Internal migration and growth in Italy

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Abstract

The analysis focuses on the impact of interregional migration flows on regional growth rates during the period 1983-2002. A first important result is that migration did affect regional growth rates in Italy. Moreover, the results from the analysis of the two sub-periods, 1983-1992 and 1993-2002, show that the different trends of migration flows during the two decades and their differences in human capital content did affect regional growth in different ways. Both net migration rate and gross migration rates are used as regressors in different estimations. Furthermore, in order to investigate how the human capital content of migrants affected the regional growth, a further specification of the empirical model differentiates the migration rates according with their educational attainment. The outcomes show that migrants with a high educational attainment have the strongest impact on regional growth.

Keywords: internal migration and growth; convergence; human capital; panel data.

1. Introduction

In this chapter, the analysis will focus on the effects of interregional migration flows on regional growth. The attempt is to see whether the changes of internal migration flows affected the regional growth rate during the period 1982-2002. Particular attention will be paid to the role played by the human capital composition of migration, exploring the effect of a change in high skilled migration during the period. The theoretical background is the extended Solow-Swan model, which allows each region to converge to its own steady state level (conditional convergence). In order to reduce the bias of unobserved heterogeneity between regions, the empirical analyses have been carried out using Panel Data technique.
This chapter will show that empirical results depend on the measure taken to study the impact of migration on growth. The first important distinction refers to the difference between net and gross migration rates. Net migration rate is the most common measure in empirical literature on migration and growth. However,

the information provided by net migration rates suffers from some shortcomings. In fact, only the net gain (or loss) is assumed to affect the regional growth rate, whilst using separately the emigration and immigration rates may provide the analysis with further relevant results. The second issue refers to the homogeneity assumption implied by using total migration rates. That is, the results using total net or gross migration rates depend on the assumption that all migrants are equal (i.e., homogenous) in their human capital content. However, migrants conveying different amount of human capital may affect growth in different ways. Taking the different educational attainment of migrants as a proxy for their human capital content can shed some light on the results obtained using total migration rates.
Being aware of these important considerations, this chapter will attempt to provide a detailed empirical analysis on the different channels through which migration affected the regional growth rates.
First, the impact of migration on regional growth will be measured using total migration rates. Another estimation will be carried out using gross migration rates. The comparison of these preliminary results will provide the study with some interesting issues, which call for a more detailed specification of migration rates. Thus, a further estimation is carried out, using migration rates which discriminate the migrants according with their educational attainment. The study will be completed with a last empirical specification which involves the impact of migration rates (gross and net) corresponding to different educational attainments and the dualism between the southern and the northern regions.

2. Theoretical framework

Following a common practice in empirical studies on convergence, the theoretical background is represented by the neoclassical growth model (Solow-Swan, 1956). According to neoclassical theory, the growth rate of per capita output (towards the steady state) is directly correlated with the distance from the steady state level and indirectly correlated with the initial level of per capita output (Solow-Swan, 1956). Thus, the further the economy is from its own steady state the faster it will grow. An important prediction of the Solow-Swan model is that if a group of economies is homogeneous in preferences and technologies, they will tend to converge to the same steady state level. Thus, during the transition path, relatively poorer countries with a lower initial level of per capita output, will grow faster than richer one. This process, known as *"*absolute convergence*"*, was first tested by Baumol (1986) in a seminal study based on a simple cross-sectional regression. Barro and Sala-i-Martin (1992) refined the method used by Baumol (1986) pointing out that cross-sectional absolute convergence can take place only if the economies share the same steady state, that is, if the economies are structurally homogenous. On the contrary, if the economies are structurally heterogeneous, they will converge to their own steady state, this second concept is known has *"*conditional convergence*"*. BSiM test the unconditional convergence using regional datasets, arguing that differences in technology tastes and institutions are

smaller across regions (within a country) than across countries (Barro and Sala-i-Martin 1994). They find evidence of absolute convergence for U.S. states, the prefectures of Japan, and the regions of eight European countries (Italy included). Moreover, they test the role played by net migration in the convergence, finding no clear evidence.

The neoclassical growth model version that has been widely tested in empirical growth literature is derived by a log-linear approximation around the steady state of the Ramsey model (Barro and Sala-i-Martin, 1994). The equation that describes the growth dynamic around the steady state, over a time interval of $T \geq 0$, is given by:

$$(1/T)\cdot \log[y(T)/\, y(0)] = x + \frac{\left(1-e^{-\beta T}\right)}{T}\cdot \log\left[\hat{y}^{*}/\, \hat{y}(0)\right], \qquad (1)$$

where *y(T)* and *y(0)* are the per-capita output measured, respectively, at the end and at the beginning of the time period, and *x* is the steady-state growth rate of per capita output. The ratio $\hat{y}^{*}/\, \hat{y}(0)$ measures the distance of per capita output (expressed in effective labour unit) from the steady-state, while the term $\left(1-e^{-\beta T}\right)/T$ relates it with the growth rate of *y*. Equation (3.1) shows that the speed at which the average growth rate of per capita output approaches to the steady-state level, during the period from 0 to T, depends positively on the parameter β. From equation (3.1) is derived the expression that is commonly tested in empirical convergence works, that is

$$(1/T)\cdot \log[y(T)/\, y(0)] = c - \left(1-e^{-\beta T}\right)/T \cdot \log\, y(0) + u(T) \qquad (2)$$

where *u(T)* is the random disturbance, *c* is a constant that includes the steady state level of per capita output and the steady-state growth rate, their values are unknown and determine the different speed of convergence β (which is the parameter to be estimated). Equation (3.2) is usually tested with nonlinear least square estimations (see Barro and Sala-i-Martin, 2004). A positive sign for β reveals the presence of convergence, although several criticisms have been expressed concerning the different techniques used in the large literatures and the robustness of the underlying neoclassical assumptions. The Solow-Swan model prediction concerning the speed of convergence refers to the single economy. In addition, the steady-state level to which the economy converges depends on technology, preferences, and institutional level. Conversely, empirical studies are often interested in studying growth convergence across different economies (regions or countries). As emphasized by Lee (1995), cross sectional growth regressions are based on the weak assumption that all the economies share the same steady-state level. Nevertheless, Barro and Sala-iMartin (1995) argue that in a context of regional growth convergence it is still possible to assume that regions are homogenous in technology and tastes, therefore, both conditional and

unconditional convergence can be tested. However, theory does not imply the same steady state level of income for all countries, as pointed out by Mankiw Romer and Weil (1992) and Barro and Sala-i-Martin (1992) that defined the concept of *conditional convergence*. In this case, a set of conditioning variables is added to equation (3.2) in order to control for differences in the steady-state levels.

