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Growth, migration and unemployment across Swedish municipalities

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Abstract

Fundamental questions in economics are why some regions are richer than others, why their economic growth rates vary, whether their growth tends to converge and the key factors that contribute to the variations. These questions have not yet been fully addressed, but changes in the local tax base are clearly influenced by the average income growth rate, net migration rate, and changes in unemployment rates. Thus, the main aim of this paper is to explore in depth the interactive effects of these factors (and local policy variables) in Swedish municipalities, by estimating a proposed three-equation system. Our main finding is that increases in local public expenditures and income taxes have negative effects on subsequent local income growth. In addition, our results support the conditional convergence hypothesis, i.e. that average income tends to grow more rapidly in relatively poor local jurisdictions than in initially "richer" jurisdictions, conditional on the other explanatory variables.

JEL classification: R11, R23, E24, O47

Keywords: Growth, net migration, unemployment, local policy, convergence

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1. Introduction

A fundamental question in economics is why some regions are richer than others. Since seminal work by Barro and Sala-i-Martin (1992, 1995), the empirical literature on regional growth has largely focused on the so-called convergence hypothesis predicted by neo-classical growth theory as presented by Solow (1956). That is, if all regions are equal in all other relevant aspects, relatively poor regions tend to catch up with initially richer regions in terms of average incomes or gross regional product, leading to an equalization of incomes across regions over time. Examples of studies testing the convergence hypothesis include Barro (1991), Barro and Sala-i-Martin (1991), Blanchard and Katz (1992), Borjas *et al.* (1992), Mankiw *at al.* (1992), and Sala-i-Martin (1996). Based on Swedish data, Persson (1997) and Aronsson *et al.* (2001) find evidence of convergence in per capita income across counties, and Lundberg (2003, 2006) finds evidence of convergence across municipalities. However, other studies find divergence, among others Romer (1986, 1990), Lucas (1988) and Scott (1989).

One of the difficulties of interpreting results from regressions of average income or gross regional product growth is that they may reflect changes in populations, the composition of the labor force and/or technological changes. Barro and Sala-i-Martin (1995) estimate an equation for average income growth with a systematic part depending on the average income, measured at the beginning of a given period, and the rate of net migration. To avoid endogeneity problems, due to potential interactions between these variables, the rate of net migration is instrumented. Other studies have also included the initial unemployment rate as an explanatory variable for regional growth. For instance, in an analysis of Swedish data, Lundberg (2003) finds that the unemployment rate, measured at the beginning of a given period, has a negative impact on the subsequent average income growth. Fagerberg *et al.* (1997) broaden the perspective by adopting a framework that takes into account the interdependence between income growth, migration and employment. They find support for the hypothesis that factors that impact GDP per capita growth also impact employment growth, and vice versa.

In this paper, we analyze the regional growth pattern in Sweden in a setting influenced by Fagerberg *et al.* (1997) and Aronsson *et al.* (2001). Fagerberg *et al.* propose and estimate a simultaneous equations model with GDP per capita growth, employment growth and migration as endogenous variables, using data for 64 European regions in the 1980s, while Aronsson *et al.* explore determinants of regional income growth and net migration in Sweden from 1970 to 1995. We extend previous investigations by examining interactions between average income growth, net migration and changes in unemployment, together with effects of factors that influence disparities in

these variables, based on data for Swedish municipalities from 1990 to 2007. A key issue addressed is the effects of local policy variables, such as local income tax rates and local public expenditures, on the local growth pattern. Therefore, a three-equation system is estimated, where the local tax base growth is represented by three dependent variables: the growth rate of average income, net migration and the change in unemployment rate. These three dependent variables are determined using functions based on local policy variables, such as the initial local income tax rate, total local public expenditures per capita and initial shares of total local public expenditures on child care, primary- and secondary-education, care for the elderly, and social care. In addition, differences in the initial endowment of human capital, political representation and stability in the local parliament, and the initial demographic structure in each municipality are controlled for. This three-equation system is estimated using a fixed effects panel data approach with three stage least squares (3SLS) regression.

Although the existing literature on regional and local growth is quite extensive, this paper adds to it in several ways. First, in comparison to Fagerberg *et al.* (1997) we employ a richer set of explanatory variables and focus on effects of local policy variables on regional growth, rather than effects of industrial structure. Second, this paper extends the framework applied in previous analyses based on Swedish data – Swedish counties, Persson (1999), Aronsson *et al.* (2001); Swedish municipalities, Lundberg (2003, 2006), and Andersson *et al.* (2007) — by taking changes in unemployment into account. This is an important aspect of our paper as it takes a broader perspective than earlier studies on regional growth based on Swedish data, allowing us to relate estimates of average income growth to changes in both labor supply and unemployment rates. Third, our dataset covers a longer timeframe than previous studies based on Swedish municipalities, e.g. Lundberg (2003, 2006) and Andersson *et al.* (2007).

Regional disparities in local tax bases (and hence average incomes, migration and unemployment rates) have been on the Swedish political agenda for decades. One reason for this is that Swedish municipalities are the main providers of welfare services (such as child care, primary and secondary education, and care for the elderly), which are mainly financed by a proportional income tax and through a redistribution system. Thus, the local tax base affects the local governments' abilities to provide these services, which depend in the long-term on the growth of per capita income and the success of the municipality and local private sector in attracting labor (net immigration) and creating jobs (low unemployment). In this respect, Sweden is a particularly interesting case to study, as high-quality data are available and the country has a strongly decentralized public sector with autonomous local authorities.

The rest of the paper is structured as follows. In Section 2 we present stylized facts regarding the Swedish situation and describe changes in municipal tax bases, average income growth, net migration and unemployment rates from 1990 to 2007. Section 3 describes the applied empirical procedures and Section 4 the applied data. Results and interpretations are given in Section 5 and final conclusions and discussion are presented in Section 6.

2. Background and stylized facts regarding Sweden and the local growth pattern between 1990 and 2007

As mentioned in the introduction, in Sweden the local governments are the main providers of child care, primary and secondary schooling, care for the elderly and other social care. These services are primarily financed through a proportional local income tax, which the local authorities are free to adjust. This means that changes at the local level in average income growth and net migration, in combination with changes in employment rates, affect the local per capita tax base and, consequently, the local authority's ability to finance the public services they are obliged by the central government to provide. To equalize local per capita tax bases, the central government has tried in various ways to equalize economic opportunities across regions by implementing a redistribution system and providing targeted subsidies to the private sector. For instance, grant-in-aid provisions for the regional and local public sector have been introduced to compensate regions and municipalities with relatively small per capita tax bases, together with location and transportation subsidies to stimulate the local private sector. In addition, the national government has tried to improve the balance of local conditions through the strategic location of national institutions, such as large numbers of new university colleges, and re-location of government agencies. Although it seems reasonable to believe that the location of new universities has had a significant impact on individual municipalities, it has been difficult to find empirical evidence of any effect of this policy on average income growth, see Lundberg (2003).

Despite these efforts, as in many other countries, the regional disparities in local per capita tax bases and hence average income levels, income growth, net migration and unemployment rates have been, and remain, substantial.

The geographical distribution of relative local per capita tax bases in 2007 is shown in Figure 1. Figure 1 illustrates the geographical disparities in local per capita tax bases (in 2007) in relative values, ranging from 1 (for Årjäng, the municipality with the lowest relative tax base) to 2.12 (for Danderyd, the municipality with the highest relative tax base, 2.12-fold higher than that of Årjäng).

