*** (0.002)	0.007*** (0.001)	0.002* (0.001)	-0.001 (0.004)
Panel 2: Employment to Nonemployment Flows			
0.026*** (0.002)	0.003*** (0.001)	-0.001 (0.001)	0.001 (0.004)
Number of firm-occupation-year records: 588,267			

Note: The regressors we use in Table 9 are identical to the ones we used in Table 5. The outcome in the “Non-employment to Employment Flows” panel is the one-year log change in the number of Swedes that had a transition out of non-employment into that firm-occupation at a given year. The outcome in the “Employment to Non-employment Flows” panel is the one-year log change in the number of Swedes that had a transition into non-employment from that firm-occupation at a given year.

Table 10: Private Firms, Changes in Swedish Flows; Into and Out of Employment			
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)
Panel 1: Employment			
0.435*** (0.003)	0.067*** (0.003)	0.011*** (0.002)	-0.005 (0.010)
Panel 2: Employer Changes			
0.307*** (0.005)	0.069*** (0.005)	0.008** (0.004)	0.037** (0.018)
Panel 3: Nonemployment to Employment Flows			
0.075*** (0.002)	0.006*** (0.002)	0.001 (0.002)	0.002 (0.007)
Panel 4: Employment to Nonemployment Flows			
0.053*** (0.002)	0.002 (0.002)	-0.002 (0.002)	0.008 (0.007)
Number of firm-occupation-year records: 163,449			

Note: Each panel represents a different set of estimates using only the sample of private firms. The regressors for each panel are the same; the log change of all immigrants within each of the four categories. Each panel has a different dependent variable, which is listed.

Table 11: Comparison of Effects: Recent Immigrants vs. Other Immigrants							
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation	Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Immigrants who immigrated to Sweden less than two years ago				Immigrants who immigrated to Sweden more than two years ago			
0.114*** (0.007)	0.010*** (0.002)	0.000 (0.001)	-0.000*** (0.000)	0.283*** (0.004)	0.050*** (0.002)	0.025*** (0.002)	-0.000** (0.000)
Number of firm-occupation-year records: 588,267							

Note: The sample of workers and firms in Table 11 are the same as Table 1. The outcome is the same as the one used in Table 5. All eight estimates are produced from the same estimation procedure. The first four columns represent the four main effects (same firm-occupation; same firm, different occupation; same occupation, different firm; same local labor market, different firm, different occupation) from immigrants who immigrated to Sweden less than two years prior to the observation year, and columns (5)-(8) represent the four main effects from immigrants who immigrated to Sweden more than two years prior to the observation year.

Table 12: Effects by Nationality				
	Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
	(1)	(2)	(3)	(4)
ESC	0.192*** (0.005)	0.012*** (0.002)	-0.002 (0.002)	-0.004 (0.003)
FIN	0.258*** (0.003)	0.039*** (0.002)	0.015*** (0.002)	0.020*** (0.007)
DIN	0.221*** (0.004)	0.022*** (0.002)	0.012*** (0.002)	0.006 (0.005)
OEU	0.212*** (0.002)	0.021*** (0.001)	0.005*** (0.001)	-0.018*** (0.006)
OTH	0.192*** (0.002)	0.025*** (0.001)	0.011*** (0.001)	-0.017*** (0.006)
Number of firm-occupation-year records: 588,267				

Note: We use the same sample and years used in Table 5. Table 12 is the output from one set of regression estimates. We now distinguish based on the immigrant's national origin. "ESC" refers to immigrants from the US, Canada, Ireland, the countries in the United Kingdom, and the Oceanic countries. "FIN" refers to immigrants from Finland. "DIN" refers to immigrants from Denmark, Iceland, and Norway. "OEU" refers to immigrants from other European nations. "OTH" refers to other immigrants. For example, "Same Firm, Occupation" and "ESC" is the one-year log change of the immigrants from "ESC" countries within the same firm and occupation of the observation.