3. Data and variables

This work uses annual data on the 20 Italian regions, with years ranging from 1983 to 2002. The CRENOS databank on Italian regions is the source of data for regional per capita GDP and per capita fixed investments, both expressed in constant price term (1995 base year). Data on population and migration flows are taken from ISTAT (National Institute of Statistics) databanks.
The dependent variable is the regional per capita GDP growth rate (in log).

Table 1. Variables description

Name	**Description**
i = 1,2,3,…,20	Regions
t = 1,2,3,….,20	Year
Dependent variable	Regional GDP growth rate
l.lngdp	Log of regional per capita GDP at time t-1
Popgr	Population growth rate
Savr	Saving rate
L2.netr	Net migration rate
L2.Inmr	Immigration rate
L2.OUTmr	Emigration rate
L2.nethr	Net emigration rate – high educational attainment
L2.netmr	Net emigration rate – medium educational attainment
L2.netlr	Net emigration rate – low educational attainment
L2.INhr	Immigration rate – high educational attainment
L2.INmr	Immigration rate – medium educational attainment
L2.INlr	Immigration rate – low educational attainment
L2.OUThr	Emigration rate – high educational attainment
L2.OUTmr	Emigration rate – medium educational attainment
L2.OUTlr	Emigration rate – low educational attainment

4. Unconditional β-convergence

The estimation of the unconditional convergence process among the 20 Italian regions over the period 1983-2002 is based on equation 3.2, which is directly estimated using nonlinear least square technique. The results for the unconditional

convergence estimation are shown in table 2. The estimates refer to three different specifications, depending on the time span and on the β coefficient restrictions. The first row regression is based on the whole period, that is 20 years. For this period, the null hypothesis of absence of unconditional growth convergence is not rejected. The second and third rows report the results for the two sub-periods, showing that for the first decade (1983-1992) there is no presence of unconditional convergence, whilst for the second period the coefficient β is positive though weakly significant. A third specification has been tested with the parameters restricted to be equal for the two sub periods. However, for this last specification the coefficients are not statistically significant. Thus, estimating equation 3.2 does not provide the same results obtained by B-SiM[1]. As expected, the main assumption required by the unconditional convergence, that is a high degree of homogeneity among the regions, appears to be too strong for the Italian regions, and results in table 2 show not clear evidence of convergence toward a unique steady state. Moreover, in presence of unobserved structural differences between regions, the error term is not independently distributed and the OLS estimation is biased, due to the fact that disturbances affect different regions (or groups of regions) in different ways.

Table 2. Absolute convergence regression

Period	*const*	*β*	*R-sq*
1983-2002	0.0277	0.0040	0.0331
P-val.	*0.0080*	*0.3410*	
1983-1992	0.0136	-0.0030	0.0393
P-val.	*0.1150*	*0.3830*	
1993-2002	0.0405	0.0094	0.2426
P-val.	*0.0000*	*0.0420*	
Joint two sub periods	-	0.0025	-
		0.3520	
Obs			20
LR-test (p-val)			0.0004

Note: Nonlinear least square estimation. The beta coefficient is the coefficient estimated for the log of initial per capita GDP. The null hypothesis of the likelihood-ratio test is that the β coefficient is the same in the two sub-periods. Standard errors are robust to heteroskedasticity.

[1] It might be interesting to note, although, that the value of β found for the last decade is very close to the value found by Paci-Pigliaru (1997), even thought they use simple OLS and the time span is 1970-1992. Also B-SiM (1995) find a similar value for convergence across European regions.

5. Conditional β-convergence and panel data

5.1 Panel Data vs cross sectional regression

The results shown in table 1 can be explained by two specification errors. The first refers to the model and the second to the econometric technique. As De La Fuente (2000) emphasizes, the rejection of the hypothesis of absolute convergence does not have any theoretical implications if the underlying assumption that all regions are substantially equal is not realistic. In fact, the low values of the R^2 together with the insignificants *p-values* clearly indicate that the model fails to provide useful information regarding the unconditional convergence. This might be due to the presence of structural differences between the different regions which in turn lead to different steady states. In cross-sectional studies of convergence growth, a set of "conditional variables" is included in order to control for different steady state levels (Mankiw Romer and Weil, 1992, and Barro and Sala-i-Martin, 1992). The population growth rate and the saving rate are the first candidates taken from the neoclassical growth model, but a set of other variables has also been introduced in different empirical works in order to control for heterogeneous steady states levels. Although it is possible, in order to reduce the unobserved heterogeneity bias, to include conditional variables into equation 3.2, the criticisms against the cross-sectional regression still remain and involve mostly theoretical issues. As a matter of fact, cross sectional regressions are useful to study the speed of convergence for a group of economies (i.e., regions or countries) if the whole group is considered as a single representative economy, with a single steady state[2]. However, once this assumption is released due to the presence of heterogeneity among different regions, then cross-sectional regression technique looses its main informational power and it becomes a weak (and potentially inconsistent) tool to analyse the conditional convergence.

Moreover, as pointed out by Islam (1995), introducing the conditioning variables does not release the assumption that the parameters of the underlying production function are homogenous. That is to assume that countries differ in steady state levels but have the same identical production function. Moreover, the unobserved heterogeneity bias is likely to affect the estimates even in presence of the conditional variables[3]. For these reasons, panel data methodology is widely recognized to be more appropriate for convergence analysis (Islam, 1995; Caselli *et al.*, 1996; Lee *et al.*, 1997).

It is worth to point out, however, that moving from cross-sectional regression to panel data estimation implies a rather different analysis, not only from an

[2] A positive and statistically significant β coefficient would be a support for endogenous growth theory in place of neoclassical convergence theory, provided that all the economies are equal in tastes and technologies.