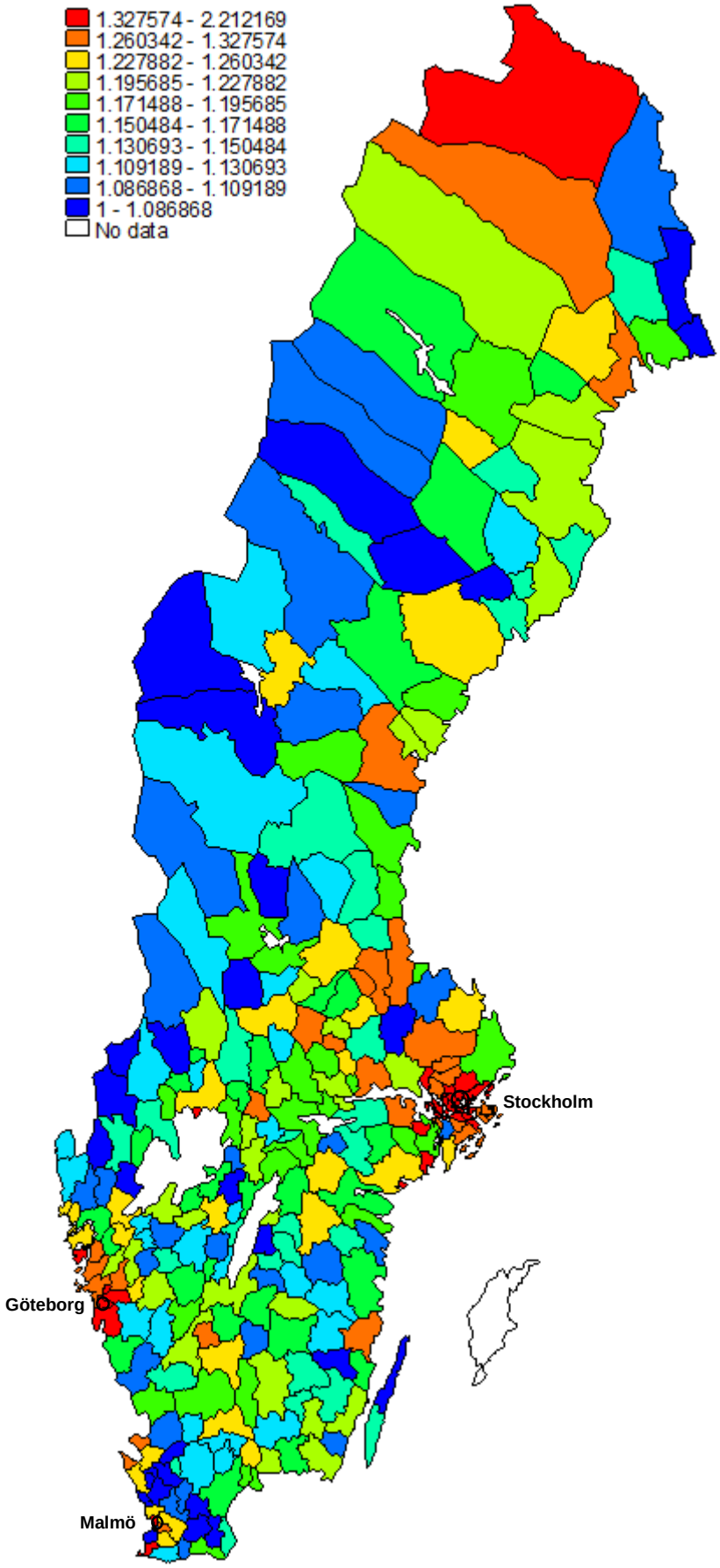

Figure 1: Relative per capita tax bases of Swedish municipalities, 2007

Municipalities with high per capita tax bases are clearly clustered in the highly urbanized areas of Stockholm, Göteborg and Malmö, as well as the most northerly county, Norrbotten, while municipalities with the smallest per capita tax bases are concentrated in western parts of Sweden.
It also shows that unemployment rates are highest and net immigration rates lowest in the already sparsely populated northern areas (such as Norrbotten, Västerbotten, and Värmland), while the situation is reversed in Stockholm and the surrounding area.

A key question is whether the disparities illustrated in Figure 1 have remained constant in recent decades, or local per capita tax bases have tended to converge (or diverge). To assess these possibilities, the correlation between the relative per capita tax bases of the municipalities in 1992 and 2007 is shown in Figure 2. The municipalities with the highest relative tax bases in 1992 (about 2.5 times higher than the lowest) still had the highest relative tax base in 2007 (2.2 times higher than the lowest). The large number of observations below and to the right of the 45 degree line suggests that the distribution in local per capita tax bases has become more compressed over time, i.e. the disparities in local per capita tax bases have decreased. Moreover, the correlation between initial per capita tax bases in 1992 and subsequent per capita tax base growth between 1992 and 2007 (Figure 3) suggests convergence over time, i.e. tax base growth since 1992 has been relatively low in municipalities with initially high relative per capita tax bases and vice versa. A simple OLS regression of initial per capita tax base in 1992 against local per capita tax base growth between 1992 and 2007 shows that this negative correlation is highly significant (*t*-value, -10.98) but very weak, with a parameter estimate of -0.011 (over 15 years), equating to an annual convergence rate of 0.07 percent.

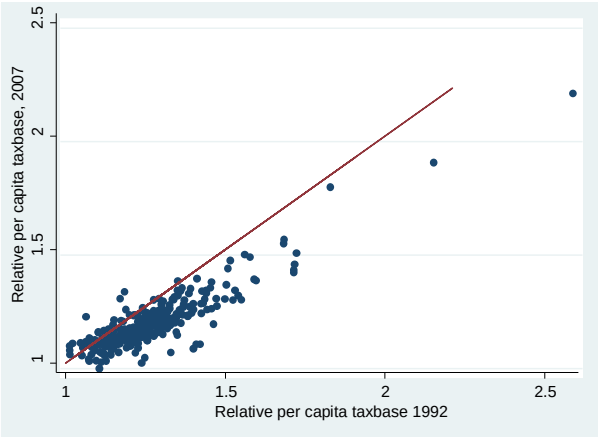

Figure 2: Correlation between the municipalities' relative per capita tax bases in 1992 and 2007

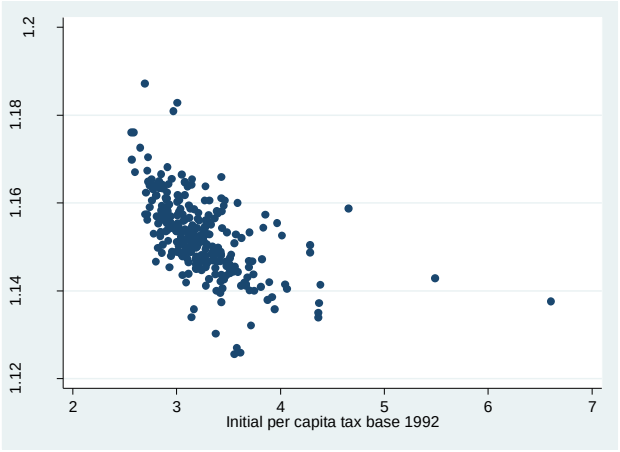

Figure 3: Correlation between the municipalities' relative per capita tax bases in 1992 (in logarithm) and subsequent growth in their per capita tax bases during 1992-2007

3. Empirical set up

Although the descriptive statistics presented and discussed above are interesting, they provide little indication of the processes responsible for the disparities. One way to broaden the analysis and acquire a better understanding of the determinants of local per capita tax base growth is to analyze effects of factors influencing specific components of the local tax base. Thus, here we examine potential determinants of average income growth, net migration and changes in unemployment rates. For instance, Aronsson *et al.* (2001) and Lundberg (2003) divided local tax base growth into two components, the average growth of income among the employed and net migration[1], thereby enabling exploration of correlations between parameter estimates of the average income growth equation and changes in both labor supply and the composition of the labor force. Fagerberg *et al.* (1997) took the decomposition a step further, suggesting that three components (average income growth, net migration and employment growth) are interdependent. They argued that relatively high average income growth is likely to lead to more jobs, thereby enhancing economic opportunities generally, and both net immigration and employment rates specifically. They assumed that migration influences income growth through its effects on labor supply and the composition of the labor force, expecting the relative productivity of immigrants (their endowments of human capital) to be positively related to the subsequent average income growth rate. Thus, Fagerberg *et al.* (1997) simultaneously estimated a three-equation system with average income growth, net migration and employment growth as endogenous variables.

