JÖNKÖPING UNIVERSITY
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The effect of Immigration on the regional labor market outcome

Master Thesis/Economics

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Abstract:

The effect of immigration on labor-market performance is the subject of various studies; most of those studies focus on the effect of immigrants on wages. The characteristics of the Nordics labor-market cause a shift in the focus to another labor-market outcome. The primary goal of this paper is to study the effect of immigration on the employment rate on a regional level. Two hypotheses are developed to study the correlation between immigration and the employment rate. By utilizing the autoregressive distributed lag technic for panel data, we find a positive association between immigration and the overall employment rate, as well as for immigrants' employment rate. Unit-root tests using both Levin–Lin–Chu **and** Harris–Tsavalis to test for time trend and cross-sectional dependence, the results show that most of the variables are integrated after the first difference I(1). Following, I perform a Westerlund cointegration test; the results for the two models show a cointegration among the variables. The two estimations developed by Pesaran PMG and DFE show different results for the two hypotheses. For the first hypothesis, Both estimators show a positive impact with the same magnitude of the share of immigrants to the total population on the employment rate, which contradict the hypothesis, and the estimators fail to capture the effect of education on the employment rate. Also, the density tends to affect the employment rate positively. A post estimation diagnostic, namely, the Hausman test, shows that the PMG estimator is both efficient and consistent. The second hypothesis of the correlation between the immigrants' employment rate and their share of the population produces less clear results. Here the PMG estimators show no association with the share of immigrants, while the human capital coefficient is significant, the density coefficient is in both estimations. The DFE methods for the second hypothesis is similar in results for the first hypothesis, which implies a positive relationship between the share of immigrants and the immigrants' employment rate.

Immigration Sweden, Employment, labor-market outcome, ardl, cointegration

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1. Introduction:

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According to the international organization for migration, a migrant is a person who moves from his or her habitual place of residence either across an international border or within the state regardless of the legal status, the reasons for the migration, and the length of the staying. When focusing on immigration only; which its definition is moving across the border to a different country. The number of immigrants globally reached 272 million people in 2019, which is an increase of 51 million from 2010. As a percentage of the population, those numbers jumped from 2.8% of the global population in 2000 to 3.5% last year (IOM, 2020). The reasons for this increase in immigration mainly comes from the conflicts in different regions, and the seek for better employment opportunities (United Nations, 2017).

Sweden's population by the end of 2018 consists of 19.12% of foreign-born comparing to 11.30% in 2000 (Statistics Sweden, 2020). Historically, Sweden witnessed a shift in the immigration porpuses and the origins of immigration during the second part of the 20th century. The economic immigrants from within the European continent predominated this immigration in the '50s and '60s. While Starting from the '80s' Sweden began to receive more refugee immigrants (Migrationsverket, 2020). The shift in both types of immigration to Sweden can be easily observed due to the increase in the number of asylum seekers comparing to work seeker immigration in the past decades (Statistics Sweden, 2020). The conflicts in Syria, Iraq, and Afghanistan resulted in most of the inflow of immigration to Sweden in the form of asylum Seekers (Migrationsverket, 2018).

 The effect on host countries includes the impact on the welfare system as a result of the increase in socio-economic disparities between native-born and immigrants (Andersson, Bråmå & Holmqvist, 2010; Favell, 2007). The scarcity of social goods poses a challenge for the governments to distribute those goods and present the immigrants as rivals to the citizen in receiving welfare aids (Huysmans, 2000). Another effect on the host country is the establishment of ethnic enclaves which can affect the pace and depth of integration, where the

distance from the host country culture for the immigrant (religiously, traditions and costumes) can play a significant effect in the segregation intensity (Andersson, Bråmå & Holmqvist, 2010). Furthermore, this distance is crucial when checking for labor market integration (Lundborg, 2013).

The other factor which affects the labor market outcome of immigrants is his/her location choice, in which residing in bigger cities with immigration heritage can improve the labor market outcome (Bartel, 1989; Zavdony, 1997, Haan, 2008). The prior presence of immigrants in the new location (Malmberg, Andersson, Nielsen & Haandrikman, 2018; Åslund, 2005; Zavdony, 1997). Population density has a definitive role in that location choice, where the majority of immigrants prefer to live in large municipalities (Åslund, 2005). A lot of studies have shown that the first waves of immigrants settle in locations where employment is more abundant (Bartel, 1989; Zavdony, 1997; Åslund, 2005). Also, large municipalities can imply the existence of better chances to acquire a job.
This immigrants cluster can affect the employment level and the wage positively when controlling for individual characters and the concentration of the individual "own people" in the same neighborhood (Lobo & Mellander, 2020.)

As mentioned above, there is a tendency among immigrants to settle in big cities. In the American context, about 63% of foreign-born used to live in the primary states California, New York, Florida, and Texas in comparison to 31% of all population (Zavdony, 1997). Those number has decreased considerably in recent decades, where only 45% of the foreign population residing in those four states (migration policy, 2020).   while in Sweden, the figures were 53% of total immigrants living in the three metropolitan areas. Sweden Statistics identify those three metropolitan areas as "Greater Stockholm," "Greater Göteborg," and "greater malmö." Each one of those metropolitan areas includes the municipalities for the city and its direct surrounding, corresponding to 35% of Sweden-born in 1997 (Åslund, 2005). Those numbers decreased in the past years to around 50,3% in 2018 (Statistics Sweden, 2020). This decrease occurred gradually since 2000 but experienced a sharp full in the following year of the

approval of the joint responsibility for reception of newly arrived policy by the legislative body of Sweden (Riksdag) in 2015. The implementation of this act led to an immediate decrease in the concentration of Foreign-born in metropolitans by 1% in 2016 (Statistics Sweden, 2020). There is a debate on which is more beneficial for immigrant's economic well-being, the concentration in big cities, or the distribution across space in the host country. Haan (2008) sheds light on this problem in the Canadian context, even though his results are inconclusive. Still, it indicates that migrants outside the metropolitan areas have significantly less level of job mismatch but on the other labor market outcomes, "wages and employment" show no significance disparity.