[3] It might be the case, in fact, that it is not possible to measure some of the steady state determinants or that they are unknown.

econometric point of view but specially for the theoretical implications. In particular, panel data technique has the main advantage to control for regional fixed effects, that is, to control for unobserved structural differences between the individuals (i.e., regions) that are time invariant. In regional convergence growth analysis this also implies to control for different steady states among regions. This is the point for a line of criticism over panel data models, which argues that they are uninformative, in that they do not provide any cross-sectional information about convergence (see Magrini, 2003). However, the aim of this work it is not to study whether per capita GDP differentials across regions are reducing over time, but to focus on the role played by internal migration flows. In other words, this study uses the conditional convergence as the main framework in order to investigate on the role played by migration.
Putting equation 3.2 in a linear form which is testable using panel data technique gives the following expression:

$$\log\left(\frac{y_{i,t}}{y_{i,t-1}}\right) = \beta_{1,i} + \beta_2 \log y_{i,t-1} + \beta_s \sum_{s=3}^{k} x_{s,i,t} + u_{i,t}$$

where, (3)

$$\beta_1 = c + \eta_i \;;\; \beta_2 = -(1 - e^{-\beta})$$

Equation 3.3 is the linear panel data version of equation 3.2, in this specification the unobserved fixed effects η_i are treated as deterministic and thus added to the constant term[4]. The vector x_i contains all the conditional variables that explicitly control for structural differences. Thus, the equation 3.3 will serve as a link between the growth theory and the empirical investigation.

5.2 Interregional migration flows: some stylized facts

As already discussed in chapter two, interregional migration flows in Italy during the period 1983-2002 have been characterized by two important aspects. The first one is represented by the trend, that is, internal migration flows were decreasing during the first decade whilst in the second decade the trend became positive[5]. The second aspect involves the human capital content of migration flows, measured by the educational attainment. Compared with the first decade, the interregional migration flows during the second decade are also characterized by the higher education level of migrants.

[4] The alternative specification is the random effect model where the fixed effects are assumed to be randomly distributed and added to the error term (see Wooldridge,2002).
[5] See the annual data on registration and deregistration of residence (ISTAT, "Iscrizioni e cancellazioni anagrafiche", different years)

5.3 The composition effect of migration

The above discussed aspects are likely to affect the regional GDP growth since, as emphasized by Shioji (2001), they directly affect the two main channels through which migration is related to per capita GDP growth rate. The first channel is called *quantity effect*, namely, if migrants are homogeneous in their human capital content, the neoclassical theory predicts that migration should act as a channel for growth convergence. In fact, as it has also shown in the last chapter, generally migrants tend to move from poor to rich regions. This, in turn, should lead to a rise of the per capita income in the poorer regions and a decrease in the rich regions (i.e., absolute convergence). If migrants are heterogeneous, however, the effect of migration on growth can be positive (negative) if the average human capital content of migrants is higher than the human capital content of non migrants. Friedberg and Hunt (1995) first point on this *composition effect* as the main explanation for the large number of empirical studies showing that migration does not turn to have the expected negative sign (or it is not statistically significant). Therefore, when people are heterogeneous and when migrants have more human capital (in average) than non migrants, the *composition effect* acts with positive sign on the per capita GDP growth. Thus, the final impact of migration on the growth rate depends on which of the two effects dominates.

6. Conditional convergence and migration

6.1 Conditional convergence and net migration rates

As previously discussed Panel Data models are particularly indicated for regional convergence analysis. In this study, fixed effect model will be used to investigate the effect of migration on regional growth during the period 1983-2002. The estimates will be carried out using the following linear version of the extended growth equation:

$$\log\left(\frac{y_{i,t}}{y_{i,t-1}}\right) = \beta_{1,i} + \beta_2 \cdot \log y_{i,t-1} + \beta_3 \cdot Popgr_{i,t} + \beta_4 \cdot savr_{i,t} + \beta_5 \cdot M_{it} + u_{i,t}, \qquad (4)$$

where *Popgr* is the population growth rate of region *i* at year *t*, and *savr* is the ratio between investments and per capita GDP in region *i* at year *t* , which has been used as a proxy for the saving rate. The variable *M* is the migration variable measured alternatively by the net migration rate and the gross migration rates[6].

[6] Net migration is computed, for each year and region, as the ratio between net gross migration and population. Net gross migration is the difference between immigration and emigration. Gross In (Out) migration rates are computed as the ratio between immigration (emigration) and the population size, for the same year. In all the regressions migration rate (in all specifications) is

Table 3 shows the results for the conditional convergence estimates with and without the net migration rate. The period has been divided into two sub-periods in order to study whether the different migration trends and human capital content of migrants, which characterized the two sub-periods, affected the regional per capita GDP growth. The first three columns report the estimation results for the entire period 1983-2002 and for two sub-periods, referring to the conditional convergence model without migration. The coefficient for the initial value of per capita GDP is negative and statistically significant, thus confirming the presence of conditional convergence during the 20 years and during the two sub-periods. The same coefficient increases when estimation is carried out for the two sub-periods, this is due to the fact that the growth rate declines as income increases[7].The population growth rate has the expected negative sign, which is also significant. The proxy for the saving rate has also the expected positive sign and is statistically significant. The signs and significance of the coefficients for the basic conditional growth model, turned out to be the same in all the estimates carried out in this analysis, for this reason they will not be discussed further.

Table 3. Conditional convergence regression plus net migration rates

	Conditional convergence			**With net migration**		
	1983-2002	*1983-1992*	*1993-2002*	*1983-2002*	*1983-1992*	*1993-2002*
l.lngdpp	-0.0323	-0.0535	-0.0767	-0.0350	-0.0520	-0.0785
P-val.	*0.0004*	*0.0074*	*0.0051*	*0.0001*	*0.0179*	*0.0021*
popgr	-1.2043	-0.9415	-1.7138	-1.2237	-0.9187	-1.7450
P-val.	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0001*	*0.0000*
savr	0.1273	0.2621	0.2988	0.1267	0.2561	0.2769
P-val.	*0.0003*	*0.0166*	*0.0060*	*0.0005*	*0.0158*	*0.0060*
l2.netr				0.0004	-0.0007	0.0004
P-val.				*0.0008*	*0.6867*	*0.0157*
Cons	0.0776	0.1009	0.1646	0.0844	0.0985	0.1736
P-val.	*0.0015*	*0.0722*	*0.0040*	*0.0007*	*0.0992*	*0.0013*
Number of obs	400	200	200	400	200	200
Rsq within	0.22	0.20	0.32	0.23	0.20	0.34

Note: Within Group Fixed Effects estimator with robust standard errors.

