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Migration and Wage Inequality - Economic Effects of Migration to and within Sweden, 1993-2003.

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Abstract

The questions addressed in this paper are *(i)* whether immigration and domestic migration over time contributes to changes in wage inequality, and *(ii)* if so, which parts of the income distribution are these changes associated with? Finally, (*iii*) what are the correlates of changes in inequality, and does ethnic and educational background of the migrant population matter? Using full population data for 1993 and 2003 for Swedish local labour markets, a fixed effect model is estimated. Factors associated with increasing wage inequality are positive net migration of the Swedish born, increasing educational inequality and low levels of employment. Immigration and domestic migration of the foreign born has no statistically significant effect.

Sammanfattning

I denna rapport undersöks kopplingen mellan inflyttning till svenska lokala arbetsmarknader och förändring i inkomstojämlikhet. Följande frågor uppmärksammas: *(i)* Bidrar invandring och inhemsk befolkningsomflyttning till förändring i inkomstspridning? *(ii)* Vilka delar av inkomstfördelningen är det i så fall som påverkas? *(iii)* Spelar den inflyttade befolkningens ursprung och utbildningsmässiga sammansättning någon roll vad avser utfallet? Resultatet pekar mot att ökad lokal nettoinflyttning bidrar till ökad inkomstspridning främst genom att människor med relativt höga inkomster upplever relativt sett snabbare inkomstökningar. Endast inflyttning av människor födda i Sverige har någon statistiskt signifikant effekt.

1. Introduction

Both U.S. and European based studies (Friedberg, 1995 ; Smith and Edmonston, 1997; Ekberg, 2003) show small, or non-existent direct negative effects of immigration and domestic migration on wage levels of workers competing with the migrant labour force. These results have been challenged by some researchers, arguing that the true effects of labour migration can only be understood through its effect on the educational composition of the total labour force within a country (Borjas, 2003; Borjas, Freeman, Katz, DiNardo and Abowd, 1997). These studies in turn, using a general equilibrium framework, show migration as having significant negative effects on some domestic wage earners, and, as a result of this, sizeable positive effects on levels of wage income inequality.

A general equilibrium framework, however, entails assumptions of constant returns to scale, precluding possible positive scale effects resulting from migration and changes in the size of local population. In previous work (Korpi, 2008), in a cross sectional study of Swedish local labour markets, wage income inequality is shown to be positively correlated with size of local population, the correlation being a function of increasing top wages as size of local population increases. This pattern, in turn, is shown as being partly a function of increasing average educational levels, and partly of increasing industrial diversity as size of local population increases. In a cross sectional setting therefore, we have clear population scale effects on wage inequality that go beyond the educational composition of the workforce within the local labour market.

This result therefore provides an alternative take on long term change in levels of wage inequality. If, in a cross sectional setting, wage inequality can be shown to be a function of labour market diversity, what are the dynamic patterns over time? Do changes in the size of local labour market population over time entail changes in local industrial diversity, in the cross-sectional sense that more specialized industries are added to the local industrial setup as size of local population increases, or does the local labour market over time remain static in this sense? Can changes in local industrial structure help explain linkages between increasing net-migration and increases in wage inequality, not because increasing population size means a race to the bottom for local workers competing with the migrant workers, but simply

because larger local population entails increasing specialization within certain industries and increasing specialization in turn entails higher average wages within these industries?

In the paper at hand, using full population data for 1993 and 2003 on Swedish local labour markets and simple panel data methods (fixed effects), these different hypotheses are tested. Three basic research questions are addressed: *(i)* Does migration (defined as both immigration and domestic migration) over time contribute to changes in wage inequality, and *(ii)* if so, which parts of the income distribution are these changes associated with? Finally, (*iii*) what are the correlates of local changes in inequality, and does ethnic and educational background of the migrant population matter?

What follows below in section 2 is theory and previous studies. Section 3 discusses data and methodology, section 4 our statistical model while section 5 and 6 contain descriptive statistics and results, respectively. Section 7 concludes.

2. Theory and previous studies

As noted above, a neoclassic economic framework has been the main theoretical approach in analysis of wage and wage inequality effects of international and domestic migration. Within this school of thought, effects on wages and wage inequality of positive net migration is dependent on who the migrants are, more specifically what their educational background is. If they're predominantly lower educated, or only find work requiring limited schooling, positive net migration should augment inequality because lower educated workers are losing out due to negative supply side effects. Therefore average wages for lower educated groups should be lower in places experiencing positive net migration, and inequality correspondingly higher. If the flow of migrants predominantly consists of higher educated however, all else equal, lower levels of inequality should follow net increases in migration due to top wages being suppressed.

To complicate matters further, on the basis of human capital theory, different types of externalities associated with the migrant population are often assumed. In other words, an assumed negative effect on inequality of a positive influx of higher educated may fail to materialize because the migrants – in an ad hoc manner – are assumed as being more productive, gifted or ambitious, thereby nullifying a possible negative supply side effect. This

often makes a neoclassic migration hypothesis somewhat hard to test empirically. (Also, as is common, positive externalities are often assumed as associated with higher and not the lower educated).

To my knowledge there are no Swedish studies focusing on direct linkages between migration and income disparities, and studies on effects on wages and relative factor prices are also sparse. Ekberg (1977), in a study on immigration and effects on the relative price of capital (the ratio between returns to capital and average wages) finds immigration to have a slight increasing tendency on this ratio in the short run, thus implying minor negative consequences for the wages of the native population, with this already tiny effect further shrinking over time. In a more detailed approach (Ibid, 1983), calculating effects both on relative wages and employment for different types of labour, a very small negative and a very small positive tendency is found for wages of the low and highly educated workers respectively.

These results are also largely in accord with what has been found in U.S. studies and for other European countries. For the US, typically, comparing labour markets with regard to increasing shares of foreign born and income developments for different groups of native workers, studies find elasticities of around -.01 to -.02, thus implying a reduction in wages for low educated workers at around minus 0.2 percent following a 10 percent increase in the foreign born population (REF). In Europe, where in general fewer studies have been made, Zimmerman (1994) finds immigration to have had very slight negative effects on the relative wages of low income workers and a corresponding slight positive effect on the income of the highly educated. Also, in a study simulating relative wage effects of immigration for several European countries (Gang and Batiz, 1994), equally very minor effects are found.