Figure 1: Employment rate since 2001
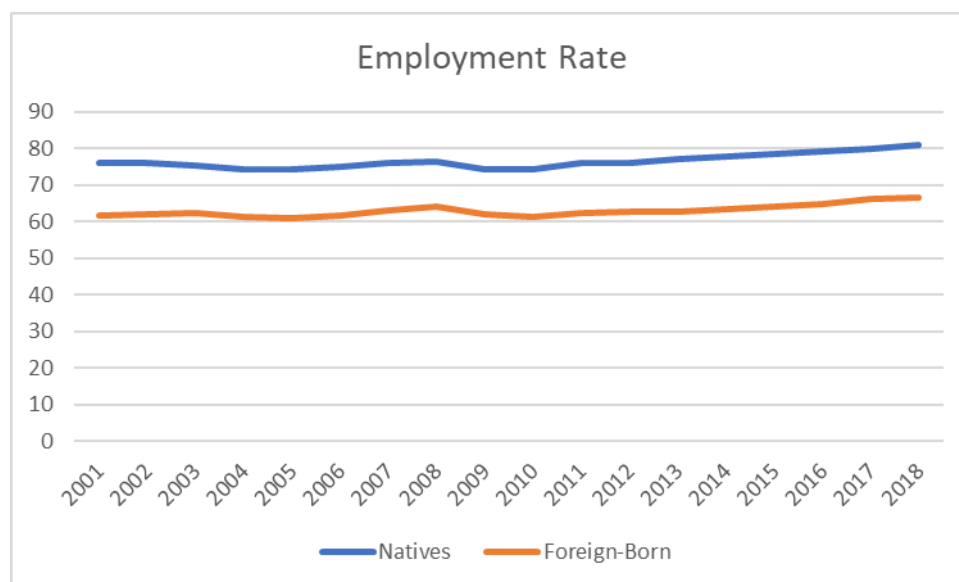
In the table below, the four biggest municipalities in Sweden are listed, where those cities have both the highest in total population and the number of foreign-born inhabitants.

Table 1: The most populated municipalities in Sweden

Municipality	Total population	Foreign-born
Stockholm	962154	220419
Göteborg	571868	142573
Malmö	339313	104534
Uppsala	225164	43182

This paper aims to study the impact of an increase in labor supply empirically resulted from the settling of immigrants on the labor market outcome on a regional level in Sweden.

Theoretically, there are different contrasting propositions. Those propositions range from a negative effect on wages (Borjas, 1999) to a positive impact of capital inflow (Longhi, Nijkamp & Poot, 2005).

Empirically, the effect of immigration on labor outcomes for natives is too small and cluster around zero (Borjas, 2003). At the same time, there is a level of competition (Longhi, Nijkamp & Poot, 2005) and collaboration (Lobo & Mellander, 2020) among immigrants. The findings differ across countries and specifications.

2. Theoretical Framework and Literature Review

Economics has theorized the concept of migration using the labor market and human capital models to answer the main questions concerning the migration theory (Borjas, 1987; Sjaastad, 1962). Those questions include who immigrates, why someone does it, and the issue of the consequences of the migration in both source and destination countries.

Adam Smith mentioned migration early in economic literature, where he explains the act of migration as a result of wage differences (Smith, 1776). This concept continues to constitute the economic theory of migration as the main driver for

people to relocate. Wages affect the decision of immigration, it can push people to leave a place, and it can also pull them towards a destination (Smith, 1776). The idea of wage differences combined with the cost of moving. The utilization of this idea led to the emerge of most of the models within the economic theory regarding migration. One of the most common models in migration study is done by (Borjas, 1987). In his model (Borjas, 1987) suggests that the migration decision is a result of a comparison between the wages in the origin and destination countries while taking into account the cost of moving. Shields & Shields (1989) improved the concept by replacing the cost of moving with a coefficient that includes more barriers to immigration. The migration has been treated almost exclusively as a factor of the labor market and human capital models. This narrow definition of immigration leads to the exclusion of some of the underlying reasons behind immigration, such as family reunification, asylum, and refuge seeking, cultural and political preferences, and so on. Those neglected factors which push someone to immigrate can explain her/his behavior, their labor market assimilation, and consequently their outcomes (Lundborg, 2013)

A new group of people arriving in a new country will lead to a change in the labor supply in the receiving country, this shock in supply will affect the market and lead to a change in the market equilibrium. Under the assumption of inelastic labor supply, the shock on the supply caused by the immigration will shift the supply to the right. The new equilibrium constitutes a decrease in wages. This decrease in wages is realized as an immigration surplus, which is gain for the capital owners; the rest of this decrease shows in the losses in income for native workers. Using the assumptions above (Borjas 1999) estimates the surplus of the immigrants in the American economy.

2.1   Immigration and Employment

A substantial amount of literature has focused on the effect of immigrants on the labor market outcome. (Johnson 1980) construct a model allowing for a different level of skills. The paper indicates both negative and positive effects on high skill native employees and capital owners; this effect originated from low skill

immigrants. An increase in wages for highly skilled workers and the gains for capital owners as a result of the decrease in wages for low skill workers embodies the positive side of that immigration. The rise of unemployment rate among native low skilled workers leads to higher pressure on the welfare system; the extra spending in the welfare system is extorted from both high skill workers and capital owners in the form of taxes. Those extra spendings are considered to be the adverse effect within this model. The impact of immigrants on wage and employment are over-represented in previous models. Endogenizing the demand of immigrants on goods attenuate that effect by allowing immigrants to buy at least part of their outcome. Also, allowing for diversity in skill among the pool immigrants improve the outcomes of the model and leads to more accurate results when analyzing the effect of immigration on low skill native workers (Altonji & Card, 1991).

The effect of immigrants on native wages has been studied heavily as the main issue. The labor economists responded to the demand created by the public and policymakers on understanding the impact of immigration by estimating the immigration effect on wages. The estimated impact of immigration on the wage of native workers varies widely from study to study and sometimes even within the same study. Also, those effects cluster around zero (Borjas, 2003). A sudden shock of migration is a good natural experiment to understand the effect of the migration on the labor market in the destination country (Card, 1990), the findings of this study show a small effect on natives' labor outcomes such as wages.

