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Martin Korpi, PhD in economic history, is an associated researcher at the Institute for Economic and Business History Research, Stockholm School of Economics.
Ayse Abbasoğlu Özgören, MA Demography and MSc Economics, is a research assistant at Hacettepe University Institute of Population Studies, Ankara, Turkey.

Abstract
This paper addresses potential effects of immigration on wage income of predominantly low income Swedish born workers. Using unique individual full population panel data for two time-periods, 1993-1999 and 1997-2003, we estimate two fixed effect models controlling for both individual and local labor market characteristics as well as individual and regional fixed effects. The models are tested for a range of population sub-groups, the compulsory and upper secondary educated and workers within certain shares of the local income distribution (using different below median percentile levels as population cut-off points). The estimates show mainly a positive relationship between increasing shares of foreign born and wage income of Swedish born workers.
Keywords: International migration, local labor markets, wage levels, labour supply
JEL-codes: F22, J22, J61, J31

Sammanfattning
Föreliggande artikel behandlar frågan om ökad invandring har någon negativ effekt på löneutvecklingen för inhemsk arbetskraft. Artikeln utnyttjar data över hela Sveriges befolkning och sambandet mellan invandring och löneutveckling för inkomsttagare med lägre än genomsnittliga inkomster testas för två tidsperioder, 1993-1999 och 1997-2003. För dessa perioder prövas två så kallade fixed-effect modeller där vi kontrollerar både för individuella och regionala faktorer som också kan påverka lönebildning. Estimaten visar ett i huvudsak positivt samband mellan invandring och löneutvecklingen för inhemsk arbetskraft.

1. Introduction

Much empirical research effort has been focused on whether immigration and the corresponding increases in labour supply is harmful or beneficial to wage growth and job opportunities of native born workers. Most of this research can be divided into two broad types, those using a factor analysis approach, gauging how immigration can affect substitution between different types of labour and/or labour and capital, and those employing a so-called "area approach" – comparing geographical areas in terms of the share of foreign born and outcomes for different sub-groups of the native working age population (see below).

Studies of the last type, whether for the US or other OECD countries, investigate this question by either cross section or panel model analysis based on regionally aggregated data. Needless to say, this approach suffers from lack of information on individual level factors affecting labour market outcomes of the native born. As a first, to our knowledge, the paper at hand furthers the research by combining local labour market characteristics with individual full population panel data on native born workers. Primarily, this allows the estimation of key variables controlling for factors affecting individual outcomes at a much more detailed level than what has hitherto been possible. Second, in terms of explained variation, it gives us an idea of the importance of these regional key variables (such as the share of foreign born) relative to other individual factors affecting wage income.

In the paper, statistical tests are made for two educational groups; the relatively low educated (compulsory + high school drop-outs, or equivalent) and workers with upper secondary education (up to 13 years of schooling). In addition, we also run our model using subsets of different income percentiles below the 50th percentile. The primary research question addressed is *i)* are changes in the relative size of the foreign born population over time related to comparatively lower income levels for the native born, either looking at workers with relatively short or intermediate length of education or workers with income in the bottom half of the income distribution? As immigrants are by no means a homogenous group and the impact of immigration may also vary greatly between different regions in an economy, we also ask whether *ii)* these effects are dependent on origin of the immigrants, as defined as immigrants from OECD and non-OECD countries, and *iii)* whether the effects are limited to just economic growth regions or if the found patterns are more of a general feature, i.e., taking place in all labour markets experiencing changes in levels of immigration?

In what follows, theory and previous studies are discussed in section 2, data and descriptives in section 3, and an outline of our empirical approaches and statistical model is provided in section 4. Results are detailed in section 5 while section 6 concludes.

2. Theory and previous studies

Theory on the impact of international migration on wages of natives can be divided into two broadly defined categories. Firstly, representing the main theoretical approach are different approaches within a neoclassical framework, second we have traditional economic geography and much of the new economic geography literature. These two theoretical strands of the literature are not altogether coherent and to some extent we are left with two competing bodies of theory with differences as regarding expected outcomes.

Within neoclassical economics, assuming constant returns scale, the skill composition and educational background of immigrants is critical in terms of the outcome. The basic reasoning corresponds to standard supply and demand theory. All else equal, an increase in the number of either low or high skilled immigrants will lower the wages of comparable native workers because these workers now face more competition in the labor market. And if different types of labour are complementary, lower wages for one group translates into higher wages for the other since downward pressure on the wages of one group should induce investment increasing demand and thus increasing wages for the other complementary group. In practice however, because much immigration has either consisted of predominantly lower educated or because higher educated immigrants often have found themselves in jobs requiring only short or compulsory education, this reasoning has mostly been applied as explanation for stagnating bottom wage income and increasing wages at the top.

Empirically, in both US and European studies, the evidence on the impact of immigration on host country wages is generally not in favour of any strong negative effects for groups competing with immigrant labour. Mostly, studies reveal elasticities that hover around zero, i.e., neither positive or negative (Friedberg and Hunt, 1995; Borjas, 1994; Ekberg and Andersson, 1995). For instance, Card (2001) finds that an inflow rate of 10 percent for one occupation group (which raises the log population share of the group by about 0.1 – would reduce relative wages for the occupation by 1.5%. An inflow of 20% - equivalent to the highest rates seen in the U.S. data between 1985 and 1990 – would be expected to lower relative wages by 3%. For Britain, Dustmann et al (2005) find positive effects of immigration on wages for all educational groups, and no strong evidence that immigration has any negative effects on aggregate employment or unemployment. Similar results are also obtained for Germany (Frank, 2007) and for Spain (Carrasco, Jimeno and Ortega, 2008), using an array of different samples and estimation procedures.