As concerning wage inequality, all these studies would of course imply immigration as having a positive – but very minor – effect on wage income disparities of the native population. As mentioned, however, the approach of these studies have been challenged by authors arguing that comparisons between local labour markets (or, for the US, Standard Metropolitan Statistical Areas), tend to hide a wider truth; that because both workers and firms can respond to negative supply side effects (attracting firms while simultaneously discouraging potential migrant workers), any negative effects on relative wages are automatically spread out over geographical space, and thus not traceable by comparative methodology. These authors instead argue the effects of immigration can and should be understood as happening on

national level, through general equilibrium effects on income disparities between low and high educated workers. In contrast to the aforementioned studies, these authors find immigration to have had considerable negative effects on the wages of lower educated and therefore strongly contributing to increasing income disparities over time (Borjas, 2003; Borjas, Freeman, Katz, DiNardo and Abowd, 1997).

While this critique is clearly relevant, this paper argues that geographical comparative methodology still has advantages which merit its further use. Firstly, assuming that the equilibrating response of workers and firms to local downward wage pressure sufficiently offsets any local wage disparities is clearly a matter of debate. For Sweden, as well as for most of Europe and certainly the US, regions experiencing population growth tend to keep on growing over time, with 'counter migration' movements – migrants heading out of larger metropolitan growth regions – making up a significantly smaller share of total domestic migration (for data on Sweden, see Korpi, forthcoming). As for Sweden, wage levels for all income percentiles tend to increase with local population size, including major population growth areas experiencing positive net migration. This pattern is also likely to be rather stable over time (see Korpi 2008). So, even though we don't have exact data on the educational composition of these differing migrant flows, just the fact that counter urbanization more or less consistently make up a smaller share of total migration raises some doubt to counter urbanization as effectively equilibrating wages over geographical space.

Also, as is argued by Friedberg and Hunt (REF), because of the fact that no negative downward wage pressure can traced even from very sudden and large 'natural experiments', like the 'Mariel Boatlift' to Miami, or the large immigration to Portugal and France at the time of their former colonies' independence (REF), this equilibrating worker and firm migration must by definition happen instantly, something which is highly unlikely.

Second, by comparing local labour markets we don't have to rely on estimates of wage elasticities based on correlations from earlier periods when the relative wages of workers were potentially dependent on variables other than what might be relevant currently, that is, for the time-period we are currently working with. In that respect, we are not in any sense drawing conclusions that are dependent on an implicit assumption that the current change in relative labour supply is equal to that of a previous time-period.

As mentioned by way of introduction, this paper argues that traditional geographic central place theory (Christaller, 1966; Lösch, 1954) also provides an alternative take on analyzing economic effects of migration, whether domestic or international. In the economics of Christaller's original theory, the main rationale for the geographic spread of different industries and services is the varying levels of fixed set-up costs relative to the local demand needed to cover these fixed costs. Assuming evenly spread levels of per capita income across regions, businesses or establishments that need a large local population to cover these fixed costs locate in central places of so-called 'higher order' (in relatively larger cities or only in the largest), whereas establishments that require lower levels of fixed costs relative to local demand can be set up in every city, regardless of size. From this we have a link between urban scale (local population size) and the degree of specialization of the local business structure, or occupational structure. If we think in terms of a cross-section, for each 'step' upwards in the urban hierarchy an additional industry or professional branch is added to the local business structure. The larger the local labour market, the more diversified the local business structure (the number of industries represented locally). This can also be verified empirically, although strong correlation does of course not prove the theory.[1]

Given this link between industrial diversification and size of local population, we can expect change in local population size over time to also be associated with changes in industrial diversification. In other words, assuming that migrant populations exert some level of demand for local goods and services, we can expect that a net positive increase in migration, regardless of their educational status, to result in more specialized industries being added on to the local business structure of the place/destination where these migrants settle. Since specialized labor can be associated with higher average wages, this increase in the number of specialized industries should then over time contribute to increasing disparities in the local wage structure. Given this, changes in the size of local population due to net changes in migration levels should affect the whole business structure of destination communities and not just the industries where the migrant population finds work (for an empirical study linking local business diversification to wage income inequality, see Korpi (2008)).

Needless to say perhaps, not much work has been done using this theoretical approach. However, in two papers, on the basis of Central Place theory, economists Haworth, Long and

[1] Using Swedish data, the number of industry branches represented within the local labour market can be shown to be a log-linear function of the size of local population, with an R^2-value of 0.96 (Strömquist, 1998).

Rasmussen (hereafter HLR) develop what they call a "monopoly" hypothesis as an alternative way to understand effects of urbanization and migration. Increasing city size due to positive net migration, they argue, effectively increases demand for local goods and services while at same time, due to existence of industry specific indivisibilities and entry barriers, different industries are to a varying degree shielded from increasing local competition following the concomitant increase in demand for goods and services. With this logic, increasing city size gives rise to 'monopoly rents' for groups that to some degree are insulated from competition (HLR illustrate by comparing the relatively high entry barriers in the local newspaper industry to the much lower equivalent in gas stations, fast food restaurants and similar enterprises), an effect of positive net migration thus being increasing inequality 'from the top', or, because upper income levels tend to increase at a faster rate than the income of workers more in the middle or lower segments of the local income distribution . Comparing developments between 1960 and 1970 for 79 US SMSAs, using simple OLS methods, they find both change in local population size and a measure of change in local occupational structure as having significantly positive effects on estimates of the local Gini coefficient (REF)

In the paper at hand, we take a similar approach to gauging the relationship between levels of migration and changing wage inequality. While controlling for unobserved city-specific heterogeneity by way of fixed effect modelling, we regress population change, occupational structure and estimates of educational composition – our main variables of interest – on levels of wage inequality using a range of inequality measures. The model is also tested for the development of labour market specific percentile levels as to get a sense of migration's possibly varying effects on different parts of the income distribution.