Some issues need to be addressed to point out the impact of immigration labor market outcomes adequately, so the real effect of immigration on labor outcomes is captured. Those issues include the increase of demand generated by the immigrants' inflow, which attenuates the effect on the outcomes (Poot, 1993; Altonji & Card, 1991). The second issue is the change in capital flow to the destination country (Poot, 1993). The theoretical framework has supported this point. Allowing for capital variability shows that the sudden abundance of labor supply due to immigration will lead to a simultaneous effect on wages and capital rent. Wages decrease, the interest rate on the capital increase and that leads to more inflow of capital to utilize the cheap labor until wages and capital

rent reaches the previous levels (Longhi, Nijkamp & Poot, 2005). Other issues are related to resource reallocation across sectors, "The Heckscher – Ohlin effect." The effect of immigrants on natives' wages growth through an economy of scale and technological progress (Longhi, Nijkamp & Poot, 2005; Poot, 1993). Those four issues indicate that the effect on native labor market outcomes imposed by immigration is overestimated in various studies. Also, immigrants are more likely to compete with each other in the destination country rather than affecting the natives (Longhi, Nijkamp & Poot, 2005).

In the period following their arrival, immigrants perform poorly in the labor market of the destination country comparing to their native counterparts (Bartel, 1989; Borjas, 1994; Chiswick, Cohen & Zach, 1997, Lundborg, 2013). Immigrants experience a higher level of unemployment and lower wages comparing to their native-born counterparts (Bartel, 1989; Borjas, 1994; Chiswick, Cohen & Zach, 1997; Lundborg, 2013). The higher unemployment rate among immigrants in the early days of immigration is prevailing across space (Chiswick, Cohen & Zach, 1997; Lundborg, 2013). The severity of the unemployment rate differs according to both the destination and origin country, where the background can ease or worsen the unemployment rate after the arrival (Chiswick, Cohen & Zach, 1997; Lundborg, 2013). The difference in the immigrant's characteristics might affect this employment/unemployment rate. Those characteristics include the origin country, the level of human capital, the age of arrival. The difference in labor market outcomes for those immigrants from native-born is a shared feature amongst all immigrants (Chiswick, Cohen & Zach, 1997; Lundborg, 2013). The wages also differ at first between the immigrants and native-born (Chiswick, Cohen & Zach, 1997; Lundborg, 2013). This difference can be explained by the imperfect transition of human capital from the source to the destination country where some of the human capital brought from origin country is either useless or untransferable (Chiswick, Cohen & Zach, 1997). The incomplete information regarding the labor market is considered a barrier for immigrants, where the knowledge about the labor market increases exponentially after the arrival (Chiswick, Cohen & Zach, 1997; Borjas, 1994). The effect of location on employment has been heavily studied, the ethnic enclaves and neighbourhood

majorly populated with immigrants are positively associated with an improvement in income and employment (Damm, 2009, Lobo & Mellander, 2020). The depth and sign of the impact of residing in ethnic enclaves on individual outcomes is associated with individual characteristics. The high skilled refugees are negatively affected if they reside in the ethnic enclaves (Damm, 2009).

Immigrants move from rural areas to more dense areas for better opportunities (Smith, 1776). While the location of immigrants is affected by the existence of prior immigrants with the same ethnic background (Bartel, 1989, Zavdony, 1997,1999, Åslund, 2005), the education level affects the concentration in any location for migrants where a higher level of education incentivizes individual to leave their communities enclaves (Bartel, 1989). The immigrants are more likely to relocate internally in the United States since the initial location for migrants is made under a lack of information. The immigrants might acquire new information, which leads to better decisions regarding the location; furthermore, education level, and language proficiency attribute to acquiring more information (Bartel, 1989). While education might affect the location choice in the USA for the whole immigrants' population, this couldn't be proved in the Danish example when restricted for refugees. Gender, age, and the years since immigrating to Denmark have a significant association with the choice of relocating, while education shows no significance on the relocating choice (Damm, 2009). Also, this location choice is dictated by the climate, which is an indicator of the presence of amenities related to immigration and the people density. Furthermore, the climate plays always a role in affecting people's locational choice; the density of population indicates the presence of opportunities (Østbye & Westerlund, 2007).

Migrants tend to be more mobile than natives for various reasons (Mühleisen & Zimmermann, 1994). Theoretically, if the cost of moving is too high, and the income differences don't cover this cost, native-born avoid bearing this cost. The migrants are a self-selected group that decides to bear the cost of moving. If the cost of choosing a location is an extra cost to the total cost of moving, migrants pay this extra to reside in the "right location" to maximize their income (Borjas,

2001). Being more mobile, the immigrant's response to the wage differences by following the higher wages, this help in equalizing the wages across states and increase the level of convergences in labor market outcome (Østbye & Westerlund, 2007, Borjas, 2001). The location of choice, which is built on those factors affect the labor market outcome directly.

2.2   Determinants of labor market outcome

In both empirical and theoretical frameworks that study the labor market outcome, wages are the primary outcome investigated. The effect of various determinants on wages in the Nordic countries lessens because of the structure of the market and the strong regulations (Østbye & Westerlund, 2007). The effects of immigration on labor market outcomes show instead on the employment rate (Østbye & Westerlund, 2007; Lundborg, 2013). Both immigrants and native-born share some common determinants of labor market outcome; among those determinants are education, population, density, and the economic structure of the region under study (Florida, Mellander, Stolarick & Ross, 2011). The study shows the impact of various determinants on the employment wages on a metropolitan level; the research also shows a significant effect of the share of immigrants on wages in the second point of time studied. The level of education significantly affects productivity, and consequently, the wages. The speed and the efficiency required to diffuse and adopt new technology require crossing a threshold of human capital (Borensztein, De Gregorio & Lee, 1998). (Kim, 1991) shows an association between population density and economic performance of the city, where wages increase due to the existence of a higher level of job matching in denser areas. By utilizing the Marshallian concept of labor market pooling, (Andini, de Blasio, Duranton & Strange, 2013) find a positive correlation between density and turnover; the thickness of the labor market and speed of job matching process is positively correlated with population density. The type of economic activity in a region affects the labor market outcome (Florida, Mellander, Stolarick & Ross, 2011; Card, 1990). Lastly,

language proficiency plays a significant role in the labor market participation of immigrants (van Tubergen, Maas & Flap, 2004; Chiswick & Miller, 2002, 2009).

2.3   Empirical Studies in Sweden:

One of the most common conclusions in the studies regarding the Swedish labor market and immigrants is the sensitivity regarding the employment status. The non-European immigrants face two times higher risk of unemployment comparing to natives (ARAI & VILHELMSSON, 2004); this risk decreases dramatically for Nordic and European immigrants comparing to the non-European immigrants. Controlling for the demographic factors, human capital, and establishments characteristics show that the unemployment risk differences are attributed to the country of origin for the individuals (ARAI & VILHELMSSON, 2004).