Table 13: Comparison of Effects: Low Human Capital vs. High Human Capital							
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation	Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Low Human Capital				High Human Capital			
0.123*** (0.006)	0.008*** (0.002)	0.005*** (0.002)	-0.000*** (0.000)	0.281*** (0.004)	0.050*** (0.002)	0.024*** (0.002)	0.000 (0.000)
Number of firm-occupation-year records: 588,267							

Note: The sample of workers and firms in Table 13 are the same as Table 1. The outcome is the same as the one used in Table 5. Human capital levels are determined by the probit model in equation (5) that attempts to predict the probability the worker is employed. Immigrants classified as “Low Human Capital” have an employment predicted value of less than 0.75, while immigrants classified as “High Human Capital” have an employment predicted value of more than 0.75. The first four columns represent the four main effects (same firm-occupation; same firm, different occupation; same occupation, different firm; same local labor market, different firm, different occupation) from low human capital immigrants, and columns (5)-(8) represent the four main effects from high human capital immigrants. All eight estimates are produced from the same estimation procedure.

Appendix Table 1: Older Women Affected by Young Men			
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)
0.052***	-0.007***	0.001*	-0.001**
(0.001)	(0.001)	(0.000)	(0.000)
Number of firm-occupation-year records: 588,267			

Note: The empirical specification is identical to the one used in Table 5; however, the outcome is the one-year log change in women over 50 years old within the firm-occupation. Instead of immigrants, we now use men under twenty four years old as the right hand side variables within the four categories.

Appendix Table 2: Swedish Worker Income Growth from Immigrant Hires, Employer Change Characteristics			
Year	Average Log Change in Income from an Employer Change	Average Log Change in Income for Job Stayers	% of Employer Changes that are Temporary
	(1)	(2)	(3)
2001	0.065	0.050	43%
2002	0.055	0.045	41%
2003	0.049	0.040	42%
2004	0.043	0.035	42%
2005	0.036	0.035	42%
2006	0.048	0.037	42%
2007	0.048	0.034	40%
2008	0.073	0.058	41%
2009	0.049	0.037	41%
2010	0.039	0.028	42%

Note: Column (1) is the average one-year log change in income for Swedish workers who had an employer change into a firm that had a net gain in immigrant employment either within the firm, or within the Swedish worker's occupation within that firm. Column (2) is the average one-year log change in income for Swedish workers who stayed at their job at a firm that had a net gain in immigrant employment either within the firm or within the Swedish worker's occupation in that firm. Column (3) is the overall percent of employer changes that are temporary employer changes; the sample used are all workers in the LOUISE database for column (3).

Appendix Table 3: Employment to Nonemployment Analysis by Age			
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)
Panel 1: Swedish Employment to Nonemployment Transitions; Less than 30 Years Old			
0.013*** (0.001)	0.001** (0.000)	0.000 (0.000)	0.000 (0.002)
Panel 2: Swedish Employment to Nonemployment Transitions; Between 30 and 40 Years Old			
0.008*** (0.001)	0.001** (0.000)	0.000 (0.000)	0.001 (0.002)
Panel 3: Swedish Employment to Nonemployment Transitions; Over 40 Years Old			
0.012*** (0.001)	0.002*** (0.001)	-0.001 (0.001)	0.000 (0.003)
Number of firm-occupation-year records: 588,267			

Note: The covariates in the three panels are identical. The only difference is the outcome used. The outcome for the first panel is the 1 year log change in the number of Swedish employment to nonemployment transitions (from the firm-occupation observation) for Swedish workers who are less than 30 years old. The outcome for the first panel is the 1 year log change in the number of Swedish employment to nonemployment transitions for Swedish workers who are between 30 and 40 years old. The outcome for the first panel is the 1 year log change in the number of Swedish employment to nonemployment transitions (from the firm-occupation observation) for Swedish workers who are over 40 years old.

Appendix Table 4: Income Characteristics of Workers who had a flow into/out of firm Concurrent with Immigrant Hires.