3. Data

The study utilizes a database consisting of longitudinal data covering all individuals living in Sweden some time between the years 1990-2003. The database (*Place*) has been compiled in cooperation between Statistics Sweden (SCB), The Department of Social and Economic Geography and the Institute for Housing and Urban Research (IBF), both at Uppsala University. The database details place of residence and work and a series of individual level data, including educational and occupational status and source and level of income.

From this data, data on the working age population (20-64) are compared for two points in time, 1993 and 2003. These two years are chosen since we can thereby roughly cover developments over the whole of a business cycle. Both the two years represent two lows in economic activity, with 1993-94 showing high unemployment following the sharp economic downturn of 1991-1992, and 2003-2004 the equivalent point in time following the downturn after the internet related stock market boom at the end of the 1990's.

By choosing these two points in time, we also – perhaps as much as possible – control for changes in economic policy, since this remains largely the same 1993 to 2003. The economic policies that followed Sweden preparing for and entering the European Union in 1994 can by large be characterized by a monetary policy of maintaining a stable inflation rate (of around two percent a year) and large restrictions on stimulating the economy by way of financial policy.

As a first measure, for both 1993 and 2003, the individual data are linked to municipalities and municipalities to local labour markets. Because of changes in the size and age structure of local and regional population, and improvements in infrastructure and communication over time, the definition of local labour markets change over time. This paper uses a 1998 definition of local Swedish labour markets by Statistics Sweden. From this definition, Sweden can be divided into 100 local labour markets, made up of some 289 municipalities. The main separation criteria is here the share of working age population commuting out of the municipality on a daily basis, the rule being that if more than 20 percent commute from municipality *a* to municipality *b*, municipality *a* is registered as belonging to the local labour market of municipality *b*, and so on. From the individual level data, in turn, the different measures characterising each local labour market are calculated separately for each local labour market. Thus, by way of clarification, the final data set used in the analysis contains no individual level data.

To summarize net domestic and international migration during these ten years, we first compare the two datasets in terms of where people live in 1993 and where the same individuals reside in 2003. Since one ten year cohort will enter and another will leave the workforce (20-64) during these ten years, we hereby have to compare the population aged 10-54 in 1993, with the "same" population aged 20-64 in 2003. For both the foreign born and the domestic population, we can thereby identify who's entered and left the country, and who's

moved domestically during these ten years. These net movements are then summarized for each local labour market. In total, the sum of individuals within each of the two compared datasets amount to around five million people.

To calculate our income data and inequality measures (plus our other control variables), in turn, we exclude all persons with a yearly wage income below 34 400 and 38 600 Swedish crowns for 1993 and 2003 respectively (the equivalent of around 4200 and 4 600 US dollars, in 1993 and 2003 exchange rates). This follows common practice in studies of income distribution, and its objective is to confine the data only to workers with a reasonably strong attachment to the labour market.[2]

What is tested with this data, using simple panel data methods described below, is the effect of changes in share of domestic and international migrants, on four different inequality measures: the local Gini-coefficient, GE(2), Theil's index and MLD (the mean logarithmic deviation). From this selection, we thereby have four commensurate statistics giving an assessment of inequality across the whole income distribution. The Gini-coefficient is chosen partly because of its familiarity, both in work on inequality in general and in studies with results pertaining to the issue at hand, and partly because we need a measure focusing on variation around mean, or median income. The GE(2), Theil's index and MLD, in turn, represent an entirely different class of inequality measures (the family of generalised entropy measures) and therefore provide an alternative take on inequality. Out of the different entropy measures, GE(2) Theil's index and MLD are chosen since they, in this listed order, focus on changes in top, upper to mid level income respectively. Given the theoretical background outlined above they therefore fit our purposes nicely. [3]

4. The Model.

The statistical approach in the following is a type of fixed effect analysis, the equivalent of ordinary first-differencing between two points in time. Firstly, the percentage change of all our variables are calculated, i.e., the absolute change between 1993 and 2003 related to their

[2] By comparison, studies in the US usually only include workers who had a salary income for more than 13 weeks of the last year, (c.f. Wheeler, 2004).
[3] For background theory, welfare properties and formal definitions of these measures, see for example Cowell (1995) or Lambert (2001).

initial values or levels 1993, where after ordinary least squares methods are used to analyze these "differences in differences". By using this method we can to some extent – perhaps as much as possible – control for any so-called fixed effects and unobserved heterogeneity, i.e. different time invariant place specific local characteristics concerning milieu, attitudes and local cultures. In other words factors which are commonly assumed as being "in the air" in different types of cluster analyses, and we resort to an approach focusing solely on the time variation of our included variables.

The model hereby tested is as follows:

$$INEQ_{i,1\text{-}4} = \alpha + \beta_1 RecArrFrgnBrn_i + \beta_2 FrgnBrn_i + \beta_3 SweBrn_i + \beta_4 NtrlPopChng_i + \beta_5 Age_i + \beta_6 EducIneq_i + \beta_7 LmDiv_i + B_8 Employment_i + B_9 Unionized_i + \varepsilon \quad (1)$$

Where;

INEQ = Percent change in inequality measures 1-4 (GE2, Theil's index, MLD and the Gini-coefficient), 1993-2003.
RecArrFrgnBrn = Recently arrived foreign born, percent foreign born migrants arriving between 1999 and 2003
FrgnBrn = General foreign born population, percent foreign born having immigrated to Sweden before 1999, this variable and the former thus mutually exclusive.
SweBrn = Total sum of Swedish born migrants arriving 1994 to 2003, as percent of local population 1993.
NtrlPopChng = Natural population change, percent change in the size of local labour market population, age 20-64, net total migration.
Age = Percent change in age structure.
EducIneq = Percent change in educational inequality.
LmDiv = Percent change in labour market diversity.
Employment = Percent change in the share of the labour force with employment.
Unionized = Change percentage unionized among blue-collar workers.
i = Local labour market, 1-100.
α = Intercept
ε = Error term

Since acquiring language skills etc takes time, we can expect that foreign born workers have better chances gaining employment the longer they've stayed within the country – indeed, obtaining Swedish residency and worker permits is sometimes a process extending several years (incl. REF). Our variable measuring change in the relative size of foreign born population is therefore divided in two. One for the recently arrived foreign born, the size of the population having arrived after 1998, and another measuring net changes in the foreign born population having resided longer within the country.