While most studies regarding immigration and labor market study the problem from wage and income aspects, the Nordic countries have specific characters that tend to eliminate the effect of immigration on wages. The presence of strong unions, centralized wage bargaining, big government, substantial public sectors, and progressive income taxes attenuate the impact of immigration on wages (Østbye & Westerlund, 2007). The small effect on wages leads to the manifestation of the immigration effect on other labor market outcomes. Looking at the unemployment status of immigrants shows more severity in the Swedish labor market comparing to the USA. The differences gap in employment days never closes between immigrants and native Swedes (Lundborg, 2013; Østbye & Westerlund, 2007). The income of the household is determined by the duration of employment rather than hourly wages. The country of origin plays a definitive role in deciding the pace and depth of integration to the Swedish labor market, and the assimilation doesn't occur fully. The cultural distance affects the integration to the labor market significantly; the more distant the country of origin from Sweden, the slower the integration process (Lundborg, 2013).

As noticed above, the distance from the Swedish culture plays a definitive role in determining the speed of integration; this distance impacts this process in

different ways. The physical appearance can play a role in obtaining help from case officers in the public employment agency (Arai, Gartell, Rödin & Özcan, 2020). The Swedish language skills and Swedish look can affect the decision the case officer takes to enroll a specific beneficiary to one of the labor market programs; this trend is associated with male officers. On the contrary, female officers show no bias for appearance, language proficiency, or job seeker name.

The changes in the structure of the Swedish economy and its need since the '60s of the twentieth century have affected the demands of skills. Shifting to a more service-based economy has increased the challenges facing the immigrants to enter and continue working within the Swedish labor market (Duvander, 2001). Language proficiency plays a significant role in improving the ability to obtain work and to lessen the gap of unemployment between native-born and foreign-born (Duvander, 2001; Rooth & Ekberg, 2006). Getting a Swedish education by a foreign-born affect their labor market outcome positively (Rooth & Ekberg, 2006). The investment in both language and academic skills in the destination country helps in the transferability of human capital from home to destination country (Rooth & Ekberg, 2006). The country-specific skills can partially explain the gap between native-born and foreign-born when it comes to the labor market, the acquisition of those skills doesn't lead to full economic integration, discriminatory behaviors can explain a part of the employment gap by employers (Duvander, 2001).

3. Hypotheses and Model

This paper studies the association between the labor outcome and immigration on the regional level in the Swedish context.

3.1 Hypothesis

The central hypothesis in this paper discusses the impact of immigrants' cluster in a specific location on the labor market outcome in that location. The theoretical framework suggests that an increase in labor supply, ceteris paribus, leads to a

decrease in wages (or a negative effect on employment rate). This argument is supported by empirical studies, where a small negative impact of immigration on wages (Altonji & Card, 1991; Borjas 2003). The first hypothesis focuses on this association between immigrants and the employment rate.

3.1.1 Hypothesis 1

The share of foreign-born to the total population is negatively correlated with the employment rate.

After accounting for the various determinant of the labor-market outcome, namely the employment rate, a negative relationship should emerge between the share of immigrants and the employment rate. The shift of the pressure to employment rather than wages is well discussed above, where the increase of labor supply caused by the rise in population due to immigration leads to less job abundance and, subsequently, the employment rate.

The second hypothesis focuses on the effect on the labor market outcome of the immigrants as a result of them clustering in a location. Information spill-over about the labor market within the heavily immigrants' concentrated neighborhoods helps in job searching efforts; this leads to a lower level of the unemployment rate (Damm, 2009; Lobo & Mellander, 2020.)

Other studies indicate a competition among foreign-born over job opportunities in the destination countries (Longhi, Nijkamp & Poot, 2005).

3.1.2 Hypothesis 2

The share of foreign-born to the total population correlates positively with the employment rates among foreign-born.

Investigating both hypotheses depart from the same analogy; the difference comes from accounting for different determinants; e.g., the degree of fluency in Swedish might attribute to the employment among immigrants, while it probably does not affect the overall employment.

3.2   The Model of Autoregressive distributed lag

Although most of the studies which analyze the correlation between the labor outcome and migration follow the traditional approach in using the econometric tools, this study utilizes a dynamic model for heterogeneous panel data. A pooled mean group estimation is used to study both the long and short-run correlation between the covariates. This empirical approach replaces the unobservable "shadow prices" by linear or simple nonlinear functions of the observable state variables which determine them (Pesaran & Smith, 1995). Also, this approach maintains the dynamic optimization structure while allowing for the relevant institutional and physical constraints to enter the problem through their impact on the "shadow prices."

The pooled mean group estimation is useful when the coefficients of the parameters differ across sections but are constant in the long run.

A basic ARDL model (p,q....,q) can be expressed in the following form

$$Y_{it} = \sum_{j=1}^{p} \alpha_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \beta'_{ij} X_{i,t-j} + \mu i + \varepsilon i \qquad (1)$$

For a set of data with time periods of $t = 1,2,3 \dots T$ and number of agents $i = 1,2,3, \dots, N$. Where Y_{it} is the main dependent variable, $X_{i,t}$ with $(k \, x \, 1)$ is a vector of explanatory variables "regressors" consist of observations through T periods for N agents. The μi represents the fixed effects; the coefficients of the lagged dependent variables α_{ij} are scalars. The β'_{ij} are $(k \, x \, 1)$ coefficients vectors.

While the expression for re-parameterized error correction form of the model is as follow

$$\Delta Y_{it} = \theta_i Y_{i,t-j} - \gamma'_i X_{i,t-j} + \sum_{j=1}^{p-1} \vartheta_{i,j} \Delta Y_{i,t-j} + \sum_{j=0}^{q-1} \tau_{i,j} \Delta X'_{i,t-j} + \mu i + \varepsilon it \qquad (2)$$

Where $\theta_i = -(1 - \sum_{j=1}^{p} \alpha_{ij})$ and $\gamma' = \sum_{j=0}^{q} \beta'_{ij}$ $\quad \vartheta_{i,j} = \sum_{m=j+1}^{p-1} \vartheta_{im}$ for $j = 1,2,3 \dots p-1$ and $\tau_{i,j} = \sum_{m=j+1}^{q-1} \tau_{im}$ for $j = 1,2,3 \dots q-1$.