	Income of N->E movers/Mean Firm- Occupation Income	Income of N->E movers/Mean Firm Income	Income of E->N movers/Mean Firm- Occupation Income	Income of E->N movers/Mean Firm Income	Income of Job Movers/Mean Firm- Occupation Income	Income of Job Movers/Mean Firm Income
	(1)	(2)	(3)	(4)	(5)	(6)
2001	0.938	0.890	1.028	1.024	1.016	1.016
2002	0.903	0.885	0.995	1.000	1.002	1.004
2003	0.912	0.889	1.007	1.017	1.002	1.004
2004	0.906	0.885	1.010	1.020	0.988	1.002
2005	0.888	0.836	0.996	0.986	0.988	0.995
2006	0.902	0.862	0.986	1.011	0.982	0.980
2007	0.903	0.871	1.007	1.033	0.979	0.979
2008	0.898	0.879	1.018	1.025	0.998	1.004
2009	0.926	0.896	1.003	1.008	0.981	0.992
2010	0.897	0.858	1.003	0.997	0.967	0.970

Note: The sample for column (1) consists of Swedish workers who a) transitioned out of non-employment into employment b) transitioned into a firm-occupation that had more than 50 workers c) the firm-occupation had a net gain in immigrant employment. The statistic is the average value of: the income of these workers divided by the average income within the firm-occupation combination they transitioned into. The sample for column (2) consists of Swedish workers who a) transitioned out of non-employment into employment b) transitioned into a firm that had more than 50 workers c) the firm had a net gain in immigrant employment. The statistic is the average value of: the income of these workers divided by the average income within the firm they transitioned into. The sample for column (3) consists of Swedish workers who a) transitioned into non-employment from employment b) transitioned out of a firm-occupation that had at least 50 workers c) the firm-occupation had a net gain in immigrant employment. The statistic is the average value of the income of these workers divided by the average income within the firm-occupation they transition out of. The sample for column (4) consists of Swedish workers who a) transitioned into non-employment from employment b) transitioned out of a firm that had at least 50 workers c) the firm had a net gain in immigrant employment. The statistic is the average value of the income of these workers divided by the average income within the firm they transition out of. The sample for column (5) consists of Swedish workers who a) had an employer change into a firm-occupation that had a net gain in immigrant employment b) the firm-occupation had more than 50 workers. The statistic is the average value of: the income of these workers divided by the average income within the firm-occupation combination they transitioned into. The sample for column (6) consists of Swedish workers who a) had an employer change into a firm that had a net gain in immigrant employment b) the firm had more than 50 workers. The statistic is the average value of: the income of these workers divided by the average income within the firm they transitioned into.

Appendix Table 5: Distribution of The Predicted Probability of Working: Immigrant Population	
Percentile	Predicted Probability of Working
5	0.04
10	0.11
25	0.38
50	0.77
75	0.91
90	0.95
95	0.97
Mean	0.64
Number of person-years: 10.055 Million	

Note: We calculate the probability person works. We use equation (5) on all Swedes and immigrants from 2000 to 2010, and calculate the predicted value from the probit regression. Appendix Table 5 is distribution of the predicted value for only the immigrants.

Appendix Table 6: Firms with Small Share of Employment			
Same Firm, Occupation	Same Firm, Different Occupation	Same Occupation, Different Firm	Same Local Labor Market, Different Firm, Occupation
(1)	(2)	(3)	(4)
Panel 1: Baseline			
0.227*** (0.005)	0.050*** (0.002)	0.033*** (0.002)	-0.042*** (0.009)
Number of firm-occupation-year records: 283,831			
Panel 2: IV			
0.120*** (0.016)	0.137** (0.064)	0.077*** (0.007)	-0.087*** (0.024)
Number of firm-occupation-year records: 83,252			

Note: The sample of firms and years is the same as Table 5, except we restrict to firms who employ less than 20% of the workers within the firm's industry and local labor market. Panel 1 is the same specification as Table 5. Panel 2 is an IV specification where we instrument the "Same Firm, Occupation" and "Same Firm, Different Occupation" with the average immigrant wage within those categories.

Appendix: Justification of Wage as the Instrument

Our main empirical specification (equation 3) is:

$$\Delta Y_{fot} = \beta_0 + \gamma_{od} + \gamma_t + \beta_1 \Delta FO_{fot} + \beta_2 \Delta FNO_{fot} + \beta_3 \Delta ONF_{fot} + \beta_4 \Delta LL_{fot} + \varepsilon_{fot}$$

We show below that we can use the immigrant-occupation firm wage to instrument for ΔFO_{fot} , and the immigrant-other occupation firm wage to instrument for ΔFNO_{fot} .