Since the theoretical implications of immigration are rather strong while empirical studies in general reveal either small negative or even positive effects, much focus has been on potential problems of different approaches, in particular on the issue of endogeneity when estimating effects. High-wage areas tend to attract migrants and this selective settlement would lead to upwardly biased estimates of labour market outcomes for natives. But, as many have argued (for example Borjas, Freeman, Katz, DiNardo and Abowd, 1997), it would be wrong to conclude that immigration thereby causes the attractive labor market conditions. The potential endogeneity of the immigrant stock suggests that OLS may lead to inconsistent estimates and that an instrumental variable approach is essential. One of the main challenges in the literature has therefore been to find suitable instruments: variables that are correlated with inward immigration but not directly related to changes in natives' wages. An instrument commonly used in studies has been the stock of migrants in previous periods. The underlying justification is that earlier immigrant concentrations are unlikely to be correlated with current economic shocks if measured with a long enough time lag, but related to existing concentrations since current inflows are also determined by historic settlement patterns of previous immigrants (see for example Federal Reserve Bank of Philadelphia, 2005). Using this instrument for immigrant inflows has also relied on the fact that not all immigrants settle in particular locations for economic reasons. Some migrants come to settle more by way of the existence of networks and the presence of individuals with the same cultural and linguistic background, inducing immigrants to settle in areas with already high immigrant concentrations such as enclaves (Edin, Fredriksson and Åslund, 2003; Åslund, 2004).[1]

[1] Because of these concerns, so-called "natural experiments" have also been exploited. A famous example is Card's analysis of the influx of Cuban refugees during the "Mariel boatlift" on the Miami labor market (Card, 1990). Card found that the event had little adverse impact on the labor market outcomes of Miami's existing less-skilled workers. Other European studies along these lines with similar results include Carrington and de Lima (1996), Hunt (1992), Friedberg (2001) and Frank (2007).

Overall however, a common notion seems to be that this instrument usually also has a high correlation with current wage developments (see e.g. Longhi, Nijkamp and Poot, 2005), and studies using instrumental variables find modest impacts as well. In their meta-analysis of a set of 18 papers (Longhi et al., 2005), the majority of effect sizes are clustered around zero with an overall mean of -0.119. This implies “that a 1 percentage point increase in the proportion if immigrants in the labor force lowers wages across the investigated studies by only -0.119 percent“ (Ibid, page 472).

However, in light of non-neoclassical approaches, our second theoretical category broadly defined, the lack of any strong negative effects of immigration may not be all that surprising. Much of the new economic geography literature and traditional economic geography underline the role of migration and labour movements as part of regional growth processes, driving investment and various economies of scale in growth regions and thereby opening up for a potentially positive impact on local wage formation (see e.g. Fujita and Thisse, 2002; World Bank, 2009; Myrdal, 1957; Pred, 1966). Within these approaches, migration, and by extension immigration, is also often seen as being part of cumulative causation processes and positive feedback loops, thereby making the “contra factual” question – i.e., what workers would have earned without the migrants moving in – more speculative in nature. As is noted by Dustmann *et al*. (2005), the key problem in general with empirical analysis in this matter is “to compare the economic outcomes of certain groups of the resident population in particular cells after immigration with the counterfactual outcomes that would be observed had migration not taken place” (Ibid, F328). The second measure is not observable, and needs to be constructed with assumptions which are always debatable, i.e. it is hard to assess what economic growth would have been if migrants were not where they are now.

So far research along these lines has been mostly theoretical, and theoretical implications are often hard to test explicitly. For our purposes however, it is important that under assumptions of increasing returns to scale, positive externalities and cumulative causation processes, theoretically we need not expect negative supply side effects as in a constant returns framework. And these approaches provide an alternate explanation for lack of negative effects or positive signs of coefficients for increasing immigration. Rather than being the results of measurement error or lack of good instruments, as is often suggested, the common clustering of immigration effects around zero may in fact reflect the existence of theses types of agglomeration economies, broadly defined.

3. Data and descriptives

The study at hand utilizes full population register data from Statistics Sweden, detailing level and source of income and a range of additional individual level data such as household type, level of education, country of birth and sources of income. The studied time period is divided in two, 1993-1999 and 1997-2003 respectively, with each data set providing data on around 4.5 million workers for every second year included in the panel. Primarily, this measure allows for potential differences over the changing stages of the business cycle and other differences between the two periods which are somewhat hard to control for. 1993 marks the bottom of a severe recession with employment picking up – albeit quite slowly – until 1999. And in general, the first half of the 1990’s marks a thorough restructuring of the Swedish economy; a net loss of employment of around 300 000 jobs, a relative move away from public to private sector service employment and a net loss of manufacturing jobs, albeit with substantial regional differences (see e.g. Lindbeck, 1997; Thakur, 2003). Although the period ends in recession, 1997-2003 is characterized by generally higher employment rates and constitutes somewhat of a return to normalcy, even if employment never reaches similar levels as before the downturn.

The individual data used pertains to native born workers, ages 18-64. As is common in studies on income distribution, we seek to confine the data to workers with a reasonably strong attachment to the labour market and also to some extent to limit the share of part time workers in the data set. We therefore exclude individuals with a yearly wage income below 34 400 Swedish crowns in 1993 (around 4200 dollars in ‘93 exchange rates), and people below the equivalent of that amount adjusted for inflation, for all consecutive years.[2] Also excluded are all individuals with income pertaining to intermediate and university level studies (student loans and subsidies). In addition, because household formation and household break-ups may affect individual hours worked and this behaviour is hard to control for, we limit our data to individuals living within stable households, i.e., households that are either single or two

[2] This amount corresponds to one unit of a summarized income measure normally used by Statsitics Sweden to compare individual- and family living standards over time (”basbelopp”).

person households throughout the two time periods. To further simplify interpretation of results, regional domestic migrants are also excluded from our population.

To provide a first immediate sense of the data and the issue at hand, in figures 1.1 and 1.2 below, we plot summarized labour market average wage income (for the primary educated) and average share of foreign born for periods 1993-1999 and 1997-2003 respectively. As indicated by the regression line, both show a clear positive relationship between these two variables.