The recently arrived foreign born (RecArrFrgnBrn), since connection to the labour market within this group is limited, is expected to be either positively associated with an increase in inequality or no effect whatsoever on levels of income inequality. As noted in our theoretical outline above, what to expect of an increase in the general foreign born population (FrgnBrn) is a more complicated matter. In a central place theoretical setting, since we would expect all increases in population size to be associated with increasing levels of business diversification, and therefore increases in top wages and wage inequality, the relationship between a increase in the general foreign born population and inequality should be positive. From the perspective of neoclassical economics on the other hand, the expected outcome is dependent on who the migrants are. Holding all else constant, an increase in a certain type of labor should depress the average wage within the industries in which this type of labor is occupied, the effects on inequality thus depending on and which parts of the domestic labor force the migrant labor is competing with for jobs and wages. Given that the foreign migrant population in Sweden is more dispersed educationally as compared with the Swedish born population (with a relatively larger share of higher educated as well as lower educated, see table 5, appendix 1), from a pure theoretical perspective, we would expect an increase in the relative number of foreign born to be either negatively associated with changes in inequality or have no effect whatsoever (in other words, that wages for the higher and lower educated are depressed to an equal extent). If this is not the case, we have to assume the existence of some kind of "positive externalities" associated with the migrant population. This reasoning also goes for the Swedish born domestic migrants (SweBrn), although this group consists of predominantly higher educated. Natural population changes (NtrlPopChng), i.e. cohort effects, is intended to pick up any effects of changes in population size not associated with international or domestic migration.

Our variable measuring age structure (Age), calculated as the ratio between age groups (20-29 + 60-64) / (30-59), is intended to pick up changes in the spread of the local age structure. If either group in the numerator is large relative to the middle-aged workforce, we would expect higher levels of inequality, and vice versa. A positive change in this variable is thereby expected to be positively related to change in inequality.

As control for human capital levels, a measure of educational heterogeneity is used (EducIneq). Following Nielsen and Alderson (2002) and Breau (2005), this measure is calculated using Theil's 1967 index of entropy, (H), defined as:

$$H = \sum_{i=1}^{n} p_i \ln\left(1/p_i\right),$$

where n = 4 and p_i is the proportion of the adult population (20 to 64 years) in each educational category. The four categories are defined as individuals with university degrees (bachelor's degree or equivalent), those with some post secondary education, secondary education (at least 13 years) and less than secondary education respectively (10 years or less). A larger value of H implies a greater dispersion (or inequality) of educational attainment.

Level of business diversification (LmDiv) is intended as a variable to test our hypothesis of changes in business diversification over time. As in Korpi (2008), the variable is defined as the inverse of the Herfindahl index, 1/*H*, where the Herfindahl index is calculated using the local shares of employed within 11 different industries. Formally,

$$H = \sum_{i=1}^{n} (s_i^2)$$

where s_i is share of employed within industry i, and *n* is the number of industries. A high Herfindahl index, in our definition, indicates a larger share of workers concentrated within one or a few industries. Since high concentration implies a lower level of diversification, we expect the coefficient for LMDIV (1/*H*) to be positively correlated with inequality, and

consequently, increasing diversification over time as positively correlated with increases in inequality.[4]

Both employment and unionization levels, in turn, (Employment and Unionized) are standard in studies of income inequality and are expected to be negatively and positively related to wage inequality respectively.

To repeat, and for clarity, all if these variables provide information pertaining to each of the 100 separate local labour markets.

5. Descriptive statistics and figures

Turning to the data, figures one and two below plot the relationship between percent changes in total net migration levels (Swedish plus foreign born) and percent change in inequality. Although at this point we cannot infer any causality between the two, for the studied time period we clearly see a positive relationship between changes in inequality and changes in migration levels, regardless if we measure inequality using the Gini coefficient, the GE(2) or Theil's index (see figures 1 and 2.).

As to give an indication as to which parts of the income distribution these changes in inequality stem from, we can calculate and plot the relationship between percent change in income levels (percentiles) and changes in total migration (figures 3 and 4). Here we see that the positive relationship between migration and inequality stems from both top wage levels increasing, and bottom wage levels decreasing, relatively as net migration increases.[5] A tentative conclusion is however that the bulk of this increase in inequality is associated with top wage increases. Firstly, the migration coefficient is sizeably larger in magnitude using the GE(2) as dependent variable – which focuses on top level income – than for example using Theil's index, which measures inequality closer to median income levels (1.2 and 0.88 respectively, see figure nr 2). Second, although we clearly see a negative relationship between

[4] For the assignment of workers to different industry categories, an industry classification by Statistics Sweden is used where workers are categorized as belonging to any of 11 broad occupational groups. These classifications basically correspond to United Nations activity classifications, ISIC. The groups used here are agriculture and forestry, construction, education and research, electricity and water supply, finance and real estate, retail and communications, health and social work, manufacturing and mining, public administration and defence, services and culture, and unspecified.