Here, we estimate a system of three equations using the average income growth rate, net migration rate and changes in the unemployment rate as endogenous variables. By examining determinants of

[1] Net migration was used as a measure of population change.

these three variables simultaneously we take the analysis of Aronsson *el al.* (2001) and Lundberg (2003) a step further. We also apply a less structural approach than Fagerberg *et al.* (1997), while still taking the interdependence between average income growth, net migration rate and changes in the unemployment rate into account. That is, our goal is to recover key parameters of interest using exogenous within-sample variation with as few structural assumptions as possible. More formally, using $y_{i,t}$, $m_{i,t}$, $u_{i,t}$ and $x_{i,t-T}$ to denote the average income growth rate in municipality i between times $t-T$ and t, the net migration rate, the change in the unemployment rate, and a vector of relevant explanatory variables at time $t-T$, respectively, we simultaneously estimate the following system of equations:

$$y_{i,t} = f^{y}(x_{i,t-T}) \qquad (1a)$$

$$m_{i,t} = f^{m}(x_{i,t-T}) \qquad (1b)$$

$$u_{i,t} = f^{u}(x_{i,t-T}) \qquad (1c)$$

Before presenting the full empirical model to be estimated, let us discuss factors that are potentially important determinants of local per capita tax base growth, i.e. the factors that should be included in $x_{i,t-T}$.

In an early paper Helms (1985) found that increases in local public consumption and redistribution negatively affect the subsequent growth rate while investments in roads, communication and human capital have positive effects. This suggests that different types of local public expenditures may have different effects. Other studies that have considered effects of local and national policy decisions include, among others, Glaeser *et al.* (1995) and Aronsson *et al.* (2001). To analyze effects of allocations of local government budgets between different locally provided public services on subsequent local growth patterns, the shares of local public expenditures on childcare, education, family care, care for the elderly, and culture and recreational services are included in the x vector. Local public expenditures on rescue services, business activities, and subsidies to political parties and the political process, are excluded and thus constitute the reference case. Based on Helms' results, it seems reasonable to expect, *a priori*, investments in human capital (expenditures on education) along with child and elderly care expenditures (which allow the working population to work longer hours) to have a positive effect on the subsequent average income growth and reduce unemployment. The other expenditure shares may have either positive or negative effects. In order to control for the size of the local public sector per capita, total local public expenditures and the initial local income tax

rate[2] (measured as the sum of municipal and county rates) are included. In general, total public expenditures could have a positive effect on employment as labor is needed to provide public services. The tax rate may also reflect incentives to supply labor. However, public expenditures could also crowd out private investments, thereby reducing subsequent average income growth and employment rates, in accordance with Helms' finding that increases in taxes negatively affect growth.

Various proxies for "economic opportunities", such as the initial average income level, endowments of human capital and unemployment rates have been used as explanatory variables in growth regressions, for instance by Treyz *et al.* (1993), Westerlund and Wyzan (1995), Fagerberg *et al.* (1997), Aronsson *et al.* (2001), and Davies *et al.* (2001). A negative correlation between the initial income level and subsequent income growth rate is taken as evidence in favor of the conditional income convergence hypothesis. High average income levels and high endowments of human capital often signal social stability, making regions with these features attractive for migrants, and thus suggesting a positive correlation between these variables and subsequent net immigration rates. Moreover, the shares of the population with relatively high educational levels are expected to be positively correlated with the subsequent growth rate. However, previous studies have noted that apparent effects of educational levels may vary depending on the measures used, see for instance Di Liberto (2008), Barro and Lee (1994), Islam (1995), Pérez, *et al.* (1996), Pérez and Serrano (1998), Petrakis and Stamatakis (2002), and Pereira and Aubyn (2009). Therefore, following Lundberg (2003) we have included two measures of education: the initial share of the population with secondary education but less than three years of postsecondary education and the initial share of the population with more than three years of postsecondary education. The reference case is then the share of the population with secondary education or less. Employment (or unemployment) rates may be considered as indicators of the probability that a potential migrant would receive the average income level in a specific region. Hence, the initial unemployment rate is expected to be negatively correlated with both subsequent net immigration and average income growth rates.

Another potentially important determinant of economic growth we have included is the political stability in the local parliament (Barro, 1991; Glaeser *et al.,* 1995), which is expected to have a positive impact on the growth rate (Roubini and Sachs, 1989a, 1989b; Alesina and Perotti 1995; Alesina *et al.*, 1996). In addition, we control for the percentage of seats in the local parliament held by liberal and conservative parties and the municipalities' demographic structure. Finally, Westerlund and Wyzan (1995) found indications of differences in migration patterns between the major city areas and the rest of Sweden, implying important structural differences across regions. Therefore, a

[2] Tax rates may also reflect incentives to supply labor.

distinction is made between the major city areas (Stockholm, Göteborg and Malmö) and the rest of the country. The data set used, definitions of the variables, and full specifications of the empirical model to be estimated are presented in the next section.

4. Data source, variable definitions and empirical specification

The data used in this paper originate from Statistics Sweden (SCB) spanning from 1992 to 2007. During that period, the number of municipalities varied from 286 in 1992 to 290 in 2007. Gotland is excluded as the county and municipal levels coincide, making it difficult to separate county and municipal expenditures. In total, our estimates are based on 1,710 observations.[3]

Starting with the three dependent variables, the average income growth rate ($y_{i,t}$) is defined as $\ln(Y_{i,t}/Y_{i,t-T})$, where $Y_{i,t}$ is the average income in year t of people aged 20 or above in municipality *i*. Here, $T=10$ years. This seems a reasonable time interval in which to evaluate effects of the selected policy variables on local growth, migration rates and unemployment rates, which may only become fully apparent after substantial time (often many years). Thus, in previous empirical studies on regional growth the applied datasets have been divided into similar time intervals, for instance 5 years (Aronsson *et al.,* 2001), 9 years (Lundberg, 2005) or ≥ 10 years (Persson, 1997; Rey and Montori, 1999).

Net immigration between $t-T$ and t is defined as $m_{i,t}=\left(\sum_{l=t-T}^{l=t} mig_{i,l}\right)/\, pop_{i,t-T}$, where mig is the net number of immigrants and pop is the total population. Changes in the unemployment rate ($u_{i,t}$) are expressed as $\ln\left(Unemp_{i,t}/Unemp_{i,t-T}\right)$, where $Unemp$ is the number of unemployed divided by the population aged 25 to 64.

Initial endowments of human capital are captured by two variables: the share of the population aged 25 to 64 with less than 3 years post-secondary education ($Edulow_{i,t-T}$), and the share of the population aged 25 to 64 with more than 3 years post-postsecondary education ($Eduhigh_{i,t-T}$). Local policy variables are represented by the shares of local public expenditures allocated to: child care ($Exchil_{i,t-T}$); elementary, high school, and adult education ($Exedu_{i,t-T}$); family care, family counseling, care and treatment of addiction, alcohol counseling etc. ($Exfam_{i,t-T}$); elderly care

[3] We have information on 283 municipalities from 1990 to 1994, 287 municipalities from 1995 to 1998, 288 municipalities from 1999 to 2002, and 288 municipalities from 2003 to 2007. As we use data from 1990 and 1991 only as instruments, the total number of observations in our data is 2,276 while the second stage regression is based on 1,710 observations.

($Exeld_{i,t-T}$); cultural and recreational services ($Excul_{i,t-T}$); per capita total local public expenditures ($Exp_{i,t-T}$); and the local income tax rate ($Tax_{i,t-T}$). As mentioned above, local public expenditures on rescue services, business activities, and subsidies to political parties and the political process are excluded and therefore constitute the reference case.