Figure 1.1. Average wage income for native born compulsory educated workers, and average share foreign born, 1993-1999. Swedish local labour markets.

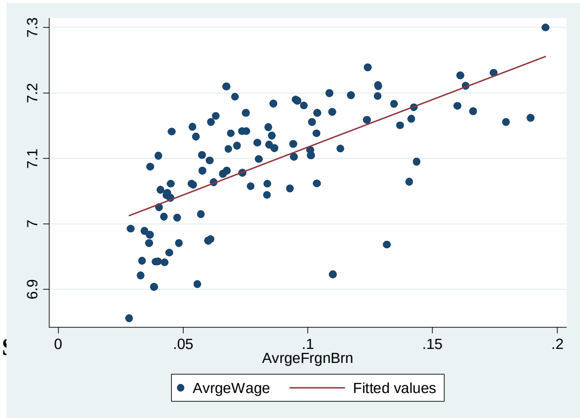
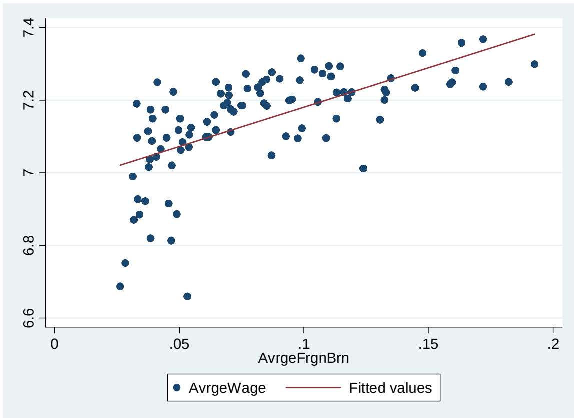


Figure 1.2. Average wage income for native born compulsory educated workers and average share foreign born, 1997-2003. Swedish local labour markets.



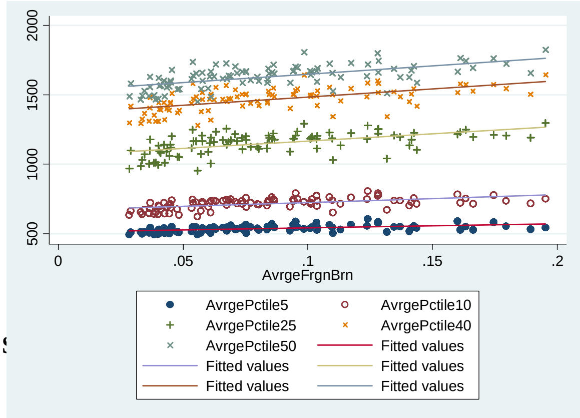
Nor does this basic positive relationship between these two variables seem to hide any large disparities within the group itself, that is, the compulsory educated. Figures 1.3 and 1.4 below show the relationship between average (local) labour market percentile levels and average shares of foreign born. Even though bi-variate regression lines for percentiles five and ten are somewhat more level than for percentiles 25, 40 and 50, the basic picture still seems to be one of a positive relationship between domestic wage income and shares of foreign born. The pooling and averaging of data does of course cloud differences over time, and as we are interested in whether this positive relationship remains also after introducing relevant controls, we therefore turn to our modelling of these patterns.

Figure 1.3. Average percentile levels (in hundreds, Swedish crowns) and average share of foreign born,

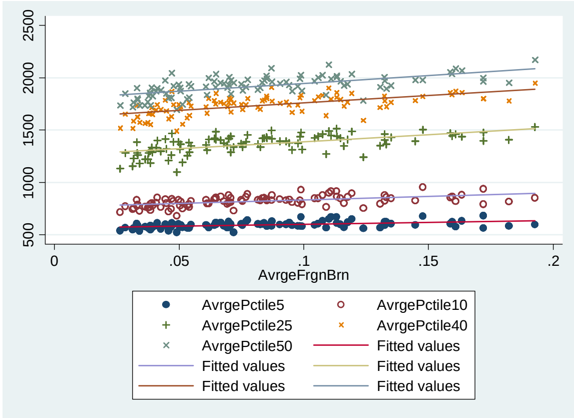
Figure 1.4. Average percentile levels (in hundreds, Swedish crowns), and average share of foreign born,

[3] Labour markets Haparanda, Sorsele, Pajala and Övertorneå excluded in figures 1.1-1.4. These labour markets are outliers in the sense that they either contain unusually high shares of foreign born (the some 40 percent mostly Finnish born population in Haparanda, right on the northern border to Finland), or have both unusual low income levels and low shares of foreign born, as the case with Sorsele, Pajala and Övertorneå, also in the north of the country. These labour markets however constitute a very small share of the total working age population.

1993-1999. Swedish local labour markets



1997-2003. Swedish local labour markets



4. Methodology and empirical model

As results vary somewhat depending on empirical approach (ref Longhi et al), and as it is not straightforward as to which is the most correct, we provide results from two different estimation strategies: OLS with regional fixed effects and individual fixed effects (difference in differences). First, we run ordinary OLS adding dummies for local labour markets. The dummies control for labour market fixed effects, for instance in terms of industry structure. Of course, the dummies control for all differences between regions that remain constant over time, including differences in individual level factors correlated within regions. Examples of the latter could be health, but also factors commonly discussed in the literature on industrial clusters such as innovativeness, drive and tradition, essentially non-measurables which are often seen as being “in the air” in different localities (see e.g. Maskell and Malmberg, 1999; , 2002; MacKinnon, Cumbers and Chapman, 2002). This model acts as a point of reference in that it corresponds to the models commonly estimated in the literature, although in those cases the regional fixed effects often are controlled for through differencing regional level data. Second, we difference the data and estimate parameters by way of fixed effects regression, a procedure which removes any additional unobserved fixed heterogeneity among individuals living in different local labour markets. As variation across regions can pertain to both individual and regional level factors, by essentially adding an individual dummy variable to our estimates, this can be seen as an alternative way of controlling for regional fixed effects while estimating our main variables of interest. Finally, to address the issue of simultaneity and the possibility of our main variable of interest being endogenous, we also provide IV-estimates using the corresponding two year lag as instrument for the share of foreign born, the most common approach within the literature to address this issue. All estimates include year specific dummy variables to capture business cycle effects across regions. The following regional and individual fixed effect models (model number 1 and 2, respectively) are tested for our two time periods, 1993-1999 and 1997-2003:

$$y_{it} = \alpha + \beta_1 AGE_{it} + \beta_2 AGE2_{it} + \beta_3 BUSINESS_{it} + \beta_4 CAPITAL_{it} + \beta_5 NEGCAPITAL_{it} + \beta_6 OTHER_{it} + \beta_7 WORKRELATED_{it} + \beta_8 EDUC_{it} + \beta_9 JOBCHANGE_{it} + \beta_{10} JOBCHANGE2_{it} + \beta_{11} EMPLOYMENTRATE_{it} + \beta_{12} SHAREFRGNBRN_{it} + \beta_{13} YEAR + \begin{cases} a_i \\ b_j \end{cases} + \varepsilon_{it} \qquad (1)\ \&\ (2)$$

Where,

y_{it} = Individual yearly real wage income (logged values)

AGE_{it} = Individual age

$AGE2_{it} = (AGE)^2$, i.e. age squared

$BUSINESS_{it}$ = Income from privately owned business, non-money market income

$CAPITAL_{it}$ = Income from stocks, interest etc.

$NEGCAPITAL_{it}$ = Loss of income due to stocks, interest paid on loans etc.

$OTHER_{it}$ = Income from welfare, housing subsidies.

$WORKRELATED_{it}$ = Income from benefits related to unemployment, early retirement, student subsidies, sick and parental leave

$JOBCHANGE_{it}$ = Dummy variable if person changes jobs

$JOBCHANGE2_{it}$ = Dummy variable if additional household member changes jobs

$EDUC_{it}$ = Variable signifying educational level, non-specified (drop-outs), compulsory and upper secondary

$EMPLOYMENTRATE_{it}$ = Employment rate in local labour market

$SHAREFRGNBRN_{it}$ = Share foreign born within each labour market

YEAR = Dummy controlling for year specific effects, 1993 and 1997 used as reference category for time period one and two respectively.

a = Regional fixed effect, included in model nr. 1

b = Individual fixed effects, included in model nr. 2.

α = Intercept. Since the intercept disappears when controlling for individual fixed effects (by time-demeaning), the intercept is estimated only in model nr 1.

i = individual

t = 1…n (year ’93, ’95, ’97 and ’99, for time period one. ’97, ’99, 2001 and 2003, for time period two)

j = local labour market, 1…n.

ε_{it} = Error term

AGE and AGE2 (age squared) controls for age effects, the second of these for differences in income growth trajectory over the life-cycle, while our different income variables (five, in all) are intended to pick up on any changes in wage income stemming from behavior related to sources of income other than wages. The most important of these is perhaps our variable for work related income (WORKRELATED) covering all income stemming from temporarily being away from ordinary salaried work, either because of unemployment or parental leave, sickness, etc. Conveniently, and as we are not interested in such specific behavior per se, this measure spares us a lot of additional work constructing variables (and is probably also a more efficient control). Change of employer (JOBCHANGE), however, and the equivalent variable for spouses (JOBCHANGE2), are not covered by any of these variables and need to be controlled for.

Turning to our labour market variables, firstly, the local labour market employment rate (EMPLOYMENTRATE) is included to capture wage pressure stemming from the ups and downs of the business cycle, while dummies for local labour markets are intended to capture labour market specifics and any differences across local labour markets not captured by our other controls. Third, our main variables of interest, share of foreign born (SHAREFRGNBRN) and share Oecd and Non-Oecd migrants (OECD and Non-OECD), are included to test our hypotheses on changes in the share of foreign born migrants residing within local labour markets. Lastly, dummies for each separate year are included to capture year-specific events across labour markets, with the initial first year used as reference category.

Expectations as regarding the signs of our individual level variables (variables 1-11) are straightforward and need not explicitly be detailed further. As regarding our remaining variables, employment rate is expected to be positive, while – as was argued in the initial theoretical discussion – the sign for foreign born indefinite and can depend on the choice of theoretical approach. In a neoclassical setting, a negative sign is what to expect. Under a broader paradigm of increasing returns, or cumulative causation, increasing immigration may reflect and further enhance growth and investment, thus potentially overruling any negative supply side effects. Therefore, along those lines, a positive coefficient may be what to expect.

5. Results

As we are working with full population data, any inference to the population is made without sampling error. The standard errors and significance levels will instead be interpreted with respect to the underlying data generating mechanism, as indicators of the uncertainty of the estimated parameters in a correctly specified model.

Results of the analyses of potential immigrant worker supply side effects on yearly wage income of native born workers are provided in Tables 1 through 5. First, estimates for the total share of foreign born using our two educational sub-groups of native born workers are shown in Table 1 and 2. Second, estimates for the share of foreign born using different percentiles of the local income distribution as population cut-off points are shown in Table 3. Tables 4 and 5 again provide estimates for our two educational sub-groups, but with the share of foreign born now divided into OECD and Non-OECD migrants. In the analyses presented in Tables 6 and 7 we then address the question of the importance of region by examining the consequences of excluding population growth regions from our analyses. Finally, in Tables A3 and A4 (in the appendix) we explore the effect of using the standard approach to modelling endogeneity providing IV-estimates using lagged population shares as instrument.

Regarding the two educational sub-groups, in both cases we find the share of foreign born to be positively related to native wage income. As can be seen in Tables 1 and 2, this result holds regardless of time period and estimator. Comparing the results for the two groups, point estimates are generally larger (around double in size) for those with upper secondary education compared to those with a degree from compulsory school. For graduates from compulsory education, estimates vary in between 0.09 to 0.72 while they range between 0.53 and 1.31 for those with an upper secondary degree.