The last three columns add the net migration rates, it is interesting to discuss the difference between the effect of total net migration rates when the whole period is considered and when the two sub-periods are estimated separately. In particular, the effect of net migration on regional per capita GDP is positive and significant when all the period is considered, although the size of the effect appears to be small. However, when the two sub-periods are estimated separately the effect of net migration still remain positive and significant in the second period, whilst in

lagged two years, in fact, the same variables with one lag and with no lag turned out to be never significant.

[7] See B-SiM (1995, pag 387).

the first period its effect is not statistically different from zero. The different result between the two sub-periods might reflect the different characteristics of internal migration flows during the two decades. While these aspects will be analysed and discussed in the subsequent estimations, the main result here is that migration affected the regional growth rate mainly during the second decade.
These preliminary results, though important, require a more detailed analysis. In fact, one of the main shortcomings of net migration rate is that it relates variation in per capita GDP growth with variation of the "difference" between the two components of net migration rate, that is the emigration rate and the immigration rate.

6.2 Total net and gross migration rates: some basic concepts

When it comes to measure the migration flows it is important to discriminate between the net and the gross migration rates[8]. The gross migration rates are defined as follow:

$$\eta_{i,t}^{E} = \frac{E_{i,t}}{P_{i,t-1}} \; ; \eta_{i,t}^{I} = \frac{I_{i,t}}{P_{i,t-1}} \tag{5}$$

where, $E_{i,t}$ ($I_{i,t}$) is the number of people who left (arrived in) region *i* during the year *t*, $P_{i,t-1}$ is the population in region *i* at the beginning of the year *t*, and η_t^E (η_t^I) is the corresponding emigration (immigration) rate. The net migration rate is, instead, the difference between the two gross migration rates, that is:

$$\psi_{i,t} = \eta_t^I - \eta_t^E \tag{6}$$

where $\psi_{i,t}$ is the net migration rate of region *i* in year *t*. Therefore, the change in the net migration rate can be expressed as:

$$\Delta\psi_{i,t} = \Delta\eta_t^I - \Delta\eta_t^E \tag{7}$$

Looking at the equation (3.7) it is clear that measuring the effect of migration on growth using only the net migration rate can lead to incomplete and probably misleading results (Østbye and Westerlund, 2007). For instance, a negligible variation in the net migration rate can be the result of two large variations of both the emigration rate and the immigration rate. In this case, while the variation of the net migration rate can be close to zero, the immigration and emigration rates (whose change is, on the contrary, considerable) might still affect (independently)

[8] See Piras (2005) for a detailed analysis of the different interregional migration rates in Italy during the period 1980-2002.

the growth rate. Thus, in the particular case when $\Delta\eta_t^I \approx \Delta\eta_t^E$ the net migration rate will not change and it will not be correlated with possible changes in the growth rate. On the contrary, the gross migration rates can still affect the regional growth if $\Delta\eta_t^I$ and $\Delta\eta_t^E$ are not negligible. Moreover, as emphasized by Østbye and Westerlund (2007) emigration and immigration rates might have the same (i.e., not symmetric) impact on growth. In the last case, the net migration rate will be a wrong measure and the results will be biased. Finally, the net migration rate might reflect the variation of only one of the two gross migration rates, that is when $\Delta\eta_t^I = 0$ or when $\Delta\eta_t^E = 0$. In this case, the coefficient estimated using the net migration rates will reflect the impact of one of the two gross migration rates, but all this information will not be unveiled.

6.3 Total net and gross migration rates: empirical results

In order to investigate how gross migration rates affected the regional growth, a second specification adds them explicitly in regression (3.4), where *l2.Inmr* is the immigration rate and *l2.OUTmr* is the emigration rate of region *i* at time *t-2*. The last three columns of table 4 show the results. The outcome for the first sub-period, contrary to what found using net migration rates, shows that migration now does affect growth. In particular, an increase of immigration rate has a negative effect on regional growth. This result is what predicted by the neoclassical model when migrants are taken to be homogeneous in their human capital content with respect to non-migrants[9] or, alternatively, when the *quantity effect* dominates the *composition effect*. For the whole period and for the second sub-period, the impact of immigration rate is not statistically significant, whilst the impact of the emigration rate is negative (and statistically significant). These outcomes help to identify the source of the positive impact of net migration rates (first and third columns in Table 4, which is likely to be determined by a reduction in the emigration rates[10]. A further detailed information, which arises from the gross migration rates estimates, concerns the net migration rate estimate found for the first period. In fact, both the coefficients of emigration and immigration rates have a negative sign and their magnitude is considerable. The stronger impact of the immigration rate (showed by its higher coefficient compared with the coefficient for the emigration rate) justifies the negative sign found for the net migration rate. However it might be the case that the size of the difference

[9] That is when only physical capital (K) and labour (L) enter the production function.

[10] In fact, using both the information of coefficients estimates for the net emigration rate and for the gross migration rates, the emigration rate is negatively correlated with growth, whilst the immigration rate is not correlated. Thus, the positive correlation between the regional growth and the net migration rate is the result of a reduction in the emigration rate. However, it is worth to notice that this does not mean that the reduction of migration rates is sizeable, in that their impact depends also on the human capital content of emigrants.

between the two migration rates did not change considerable, leading to the results for the net migration rate estimation which are not statistically significant.

Table 4. Conditional convergence regression with total migration rates

	Net Migration			In Out Migration		
	1983-2002	*1983-1992*	*1993-2002*	*1983-2002*	*1983-1992*	*1993-2002*
l.lngdpp	-0.0350	-0.0520	-0.0785	-0.0517	-0.1170	-0.0942
P- val.	*0.0001*	*0.0179*	*0.0021*	*0.0002*	*0.0002*	*0.0003*
popgr	-1.2237	-0.9187	-1.7450	-1.2278	-0.8572	-1.7558
P- val.	*0.0000*	*0.0001*	*0.0000*	*0.0000*	*0.0003*	*0.0000*
savr	0.1267	0.2561	0.2769	0.1331	0.3165	0.2438
P- val.	*0.0005*	*0.0158*	*0.0060*	*0.0002*	*0.0072*	*0.0099*
l2.netr	0.0004	-0.0007	0.0004			
P- val.	*0.0008*	*0.6867*	*0.0157*			
l2.INmr				0.0002	-0.0056	0.0001
P-val.				*0.2558*	*0.0017*	*0.4201*
l2.OUTmr				-0.0024	-0.0044	-0.0027
P- val.				*0.0138*	*0.0684*	*0.0036*
Cons.	0.0844	0.0985	0.1736	0.1400	0.3172	0.2362
P-val.	*0.0007*	*0.0992*	*0.0013*	*0.0009*	*0.0017*	*0.0001*
Number of obs	400	200	200	400	200	200
Rsq within	0.23	0.20	0.34	0.24	0.26	0.37

Note: Within Group Fixed Effects estimator with robust standard errors.