Political fragmentation in the local council is captured by a Herfindahl index ($Herf_{i,t-T}$), defined as $\sum_{p=k}^{P} SH_p^2$, where SH_p is the share of representatives from party p in the local parliament. Political ideology is measured by the share of the seats in the local parliament held by representatives of the liberal and conservative parties, defined here as the Conservative party, Liberal party, Christian Democratic party, and the Center party ($Cons_{i,t-T}$). Demographic characteristics are controlled for by including the shares of the population aged 0 to 6 ($Age06_{i,t-T}$), 7 to 15 ($Age715_{i,t-T}$), more than 65 ($Age65_{i,t-T}$), and the population density ($Dens_{i,t-T}$). All monetary variables are deflated by consumer prices index using 2005 as base year.

Table A1 in the Appendix provides more detailed definitions, Table A2 presents descriptive statistics and Table A3 displays a correlation matrix of all variables for 1992-2007, which clearly shows that the municipalities' expenditure shares are correlated with the population shares. The correlations are especially high between $Age06_{i,t-T}$ and $Age65_{i,t-T}$, as well as between the expenditure shares $Exchil_{i,t-T}$ and $Exeld_{i,t-T}$. This might be problematic from an econometric perspective, because if all these variables were included in the same regression it would be difficult to accurately estimate the parameters. We will return to this issue when we discuss the results in section 5.

Based on the discussion in Section 3, and the above definitions of the variables, the average income growth, net migration, and changes in unemployment rates are assumed to develop according to:[4]

[4] We use a log model because it is not affected by the scale of the independent variables when estimating relative changes in dependent variables. Taking logs also reduces extrema in the data and effects of outliers.

$$
\begin{aligned}
&y_{i,t} = \\
&(\alpha_i^y + \alpha_d^y D) + (\beta^y + \beta_d^y D)\ln Y_{i,t-T} + (\gamma_{un}^y + \gamma_{un,d}^y D)\ln Unemp_{i,t-T} + (\gamma_{tax}^y + \gamma_{tax,d}^y D)\ln Tax_{i,t-T} + \\
&(\gamma_{\exp}^y + \gamma_{\exp l,d}^y D)\ln Exp_{i,t-T} + (\gamma_{cul}^y + \gamma_{cul,d}^y D)\ln Excul_{i,t-T} + (\gamma_{edu}^y + \gamma_{edu,d}^y D)\ln Exedu_{i,t-T} + \\
&(\gamma_{chil}^y + \gamma_{chil,d}^y D)\ln Exchil_{i,t-T} + (\gamma_{fam}^y + \gamma_{faml,d}^y D)\ln Exfam_{i,t-T} + (\gamma_{eld}^y + \gamma_{eld,d}^y D)\ln Exeld_{i,t-T} + \\
&(\gamma_{low}^y + \gamma_{low,d}^y D)\ln Edulow_{i,t-T} + (\gamma_{high}^y + \gamma_{high,d}^y D)\ln Eduhigh_{i,t-T} + (\gamma_{cons}^y + \gamma_{cons,d}^y D)\ln Cons_{i,t-T} + \\
&(\gamma_{herf}^y + \gamma_{herf,d}^y D)\ln Herf_{i,t-T} + (\gamma_{a06}^y + \gamma_{a06,d}^y D)\ln Age06_{i,t-T} + (\gamma_{a715}^y + \gamma_{a715,d}^y D)\ln Age715_{i,t-T} + \\
&(\gamma_{a65}^y + \gamma_{a65,d}^y D)\ln Age65_{i,t-T} + (\gamma_{dens}^y + \gamma_{dens,d}^y D)\ln Dens_{i,t-T} + \varepsilon_{i,t}^y
\end{aligned}
\tag{2a}
$$

$$
\begin{aligned}
&m_{i,t} = \\
&(\alpha_i^m + \alpha_d^m D) + (\beta^m + \beta_d^m D)\ln Y_{i,t-T} + (\gamma_{un}^m + \gamma_{un,d}^m D)\ln Unemp_{i,t-T} + (\gamma_{tax}^m + \gamma_{tax,d}^m D)\ln Tax_{i,t-T} + \\
&(\gamma_{\exp}^m + \gamma_{\exp l,d}^m D)\ln Exp_{i,t-T} + (\gamma_{cul}^m + \gamma_{cul,d}^m D)\ln Excul_{i,t-T} + (\gamma_{edu}^m + \gamma_{edu,d}^m D)\ln Exedu_{i,t-T} + \\
&(\gamma_{chil}^m + \gamma_{chil,d}^m D)\ln Exchil_{i,t-T} + (\gamma_{fam}^m + \gamma_{faml,d}^m D)\ln Exfam_{i,t-T} + (\gamma_{eld}^m + \gamma_{eld,d}^m D)\ln Exeld_{i,t-T} + \\
&(\gamma_{low}^m + \gamma_{low,d}^m D)\ln Edulow_{i,t-T} + (\gamma_{high}^m + \gamma_{high,d}^m D)\ln Eduhigh_{i,t-T} + (\gamma_{cons}^m + \gamma_{cons,d}^m D)\ln Cons_{i,t-T} + \\
&(\gamma_{herf}^m + \gamma_{herf,d}^m D)\ln Herf_{i,t-T} + (\gamma_{a06}^m + \gamma_{a06,d}^m D)\ln Age06_{i,t-T} + (\gamma_{a715}^m + \gamma_{a715,d}^m D)\ln Age715_{i,t-T} + \\
&(\gamma_{a65}^m + \gamma_{a65,d}^m D)\ln Age65_{i,t-T} + (\gamma_{dens}^m + \gamma_{dens,d}^m D)\ln Dens_{i,t-T} + \varepsilon_{i,t}^m
\end{aligned}
\tag{2b}
$$

$$
\begin{aligned}
&u_{i,t} = \\
&(\alpha_i^u + \alpha_d^u D) + (\beta^u + \beta_d^u D)\ln Y_{i,t-T} + (\gamma_{un}^u + \gamma_{un,d}^u D)\ln Unemp_{i,t-T}(\gamma_{tax}^u + \gamma_{tax,d}^u D)\ln Tax_{i,t-T} + \\
&(\gamma_{\exp}^u + \gamma_{\exp l,d}^u D)\ln Exp_{i,t-T} + (\gamma_{cul}^u + \gamma_{cul,d}^u D)\ln Excul_{i,t-T} + (\gamma_{edu}^u + \gamma_{edu,d}^u D)\ln Exedu_{i,t-T} + \\
&(\gamma_{chil}^u + \gamma_{chil,d}^u D)\ln Exchil_{i,t-T} + (\gamma_{fam}^u + \gamma_{faml,d}^u D)\ln Exfam_{i,t-T} + (\gamma_{eld}^u + \gamma_{eld,d}^u D)\ln Exeld_{i,t-T} + \\
&(\gamma_{low}^u + \gamma_{low,d}^u D)\ln Edulow_{i,t-T} + (\gamma_{high}^u + \gamma_{high,d}^u D)\ln Eduhigh_{i,t-T} + (\gamma_{cons}^u + \gamma_{cons,d}^u D)\ln Cons_{i,t-T} + \\
&(\gamma_{herf}^u + \gamma_{herf,d}^u D)\ln Herf_{i,t-T} + (\gamma_{a06}^u + \gamma_{a06,d}^u D)\ln Age06_{i,t-T} + (\gamma_{a715}^u + \gamma_{a715,d}^y D)\ln Age715_{i,t-T} + \\
&(\gamma_{a65}^u + \gamma_{a65,d}^u D)\ln Age65_{i,t-T} + (\gamma_{dens}^u + \gamma_{dens,d}^u D)\ln Dens_{i,t-T} + \varepsilon_{i,t}^u
\end{aligned}
\tag{2c}
$$

Here, the α's , β's and γ's are parameters to be estimated, and the ε's are error terms, in ten-year windows with $T = 10$ years and $t = 2004,2005,2006$, and *2007*. D is a dummy variable taking the value 1 for the major city areas, otherwise zero. This specification gives different parameter estimates for the major city areas compared with the rest of the country, in accordance with previous findings using Swedish data, see Westerlund and Wyzan (1995).