The main parameters of interest here are the long-run coefficients δi, α_{ij}, and β_{ij}. The group-specific speed of adjustment θ_i is also of importance. Using this model allows for differences among short-run coefficients, intercept terms, and the variance cross-section, while the long-run factors are the same.

There are three main assumptions, first is the distribution of the disturbances, which is assumed to be (IID) with mean of zero, and variance >0. The second assumption ensures that $\theta_i < 0$, which shows the existence of the long-run relationship between the regressand and the regressors by assuming the stability of equation (1). The third assumption emphasizes the long-run homogeneity of the coefficients across the groups.

To address the two hypotheses, I derive two models from the basic ARDL model mentioned above. For the first hypothesis, the model includes the employment rate as the dependent variable; the main independent variable is the percentage of foreign-born to the total population; this model includes different control variables. All the variables in the first estimation are taken in logarithmic form.

$$EMP_{it} = \sum_{j=1}^{p} \alpha_{ij} EMP_{i,t-j} + \sum_{j=0}^{q} \beta_{1j} IMM_{i,t-j} + \sum_{j=0}^{q} \beta'_{ij} X_{i,t-j} + \mu i + \varepsilon i \qquad (1a)$$

And the re-parameterized error correction form of the model is

$$\Delta EMP_{it} = \theta_i \, EMP_{i,t-j} - \gamma_1 IMM_{i,t-j} - \gamma'_i X_{i,t-j} + \sum_{j=1}^{p-1} \vartheta_{i,j} \Delta EMP_{i,t-j} + \sum_{j=0}^{q-1} \tau_{i,j} \Delta X'_{i,t-j}$$

$$+ \sum_{j=0}^{q-1} \tau_{i,j} \Delta IMM_{i,t-j} + \mu i + \varepsilon it \qquad (3a)$$

The second hypothesis is represented in an estimation model with the employment rate among foreign-born as the dependent variable; this model includes extra control variables that address the specific characteristics of immigrants employment, namely language proficiency. The main ARDL model is

$$EMP\_IM_{it} = \sum_{j=1}^{p} \alpha_{ij} EMP\_IM_{i,t-j} + \sum_{j=0}^{q} \beta_{1j} IMM_{i,t-j} + \sum_{j=0}^{q} \beta'_{ij} X_{i,t-j} + \mu i + \varepsilon i \qquad (1b)$$

While the re-parameterized error correction form of the model is

$$\Delta EMP_{IM_{it}} = \theta_i \, EMP_{IM_{i,t-j}} - \gamma_1 IMM_{i,t-j} - \gamma'_i X_{i,t-j} + \sum_{j=1}^{p-1} \vartheta_{i,j} \Delta EMP_{IM\,i,t-j}$$

$$+ \sum_{j=0}^{q-1} \tau_{i,j} \Delta X'_{i,t-j} + \sum_{j=0}^{q-1} \tau_{i,j} \Delta IMM_{i,t-j} + \mu i + \varepsilon it \qquad (4b)$$

The second function studies the short-term relation among the covariates.

3.3 Post Estimation And diagnostics

3.3.1 Autocorrelation and Heteroskedasticity

The problem of autocorrelation leads to a bias in the standard error and affects the efficiency of the parameters in panel data models. A test is needed to account for this autocorrelation; the test suggested by (Wooldidge 2002) has some advantages such as the reliance on fewer assumptions and can be easily implemented (Drukker 2003). This test utilizes the residuals of the first difference regression to examine the serial correlation. Also, this test performs well with reasonably sized data; it requires a larger sample to achieve the same power in the presence of conditional heteroskedasticity. The null hypothesis states that there is no serial correlation in the idiosyncratic errors, which would cause the standard errors to be biased and the estimates to be less efficient.[1] The presence of heteroskedasticity or the non-constant variance across the disturbances is another issue; a modified Wald test is the solution to address this issue. According to (Greene 2000), the variance of the disturbance term is heteroskedastic. While there are different tests for heteroskedasticity, the usage of the modified Wald test has an advantage over Lagrange multiplier, likelihood ratio, and standard Wald test statistics; those tests are sensitive to the normality assumption of the disturbance term. The modified Wald test performs fairly under the violation of such an assumption. The null hypothesis is homoskedasticity across individuals, with test statistic distributed under chi distribution χ^2 (N).[2]

3.3.2 Hausman Specification Test:

The Hausman test is a method of comparison between estimators produced by PMG and DFE; this step follows after testing for autocorrelation and heteroskedasticity.

The Hausman test is a specification test that compares the estimators produced by two models. Under a null hypothesis of no misspecification, a consistent asymptotically normal, and asymptotically efficient estimator will exist—the alternative hypothesis of misspecification, where this estimator will be biassed

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[1] The results for the autocorrelation is listed in appendix 1

[2] The results for the hetroskedasticity is listed in appendix 2

and inconsistent. In the case of rejecting the null hypothesis, the DFE estimators are favored to PMG estimators.

3.3.3 Unit Root Tests

Checking for stationarity requires preforming unit root tests for panel data. First, I run the Levin–Lin–Chu test, which is the procedure that utilizes pooled cross-section and time-series data. This test examines a null hypothesis that each time series contains a unit root against the alternative hypothesis, that each time series is stationary. LLC is more effective in cases where time series is considerably longer than the number of agents $N/T \rightarrow 0$. Another test is used to account for the relatively short time dimension. When in a dataset, the time dimension, T, is short, so tests that asymptotic properties are established by assuming that T tends to infinity can lead to incorrect inference. Harris–Tsavalis (1999) derived a unit-root test that assumes that the time dimension, T, is fixed.

3.3.4 Cointegration tests

After addressing the issue of a unit root in the panel data context, there is a need to examine the presence of cointegration relationship among the variables. (Westerlund 2005) provides new tests that are simple because they do not require any correction for the temporal dependencies of the data. Yet they are able to accommodate individual-specific short-run dynamics, individual-specific intercept and trend terms, and individual-specific slope parameters. These nonparametric tests have three advantages comparing to (Kao 1999) and (Pedroni 1999). First, the need not to collect the time series properties reduces both the complexity and the number of computations needed to construct the invariant tests. Secondly, correcting for the effects of dependent data enforces uncertainty. Finally, these nonparametric tests are more suitable for small samples.