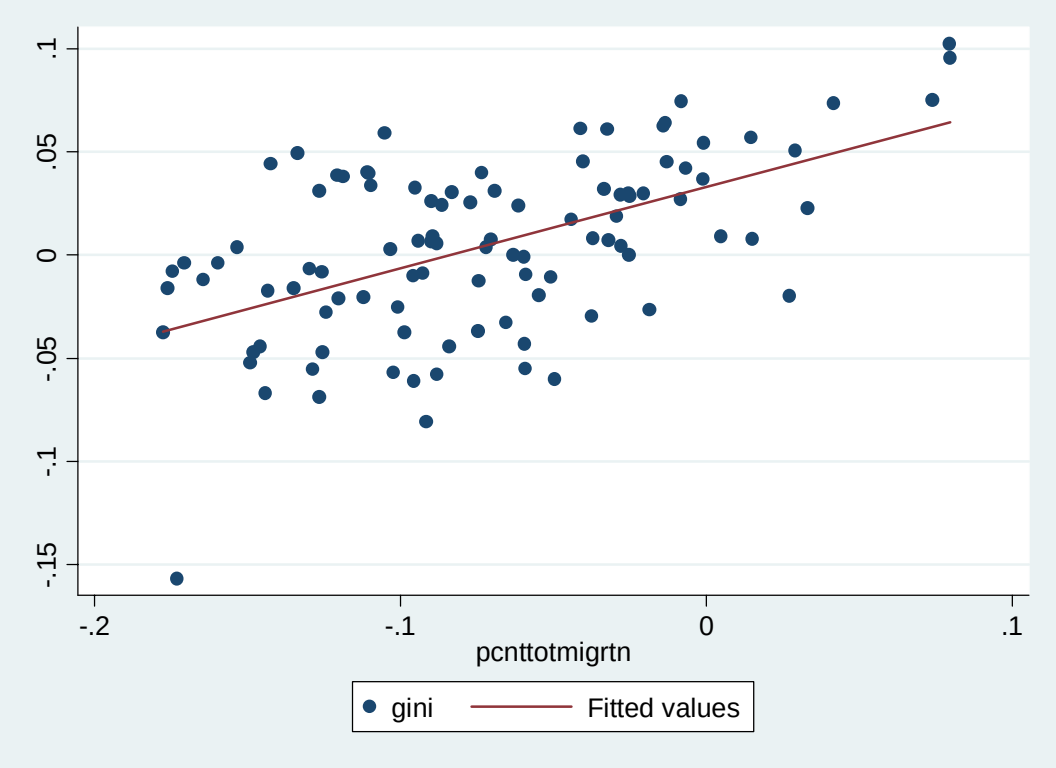
[5] In these calculations wage increases have not been corrected for inflation. Since we are here interested in relative and not real wages, this is however no concern for our reasoning.

change in total migration and bottom wage levels, the relationship is much stronger for relative top wage increases than for the bottom decreases, with adjusted R-square as high as .44 using percent change in the 95^{th} and 90^{th} as dependent variable, while much lower for the equivalent regression using the 10^{th} and the 5^{th} (.12 and .08 respectively).

Noteworthy is also that very few – about ten out of one hundred – of the Swedish local labour markets actually experience positive net migration in ages 20-64 during this period in time. The figures also indicate that local labour markets can experience significant negative net migration flows without this having any consequence for the local income dispersion. The predicted values (the regression line) in figures one and two, indicate that a local labour market has to experience negative net migration of around minus 8-10 percent before any decreases in levels of inequality can be seen.

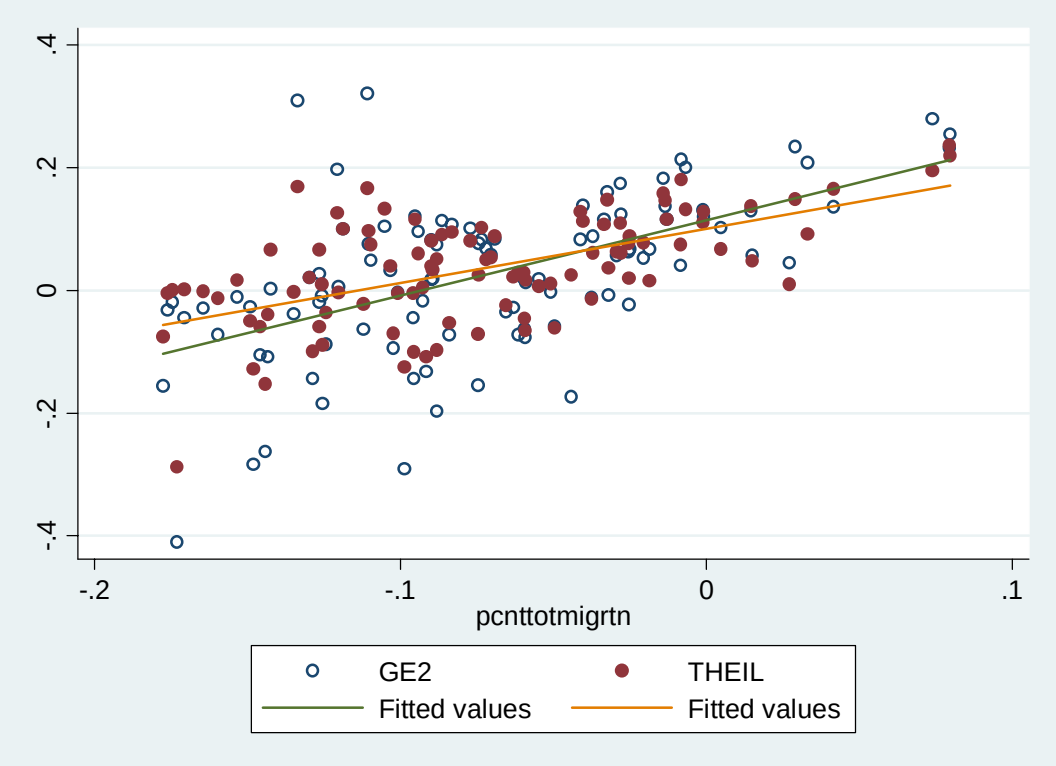
With this in mind we now turn to potential explanations of the shown pattern.

Figure 1. Percent change Gini coefficient and percent change in total migration, 1993-2003.