Using the same theoretical setup as in the main text, our first order conditions for all four endogenous variables are:

$$R_1 Q_1 = w_{S1}$$

$$R_1 Q_3 = w_{I1}$$

$$R_1 Q_4 = w_{I2}$$

$$R_1 Q_2 = w_{S2}$$

We focus our discussion on the first three first order conditions for this appendix. If we totally differentiate each of these first order conditions, we obtain the following:

$$dS_1 = \theta_{I1} dI_1 + \theta_{I2} dI_2 + \theta_{I_{o1}} dI_1^{oth} + \theta_{I_{o2}} dI_2^{oth} + \theta_{S2} dS_2 + \theta_{w_{S1}} dW_{S1} \quad (A1)$$

$$dI_1 = \theta_{S1}^I dS_1 + \theta_{I2}^I dI_2 + \theta_{I_{o1}}^I dI_1^{oth} + \theta_{I_{o2}}^I dI_2^{oth} + \theta_{S2}^I dS_2 + \theta_{w_{I1}} dW_{I1} \quad (A2)$$

$$dI_2 = \theta_{S1}^I dS_1 + \theta_{I1}^I dI_1 + \theta_{I_{o1}}^I dI_1^{oth} + \theta_{I_{o2}}^I dI_2^{oth} + \theta_{S2}^I dS_2 + \theta_{w_{I2}} dW_{I2} \quad (A3)$$

Where

$$\theta_{S1}^{I1} \equiv \frac{[Q_1 Q_3 R_{11} + R_1 Q_{13}]}{-[(Q_3)^2 R_{11} + R_1 Q_{33}]}, \theta_{S1}^{I2} \equiv \frac{[Q_1 Q_4 R_{11} + R_1 Q_{14}]}{-[(Q_4)^2 R_{11} + R_1 Q_{44}]}$$

$$\theta_{I1} \equiv \frac{[Q_1 Q_3 R_{11} + R_1 Q_{13}]}{-[(Q_1)^2 R_{11} + R_1 Q_{11}]}, \theta_{I1}^{I2} \equiv \frac{[Q_4 Q_3 R_{11} + R_1 Q_{34}]}{-[(Q_4)^2 R_{11} + R_1 Q_{44}]}$$

$$\theta_{I2} \equiv \frac{[Q_1 Q_4 R_{11} + R_1 Q_{14}]}{-[(Q_1)^2 R_{11} + R_1 Q_{11}]}, \theta_{I2}^{I1} \equiv \frac{[Q_3 Q_4 R_{11} + R_1 Q_{34}]}{-[(Q_3)^2 R_{11} + R_1 Q_{33}]}$$

$$\theta_{Io1} \equiv \frac{[Q_1 R_{12} A_1^f]}{-[(Q_1)^2 R_{11} + R_1 Q_{11}]}, \theta_{Io1}^{I1} \equiv \frac{[Q_3 R_{12} A_1^f]}{-[(Q_3)^2 R_{11} + R_1 Q_{33}]}, \theta_{Io1}^{I2} \equiv \frac{[Q_4 R_{12} A_1^f]}{-[(Q_4)^2 R_{11} + R_1 Q_{44}]}$$

$$\theta_{Io2} \equiv \frac{[Q_1 R_{12} A_2^f]}{-[(Q_1)^2 R_{11} + R_1 Q_{11}]}, \theta_{Io2}^{I1} \equiv \frac{[Q_3 R_{12} A_2^f]}{-[(Q_3)^2 R_{11} + R_1 Q_{33}]}, \theta_{Io2}^{I2} \equiv \frac{[Q_4 R_{12} A_2^f]}{-[(Q_4)^2 R_{11} + R_1 Q_{44}]}$$

$$\theta_{ws1} \equiv \frac{1}{[(Q_1)^2 R_{11} + R_1 Q_{11}]}, \theta_{wl1} \equiv \frac{1}{[(Q_3)^2 R_{11} + R_1 Q_{33}]}, \theta_{wl2} \equiv \frac{1}{[(Q_4)^2 R_{11} + R_1 Q_{44}]}$$

Equation (A1) is the same first order condition as the one we write in section 2. We see that the dW_{I1} and dW_{I2} terms in equations (A2) and (A3) are not in equation (A1), and they affect dI_1 and dI_2 , the two endogenous variables in (A1). Therefore, these are credible instruments for our analysis.