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Structural change, growth, and convergence in Italy: 1951–1970

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ABSTRACT

We study the role of structural change on convergence in Italy by investigating the shifting of the labor force from agricultural to the manufacturing, market service, and nonmarket service sectors during the years of the Italian economic miracle. We find that the standard capital deepening mechanism was not the one that worked for convergence, rather it was structural change. Furthermore, we document that such a role was heterogeneous between the Center-Northern and the Southern regions. Finally, notwithstanding the huge internal and international migration flows that occurred during this period, we detect no significant role of migration in the convergence process.

1. Introduction

Starting from the nineties of the last century, economic convergence across Italian regions has been extensively scrutinized by many authors and under different viewpoints.[1] The central question is whether some form of (absolute, conditional or sigma) convergence happened. The results of these studies conclude that conditional convergence occurred in Italy, but only during the fifties, the sixties, and up to the first years of the seventies of the last century (the years of the so-called *miracolo economico*, i.e., economic miracle). From then onwards, the convergence process stopped Iuzzolino et al. (2011, p. 33) report that “For decades beginning in 1951, the South underwent a period of exceptional growth … For the first and last time since national unification, the output gap between South and North was reduced significantly and over a protracted period.” This result is summarized by Felice (2019, p. 519) who claims that “such a convergence process is an exception in the entire history of post-unification Italy: it did not happen before, it would not happen again.” He labels the period from 1951 to 1971 the golden age period of convergence during which structural change and within-sector increased productivity played a key role in regional convergence.

Startlingly, however, almost all the empirical literature that investigated the convergence process during these years paid no attention to the structural transformation of the country. While this might not be a surprise considering that the convergence debate was initially fueled by the standard one-sector aggregate neoclassical growth model (Barro and Sala-i-Martin, 2005, Chapter 1), which leaves no room for structural change, yet, astonishingly, the empirical investigations on the role of structural change in the Italian regional convergence process are virtually absent. Two notable exceptions are Paci and Pigliaru (1997) and Capasso et al. (2012).

Investigating the 1970–1992 period, Paci and Pigliaru (1997) find little support for the neoclassical capital-deepening mechanism. On the contrary, they find a crucial role of structural change on aggregate convergence linked to the labor force shifting from agricultural to manufacturing sector. This paper presents important results, but from the standpoint of the analysis pursued here, it has three shortcomings. First, following Barro and Sala-i-Martin (1992), it relies on a somehow ad-hoc way of treating structural change into a standard one-sector aggregate neoclassical growth model. Second, as it was custom in the first empirical works on convergence, the econometric analysis is based on simple ordinary least square (OLS) estimates with no attempt to cope with endogeneity issues. Third, the investigated period starts from 1970, when most of the structural change was accomplished, and ignores the years of the *miracolo economico* during which structural change was most prominent. A final point that makes the comparison of our results with those obtained by Paci and Pigliaru (1997) difficult is that two different policy

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[1] A survey of all these works goes beyond the scope of the present work. Among the first papers dealing with this issue, see Mauro and Podrecca (1994), Goria and Ichino (1994), Paci and Pigliaru (1995), Cellini and Scorcu (1995), and Piras (1996). More recent works are those of Brida et al. (2014) and Piras (2013).

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regimes characterized the two periods. During the years of the economic miracle, the development policy aimed at boosting industrialization through a centralized top-down supply-side approach. After the seventies, the approach of regional development policy changed toward demand-targeted measures, such as fiscal subsidies to firms, income support to households, and job-creation measures in the public sector (Giannola et al., 2016; Petraglia et al., 2018). For all these reasons, a direct comparison among the results obtained by Paci and Pigliaru (1997) and ours can only be partial.