Gini=0.03+0.39 pcnt total migration+ *e*. Adj. R^2=0.3

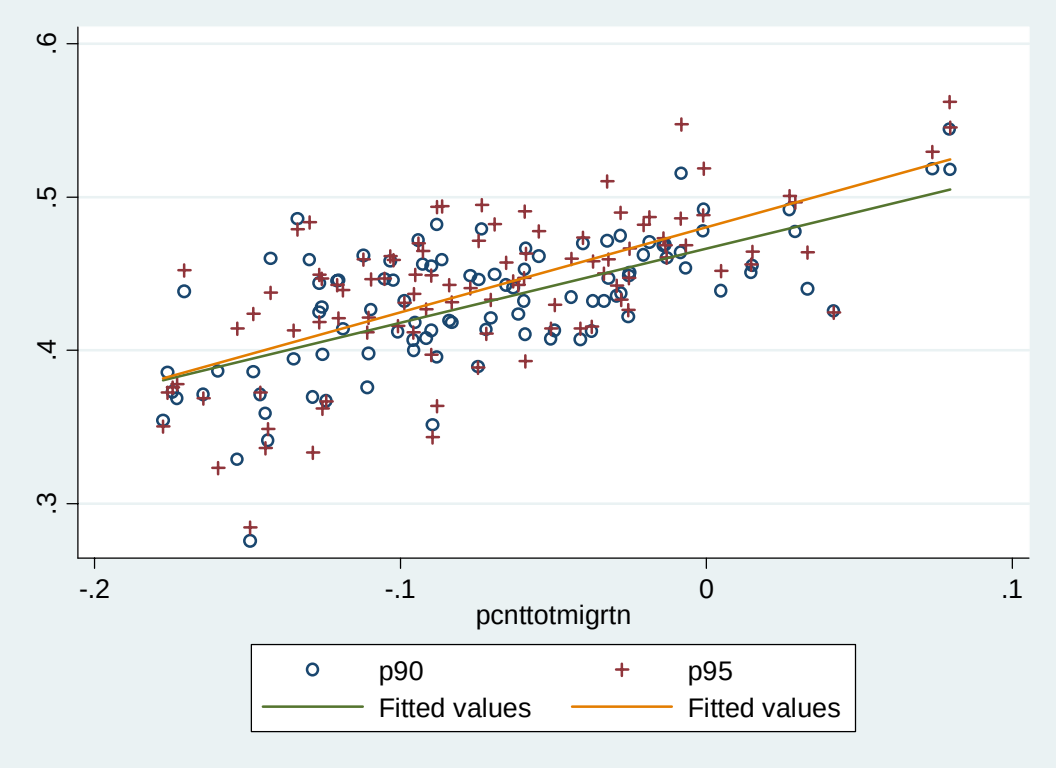
Figure 2. Percent change GE2n Theil's index and percent change total migration, 1993-2003.



GE2= 0.11 + 1.2 pcnt change total migration + *e*. Adj. R^2= 0.31

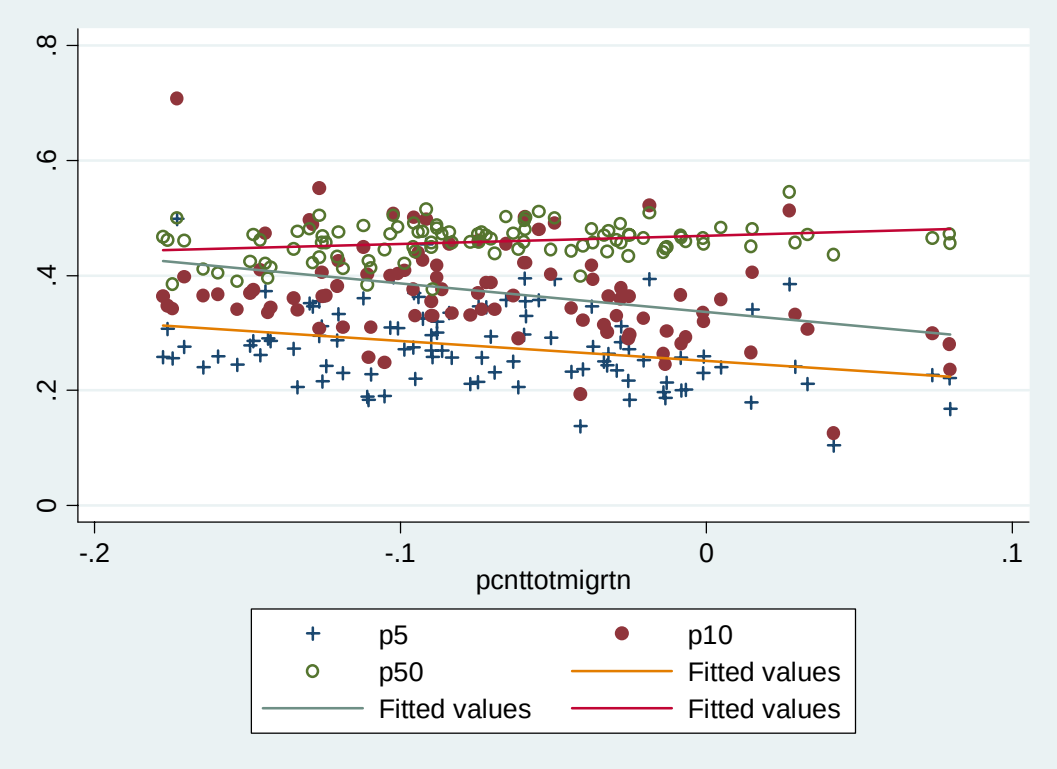
Theil = 0.10 + 0.88 pcnt change total migration + *e*. Adj. R^2=0.35

Figure 3. Percent change percentiles 95, 90 and percent change in total migration, 1993-2003.



P95=.55 pcnt total migration + e. Adj. R-squared = 0.44
P90=.48 pcnt total migration + e. Adj. R-squared = 0.44

Figure 4. Percent change percentiles 50, 10, 5 and percent change in total migration, 1993-2003.