This set up allows various hypotheses to be easily tested. For instance, $\beta^y < 0$ indicates that the conditional convergence hypothesis is valid for municipalities outside of the major city areas Stockholm, Göteborg and Malmö, while $\beta^y + \beta_d^y < 0$ is consistent with conditional convergence in the major city areas.

Equations (2a), (2b) and (2c) are estimated by applying an unbalanced fixed effects panel data approach[5] using three-stage least squares (3SLS) regression. As model (2a) includes the initial income per capita as an explanatory variable, it cannot be estimated consistently with OLS, due to endogeneity problems associated with correlations between the lagged dependent variable and the fixed effects. Therefore, the three equations are simultaneously estimated via 3SLS. The instrumentation of $Y_{i,t-T}$ is influenced by Arellano and Bond (1991) and more generally by Baltagi (1995), which essentially involves using lagged variables as instruments, with efficiency gained by expanding the set of instruments over time. That is, $Y_{i,t-2}$ and $Y_{i,t-3}$ are used as instruments for $Y_{i,t}$; $Y_{i,t-1}$, $Y_{i,t-2}$ and $Y_{i,t-3}$ as instruments for $Y_{i,t+1}$ and so on. This procedure exploits the validity of using $Y_{i,t-2}$, $Y_{i,t-3}$,…, as instruments for the lagged dependent variable $Y_{i,t}$ that generate consistent and efficient estimates of the parameters of interest.

5. Results

Parameter estimates of the three equations (2a), (2b) and (2c) are presented in Table 1. The "Basic" and "Major city" columns respectively show estimated parameters of the indicated variables for municipalities located outside the major city areas (Stockholm, Göteborg and Malmö), and the major city areas (the latter calculated as the sum of the "Basic" and the "Dummy" estimates of the respective variables). In the following text, the data presented in parentheses are the parameters obtained and corresponding *t*-values.

Let us start by discussing conditional convergence, which should be reflected (if present) in a negative parameter for the relationship between the initial average income level (Y) and subsequent average income growth (y). According to the estimates in Table 1, the initial average income is significantly, negatively related to the subsequent average income growth (-0.570, *t*-value -5.34) for municipalities outside the major city areas. That is, among these municipalities, those with relatively low initial income levels tend to grow faster, *ceteris paribus*, than municipalities with relatively high initial income levels, conditional on the other explanatory variables in the model. This result also holds for the major city areas (the sum of the "Basic" and "Dummy" parameter estimates is -0.483, *t*-value -7.13). These results are consistent with findings of previous studies based on both Swedish data (e.g. Persson, 1997; Aronsson *et al.*, 2001; Lundberg, 2003), and data on U.S. states (e.g. Barro and Sala-i-Martin, 1992, 1995). Our results suggest a convergence rate of about 5% per year, faster than rates frequently reported in the growth literature. One reason for this could be the inclusion of

[5] This approach allows us to control for all unit-specific factors whether observable or unobservable that are constant over time. Including lagged dependent variables in a model can also control to a large extent for many omitted variables.

fixed effects in addition to other covariates, which also implies that each municipality is converging at a specific rate, rather than the average rate within the country.

Table 1: Estimated parameters for relationships between the indicated variables

	BASIC	MAJOR CITY	BASIC	MAJOR CITY	BASIC	MAJOR CITY
Dependent variable	$y_{i,t}$		$m_{i,t}$		$u_{i,t}$	
$Y_{i,t-T}$	-0.570 (-5.34)	-0.483 (-7.13)	0.287 (2.99)	0.172 (2.83)	0.457 (1.09)	0.154 (0.58)
$Unemp_{i,t-T}$	0.065 (5.90)	0.044 (6.49)	-0.009 (-3.09)	-0.004 (-0.75)	0.376 (8.67)	0.432 (16.06)
$Tax_{i,t-T}$	-0.053 (-0.50)	0.006 (0.09)	-0.240 (-2.52)	-0.153 (-2.53)	0.050 (0.12)	0.062 (0.23)
$Exp_{i,t-T}$	-0.052 (-1.80)	-0.030 (-1.74)	-0.052 (-2.02)	-0.030 (-1.97)	0.112 (1.00)	0.60 (0.89)
$Excul_{i,t-T}$	0.003 (0.29)	0.000 (0.05)	-0.006 (-0.57)	-0.002 (-0.27)	0.001 (0.01)	-0.004 (-0.13)
$Exedu_{i,t-T}$	-0.048 (-2.20)	-0.027 (-2.09)	-0.033 (-1.66)	-0.018 (-1.55)	0.096 (1.11)	0.052 (1.01)
$Exchil_{i,t-T}$	-0.057 (-3.31)	-0.033 (-3.21)	-0.011 (-0.72)	-0.005 (-0.52)	0.030 (0.45)	0.025 (0.61)
$Exfam_{i,t-T}$	-0.006 (-0.91)	-0.004 (-0.99)	-0.010 (-1.64)	-0.007 (-1.87)	-0.001 (-0.04)	0.001 (0.08)
$Exeld_{i,t-T}$	0.019 (1.34)	0.006 (0.68)	-0.005 (-0.36)	-0.003 (-0.36)	-0.064 (-1.13)	-0.046 (-1.29)
$Edulow_{i,t-T}$	-0.046 (-1.36)	-0.026 (-1.28)	-0.082 (-2.71)	-0.074 (-4.01)	0.084 (0.64)	0.068 (0.85)
$Eduhigh_{i,t-T}$	0.131 (2.34)	0.067 (2.05)	0.075 (1.50)	0.029 (1.00)	-0.776 (-3.54)	-0.467 (-3.63)
$Cons_{i,t-T}$	0.001 (0.08)	-0.007 (-0.76)	0.046 (3.13)	0.023 (2.69)	0.000 (0.00)	0.026 (0.68)
$Herf_{i,t-T}$	0.013 (0.64)	0.011 (0.83)	-0.028 (-1.48)	-0.013 (-1.10)	0.051 (0.62)	0.028 (0.55)
$Age06_{i,t-T}$	-0.259 (-4.87)	-0.166 (-5.18)	0.101 (2.11)	0.069 (2.38)	0.023 (0.11)	0.027 (0.22)
$Age715_{i,t-T}$	-0.060 (-0.91)	-0.042 (-1.07)	-0.014 (-0.23)	-0.011 (-0.32)	0.324 (1.25)	0.152 (0.98)
$Age65_{i,t-T}$	0.168 (2.12)	0.102 (2.05)	-0.014 (-0.20)	0.027 (0.61)	-0.470 (-1.51)	-0.235 (-1.20)
$Dens_{i,t-T}$	0.269 (3.18)	0.219 (4.26)	0.272 (3.57)	0.081 (1.75)	0.041 (0.12)	-0.040 (-0.20)
# of observations	1710		1710		1710	

Note: t-values in parentheses.