These outcomes show that net migration rate can be a bad measure to estimate the impact of migration if (contrary to what might be predicted by the standard theory) both immigration and emigration rates affect the growth rate in the same direction, that is exactly what results show it happened during the first decade. In order to investigate on the source of these preliminary outcomes, a more detailed analysis that involves the human capital content of migrant is needed.

7. Growth and human capital composition of migration

7.1 The human capital content of migrants in Italy

As previously discussed, internal migration flows in Italy did not have the same characteristics during the period 1983-2002. Apart from the different trend, also the human capital composition changed during the two decades. Using the human capital indexes constructed by Becker *et al.* (2004), Piras (2005) measures the human capital contents of interregional migrants for Italy during the period 1980-2002. The results show that throughout the period migrants possessed higher human capital content than non migrants. Furthermore, the same study shows that the human capital content of migrants during the second period of our analysis (i.e., 1983-1992) was higher than the human capital content of migrants during the first period of our analysis (i.e., 1993-2002).

These stylised facts of Italian interregional migration flows may bear important implications for regional growth. According to neoclassical growth theory, a higher level of per capita human capital leads to higher productivity and thus to higher income per capita levels. The endogenous growth theory allows the increase in human capital stock to affect positively the per capita income growth rate (Lucas, 1988). The regression used for the estimates has the advantage of being fit for both theories[11]. In fact, under the assumption that labour forces (and thus migrants) are homogeneous, a negative impact of migration rates on growth is what predicted by the neoclassical theory, where physical capital and labour are the only two inputs and exhibit diminishing returns. A net gain of migrants, thus, leads to an increase in the labour force and to a decrease in labour marginal product.
If the population is allowed to be heterogeneous in its human capital content, migrants can increase (decrease) the human capital stock in the destination (sending) region, provided that their human capital content is higher (lower) than the human capital content of non migrants. As a result the net effect on growth is ambiguous and depends on whether the negative *quantity effect* of migration dominates the positive *composition effect*.

7.2 Measuring the human capital content of migrants

In order to better understand the results found with total net and gross migration flows, the further step of this analysis will investigate whether migration conveying different human capital content affected growth in different ways. For this purpose, the human capital stock of migrants is measured by the educational attainment held by migrants at the moment when they cancelled their residency in the region of origin and when they registered the new residency in the destination region. This measure is a proxy for the human capital stock and assumes that the productivity differentials among workers are proportional only to the differentials in educational attainments. Other important human capital components, like the quality of education, the different kind of education and the work experience are not considered by this measure (see Wößmann L., 2003)[12]. Although it does present some shortcomings, this proxy is the most popular in empirical growth analysis (Shioji, 2000, Islam, 1995, Temple, 1999b).
Migrants have been divided into three groups pertaining to the corresponding educational attainment. The first group, called *high*, includes all migrants holding at least the high school diploma. The second group, called *medium*, includes all migrants holding at most the secondary school diploma. The third group, called

[11] This characteristic has been criticised in that it does not allow to discriminate between the two different growth theories (Magrini,2004). On the contrary, in this analysis it turns out to be a useful feature in that it allows to test whether migration affects growth without imposing restrictions.
[12] Wößmann (2003) reviews the different measures for the stock of human capital used in empirical growth research.

low, includes all migrants holding at most the elementary school degree (including also all migrants with no educational attainment).

7.3 The results using the net migration rates

Following the same criteria adopted so far, the analysis discriminates between net and gross migration rates. A first specification of the model, that includes net migration rates for each group of migrants, is represented by the following expression:

$$\log\left(\frac{y_{i,t}}{y_{i,t-1}}\right) = \beta_{1,i} + \beta_2 \cdot \log y_{i,t-1} + \beta_3 \cdot Popgr_{i,t} + \beta_4 \cdot savr_{i,t} + \\ + \beta_5 \cdot l2.nethr_{it} + \beta_6 \cdot l2.netmr_{it} + \beta_7 \cdot l2.netlr_{it} + u_{i,t} \tag{8}$$

Where, *l2.nethr*, *l2.netmr*, and *l2*.netlr, are, respectively, the net migration rate of migrants with a *high*, *medium* and *low* educational attainment. The estimation results for equation (3.8) are shown in Table 5. Note that only a net gain in migrants with a high educational attainment seemed to affect growth[13]. Moreover, the impact is positive and the size of coefficients is high compared with the coefficients estimated for the other two groups.

The results reported in the second column confirm what has been found previously considering net total migration rates, that is, during the first decade migration did not affect the regional growth rate. As showed by Shioji (2000) it is possible that, though the human capital content of migrants was higher than the human capital content of non migrants, the differential might not have been enough to overcome the *quantity effect*, but just enough for the two effects to compensate each other.

The third column reports the results for the second decade. During this period the rise in human capital level of migrants (compared to the first period) leads to a stronger *composition effect*, which appears to overcome the *quantity effect*[14]. The relevance of the composition effect arises also from the comparison between the coefficients for net migration rate in table 4 and those found in table 5 for the net high migration rate. When the net migration rate is computed considering only migrants with a high education level, the impact on growth is stronger than the impact of net migration rate computed considering all migrants. This result emphasizes the impact on growth which is well known as *brain drain*. In other words, the impact on per capita GDP growth rate caused by a net gain of migrants

[13] The results which refer to the standard conditional model have not changed.

[14] It is worth to notice that this is true even when the results refer only to the *high* group. For instance, a higher percentage of graduate with respect to high school level diploma improves the overall human capital level of the group. This is what, actually, happened in the second decade.

with a high educational attainment is stronger than the impact caused by the total net gain. Thus the effect of a net loss (or gain) of migrants depends on the human capital content of the migrants, holding constant the difference in human capital content between migrants and non migrants.