4. Data

The data used in the analysis are retrieved from two different databases; first is the Swedish agency for economic and regional growth ¨tillväxtverket¨; second is Sweden statistics ¨SCB¨ for the period 2003-2018., the time series chosen is short due to data availability; the time period selected represents the longest period of data available. Some variables like employment rate are accessible for a more extended period, and others are available only for the time period selected. Some of the labor market outcome determinants are unattainable (the effect of skill type on wages). The impact of age on employment doesn't fit in this model. The final model excludes different control variables due to collinearity (population and the economic structure)

The table below summarizes the primary information regarding the variables included in this study.

Table 2: Brief variable description

Variable Name	Abbreviation	Definition
Labor market outcome	**EMP**	Employment rate: the share of employed people among the workforce %
Immigrants labor market outcome	**EMP_IM**	The employment rate among immigrants' workforce %
Immigration	**IMM**	The share of immigrants to the total population %
Human Capital	**HC**	The percentage of bachelor degree holders to the total population %
Density	**DENSE**	The natural logarithm of the number of inhabitants divided by area
Language proficiency	**SFI**	The percentage of students who passed the SFI course

4.1 Dependent variables

To study the hypotheses, I obtain two dependent variables stated below:

Employment rate

This variable represents the primary variable of the study; it represents the labor market outcome. The number of employed personals in a county divided by the workforce in the same county; the number obtained represents the employment rate for every year. The workforce definition is the population between ages 20-64. This variable is used to test the first hypothesis, where immigration is expected to affect the labor market outcome on the regional level.

Employment rate among immigrants

Similar to the previous variable, the labor market outcome for foreigners is obtained to study the effect on the foreign-born outcome. The number of employed people from foreign backgrounds to the total foreign workforce in the counties represents the immigrants' labor market outcome. This variable is used to test the second hypothesis.

4.2 Independent variable

Immigration

This variable is the main independent variable; it's the ratio of the foreign-born to the total population for each county throughout the time period. The impact of the act of immigration on both employment rates is the primary goal of this paper. The previous studies' findings are contradictory, while some associate the immigration with a positive impact, others find an adverse effect.

4.3 Control variables

While this study is focusing on the association between employment and immigration, other factors play a definitive role in forming the labor market outcomes, accounting for those factors will help in the capture of the real effect of immigration on the employment rate.

Human Capital

This variable measures the level of education on a regional level for every year through the time period. Here we measure the human capital as the percentage of the total population with three years post-secondary education or more. Level of education affects the labor outcome (Chiswick, Cohen & Zach, 1997; Florida, Mellander, Stolarick & Ross, 2011)

Density

Measuring the degree of concentration of inhabitants in each county during the period of study represents this control variable. The data for this variable is obtained from statistics Sweden

Language proficiency

For the second hypothesis, we include a variable that measures the language competence for immigrants. Various studies have shown the effect of language on the labor outcome of the immigrants. By dividing the number of passing students to the total enrolled each year in (SFI) program, we obtain this variable. Swedish For Immigrants (SFI) is a publicly funded and tuition-free program.

All the variables are in logarithmic form.

4.4 Descriptive statistics

The table below depicts the descriptive statistics of the variables included in the study. The variables cover 21 Swedish counties over the period 2003-2018. A balanced panel is obtained with 336 observations for each variable. there is a difference in the employment rates between the overall population and immigrants, where the mean for employment rate is 81% with a standard deviation of 3%; the immigrants' employment rate averages around 58%. The immigrants' share of the population ranges between 4% and 25% of the total

population in each county. Some of the counties have a higher level of education with almost 21% of the population holding a post-secondary education, while other provinces have a lower level of education. The numbers stated in the table are calculated on a regional level without taking to account the differences in the number of inhabitants; this explains the difference between these numbers and the national accounts, especially the human capital variable.

The density variable shows a high standard deviation which indicates the disparity between the centers and the peripheries.

Table 3: Summary statistics

Variable	Mean	SD	MIN	MAX
EMP	81%	3%	74%	88%
EMP_IM	58%	5%	46%	71%
IMM	12%	4%	4%	25%
HC	12%	3%	7%	21%
DENSE	46.33	66.45	2.5	359.9
SFI	48%	8%	30%	71%
N	336			

Note: The variables in this table are in standard form, I,e no logarithmic form

5. Analysis results and discussion

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In this section, the analysis of the data is presented; this includes the primary analysis, the ARDL model, and post estimations and diagnostic.

5.1   Correlation and association

Two correlation matrices are listed to show the presence of an association between the various variables in both models. For the model, the association between the dependent and independent variables shows that immigration and employment are

significantly correlated. The positive sign is noteworthy; the expected sign is negative, which imposes a challenge for the later analysis. The positive sign might indicate inaccuracy in the variables choices. Both control variables show a meaningful correlation with the regressand.

Table 4: Correlation matrix

	EMP	IMM	HC	DENSE
EMP	1			
IMM	0.479***	1		
HC	0.377***	0.580***	1	
DENSE	0.182***	0.690***	0.399***	1

t statistics in parentheses, the variables enter this matrix in the logarithmic form.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The second model differs in two aspects from the first one; first, the regressand here is the employment rate amongst immigrants. The second aspect is including an extra control variable that accounts for language proficiency. Again, the main independent variable correlates significantly with the dependent variable. The positive sign of the correlation between the share of immigrants and the employment rate here makes more sense; this can occur due to the possible positive impact of the size of the immigrant population on their outcomes. Both human capital and density are associated positively with the employment rate among foreign-born.

Table 5: correlation matrix

	EMP_IM	IMM	HC	DENSE	SFI
EMP_IM	1				
IMM	0.364***	1			
HC	0.481***	0.580***	1		
DENSE	0.123*	0.690***	0.399***	1	
SFI	-0.392***	-0.314***	-0.435***	-0.171**	1

t statistics in parentheses, the variables enter this matrix in the logarithmic form.
$^{*} p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

The negative association between language proficiency and employment is noteworthy; one explanation can be that the increase of performance within language courses is associated with full-time attendance and less work.

5.2   Unit-Root Tests

The table below depicts the unit-root test results for the test conducted in this analysis. According to Levin–Lin–Chu test, only the human capital is stationary in levels without including time trend; the includes of time trend render most of the variables stationary.

Employment displays a unit-root process on levels for both procedures; this process disappears when time trend is included, a known disruption occurs in 2009 and affect both outcome variables. The problem with a structural break in the panel data context is the lack of feasible tests to account for.