For further interpretation, it is useful to examine effects of the initial average income level (Y) on subsequent net migration rates (m) and changes in unemployment rates (u). Our results suggest

that the initial average income level is positively related to the subsequent net migration rate for municipalities located both outside and in the major city areas (0.287, *t*-value 2.99 and 0.172, *t*-value 2.83, respectively), indicating that high average income levels make municipalities more attractive tomigrants. If individuals generally migrate to areas with high average income levels (areas with high per capita productivity), the labor supply in those areas will increase, thereby negatively affecting the subsequent average income growth rate, provided there are no significant differences in other determinants. Hence, this suggests that labor mobility may contribute to the equalization of average income levels across municipalities as the labor force tends to migrate to municipalities with high average incomes. The speed of convergence (or equalization) could also be affected if the labor mobility affects the composition of the labor force. For instance, if those who migrate to relatively high income municipalities are less productive (e.g. have lower human capital)[6] than those who stay, the per capita productivity will decrease in municipalities with initially high average incomes, but increase in municipalities with initially low average incomes. This could partly explain the relatively high convergence rate we find across Swedish municipalities. Our model does not predict any significant relationship between the initial average income and subsequent changes in unemployment rates. Two other factors that may contribute to convergence, proposed by Aronsson *et al.*, relate to high capital mobility and the Swedish system for setting wages, which may make municipalities more homogeneous over time and compress the wage distribution, respectively

The initial unemployment rate could be seen as an indicator of economic opportunities and future earning possibilities. The parameter estimates presented in Table 1 suggest that the initial unemployment rate $(Unemp)$ is significantly positively related to the subsequent average income growth (y) for municipalities both outside and in the major city areas (0.065, *t*-value 5.90 and 0.044, *t*-value 6.49, respectively). This suggests that average income growth rates tend to be higher in municipalities with high initial unemployment rates than in other municipalities. For further interpretation the relationships between the initial unemployment rate $(Unemp)$ and the subsequent net migration rate (m) and changes in unemployment rates (u) provide useful indications. Our model predicts that the initial unemployment rate $(Unemp)$ is negatively related to the subsequent net migration rate (m), in accordance with findings by Aronsson *et al.* (2001). The estimated parameter for this negative effect is only significant for municipalities outside the major city areas. However, we can take the analysis one step further than Aronsson *et al.* by incorporating the relationship between $(Unemp)$ and (u). The results presented in Table 1 suggest that these

[6] Here, human capital includes both work experience and formal education. In Sweden, as in many other countries, the propensity to migrate across municipal borders decreases with age. Hence, among those who migrate individuals with low work experience are likely to be overrepresented.

variables are highly significantly and positively correlated (0.376, *t*-value 8.67 and 0.432, *t*-value 16.06, respectively), indicating that growth in unemployment tends to be higher in municipalities with high initial unemployment rates than in other municipalities. One potential interpretation of the negative relationship between $(Unemp)$ and (m) (at least outside the major city areas), in combination with the positive correlation between $(Unemp)$ and (u), is that most individuals who tend to migrate from municipalities with initially high unemployment rates are employed, leading to increased unemployment rates within these areas. At the same time there seems to be a mismatch in the local labor markets. That is, as employed individuals tend to emigrate from areas with initially high unemployment rates the prospects for previously unemployed individuals finding employment should increase. However, if the skills of the unemployed do not match those required in the local labor market the emigration of employed individuals will reduce the labor supply and, consequently, raise incomes of employed individuals who have remained, as indicated by the positive correlation between $(Unemp)$ and (y). This interpretation is consistent with the positive (and highly significant) correlation between the initial unemployment rate and subsequent changes in unemployment rates. Hence, the work opportunities of those that remain deteriorate.

Turning to local policy variables, the local income tax rate is a factor that might influence migration between municipalities located in densely populated areas near the major cities, where a decision to move does not necessarily mean that the individual changes his/her place of work or social network. The local income tax rate may also crowd out private investments and thus have a negative effect on the subsequent average income growth. Our results do not provide any evidence suggesting that the initial income tax rate affects the subsequent average income growth significantly. However, our results suggest a negative relationship between the initial local income tax rate (Tax) and the subsequent net migration rate (m) for both municipalities outside the major city areas (-0.240, *t*-value -2.52) and municipalities in the major city areas (-0.153, *t*-value -2.53). No significant correlation is found between (Tax) and (u). Thus, we conclude the initial income tax rate is negatively related to the subsequent net migration rate but has no significant effects on either (y) or (u). A possible explanation is that the composition of the labor force is unaffected by the net emigration caused by high income tax rates.

From a theoretical perspective, local public expenditures could have either positive or negative effects on the subsequent growth rate. Results presented by Helms (1985) suggest that public investments in roads and education enhance growth while local public consumption crowds out private initiatives and hence negatively affects growth. Our model indicates that initial local public expenditures per capita (Exp) are negatively related to subsequent net migration rates (m) for both

the major city areas (-0.030, *t*-value -1.97) and the rest of the country (-0.052, *t*-value -2.02), but has no significant effect on either the subsequent average income growth (y) or changes in unemployment rates (u). In terms of Helms' interpretations, this suggests that local public expenditures in Sweden are a mixture of investments in human capital and local public consumption, leaving both the subsequent average income growth rate and changes in unemployment unaffected. If increased public expenditure reduces average income growth, for which we have weak evidence, this might be due to the crowding-out effect that Helms also refers to (or other disincentives during revenue collection). In turn, lower income growth may signal worse employment prospects in the future, leading to emigration. This result is consistent with the findings of Fagerberg *et al.* (1996). Our results also indicate that although high initial local public expenditures tend to lead to net emigration, they may have little effect on the composition of the labor force.

It is of interest to consider whether, and if so to what extent, expenditure allocations by the local government affect subsequent growth patterns. Our results indicate that the shares of local public expenditure on cultural activities $(Excul)$, family care $(Exfam)$ and care for the elderly $(Exeld)$ have no significant effects on the subsequent growth pattern. However, shares of local public expenditures on both education $(Exedu)$ and child care $(Exchil)$ appear to be negatively related to subsequent average income growth (y). These results are surprising, as expenditures on both child care and education[7] could be viewed as investments in future productivity and thus are expected to enhance subsequent average income growth. A potential explanation is that these expenditures may also reflect social disparities between municipalities. In support of this hypothesis, the local public sector was the main provider of child care and both primary and secondary education during the study period, and although local authorities enjoy considerable autonomy from the central government, child care and education were (and are) highly regulated by national authorities. Thus, municipalities with "unfavorable" socio-economic backgrounds may have higher child care and school expenditures than other municipalities. That is, in order to achieve the standards set by national authorities, local public expenditures on child care and education might reflect socio-economic differences between municipalities. In addition, the findings could be due to a potential labor supply effect of children, i.e., parents of small and school-aged children cannot work as long hours as adults with no children. Moreover, as correctly pointed out by Aronsson *et al.* (2001), it is generally difficult to interpret such results as local public expenditures and local income tax rates not only reflect current service levels, but may also give signals of future local policies. In fact, neither

[7] Remember that expenditures on education are measured as elementary, high school and adult education except university education.

the counties nor the municipalities were required to balance their budgets every year during the study period, making it difficult to form expectations in advance about their effects on the subsequent local growth pattern.[8] Considering the impact of $(Exchil)$ on the net migration rate (m) and unemployment rate (u) gives no further guidance for the interpretation of these results. Nor do our results indicate any significant correlations between expenditures on elderly care $(Exeld)$ and average rates of growth (y), migration (m) or unemployment (u). These rather contradictory results may be explained by the lack of the ability, using our data, to evaluate how the quality of care and education provisions for children ($Exchil$ and/or $Exedu$) in particular municipalities influence decisions of potential emigrants to remain in them. Given this inability, and lacking other plausible hypotheses, we simply conclude that our results indicate that local public expenditures and local income tax rates are negatively related to the local growth rate.

As mentioned in section 4 and displayed in Table A3, $Age06_{i,t-T}$ and $Age65_{i,t-T}$ are highly correlated with the expenditure shares $Exchil_{i,t-T}$ and $Exeld_{i,t-T}$, respectively. Although this is not surprising, it might be problematic from an econometric perspective as it makes it more difficult to accurately estimate parameters for these variables. We have tested the relationships using models with different specifications, excluding all expenditure shares, some of the expenditure shares, and the age distribution, etc. However, none of the variations significantly affected the signs of the parameter estimates or their significance level (data not shown).