As we are using the log yearly income as dependent variable, these estimates to also reflect elasticities. Thus, among those with compulsory education, a one percent increase in the share of foreign born is associated with 0.09 and 0.72 percent higher income, and 0.53 and 1.31 for upper secondary graduates. All estimates except one – Table 1, column one – are also highly significant

Comparing our two estimators, for both educational groups and time periods estimates are larger using our individual instead of our regional fixed effect estimator. Estimates are also generally larger for the second of our two periods as compared to the first.

Table 1. The effect on compulsory educated natives' yearly wage income of the share of foreign born immigrants, 1993-1999, 1997-2003.

	Regional fixed effects		**Individual fixed effects**	
	1993-1999	1997-2003	1993-1999	1997-2003
SHAREFRGNBRN	.087	.654***	.373**	.722***
	(0.117)	(0.117)	(0.119)	(0.155)
Constant	6.502***	6.284***	4.749***	5.161***
	(0.072)	(0.168)	(0.060)	(0.083)
Observations	1936344	1551465	1936344	1551465
R-squared	.3721	.3567	.1124	0.1791

legend: * p<0.05; ** p<0.01; *** p<0.001.

Note: Robust standard errors in parenthesis. Estimates include all controls as specified in models 1 and 2. Complete tables are available from the authors but cannot be included here.

Table 2. The effect on upper secondary educated natives' yearly wage income of the share of foreign born immigrants, 1993-1999 & 1997-2003

	Regional fixed effects		**Individual fixed effects**	
	1993-1999	1997-2003	1993-1999	1997-2003
SHAREFRGNBRN	.524***	1.004***	.865***	1.306***
	(0.118)	(0.188)	(0.152)	(0.315)
Constant	6.243***	6.112***	4.367***	4.818***
	(0.150)	(0.204)	(0.138)	(0.121)
Observations	5801502	5727102	5801502	5727102
R-squared	.3987	.3588	0.1868	.1934

legend: * p<0.05; ** p<0.01; *** p<0.001.
Note: Robust standard errors in parenthesis. Estimates include all controls as specified in models 1 and 2. Complete tables are available from the authors but cannot be included here.

Turning to our analyses of workers in different shares of the local income distribution (using percentile levels 5-50 as population cut-off points), the patterns evident in Table 3 are very similar to those in the analyses above. As previously, the basic picture for both periods is one where the coefficient for foreign born is positive regardless of using a regional or individual fixed effects estimator. However, compared with Tables 1 and 2 where we found larger coefficient estimates for the relatively more educated, we do not find our positive coefficients increasing the further up the cut-off point in the income distribution. Rather, the pattern is one where the largest coefficient estimates are found when the cut-off is the 25th percentile, with estimates decreasing somewhat in size using the 40th and 50th percentiles. There is probably a rough overlap between the population of workers with the lowest level of educational attainment and with the lowest incomes, and the results are also roughly comparable. However, the analyses using a higher cut-off are more likely to combine workers with different educational qualifications, and these estimates are therefore less comparable to the previous ones. Nevertheless, one similarity is that the estimated coefficients are substantially larger for the second period as compared to the first, regardless of estimator.

The mean association between foreign born population and income is thus positive in all populations. However, the spread around these point estimates is large at the very bottom of the distribution and, as a rule, decreases the closer we get to the 50th percentile. Most of these bottom estimates (below the 25th) are also not significant on ordinary levels of significance. And, notably, no estimate except one for our first period is significant, regardless of estimator.

Table 3. The effect on native workers' yearly wage income of the share of foreign born immigrants. Models estimated for different sub-groups of native workers below percentile levels 5-50, 1993-1999 and 1997-2003.

	Regional fixed effects		**Individual fixed effects**	
	1993-1999	1997-2003	1993-1999	1997-2003
<5th	0.057	0.651	0.402	0.415
	(0.238)	(0.326)	(0.339)	(0.428)
<10th	0.080	1.110*	0.186	0.538
	(0.299)	(0.475)	(0.312)	(0.436)
<25th	0.303	1.498***	0.374*	0.744**
	(0.239)	(0.390)	(0.181)	(0.244)
<40th	0.127	1.137***	0.226	0.487***
	(0.140)	(0.227)	(0.153)	(0.143)
<50th	0.131	1.002***	0.265	0.613***
	(0.104)	(0.177)	(0.138)	(0.126)

legend: * $p<0.05$; ** $p<0.01$; *** $p<0.001$

Note: Robust standard errors in parenthesis. Estimates include all controls as specified in models 1 and 2. Complete tables are available from the author but cannot be included here.

To summarize, although the size of the estimates varies across populations, on the level of the local labour market increasing shares of foreign born migrants is positively related to income for both our educational groups and for the whole of the income distribution below median income. For our first period however, these coefficient estimates are largely indistinguishable from zero for the compulsory educated as well as workers below our different income percentiles.

Turning to our second research question, whether these results to some extent depend on the origin of immigrants, the sign of the estimated coefficients presented in Tables 4 and 5 differ for workers with compulsory and upper secondary education. For those with compulsory education, all coefficient estimates are positive for both the share of OECD and Non-OECD migrants. Among those with a secondary degree, the estimate for share of OECD is generally negative while share of Non-OECD is positive all throughout. Apart from this, the results largely display the same patterns as in Tables 1 and 2. Coefficient estimates are thus larger for graduates from upper secondary as compared to those from compulsory education and larger for the second of our two periods. The spread around the estimates relative to coefficient size is also larger for those having completed compulsory school as compared to those with degree from secondary education and larger for our first relative to our second period. Thus, of the estimates for 1993-1999 for compulsory educated, only one in four estimates – for Non-OECD using individual fixed effects – is statistically significant while three out of four are significant for 1997-2003. For the secondary educated in turn, all estimates except one (table 5, column 4) are significant at 95 to 99.9 percent level of confidence.