P50= .14 pcnt total migration + e. Adj. R-squared = 0.0680
P10= -.50 pcnt total migration + e. Adj. R-squared = 0.1204
P5= -.35 pcnt total migration + e. Adj. R-squared = 0.0848

6. Results

The picture emerging from tables two through five, helps shed some light on the broad positive link between total migration and change in inequality previously shown. For all our different inequality measures, the sole significant factor among our migration variables seem to be change in the share of Swedish born domestic migrants, with the relationship being positive and the value of the coefficient varying between 0.30-0.99 depending on which inequality measure we use as dependent variable. In other words, a one percent increase of Swedish born migrants is associated with a 0.30 - 0.99 percent increase in inequality.

Turning to the foreign born, we have negative coefficients for both foreign born and recently arrived foreign born. As none of these two variables are close to being significant in any of our regressions, it seems safe to assume that the increase of foreign born migrants in Sweden

during the 1990's has not been a significant factor in the overall increase in wage inequality that can be seen during the studied time-period.

Turning to our other control variables, employment, educational inequality and business diversification all have the expected coefficients and are significant on a 90 to 99 percent confidence level in all our regressions. That higher employment levels are associated with a decrease in wage income inequality is perhaps not surprising, and is also a common result in studies on the determinants of inequality. This also goes for the positive and significant relationship between educational heterogeneity and income inequality. Given this relationship, a possible explanation for the non significant effects of increases in the foreign born population might be that their possible effect on inequality goes through a possible effect on educational inequality. However, this does not seem to be the case since regressing only our migration variables on our inequality measures leaves us with the same result in terms of coefficient signs and levels of significance (see table 6, appendix 1).

Table 1. Fixed effects model using the Gini as dependent variable.

```
      Source |       SS       df       MS              Number of obs =     100
-------------+------------------------------           F(  9,    90) =   25.36
       Model |   .12947737     9  .014386374           Prob > F      =  0.0000
    Residual |  .051055297    90  .000567281           R-squared     =  0.7172
-------------+------------------------------           Adj R-squared =  0.6889
       Total |  .180532667    99  .001823562           Root MSE      =  .02382

------------------------------------------------------------------------------
        GINI |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     FRGNBRN |  -.3038242   .2194332    -1.38   0.170    -.7397666    .1321182
RECARRFRGN~N |  -.0393986   .2289449    -0.17   0.864    -.4942376    .4154405
      SWEBRN |     .35559   .0741556     4.80   0.000     .2082669    .5029131
 NTRLPOPCHNG |   -.116707    .113438    -1.03   0.306    -.3420714    .1086573
         AGE |  -.0435991   .0344583    -1.27   0.209    -.1120566    .0248583
    EDUCINEQ |   .2232338   .0782801     2.85   0.005     .0677167    .3787509
       LMDIV |    .134258   .0405098     3.31   0.001     .0537783    .2147377
  EMPLOYMENT |  -.5153472    .092747    -5.56   0.000    -.6996054    -.331089
       UNION |  -.0019604    .022953    -0.09   0.932    -.0475605    .0436397
       _cons |   .0304875    .019017     1.60   0.112     -.007293     .068268
------------------------------------------------------------------------------
```

Table 2. Fixed effects model using the GE2 as dependent variable.

```
      Source |       SS       df       MS              Number of obs =     100
-------------+------------------------------           F(  9,    90) =   12.48
       Model |  .925536562     9  .102837396           Prob > F      =  0.0000
    Residual |  .741686636    90  .008240963           R-squared     =  0.5551
-------------+------------------------------           Adj R-squared =  0.5107
       Total |   1.6672232    99  .016840638           Root MSE      =  .09078

------------------------------------------------------------------------------
         GE2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     FRGNBRN |   1.026287    .836358     1.23   0.223    -.6352845    2.687858
RECARRFRGN~N |   .9141725   .8726113     1.05   0.298    -.8194222    2.647767
      SWEBRN |   .9930376   .2826402     3.51   0.001     .4315235    1.554552
 NTRLPOPCHNG |   .2751442   .4323628     0.64   0.526      -.58382    1.134108
         AGE |  -.2475577    .131336    -1.88   0.063    -.5084797    .0133643
    EDUCINEQ |   .0762109   .2983605     0.26   0.799    -.5165342     .668956
       LMDIV |   .4475205   .1544008     2.90   0.005     .1407764    .7542646
  EMPLOYMENT |  -1.132548   .3535004    -3.20   0.002    -1.834838    -.430258
       UNION |    .004062   .0874841     0.05   0.963    -.1697405    .1778644
       _cons |   .1241495   .0724821     1.71   0.090    -.0198489    .2681479
------------------------------------------------------------------------------
```

Table 3. Fixed effects model using the Theil's index as dependent variable.

```
      Source |       SS       df       MS              Number of obs =     100
-------------+------------------------------           F(  9,    90) =   22.21
       Model |   .53528073     9  .059475637           Prob > F      =  0.0000
    Residual |  .240968355    90  .002677426           R-squared     =  0.6896
-------------+------------------------------           Adj R-squared =  0.6585
       Total |  .776249086    99    .0078409           Root MSE      =  .05174

------------------------------------------------------------------------------
       THEIL |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     FRGNBRN |  -.1364619   .4767185    -0.29   0.775    -1.083546    .8106225
RECARRFRGN~N |   .2588276   .4973826     0.52   0.604    -.7293098    1.246965
      SWEBRN |   .7816772    .161103     4.85   0.000     .4616179    1.101737
 NTRLPOPCHNG |  -.0365413   .2464439    -0.15   0.882    -.5261451    .4530625
         AGE |  -.1339763   .0748607    -1.79   0.077    -.2827001    .0147475
    EDUCINEQ |   .2958097   .1700635     1.74   0.085     -.042051    .6336705
       LMDIV |   .2857532   .0880074     3.25   0.002     .1109111    .4605953
  EMPLOYMENT |  -.9632305   .2014928    -4.78   0.000    -1.363531   -.5629297
       UNION |  -.0099898   .0498654    -0.20   0.842     -.109056    .0890765
       _cons |   .1007986   .0413143     2.44   0.017     .0187205    .1828768
------------------------------------------------------------------------------
```