The endowments and formation of human capital are often seen as major determinants of economic growth and wealth. Human capital is a complex concept and includes several unobservable components, but in empirical growth models it is often measured as the share of the population with a certain type of formal education, such as a university degree. For instance, results presented by Di Liberto (2008), Barro and Lee (1994), Islam (1995), Pérez *et al.* (1996), Pérez and Serrano (1998), Petrakis and Stamatakis (2002), and Pereira and Aubyn (2009) suggest that different levels of formal education have different effects on the subsequent growth pattern. Here, we use two measures: the share of the population aged 25 to 64 with less than 3 years post-postsecondary education $(Edulow)$, and the share of this population with more than 3 years post-postsecondary education $(Eduhigh)$. Although Sweden could be regarded as a highly educated country, in comparison to many other countries, there are large regional disparities in levels of formal education. Shares of the population with at least three years postsecondary education are highest in or close to the major city areas and lowest in rural areas. The results presented in Table 1 suggest a

[8] Balanced budget requirements were imposed in 2000.

negative relationship between $(Edulow)$ and (m), but no significant correlations between $(Edulow)$ and either (y) or (u). On the other hand, our model indicates a significantly positive relationship between $(Eduhigh)$ and the subsequent average income growth rate (y), and a significantly negative relationship between $(Eduhigh)$ and subsequent changes in the unemployment rate (u). These findings indicate that different levels of education have different impacts on the subsequent growth rate. Higher education appears to have positive effects,[9] as the share of the population with at least three years of university education is positively related to the subsequent growth pattern. In contrast, the share of the population with only a secondary education is negatively related to the subsequent net migration rate. The latter result conflicts with findings presented by Aronsson *et al.* (2001) and Lundberg (2006), that human capital has no effect on subsequent net migration. To explore these relationships in more detail it would be interesting to differentiate between types of education, but we do not have access to pertinent information.

Other potentially important determinants of economic growth we tested are the political composition and stability of the local council. The results suggest that our indicator of political representation — the share of seats in the local parliament held by members of the Conservative Party, Centre Party, Liberals and Christian Democrats $(Cons)$ — is positively related to subsequent immigration (m) both inside and outside the major city areas (0.046, *t*-value 3.13 and 0.023, *t*-value 2.69, respectively), but has no significant effects on either (y) or (u). Given that conservatives and social democrats often collaborate at the local government level, the political agenda is in many respects different at the local level compared to the national level. In addition, our controls of effects of factors such as the initial average income level, endowments of human capital, income tax rates and local public expenditures exclude explanations for this result based on them. One tempting interpretation is that conservatives and liberals generally favor private initiatives and private entrepreneurs more strongly than their political opponents, but we do not have empirical support to confirm such an interpretation. In contrast to political representation, our model indicates that political stability, measured using a Herfindahl-index $(Herf)$, has no significant effect on the subsequent growth rate. This conflicts with findings of several previous studies.

Finally, according to our estimates the measures of socio-economic and demographic structure mainly affect the subsequent average income growth and net migration rate. The initial share of

[9] We have further examined this relationship by using different definitions of human capital and higher education. When we combine *Eduhigh* and *Edulow* into a single variable we find no significant effect of formal education on subsequent growth.

inhabitants aged 0-6 $(Age06)$ is negatively correlated with (y) and positively correlated with the net migration rate (m) for municipalities situated both outside and inside the major city area. One potential explanation for these results is that some municipalities are more attractive than others to families with small children, and as the children grow up the attracted families tend to stay, thereby increasing the labor supply and (hence) negatively affecting (y). We also obtain **a** positive correlation between the initial share of inhabitants aged 65 and above $(Age65)$ and (y). This effect is more difficult to explain, we simply note that it is consistent with findings reported by Lundberg (2006). Population density $(Dens)$ also appears to have a significant, positive effect on the subsequent growth pattern in municipalities both outside and inside major city areas (3.18, *t*-value 0.269 and 0.219, *t*-value 4.26, respectively), as found by Aronsson *et al.* (2001). Population density is also positively associated with net migration for municipalities outside major city areas (0.272, *t*-value 3.57). However, there is no evidence that the population density $(Dens)$ affects the unemployment rate (u).

6. Conclusions

This paper explores effects of key determinants (the average income growth rate, net migration rate, and changes in unemployment rates) of changes in local tax bases of Swedish municipalities in an attempt to identify factors that may explain disparities among them in this respect. In recognition of the importance of these three variables, a three-equation system is estimated. Based on a dataset covering Swedish municipalities from 1992 to 2007, our results show that initial local public expenditures and income taxes are negatively related to the subsequent local growth pattern. Our results also support the conditional convergence hypothesis for average income levels across Swedish municipalities, i.e. that average income tends to grow more rapidly in initially "poor" local jurisdictions than in initially "richer" jurisdictions, conditional on the other explanatory variables

Moreover, we find that the share of individuals with more than three years formal postsecondary education is positively related to the subsequent net migration rate and negatively related to subsequent changes in unemployment rates, while the share of individuals with secondary education but less than three years postsecondary education is negatively related to the subsequent net migration rate.

Besides the findings that local public expenditures and taxes seem to have negative effects on subsequent local growth, one of the most interesting results of our study is a positive correlation between the initial unemployment rate and the subsequent average income growth. As the initial unemployment rate is positively correlated with the subsequent change in unemployment rate and

negatively correlated with the subsequent net migration rate, we attribute this result to mismatches in the local labor market. This interpretation is enabled by the three-equation approach used in this paper.

Appendix

Table A1-Definitions

Variable	Description
Economic factors	
$Y_{i,t}$	Average income (thousand SEK) of employed individuals aged ≥20 years
$Unemp_{i,t}$	Number of unemployed divided by the population aged 25 to 64
$y_{i,t} = ln(Y_{i,t} / Y_{i,t-T})$	Average income growth
$m_{i,t} = \left(\sum_{l=t-T}^{l=t} mig_{i,l}\right) / pop_{i,t-T}$	Net migration rate
$u_{i,t} = ln\left(Unemp_{i,t} / Unemp_{i,t-T}\right)$	Unemployment growth rate
Local Policy Variables	
$Tax_{i,t-T}$	The local plus regional income tax rate. This variable is divided by 100 for computational purposes.
$Exp_{i,t-T}$	Total local public expenditure per capita given by the sum of local public expenditures on culture, education, child care, family care, elderly care, environment, rescue services, subsidies to political organizations and business activities.
$Excul_{i,t-T}$	The share of local public expenditure on culture
$Exedu_{i,t-T}$	The share of local public expenditure on education
$Exchil_{i,t-T}$	The share of local public expenditure on child care
$Exfam_{i,t-T}$	The share of local public expenditure on family care
$Exeld_{i,t-T}$	The share of local public expenditure on elderly care
Human Capital	
$Edulow_{i,t-T}$	The percentage of inhabitants between 25 and 65 years with secondary education but less than 3 years of postsecondary education
$Eduhigh_{i,t-T}$	The percentage of inhabitants between 25 and 65 years with more than 3 years of postsecondary education
Political representation	
$Cons_{i,t-T}$	The share of seats in the local parliament held by the Conservative party, Centre Party, Liberals and Christian Democrats
$Herf_{i,t-T}$	A Herfindahl index measuring political stability in a municipality's parliament
Socio-economic demographic structure	
$Age06_{i,t-T}$	The percentage of inhabitants aged 0-6
$Age715_{i,t-T}$	The percentage of inhabitants aged 7-15
$Age65_{i,t-T}$	The percentage of inhabitants aged **≥ 65**
$Dens_{i,t-T}$	Population density, residents per square kilometer This variable is divided by 1000 for computational purposes
Dummy	
D	A dummy for municipalities situated in the major **city** areas: Stockholm, Malmö and Göteborg

Note: Income and expenditure are normalized using the Swedish consumer price index (with 2005 as the base year). All variables are expressed in log form.