The negative estimate for OECD migrants among those with upper secondary education, for the first of our time periods, can be interpreted in one of either two ways (for the second period, coefficient sign depends on the estimator used with the negative estimate insignificant); Either causally as a negative supply side effect, or as a possibly spurious correlation. Supporting the first interpretation would be the fact that relatively higher education levels among immigrants from OECD countries, and potentially lower language and cultural barriers, can give them easier access to the Swedish labour market, and therefore to a larger degree constitute potential competition for jobs and wages of the native born with an upper secondary degree. On the other hand, the negative sign may also reflect the fact that the share of OECD migrants for most of this period actually decreases as a share of the Swedish working age population (see Figure A1, Appendix). We return to possible interpretations of this in our concluding discussion below.

Table 4. The effect on compulsory educated natives' yearly wage income of the share of OECD and Non-OECD immigrants, 1993-1999, 1997-2003.

	Regional fixed effects		**Individual fixed effects**	
	1993-1999	1997-2003	1993-1999	1997-2003
OECD	.473	.833**	.128	.343
	(0.455)	(0.265)	(0.207)	(0.196)
Non-OECD	.090	.610***	.372*	.801***
	(0.118)	(0.112)	(0.120)	(0.191)
Constant	6.441***	6.266***	4.79***	5.212***
	(0.133)	(0.179)	(0.071)	(0.071)
Observations	1936344	1551465	1936344	1551465
R-squared	.3721	.3567	.1129	0.1818

legend: * p<0.05; ** p<0.01; *** p<0.001
Note: Robust standard errors in parenthesis. Estimates include all controls as specified in models 1 and 2. Complete tables are available from the author but cannot be included here.

Table 5. The effect on upper secondary educated natives' yearly wage income of the share of OECD and Non-OECD immigrants, 1993-1999 & 1997-2003.

	Regional fixed effects		**Individual fixed effects**	
	1993-1999	1997-2003	1993-1999	1997-2003
OECD	-.538**	.672***	-.832*	-.0970158
	(0.185)	(0.176)	(0.385)	(0.301)
Non-OECD	.494***	1.076***	.828***	1.578229***
	(0.101)	(0.200)	(0.129)	(0.348)
Constant	6.428***	6.143***	4.647***	4.983***
	(0.106)	(0.208)	(0.053)	(0.094)
Observations	5801502	5727102	5801502	5727102
R-squared	.3987	.3588	0.1868	.1934

legend: * p<0.05; ** p<0.01; *** p<0.001
Note: Robust standard errors in parenthesis. Estimates include all controls as specified in models 1 and 2. Complete tables are available from the author but cannot be included here.

Our third and last research question concerns to what extent our general estimates of the effects of immigration are driven by certain economic and population growth regions, e.g. larger metropolitan areas. That is, are our positive coefficients for shares of foreign born generated by the comparatively few large growth regions where immigrants also settle disproportionately? (Edin et al., 2003).

To gain some insight into this, we present estimates where we exclude all population growth regions, defined as labour market regions where the Swedish born working-age population increases between any two consecutive years. However, as is seen in Tables 6 and 7, this does not change our basic results. For both periods and both educational groups, our estimate for share of foreign born thus remains positive, although the positive coefficients are reduced depending on estimator and educational group. (A bit more for the upper secondary as compared to the compulsory educated, and a bit more using our individual fixed effects estimator as compared to regional fixed effects). Thus, the mostly positive estimates presented in Tables 1-5 are largely general in character and only to a minor degree driven by the inclusion of population/economic growth areas.[4]

Table 6. The effect on compulsory educated natives' yearly wage income of the share of foreign born immigrants, excluding population growth regions, 1993-1999, 1997-2003.

	Regional fixed effects		**Individual fixed effects**	
	1993-1999	1997-2003	1993-1999	1997-2003
SHAREFRGNBRN	0.083	0.588***	0.174	0.503***
	(0.154)	(0.129)	(0.166)	(0.138)
Constant	6.498	6.486	4.900	5.268
	(0.077)	(0.065)	(0.056)	(0.087)
Observations	767032	671815	767032	671815
R-squared	0.388	0.375	0.346	0.332

Legend: * p<0.05; ** p<0.01; *** p<0.001.
Note: Robust standard errors in parenthesis. Estimates include all controls as specified in model 1 and 2. Complete tables are available from the author but cannot be included here.

Table 7. The effect on upper secondary educated natives' yearly wage income of the share of foreign born immigrants, excluding population growth regions, 1993-1999 & 1997-2003.

	Regional fixed effects		**Individual fixed effects**	
	1993-1999	1997-2003	1993-1999	1997-2003
SHAREFRGNBRN	0.321**	0.469	0.484***	0.418**
	(0.112)	(0.130)	(0.105)	(0.156)
Constant	6.434***	6.452***	4.627***	4.989***
	(0.064)	(0.050)	(0.031)	(0.049)
Observations	2035609	2186921	2035609	2222871
R-squared	0.407	0.373	0.392	0.234

legend: * p<0.05; ** p<0.01; *** p<0.001.

Note: Robust standard errors in parenthesis. Estimates include all controls as specified in model 1 and 2. Complete tables are available from the author but cannot be included here.

Last, as discussed in Section 2, problems of endogeneity are often a concern in studies of the potential impact of immigration. To address the issue of possible simultaneity, Tables A3 and A4 (see appendix) also provide IV-regression estimates where corresponding two year lags are used as instrument for the share of foreign born, OECD and Non-OECD migrants. For the

[4] As comparison, we also test our model excluding metropolitan areas Stockholm, Gothenburg, Malmö, Linköping and Umeå. Although we cannot include the results here, these estimates are very similar to what we get when excluding all population growth regions as in Tables 6 and 7.

compulsory educated estimates are positive for both 1993-1999 and 1997-2003 with somewhat stronger results for the second of the two periods (see Table 8.). For those with upper secondary education the estimates provide a more mixed picture. In contrast to Table 2, the estimated sign for share of foreign born is negative for 1997-2003. Nevertheless, as in Table 5, share of OECD is negative in both periods while Non-OECD is positive.