Table 5. Conditional convergence regression with net migration rates and education

	Periods		
Variables	*1983-2002*	*1983-1992*	*1993-2002*
l.lngdpp	-0.0373	-0.0633	-0.0773
P-val.	*0.000*	*0.006*	*0.003*
popgr	-1.2380	-0.8657	-1.7771
P-val.	*0.000*	*0.000*	*0.000*
savr	0.1188	0.2913	0.2513
P-val.	*0.001*	*0.006*	*0.008*
l2.nethr	0.0020	0.0073	0.0019
P-val.	*0.011*	*0.237*	*0.015*
l2.netmr	0.0003	-0.0021	0.0003
P-val.	*0.084*	*0.773*	*0.094*
l2.netlr	0.0002	-0.0026	0.0002
P-val.	*0.628*	*0.217*	*0.614*
Cons	0.0921	0.1194	0.1751
P-val.	*0.001*	*0.043*	*0.002*
Obs.	400	200	200
Rsq within	0.23	0.22	0.35

Note: Within Group Fixed Effects estimator with robust standard errors.

7.4 Are migrants homogeneous?

It is possible, however, that the previous results might be misleading, in that they can lead to the wrong conclusion that migrants with medium or low educational attainment did not affect the regional growth rate. It is worth to point out again that the contribution given to growth may be different when the gross migration rates are considered instead of net migration rates. For instance, a net gain of migrants with low educational attainment might not be directly related with the growth rate of a region. On the contrary, a change in the immigration (or emigration) rate might affect the productivity of a specific sector which, in turn, affects the growth rate. In this case the change in the immigration (or emigration) rate and the growth rate would be correlated, independently from the net migration rate.

Moreover, migrants might be heterogeneous, in that immigrants and emigrants differ in some personal characteristic, which may involve age, education, and occupation among the others (Greenwood, 1997)[15]. Cushing and Poot (2004) point out that researchers should sort migrants according with their different

[15] In particular, age, education and employment status.

stratification[16]. This study focuses on the educational attainment, but also occupational status may be crucial[17]. Using micro data from the Panel Study of Income Dynamics (PSID), Da Vanzo (1978) finds that areas with high unemployment rates encourage unemployed people to migrate, but have a little influence on employed people.

This is important considering that emigration and immigration rates can have a different impact on productivity depending on the occupational status of immigrants and emigrants[18]. The human capital content of a worker (i.e., employed migrant) with a low educational attainment, but with a sufficient level of work experience, is likely to be underestimated when only the educational attainment is taken into account[19]. Unfortunately, due to data availability, this analysis is not able to discriminate between the educational attainment and the occupational status of migrants. This measurement error can represent a potential source of bias when it comes to study the impact on growth of migrants disaggregated by the different educational attainment but not by the different occupational status. However, it is worth to point out that with respect to internal migration analysis, this bias is likely to affect more the emigration than the immigration rates. In fact, internal immigrants are hardly moving to another region if they have not already found a job, whilst this is not necessary true for international immigrants[20]. Thus, assuming that all interregional immigrants are homogeneous in their occupational status, their educational attainment should be a good proxy for their human capital content. On the contrary emigrants can be quite heterogeneous, in that occupational status and work experience can affect the regional growth differently from their educational attainment. That is, emigrants with high educational attainment that were unemployed in the sending regions and emigrants with a lower educational attainment but employed can affect the growth of the sending regions quite differently. This can be relevant, in the case of Italy, due to the existence of the dualism between the northern and the southern regions. The southern regions with high unemployment level are reported to lose a large part of new graduate students in favour of the northern regions (see Piras, 2006, and SVIMEZ, different years). In this case, a loss of

[16] They also point out that ignoring this type of selectivity biases the results at the same extent as omitting an important variable (Cushing and Poot, 2004)

[17] In a survey used in Owen and Green (1992) the largest flows of migrants changing their economic status moved from "education" to "employment" the subsequent year of move.

[18] The different impact on productivity, captured by the different educational attainment depends strongly on the underlined assumption that there are no differences in the occupational status among migrants (Wößmann L., 2003).

[19] On the contrary, migrants with a high educational attainment and that are also not employed, do not represent a good proxy to measure the impact of human capital on growth, particularly in the short period.

[20] Consider, for example, the large flow of low skilled immigrants coming to Italy from developing countries and Eastern Europe. Furthermore, Daveri and Faini (1999) estimate the impact of risk variables on internal and international migration, finding a strong impact for the former. They conclude, thus, that domestic destinations are riskier than foreign destination.

migrants with a high educational attainment, but unemployed, is likely to affect growth more in the long term than in the short term, whilst the loss of migrants that were also employed is likely to produce effect also in the short time[21].

7.5 The results using gross migration rates

Bearing all of this in mind, the aim of the next estimation is to provide the whole analysis with an alternative estimate, which is able to capture the possible effects of immigration and emigration rates of migrants with different educational attainments. The following equation has been estimated:

$$\log\left(\frac{y_{i,t}}{y_{i,t-1}}\right) = \beta_{1,i} + \beta_2 \cdot \log y_{i,t-1} + \beta_3 \cdot Popgr_{i,t} + \beta_4 \cdot savr_{i,t} + \beta_5 \cdot l2.INhr_{it} + \\ + \beta_6 \cdot l2.INmr_{it} + \beta_7 \cdot l2.INlr_{it} + \beta_8 \cdot l2.OUThr_{it} + \beta_9 \cdot l2.OUTmr_{it} + \\ + \beta_{10} \cdot l2.OUTlr_{it} + u_{i,t} \qquad (9)$$

Where, l2.INhr (l2.OUThr), l2.INmr (l2.OUTmr), and l2.INlr (l2.OUTlr) are the immigration (emigration) rates computed considering migrants with a high, medium and low educational attainment, respectively. As expected, the results reported in Table 6 show that considering gross migration rates, also migrants with a medium and a low educational attainment affect regional growth. Starting from the impact of different immigration rates, the results emphasize again the important role of immigrants with a high educational attainment. As expected, in fact, a high immigration rate for migrants with a high educational attainment affects positively the regional growth rate. Contrary to what shown in the estimates with net migration rates, when considering only immigration rates, it appears that the medium educational attainment does affect the growth rate. The effect is positive for the whole period estimation and in the last decade, yet its impact is rather weak. The effect of diminishing returns due to an increase in the labour stock is emphasized by the negative sign for the immigration rate with low educational attainment, statistically significant both for the whole and the two sub periods.