Table 6: Unit-root test

LLC Unit-root Test					
Ho: Panels contain unit roots					
DENSE	EMP	HC	EMP_IM	IMM	SFI
Constant					
4,868	-1,465	-11,927**	2,741	1,177	-0,467
Constant with Trend					
-2,187*	-6,816***	-11,615***	-3,665***	-7,823***	-4,755***
ΔDENSE	ΔEMP	ΔHC	ΔEMP_IM	ΔIMM	ΔSFI
Constant					
-6,619***	-13,626***	-16,538***	-10,686***	-8,207***	-7,666***
Constant with Trend					
-7,817***	-11,289***	-15***	-10,839***	-6,411***	-5,848***
HT Unit-root Test					
Ho: Panels contain unit roots					
DENSE	EMP	HC	EMP_IM	IMM	SFI
Constant					
0,967	0,838	0,910	0,949	1,027	0,424***
Constant with Trend					
0,613	0,342***	0,792	0,642	0,784	0,235***
ΔDENSE	ΔEMP	ΔHC	ΔEMP_IM	ΔIMM	ΔSFI
Constant					
-0,136***	-0,073***	0,506***	-0,068***	0,418***	-0,280***
Constant with Trend					
-0,004***	-0,065***	0,526***	-0,059***	0,547***	-0,277***

$^{*} p < 0.05, ^{**} p < 0.01, ^{***} p < 0.001$

The framework used in the regression allows for the variables to be integrated on I (0) and I (1); this condition is satisfied for all variables included.

When assuming a fixed time comparing to N, the results differ a little. Most of the variables still demonstrate a unit-root, including human capital, while only the language competence becomes stationary.

5.3   Cointegration tests

According to the unit-root tests, most of the variables are integrated of order one. In order for those variables to be on long-run equilibrium, a cointegration should exist; this implies that those variables are moving together, although some of them might walk arbitrarily.

The variance ratio test developed by Westerlund 2005; the results are reported in the table below. The alternative hypothesis here is all panels are cointegrated. The

test provides two options for alternative hypotheses, and the second one is to test against only some panels that are cointegrated. This test does not require the correct specification of the DGP, apart from some mild regulatory conditions, or the estimation of nuisance parameters. Yet each test can accommodate individual-specific short-run dynamics, individual-specific intercept and trend terms, and individual-specific slope parameters. We can reject the null hypothesis of no cointegration for both models at a 5% level.

Table 7: Cointegration test:

Westerlund test for cointegration				
Ho: No cointegration		Number of panels		21
Ha: All panels are cointegrated		Number of periods		16
Models	Model 1	Model 2		
Statistics	-2.0074*	-1.6612*		
P_Value	0.0224	0.0483		

5.4   Regression results

Table 8 represents the results of the regression analysis for both models. The pooled mean group and dynamic fixed effects are used to estimate those models. A Hausman test is performed to compare estimators' consistency. The lag criteria those models are chosen to be (1,1,1,0) for the first model and (1,1,1,0,1) according to the Bayesian Information Criterion as well as the Hannan-Quinn Information Criterion, which are commonly applied in maximum likelihood models.

5.4.1   Model 1
 The association between the employment rate and the foreign-born share of the total population is examined here. Column (1) illustrates the PMG estimation results. An increase in the stock of foreign-born by 1% leads to a rise of 0.1% in employment rate; this represents the main question of this paper; investigating the presence of association and its sign is the main goal. The results here show a positive correlation between the share of immigrants and the overall employment rate, which contradicts the hypothesis; this might be a result of the unit of study choice. The study unit in this paper is the Swedish counties; those geographical

units might be affected by other macroeconomic factors that this study fails to account for rather than immigration. Another explanation might be the reverse causality, where the immigrants are usually drawn to places with higher-level employment rate (Åslund, 2005; Zavdony, 1997). A negative, small, and insignificant effect of human capital on employment rate, the level of education appears not to affect the employment rate on the regional level. The Density affects employment rate positively, in which an increase in density by 1 leads to a rise of employment rate by 0.18%; this association aligns with the Marshallian economics of agglomeration, where the thickness of the labor market improves job-matching and reduces the periods of unemployment.

The short-run equation estimators show a higher positive correlation between foreign-born and employment rate; the coefficient of the short-run rises to 0.18 comparing to 0.1 in the long term. With the share of immigrants' responses to the abundance of job opportunities, this response in the short-run is adjusted in the long-run. Again, human capital shows no significance in the short-run. The short-run coefficient for density has a value similar to the coefficient in the long run, but it loses its significance. The error correction term has a value lying between 0 and 1 in absolute value; the value is negative, and it's highly significant. This value indicates a stable relationship with the speed of convergence to equilibrium of around 67%.

When reading the results for the dynamic fixed effect in model 1, the results change slightly from the one produced by the pooled mean group estimation. In the long-run equation, both estimations provide the exact coefficient for the effect of the share of foreign-born on the employment rate, with small differences in the standard errors; once again, the coefficient is highly significant. Human capital continues to enter the equation insignificantly in DFE estimation; the sign is still negative, and the value decreases by approximately 40%.

The density is still significant in the long-run in DFE estimation; the coefficient falls to 0.108%, which is a decrease of 40%.

The short-run equation produces an error correction term of 54% of the speed of convergence with a negative sign; again, this expresses the long-run stable relationship.

Table 8: Main regression results

Models	Model 1		Model 2	
Dependent variable	Employment rate		Immigrants employment rate	
VARIABLES	PMG	DFE	PMG	DFE
Ect	-0.677***	-0.535***	-0.332***	-0.305***
	(0.0545)	(0.0500)	(0.0613)	(0.0433)
D.IMM	0.178***	0.0801**	-0.183	-0.263**
	(0.0674)	(0.0384)	(0.146)	(0.123)
D.HC	0.0850	0.0116	0.856***	0.108
	(0.0931)	(0.0795)	(0.317)	(0.251)
D.DENSE	0.184	-0.0276	0.641	0.0559
	(0.177)	(0.0541)	(0.762)	(0.172)
D.SFI			-0.000372	-0.0334**
			(0.0183)	(0.0169)
IMM	0.104***	0.104***	0.0519	0.429***
	(0.0167)	(0.0188)	(0.0711)	(0.108)
HC	-0.0441	-0.0267	0.440***	-0.0621
	(0.0297)	(0.0350)	(0.112)	(0.193)
DENSE	0.181***	0.108**	2.320***	0.542**
	(0.0509)	(0.0473)	(0.339)	(0.265)
SFI			-0.127***	0.0266
			(0.0351)	(0.0666)
Constant	-0.457***	-0.206**	-1.814***	-0.470
	(0.0627)	(0.0968)	(0.341)	(0.337)
Observations		315		
Hausman Test	0.15		54.19**	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The short-run coefficient for immigration is of relevance, but the value goes down by 55%; this might mean that the long-term effect of the settlement of more foreign-born in a county is higher than the direct impact of this settlement.