These results thus largely seem to corroborate those obtained in the previous analyses. In theory, a good instrument should be correlated with the problematic endogenous variable but not correlated with the dependent variable, or as this is commonly expressed, with the error term. Since immigrants tend to move to places were previous immigrants have settled, using lagged values as instruments for current shares of migrant population surely meets the first of these two requirements. The likelihood of the instrument also fulfilling the second of these two requirements, however, increases with the length of the lag. Using two year lags may in this regard not be optimal, but we have here been limited by the available data. Further complicating our case is that normal statistical tests for endogeneity are problematic when observations are clustered within geographic areas. Observations within these clusters are therefore not independent, motivating correction of standard errors when estimating our models. However, ordinary specification tests of instruments cannot be conducted with the number of exogenous variables exceeding the number of clusters without this compromising the validity of the test statistics.

Nevertheless, we have examined the instruments using a model in which we have significantly reduced the number of exogenous variables (dummies controlling for labour market fixed effects). Using this alternative specification, ordinary tests of both relevance and weakness of the instruments provide no cause for concern. That is, the instruments are sufficiently correlated with the problematic endogenous variables.[5] This however is not the case testing for validity (i.e., to what extent the instrument is also correlated with the dependent variable). In none of the above regressions – albeit in reduced form – are we able to reject the null-hypothesis of the tests involving the so-called Hansen J-statistic, i.e., that all instruments are invalid (not shown). Even though these specification tests thus have been done on a reduced – and therefore essentially different – model, the tests readily correspond to the intuition of the instruments that we outlined above.

[5] In STATA, a number of statistics for instrument weakness and relevance are reported. Conclusions here are based on Sheas's partial R-squared and the Kleinbergen-Paap rk LM and rk Wald statistic, respectively.

This may indicate that our instruments are problematic and that we cannot rule out our main variables of interest being endogenous. However, to the extent that the instruments are appropriate they would seem to support our main results. Also strengthening our case vis-à-vis any endogeneity problems, is that our mostly positive estimates hold even while excluding the major economic and population growth regions from our regressions. Thus, even if positive labour market conditions to some extent cloud cause and effect – in our study as in others – it should be noted that the estimates are not dependent on the inclusion of these growth regions, in the literature deemed as the major cause for concern as regarding endogeneity.

Issues of endogeneity aside, how important are these estimated effects? Although both variables Share foreign born and Share OECD and Non-OECD survive F-tests for joint significance together with employment rate (not shown), their contribution to R-squared and explaining total variation is limited. When testing different specifications of our model, starting off with our main variable of interest (the share of foreign born, or equivalent) and subsequently adding our additional controls, the simple bi-variate regression between average wage levels for those with compulsory and secondary education yield very low R-squared, less than one percent of total variation (see Tables A5 and A6, in the appendix). Further, this figure is only marginally affected by adding our additional contextual variable (employment rate), time dummies and even our controls for labour market fixed effects. As measured by their effect on levels of R-squared, the main variables of importance are the individual level variables (see specification number 4, Table A5 and A6), increasing R-squared by around 30 percentage points. Neither does adding the independent variables in the opposite order alter this conclusion. In other words, individual level variables add to explained variation by around 30 percentage points regardless of the order by which our controls are introduced, while our variables related to the share of foreign born migrants add less than one percent.

6. Summary and conclusions

The analysis conducted previously shows that increasing shares of foreign born at the level of the local labour market are related to increasing real wage income for the vast majority of the native born population within our different sub-groups. This conclusion holds regardless of time period and sub-population analysed. The relationship is generally weaker for the less educated as compared to the relatively more educated, with a one percent increase in the share of foreign born associated with around 0 to 0.7 and 0.5 to 1.3 percent higher income for the first and latter group respectively (with size of the estimates increasing over time).

Though not directly comparable, this positive relationship also holds for our analysis using different shares of the income distribution as population cut-off points (Table 3.). As in Tables 1 and 2, estimate size also clearly increases over time, albeit to a very modest degree using the lowest percentiles as population cut-off points.

These generally positive estimates are for the most part not dependent on the composition of the foreign born as measured by the share of OECD and Non-OECD migrants. However, for the secondary educated we find the share of OECD to be negatively related to native income development for the first of our time periods, thus possibly indicating a negative supply side effect. Supporting this interpretation would be the fact that relatively higher education levels among immigrants from OECD countries, and potentially lower language and cultural barriers, can give them easier access to the Swedish labour market, and therefore to a larger degree constitute potential competition for jobs and wages of the native born with an upper secondary degree. These two disparate estimates do however represent something of a conundrum: to interpret one from the other as a negative supply side effect begs the question why the share of Non-OECD is positively related to native wage income. The interpretation is also to some extent (as always) dependent on our chosen theoretical approach; in a neoclassical setting the negative estimate is more or less straightforward and a result of, for the first period decreasing, and for the second slightly increasing wage competition. This is because the share of OECD migrants decreases during our first and slightly increases during our second period (see Figure A1). Under the paradigm of cumulative causation and non-neoclassical approaches discussed in section 2, this negative estimate could however largely represent a spurious correlation and the generally positive estimates of the share of foreign born (in tables 1 to 3) is where we should focus our attention.

Further comparing the two broad theoretical approaches outlined in section two, neoclassic and non-neoclassic approaches, we can readily conclude that we find most support for the latter. Except for the share of OECD migrants during the first of our two time periods, all estimates are positive for both our educational groups and for percentile levels as low as the bottom 25th. And except for this negative estimate, we can rule out negative supply side effects for Sweden and for the time period and sub-populations analyzed here. A possibility remains however, in that our population sub groups are perhaps too broadly defined to really get to possible wage competition. An area of future study could therefore be to further decompose sub groups along lines of occupation, and particularly look at occupational groups where immigrants tend to find work.