Conversely, the results for the emigration rates are (as expected) not so clear cut and might suffer from the measurement bias discussed above. In fact, the emigration rate for migrants with high educational attainment has the expected negative sign but is statistically significant only for the whole period. This result shows that, for this group, the positive impact previously found for the net (high) migration rates was determined by the immigration rate rather than the emigration rate. That is to say that, particularly for the second decade, an increase in the emigration rate of high skilled people did not affect the regional growth. As

[21] Both theoretical (Mountford, 1997, Bein *et al.*, 2001) and empirical studies (Bugamelli, Marconi, 2006) show that the emigration of people with a high education level might affect positively the investment in human capital in the sending region.

discussed above, a possible explanation is the heterogeneity in the occupational status between immigrants and emigrants with a high educational attainment. Thus, the large number of (young) high skilled people who left the southern regions, where they were not employed, in order to work in the northern regions might provide an explanation for this result. The most controversial results, however, come from the emigration rates of migrants with a low educational attainment. Contrary to what expected, the sign is negative, highly significant and shows a strong impact on growth. However, the equal (negative) sign for both the low skilled immigration and emigration rate unveils the wrong information reported by the results obtained with the net migration rate, where the coefficients were not statistically significant. Thus, both an increase of immigrants and an increase of emigrants with a low educational attainment affected negatively the regional growth rate.

Table 6. Conditional convergence regression with gross migration rates

	In Out Migration		
	1983-2002	*1983-1992*	*1993-2002*
l.lngdpp	-0.0752	-0.1259	-0.2236
P-val.	*0.0004*	*0.0003*	*0.0000*
popgr	-1.2091	-0.8002	-1.4235
P-val.	*0.0000*	*0.0002*	*0.0000*
savr	0.1529	0.3396	0.2523
P-val.	*0.0001*	*0.0029*	*0.0006*
l2.INhr	0.0017	0.0081	0.0024
P-val.	*0.0470*	*0.2715*	*0.0278*
l2.INmr	0.0003	-0.0156	0.0002
P-val.	*0.0040*	*0.1676*	*0.0095*
l2.INlr	-0.0005	-0.0053	-0.0005
P-val.	*0.0295*	*0.0207*	*0.0411*
l2.OUThr	-0.0041	-0.0164	-0.0004
P-val.	*0.0397*	*0.0929*	*0.8622*
l2.OUTmr	0.0028	-0.0054	0.0023
P-val.	*0.2126*	*0.5062*	*0.2898*
l2.OUTlr	-0.0058	-0.0011	-0.0138
P-val.	*0.0075*	*0.7244*	*0.0000*
Cons	0.1984	0.3418	0.5903
P-val.	*0.0010*	*0.0020*	*0.0000*
Number of obs	400	200	200
Rsq within	0.26	0.29	0.46

Note: Within Group Fixed Effects estimator with robust standard errors.

7.6 The impact of migration in the South and in the Centre-North

The main purpose of this section is to shed some light on the (apparently) surprising results obtained for the emigration rates. As already discussed in Chapter 2, another characteristic of interregional migration flows in Italy is the persistency in their direction. That is, emigrants are reported to move mainly from the southern regions to the regions in the centre-north. Furthermore, the results of the empirical analysis carried out in Chapter 2 have shown that the unemployment rate is an important *push factor* which induces people to leave regions with high unemployment rates in favour of regions with lower unemployment rates and higher per capita GDP. In other words, it is investigated whether the heterogeneity in the occupational attainment between emigrants and immigrants is valid only for the southern regions. Thus, taking into account the dualism between the southern regions (i.e., the so called "Mezzogiorno") and the regions in the centre-north[22] may help to better understand the results found in the last estimation. Table 7 shows the outcomes for the estimations carried out considering two sub-samples: the first includes only regions pertaining to the "Mezzogiorno" and the second includes only the regions of the "Centre-North".

Focusing first on the results for the immigration rates, some interesting differences appear comparing the "Mezzogiorno" with the Centre-North. The first difference refers to the immigration rate of people with *medium* educational attainment. In fact, the estimated coefficients are positive and small for the "Mezzogiorno", whilst it is negative and sufficiently large for the Centre-North. Sectorial differences between the two areas are the possible explanation for the opposite impact on growth. Moreover, as reported by Piras (2006), immigration rates are higher in the Centre-North regions than in the southern regions, this may explain the larger coefficients for the Centre-North[23]. Thus, a change in the immigration rate for people with *medium* educational attainment can be positively correlated with the productivity of traditional sectors in the "Mezzogiorno". On the contrary, for the more advanced sectors of regions in the Centre-North an increase (decrease) of immigrants with *medium* educational attainment leads to an increase (decrease) in the labour capital stock and a consequently reduction (increase) of labour productivity.

As for the results pertaining to the immigration rates for the high and the low educational attainment, the sign of estimated coefficients confirms what found for the whole sample. The results for the emigration rates are also interesting. In particular, there are considerable differences between the "Mezzogiorno" and the Centre-North for the emigration rates of emigrants with high and low educational

[22] The eight southern regions are: Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia and Sardegna. The other twelve regions of the Centre-North are the following: Piemonte, Val d'Aosta, Lombardia, Trentino Alto Adige, Veneto, Friuli Venezia Giulia, Liguria, Emilia Romagna, Toscana, Umbria, Marche and Lazio.

[23] In fact, large migration rates mean large impact of migration in the labour factor, which in turn affects the productivity.

attainment. The results show that changes in the emigration rate of high skilled people did not affect regional growth in the southern regions. On the contrary, the effect is negative and statistically significant for the regions in the Centre-North. These results may reflect the fact that high skilled emigrants are mostly unemployed in the "Mezzogiorno", whilst high skilled emigrants in the Centre-North are more homogenous[24].