The Hausman test for the first model indicates no systematic difference between

the two estimators; as a result of that, we retain the null hypothesis of the PMG estimators are indeed an efficient (and consistent) estimators of the true parameters.

5.4.2 Model 2:

The second hypothesis assumes a correlation between the share of immigrants and the employment rate among them. The PMG model doesn't indicate this correlation; the coefficient of the share of immigrants in the long-run equation is unquestionably small and insignificant. All the control variables are significant and of high factor values; the human capital factor affects the employment rate among immigrants positively, the increase of the bachelor degree holders percentage over total population by 1% increases the immigrant employment rate by 0.44%. The effect of human capital can indicate a complementary effect between immigrants and the high-skill population, where the existence of a concentration of high-skill labor requires the abundance of low-skill to occupy the service sector needed in the region. Also, the density coefficient is accounting for a significant proportion of the employment rate among immigrants. The increase in density by 1 leads to an increase in the employment rate of 2.3%; this aligns with a lot the literature that found a tendency among immigrants to reside in more dense areas because of the abundance of jobs. The extra control variable (SFI) produces a negative coefficient in the long-run equation. The increase in the percentage of passing students in the language program by 1% brings about a reduction in employment among immigrants of 0.12%; the interpretation of this can be that immigrants engage more with language competence programs when they are unemployed or before they get employed.

The short-run equation presents a speed of adjustment term that lays between 0 and -1; this indicates a long-run relationship between the regrssand and the regressors with a speed of adjustment of 33%. The short-run model shows significance only with the human capital; the other control variables lose their significance in the short-run. The share of immigrants in the short-run is also insignificant and has a negative impact.

Alternatively, DFE prediction produces opposing results, starting with the impact of the share of foreign-born. The long-run equation suggests that an increase of

the share of immigrants by 1% drives the employment rate among the foreign-born by 0.42%; this coefficient is highly significant. The human capital variable loses its significance with a negative coefficient. The density variable keeps its significance, but it loses a substantial amount of its impact, where the increase of density by 1 causes the dependent variable to rise by only 0.5%. The other control variable, namely language competence, appears insignificant in the long-run.

The speed of adjustment in the short-run is 30%, while only the share of foreign-born is significant, the coefficient is negative, which suggests a high competition in the short-run among immigrants. The long run, on the other hand, suggests more collaboration and information spillovers among immigrants.

The Hausman test for model 2 shows a significant value of χ^2. A significant value of the Hausman test indicates a rejection of the null hypothesis of the difference between estimators being unsystematic. The results of the Hausman test suggest that the PMG estimators are efficient but inconsistent. As a result of this, we can conclude that the association between the share of immigrants and their employment rate is positive. These results align with the finding of the first model.

6. Concluding remarks:

In summary of all the above, this paper starts by emphasizing the existence of an association between labor-market outcomes and immigration on the regional level. The unique characteristics of the Nordic labor market suggest a restriction of the effect on those outcomes within the employment rate, as a result of a highly regulated market and the strong labor unions. A pooled mean group estimation of dynamic heterogeneous panels is the method applied. Two hypotheses are tested, the first hypothesis look into the association between the employment rate and the share of foreign-born of the total population. The results indicate a positive relationship between the share of immigrants and the labor-market outcome in both long and short terms; these results contradict the main hypothesis where a negative correlation is expected rather than a positive one. The results for the first implies either a mistake in defining the model or in identifying the geographical unit under study. Another explanation is the existence of reverse causality, where the immigrants tend to invest more in

finding the perfect location, and they move to counties with better job opportunities; hence, the employment rate is affecting the share of immigrants. The method fails to detect the effect of human capital on the employment rate. At the same time, the results suggest a positive relationship between the labor-market outcome and human clustering on the regional level. Both dynamic fixed effect and pooled mean group produce similar results, and after running a Hausman test, there is no systemic difference between estimators; this leads to consider the PMG as both an efficient and consistent estimator. The density is also positively associated with the employment rate. Finally, the estimation fails to finds an association between the level of education and labor-market outcome. For the second hypothesis, the results were less visible. The PMG estimation suggests a strong correlation between the level of education on the regional level and the labor-market outcome among the immigrants, with a strong positive effect of density on the employment rate among immigrants. The PMG method fails to find a correlation between the share of immigrants to the total population and their labor-market outcome. On the contrary, the dynamic fixed effect model produces estimates which align with findings of the first hypothesis, a highly significant coefficient with a positive sign, an association between the density and the employment rate among the immigrants. The human capital appears as insignificant in this model when we use a fixed-effect method. The Hausman test in the second model leads to a rejection of the null hypothesis, and the fixed-effect estimate tends to be consistent.

This study can be improved by focusing on smaller geographical units such as municipalities or neighborhoods which might be more sensitive to the effect of immigration on its labor-market outcome. The reverse causality which the findings here suggest is noteworthy. A study of the effect of the labor-market position on the location choice for immigrants is feasible. Incorporating different controls such as population and the economic structure can help in capturing the real impact of immigration on the employment rate. Finally, the effect of structural breaks that occurred like the fall in employment as a result of the 2009 crisis removes any spurious correlation between the employment rate and immigration.

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Appendix:

Wooldridge test for autocorrelation in panel data		
H0: no first order autocorrelation		
Models	Model 1	Model2
F(1, 20)	823.580	176.910
Prob > F	0.0000	0.0000

We reject the null hypothesis, which implies the existence of autocorrelation.

Modified Wald test for groupwise heteroskedasticity		
H0: Data is Homoskedastic		
Models	Model 1	Model2
chi2 (21)	90.25	842.36
Prob > chi2	0.0000	0.0000

We reject the null hypothesis, which implies the data is heteroscedastic.