Even though most estimates are positive, as shown in tables A3-A4, we must keep in mind that the share of foreign born represent a very modest contribution to explaining wage disparities within our different sub-populations. Not at any time, and regardless of estimator and the order by which variables are added, does the share of foreign born exceed one percent of the total explained variation, substantially less than for example our individual level variables.

All in all, we therefore conclude that this study largely corroborates results from previous studies, both for Sweden and for other countries. In terms of coefficient sign and size, for the most part our results are positive and any negative effects are modest. In addition to what has been done previously, our study also points to something worth exploring further; the contribution of the share if immigrants as explaining changes in income for the native born – whether positive or negative – seems to be very modest as well.

7. Appendix:

Table A1. OLS and fixed effects regression results of the effect of share of foreign born immigrants on native yearly wage income, excluding major metropolitan areas. Compulsory educated natives, 1993-1999 and 1997-2003. (T-values in parenthesis)

	Regional fixed effects		**Individual fixed effects**	
	1993-1999	1997-2003	1993-1999	1997-2003
SHAREFRGNBRN	0.100	0.579***	0.267*	0.477***
	0.721	(4.123)	(2.115)	(3.525)
Constant	6.512***	6.523***	4.829***	5.281***
	125.934	(108.069)	(116.392)	(89.592)
Observations	1236330	984840	1236330	984840
R-squared	0.381	0.369	0.347	0.330

legend: * p<0.05; ** p<0.01; *** p<0.001

Table A2. OLS and fixed effects regression results of the effect of share of foreign born immigrants on native yearly wage income, excluding population growth regions. Upper secondary educated natives, 1993-1999 & 1997-2003. (T-values in parenthesis)

	Regional fixed effects		**Individual fixed effects**	
	1993-1999	1997-2003	1993-1999	1997-2003
SHAREFRGNBRN	0.257**	0.514***	0.506***	0.450**
	(2.646)	(3.988)	(5.422)	(3.342)
Constant	6.441***	6.510***	4.597***	5.079***
	(153.678)	(127.568)	(154.511)	(155.283)
Observations	3283754	3246790	3283754	3246790
R-squared	0.407	0.365	0.400	0.355

legend: * p<0.05; ** p<0.01; *** p<0.001

Table A3. IV regression results of the effect of share of Foreign born, OECD and Non-OECD immigrants on native yearly wage income, compulsory educated natives, 1993-1999 & 1997-2003. (The two year lag of each group used as instrument, robust standard errors in parenthesis)

	IV-estimates, compulsory	
	1993-1999	1997-2003
SHAREFRGNBRN	0.242	0.857**
	(0.172)	(0.302)
OECD	0.566	1.077**
	(0.574)	(0.374)
Non-OECD	0.243	0.696**
	(0.173)	(0.228)

legend: * p<0.05; ** p<0.01; *** p<0.001.
Note: Robust standard errors in parenthesis. Estimates include all controls as specified in model 1, page 9.

Table A4. IV regression results of the effect of share of foreign born, OECD and Non-OECD immigrants on native yearly wage income, upper secondary educated natives, 1993-1999 & 1997-2003. (The two year lag of each group used as instrument).

	IV-estimates, upper secondary	
	1993-1999	1997-2003
SHAREFRGNBRN	0.477***	-0.403
	(0.121)	(1.338)
OECD	-0.677**	-0.755
	(0.253)	(1.073)
Non-OECD	0.450***	0.160
	(0.116)	(0.645)

legend: * p<0.05; ** p<0.01; *** p<0.001.
Note: Robust standard errors in parenthesis. Estimates include all controls as specified in model 1, page 9.

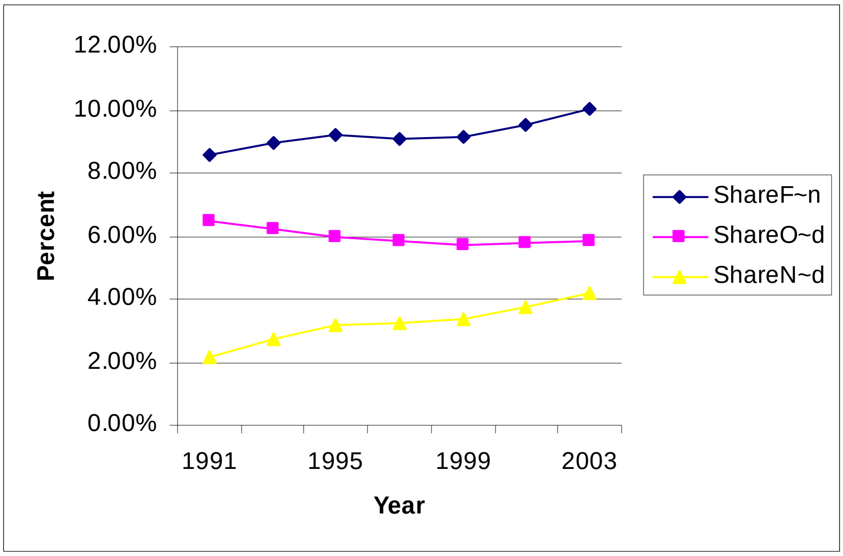
Table A5. R-squared and sequentially added independent variables, 1993-1999. Compulsory and secondary educated. Dependent variable is real annual earnings.

Specification	1 Share foreign born	2 + Employment	3 + Year fixed effects	4 + Individual controls	5 + Labour market fixed effects
Compulsory	0.007	0.011	0.032	0.369	0.372
Secondary	0.015	0.019	0.049	0.394	0.398

Table A6. R-squared and sequentially added independent variables, 1997-2003. Compulsory and secondary educated. Dependent variable is real annual earnings.

Specification	1 Share foreign born	2 + Employment	3 + Year fix effects	4 + Individual controls	5 + Labour market fix effects
Compulsory	0.007	0.011	0.015	0.354	0.357
Secondary	0.016	0.022	0.029	0.355	0.359

Figure A1. Foreign born, Oecd and Non-Oecd migrants as share of population, ages 18-64. Sweden, 1991-2003



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