Table A2-Descriptive statistics for the overall sample (1992-2007)

Variable	Obs	Mean	Std. Dev.	Min	Max
$y_{i,t}$	1710	1.283	0.047	1.131	1.477
$m_{i,t}$	1710	0.993	0.051	0.869	1.311
$u_{i,t}$	1710	0.483	0.119	0.174	1.206
$Y_{i,t-T}$	1710	57.795	6.600	45.894	113.535
$Unemp_{i,t-T}$	1710	0.087	0.024	0.024	0.166
$Tax_{i,t-T}$	1710	30.792	1.330	25.700	34.410
$Exp_{i,t-T}$	1710	9.156	2.302	5.154	15.985
$Excul_{i,t-T}$	1710	0.078	0.021	0.068	0.298
$Exedu_{i,t-T}$	1710	0.377	0.072	0.127	0.612
$Exchil_{i,t-T}$	1710	0.180	0.049	0.127	0.390
$Exfam_{i,t-T}$	1710	0.076	0.034	0.061	0.216
$Exeld_{i,t-T}$	1710	0.339	0.098	0.081	0.706
$Edulow_{i,t-T}$	1710	0.126	0.036	0.066	0.347
$Eduhigh_{i,t-T}$	1710	0.091	0.044	0.041	0.422
$Cons_{i,t-T}$	1710	0.438	0.121	0.086	0.844
$Herf_{i,t-T}$	1710	0.285	0.058	0.160	0.492
$Age06_{i,t-T}$	1710	0.093	0.010	0.066	0.131
$Age715_{i,t-T}$	1710	0.113	0.011	0.066	0.154
$Age65_{i,t-T}$	1710	0.186	0.039	0.059	0.282
$Dens_{i,t-T}$	1710	120.985	393.711	0.276	3883.491

Table A2-Descriptive statistics for 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
$y_{i,t}$	283	1.008	0.010	0.982	1.041
$m_{i,t}$	283	1.000	0.008	0.978	1.042
$u_{i,t}$	283	2.341	0.463	1.421	3.926
$Y_{i,t-T}$	283	56.715	6.001	46.604	91.273
$Unemp_{i,t-T}$	283	0.070	0.017	0.025	0.120
$Tax_{i,t-T}$	283	30.336	1.124	25.700	32.300
$Exp_{i,t-T}$	283	9.358	2.554	5.154	14.023
$Excul_{i,t-T}$	283	0.086	0.025	0.027	0.200
$Exedu_{i,t-T}$	283	0.355	0.057	0.100	0.502
$Exchil_{i,t-T}$	283	0.175	0.042	0.083	0.314
$Exfam_{i,t-T}$	283	0.066	0.029	0.013	0.189
$Exeld_{i,t-T}$	283	0.292	0.076	0.083	0.483
$Edulow_{i,t-T}$	283	0.113	0.028	0.068	0.201
$Eduhigh_{i,t-T}$	283	0.086	0.043	0.041	0.389
$Cons_{i,t-T}$	283	0.497	0.107	0.229	0.800
$Herf_{i,t-T}$	283	0.256	0.049	0.160	0.428
$Age06_{i,t-T}$	283	0.096	0.009	0.078	0.125
$Age715_{i,t-T}$	283	0.108	0.011	0.066	0.154
$Age65_{i,t-T}$	283	0.185	0.040	0.059	0.277
$Dens_{i,t-T}$	283	119.126	384.578	0.288	3655.361

Table A2-Descriptive statistics for 2007

Variable	Obs	Mean	Std. Dev.	Min	Max
$y_{i,t}$	289	1.016	0.008	0.989	1.045
$m_{i,t}$	289	1.003	0.007	0.986	1.030
$u_{i,t}$	289	0.798	0.089	0.570	1.128
$Y_{i,t-T}$	289	128.173	41.701	114.510	143.642
$Unemp_{i,t-T}$	289	0.033	0.011	0.010	0.069
$Tax_{i,t-T}$	289	31.979	0.987	28.890	34.240
$Exp_{i,t-T}$	289	13.175	1.377	9.594	17.906
$Excul_{i,t-T}$	289	0.057	0.014	0.014	0.121
$Exedu_{i,t-T}$	289	0.398	0.037	0.300	0.518
$Exchil_{i,t-T}$	289	0.156	0.039	0.074	0.303
$Exfam_{i,t-T}$	289	0.067	0.022	0.018	0.154
$Exeld_{i,t-T}$	289	0.428	0.062	0.226	0.576
$Edulow_{i,t-T}$	289	0.150	0.032	0.097	0.276
$Eduhigh_{i,t-T}$	289	0.167	0.068	0.083	0.543
$Cons_{i,t-T}$	289	0.467	0.123	0.129	0.889
$Herf_{i,t-T}$	289	0.256	0.049	0.180	0.534
$Age06_{i,t-T}$	289	0.074	0.013	0.051	0.126
$Age715_{i,t-T}$	289	0.107	0.011	0.063	0.141
$Age65_{i,t-T}$	289	0.198	0.036	0.103	0.302
$Dens_{i,t-T}$	289	131.109	442.010	0.241	4228.241

Table A3-Correlation matrix for 1992-2007

	$y_{i,t}$	$m_{i,t}$	$u_{i,t}$	*Y*	*Unemp*	*Tax*	*Exp*	*Excul*	*Exedu*	*Exchil*	*Exfam*	*Exeld*	*Edulow*	*Edulhigh*	*Cons*	*Herf*	*Age*06	*Age*715	*Age*65	*Dens*
$y_{i,t}$	1																			
$m_{i,t}$	0.285	1																		
$u_{i,t}$	0.108	-0.171	1																	
Y	0.165	0.410	-0.245	1																
Unemp	0.186	-0.174	0.917	-0.222	1															
Tax	-0.190	-0.346	0.297	-0.280	0.299	1														
Exp	-0.234	-0.374	0.337	-0.261	0.410	0.304	1													
Excul	-0.330	0.077	-0.167	0.206	-0.191	-0.123	-0.130	1												
Exedu	0.116	0.051	-0.290	0.212	-0.325	0.013	-0.639	-0.040	1											
Exchil	0.124	0.462	-0.360	0.690	-0.404	-0.292	-0.606	0.208	0.439	1										
Exfam	0.110	0.372	0.063	0.355	0.048	-0.107	-0.265	0.122	-0.041	0.368	1									
Exeld	0.257	-0.218	0.525	-0.339	0.527	0.461	0.091	-0.221	-0.036	-0.333	-0.202	1								
Edulow	0.279	0.554	-0.016	0.710	-0.006	-0.215	-0.241	0.215	0.081	0.600	0.431	-0.129	1							
Edulhigh	0.279	0.607	-0.169	0.705	-0.160	-0.374	-0.230	0.182	0.030	0.549	0.362	-0.251	0.887	1						
Cons	0.225	0.361	-0.353	-0.003	-0.404	-0.430	-0.284	-0.154	0.096	0.106	-0.098	-0.265	0.079	0.233	1					
Herf	-0.127	-0.218	0.264	0.081	0.311	0.234	0.197	0.155	-0.057	-0.016	0.028	0.227	-0.026	-0.139	-0.630	1				
*Age*06	0.163	0.256	-0.211	0.293	-0.229	-0.409	-0.210	-0.168	0.181	0.362	0.170	-0.544	0.126	0.155	0.337	-0.313	1			
*Age*715	0.275	-0.080	-0.098	0.107	-0.090	0.034	-0.190	-0.347	0.561	0.175	-0.106	-0.011	-0.009	-0.054	0.182	-0.139	0.398	1		
*Age*65	-0.074	-0.366	0.237	-0.697	0.232	0.348	0.322	-0.034	-0.333	-0.650	-0.398	0.620	-0.498	-0.445	-0.146	0.124	-0.704	-0.375	1	
Dens	0.214	0.583	-0.215	0.629	-0.229	-0.472	-0.434	0.174	0.021	0.562	0.613	-0.390	0.567	0.608	0.227	-0.149	0.304	-0.094	-0.551	1

Note: The variables are at time $t-T$

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