Table 4. Fixed effects model using MLD (mean logarithmic deviation) as dependent variable.

```
      Source |       SS       df       MS              Number of obs =     100
-------------+------------------------------           F(  9,    90) =   28.98
       Model |  .488242837     9  .054249204           Prob > F      =  0.0000
    Residual |  .168503957    90  .001872266           R-squared     =  0.7434
-------------+------------------------------           Adj R-squared =  0.7178
       Total |  .656746794    99  .006633806           Root MSE      =  .04327

------------------------------------------------------------------------------
         MLD |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     FRGNBRN |  -.5786163   .3986456    -1.45   0.150    -1.370595    .2133628
RECARRFRGN~N |  -.0013785   .4159256    -0.00   0.997    -.8276874    .8249303
      SWEBRN |   .7651505    .134719     5.68   0.000     .4975077    1.032793
 NTRLPOPCHNG |   -.158896   .2060835    -0.77   0.443    -.5683167    .2505248
         AGE |  -.0651478   .0626006    -1.04   0.301    -.1895149    .0592193
    EDUCINEQ |   .3205493   .1422119     2.25   0.027     .0380204    .6030781
       LMDIV |   .2699988   .0735943     3.67   0.000     .1237908    .4162067
  EMPLOYMENT |  -.9643573   .1684941    -5.72   0.000      -1.2991   -.6296144
       UNION |  -.0277396   .0416988    -0.67   0.508    -.1105816    .0551024
       _cons |   .1450642   .0345482     4.20   0.000     .0764282    .2137003
------------------------------------------------------------------------------
```

Turning to our variable measuring change in levels of business diversification, the results are somewhat confusing. That change in diversification seems to be a factor in increasing inequality on par with changes in educational inequality (less important using the Gini as dependent variable, much more important using the GE2) is somewhat novel and at least potentially important. It suggests that change in diversification levels should not, as is commonly the case, be left out of analyses of long term change in income inequality. However, we cannot find support for our hypothesis migration has an effect on inequality through a potential effect on local business diversity. Even though increasing diversity is positively related to change in wage inequality, its relationship with changes in migration is very weak (see table 7, appendix 1). Given our model, we can thus not understand effects of migration as affecting the whole of the local business structure, at least not significantly over a ten year span.

7. Conclusions

Tentative conclusions from this study are as follows:

For the studied time period, a change in the size of local population due to migration is a sizeable and significant factor in changes in income structure and wage inequality. Domestic migration patterns thus seem to be potentially important in understanding changes in wage inequality over time.

We find some support that the migration patterns seen during this time affect local wages negatively, with lower wage increases with higher net total migration, something that would be an expected result given a neoclassical economic framework, and that this is also a factor explaining increasing inequality. However, the increases in upper wage levels associated with an influx of younger predominantly higher educated Swedish born domestic migrants seem to be the main source of this development. Change in the share of foreign born migrants is also not significantly related to increases in wage income inequality, regardless of which inequality measure we use.

Given that we see no negative downward pressure on top wage levels, from an economic theoretical standpoint, we thus have to either assume the existence of positive externalities associated with these domestic in-migrants, or simply that our assumption of 'all else equal' is not valid, and increases in labour demand during this period are larger than increases in labour supply.

Local increases in wage inequality are associated with increases in local business diversification. This change in business diversification is however not significantly associated with changes in migration patterns. The cross-sectional pattern of a positive link between increasing labour market diversity and size of local population (see Korpi, 2008) is thereby not discernable in a dynamic setting. Given our model and the available data, migration can therefore not be understood as affecting the total business structure of receiving (and sending) local labour markets.

Changes in wage inequality can only partly be explained by changes in education inequality and employment levels, i.e. by factors which are standard in explaining wage income inequality. Instead, even though migration increases levels of educational disparities, it is associated with increases in top wage levels that seem to go beyond measurable disparities in levels of human capital.

8. Appendix 1.

Table 5. Share of higher educated (bachelor's degree or equivalent) and educational inequality among migrant and total population.

	Foreign born	Swedish born domestic migrants	Swedish born total population		
Share of higher educated	23 %	19%	15%		
Education inequality	1.32	1.02	1.22		

Source: GeoSwede (Place), author's calculations.

Table 6. Fixed effects model, migration and natural population change regressed on the Gini coefficient.

```
      Source |       SS       df       MS              Number of obs =     100
-------------+------------------------------           F(  4,    95) =   12.56
       Model |  .062460456     4  .015615114           Prob > F      =  0.0000
    Residual |  .118072211    95  .001242865           R-squared     =  0.3460
-------------+------------------------------           Adj R-squared =  0.3184
       Total |  .180532667    99  .001823562           Root MSE      =  .03525

------------------------------------------------------------------------------
        GINI |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
RECARRFRGN~N |   .0549044   .3255577     0.17   0.866    -.5914093    .7012181
     FRGNBRN |   -.288747   .2932886    -0.98   0.327    -.8709986    .2935045
      SWEBRN |   .5566835   .0969753     5.74   0.000     .3641631    .7492038
 NTRLPOPCHNG |   .0866544   .1547111     0.56   0.577     -.220486    .3937948
       _cons |   .0467217   .0118711     3.94   0.000     .0231546    .0702889
------------------------------------------------------------------------------
```

(Note: The results are the same using GE2, Theil's index and MLD as dependent variable (not shown)).

Table 7. Correlation coefficients for selected variables.

```
             |     GINI RECARR~N PRVSAR~N   SWEBRN EDUCINEQ    LMDIV EMPLOY~T
-------------+------------------------------------------------------------------
        GINI |   1.0000
RECARRFRGN~N |   0.1728   1.0000
PRVSARRFRG~N |   0.2538   0.0109   1.0000
      SWEBRN |   0.5807   0.2394   0.5485   1.0000
    EDUCINEQ |   0.6186   0.1018   0.4608   0.6044   1.0000
       LMDIV |   0.4441  -0.0430  -0.2253   0.0404   0.1667   1.0000
  EMPLOYMENT |  -0.7019  -0.2335  -0.2970  -0.3663  -0.5144  -0.3038   1.0000
```

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