Table 7. Conditional convergence regression with gross migration rates

	Mezzogiorno			**Center-North**		
	1983-2002	*1983-1992*	*1993-2002*	*1983-2002*	*1983-1992*	*1993-2002*
l.lngdpp	-0.1271	-0.2905	-0.1986	-0.0438	-0.0990	-0.2551
P-val.	*0.0067*	*0.0288*	*0.0046*	*0.0303*	*0.0012*	*0.0000*
popgr	-1.2285	-0.9248	-1.2860	-1.2868	-0.7223	-1.4562
P-val.	*0.0015*	*0.0051*	*0.0055*	*0.0000*	*0.0094*	*0.0000*
savr	0.1514	0.2935	0.1791	0.1797	0.2628	0.4874
P-val.	*0.0668*	*0.0550*	*0.0113*	*0.0413*	*0.1096*	*0.0001*
l2.INhr	0.0042	0.0197	0.0046	0.0020	0.0090	0.0016
P-val.	*0.0477*	*0.2674*	*0.2322*	*0.0417*	*0.3331*	*0.0327*
l2.INmr	0.0004	0.0191	0.0002	-0.0094	-0.0223	-0.0073
P-val.	*0.0026*	*0.3207*	*0.0486*	*0.0316*	*0.1785*	*0.0188*
l2.INlr	-0.0009	-0.0203	-0.0006	-0.0023	-0.0080	0.0001
P-val.	*0.0162*	*0.0091*	*0.1859*	*0.0210*	*0.0339*	*0.9172*
l2.OUThr	-0.0017	-0.0157	-0.0011	-0.0074	-0.0257	0.0023
P-val.	*0.3843*	*0.4541*	*0.7627*	*0.0094*	*0.0787*	*0.4742*
l2.OUTmr	0.0031	-0.0078	0.0055	0.0040	0.0081	0.0010
P-val.	*0.4011*	*0.3034*	*0.3298*	*0.2775*	*0.7235*	*0.5703*
l2.OUTlr	-0.0100	0.0017	-0.0136	0.0013	-0.0012	-0.0112
P-val.	*0.0028*	*0.7516*	*0.0155*	*0.5428*	*0.8601*	*0.0088*
Cons	0.3026	0.6466	0.4722	0.1316	0.3246	0.6892
P-val.	*0.0173*	*0.0554*	*0.0049*	*0.0314*	*0.0064*	*0.0000*
Number of obs	160	80	80	240	120	120
Rsq within	0.34	0.39	0.46	0.28	0.30	0.52

Note: Within Group Fixed Effects estimator with robust standard errors.

In other words, northern regions suffer the brain drain more than the southern regions do, due to the heterogeneity in the occupational status. Looking at the emigration rates for emigrants with low educational attainment, instead, the results confirm the negative sign found for the whole sample. This last result emphasizes the negative impact of emigration on regional growth, which, according to the outcomes found in the previous estimations, does not depend on the human capital content of emigrants.

[24] Becker *et al.* (2003) show that the college graduates leaving the northern regions go mostly to foreign countries (north Europe and USA).

8. Conclusions

This chapter has attempted to carry out a detailed empirical investigation on the effects of interregional migration on regional growth. Testing both unconditional and conditional convergence, a preliminary analysis showed that only the latter can be assumed as a valid assumption for Italy. Italian regions are structurally different and do not share the same steady state level. Therefore, conditional convergence has been taken as theoretical framework for the analysis. The results using Panel Data fixed effects analysis are in line with those reported by the main literature[25]. The standard *conditional variables* have the expected signs and are all statistically significant.

The effect of migration on regional growth has been initially tested by adding the total net migration rate in the conditional convergence regression. The results showed that a net gain of migrants has a positive impact on regional growth. The outcome is valid mostly for the second decade, characterised by rising internal migration flows. However, the net migration rate implies the restrictive assumption that gross migration rates work symmetrically and may provide misleading results (Østbye and Westerlund, 2007). Therefore, a second estimation has been carried out using the gross migration rates. The outcomes show that emigration rate has a negative impact on growth. The impact of immigration rate, conversely, is positive but statistically significant only for the first decade. Thus, the first implication coming from the analysis of gross migration rates is that the positive impact of a net gain in migration depends mostly on out flows migration. Moreover, the assumption that gross migration flows have a symmetric impact on growth is not satisfied for the first period, which explains why net migration coefficient is not significant.

In order to investigate the role of human capital, a second set of estimations has been carried out differentiating migrants according with their educational attainment. For this purpose, migration rates (net and gross) are computed considering three educational attainment groups, that is, high, medium and low. The idea is that high skilled migrants account for the composition effect of migration (Friedberg and Hunt, 1995). The first results, obtained considering the net migration rates, are statistically significant only for the high educational attainment. This result proves that a net gain in high skilled migration does affect regional growth. However, these outcomes do not necessary imply that migrants with a lower educational attainment do not have impact on growth. In fact, they appear to affect the regional growth when estimations are carried out using gross migration rates. In particular, both low immigration and emigration rates appear with negative sign, which implies that considering only the difference between inward and outward low skilled migrants underestimates their impact on growth. As predicted by economic theory, the effect is positive for high skilled immigrants

[25] See Dobson *et al.* (2006) for a survey of empirical studies on convergence and the different estimation techniques.

whilst it is negative for immigrants with low educational attainment. This result emphasizes the different channels through which migration affects regional growth rates and explains the ambiguous outcomes found considering the total immigration rates. That is, considering only total immigration rates it does not take into account that immigrants are heterogeneous in their human capital content. The impact of emigration rates, nevertheless, is always negative for all the different educational attainments. This result shows that emigrants exert the same effect on growth and explains the robust result found considering the total emigration rates.

A last set of estimations represents an elementary test to check the presence of selectivity bias due to heterogeneity in occupational status between emigrants and immigrants. If unemployed tend to migrate more than unemployed (Da Vanzo, 1978), then, the educational attainment fails to provide a good measure for the human capital level of emigrants (Wößmann L., 2003). Moreover, official national statistics (SVIMEZ, different years) show that unemployed young graduates leaving the southern regions mostly represent high skilled emigrants[26]. Estimates carried out separately for the "Mezzogiorno" and the Centre-North show, indeed, that high skilled emigrants do not affect regional growth in the southern regions. On the contrary, high skilled emigrants do affect negatively the growth rates in the Centre-North. The unexpected negative impact of low skilled emigrants, on the contrary, is puzzling and its explanation is left to future research.

[26] In the "Mezzogiorno", only 40% of new graduates find a job within the first year (SVIMEZ, different years).

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