A longer period, from 1964 to 2002, is scrutinized by Capasso et al. (2012) whose aim is to study the impact of migration flows on growth via their effects on structural change. According to Capasso et al. (2012), migration flows can speed up or slow down intersectoral labor adjustment depending on migrants' human capital. They argue that since skilled migrants can be more productively employed in the advanced manufacturing sector, regional productivity is boosted by the incoming of skilled migrants. The reverse is true for unskilled migrants. Their results seem to confirm that migration is a relevant factor in determining the speed of technological change and growth. However, they did not find a direct role of structural change on growth because the impact of *MGROWTH* (see Eq. (3) below), which captures the direct effect of structural change on growth, is negative or is statistically insignificant. Different from Paci and Pigliaru (1997), this work is framed inside the two-sector neoclassical growth model set out by Temple and Wößmann (2006), explicitly extended to investigate the role of structural change on growth and convergence and deals with endogeneity by applying generalized methods of moments (GMM) techniques. Capasso et al. (2012) cover the period from 1964, thus entailing the time before the contribution of Paci and Pigliaru (1997); however, it leaves all the fifties and the first half of the sixties of the last century out of the analysis. In the recent history of Italian economic development, this period is crucial because during those years, the employment share in agriculture dropped across all regions (especially in Southern ones) much more than it did in the following years. Analogously, the employment share in the manufacturing, market service, and nonmarket service sectors grew more quickly during the fifties and the first half of the sixties than they did in the subsequent years.

This paper has three main novelties with respect to previous works. First, we study the role of structural change on convergence by investigating not only the shifting of the labor force from agricultural to manufacturing sector but also to the market service sector (private services) and the nonmarket service sector (public services). We believe that to gain an improved understanding of the links between economic growth and convergence, on the one hand, and structural change, on the other hand, expanding the empirical investigation from the two-sector analysis to a multisector perspective is necessary. Such a perspective is more important, the faster the structural transformation underwent by the economy. Second, we analyze the country as a whole and separately, the Center-Northern and Southern regions, showing that the effects of the structural change were different between these two macro areas. Third, we expand backward the analysis of Capasso et al. (2012) and investigate the role of internal and international migration flows on growth and convergence during the fifties and sixties of the last century, finding that neither internal, nor international migration had any role on them.

The rest of the paper is organized as follows: Section 2 illustrates the theoretical two-sector growth model and its extension to a four-sector growth model upon which we base our empirical analysis. Section 3 describes the dataset and sources. Section 4 provides a description of the evolution of the employment shares. Section 5 shows the econometric methodology. Section 6 presents the empirical analysis. Section 7 offers some concluding remarks. Finally, in the Appendix, a full description of the theoretical model and additional empirical results are given.

2. Structural change in the neoclassical growth model

Mankiw et al. (1992) consider a theoretical growth model with physical capital, human capital, and labor and assume the following aggregate production function:

$$Y_t = K_t^{\alpha} H_t^{\beta} (B_t L_t)^{1-\alpha-\beta}, 0 < \alpha < 1\ 0 < \beta < 1\ 0 < \alpha + \beta < 1, \quad (1)$$

where total output Y_t depends on: physical capital K_t; human capital H_t; labor $L_t = L_0 e^{nt}$, where L_0 is the initial stock of labor that grows at rate n; $B_t = B_0 e^{gt}$, where B_0 and g are the initial level of technology and its *constant* growth rate, respectively. In the neighborhood of the long-run equilibrium, the growth rate of per capita output between periods 0 and t is represented as follows:

$$ln\frac{Y_t}{L_t} - ln\frac{Y_0}{L_0} = \theta ln B_0 + gt + \theta\gamma' X_t - \theta ln\frac{Y_0}{L_0}, \quad (2)$$

where $\theta = 1 - e^{-\lambda t}$, and $\lambda = (n + g + \delta)(1 - \alpha - \beta)$ is the speed of convergence toward the long-run equilibrium (δ is the depreciation factor of physical and human capital); γ is a vector of structural parameters of the model, and vector X_t contains the (log of the) variables that explain per capita output growth, namely, the share of output invested in physical ($\ln s_K$) and human capital ($\ln s_H$) and the effective depreciation rate $\ln(n + g + \delta)$.

Temple and Wößmann (2006) extend this model to explore the impact of structural change on growth. They consider a two-sector model and assume labor reallocation from a traditional less advanced sector to a more advanced sector, the former typically being the rural agricultural sector and the latter the urban non-agriculture sector. In this framework, labor reallocation arises because of marginal product differentials and of an intersectoral wage gap that, in the long-run equilibrium, drives wages to be given by $w_M = \kappa w_A$, where w_A and w_M are respectively agricultural and non-agricultural wages, and $\kappa \geq 1$ Temple and Wößmann (2006) show that in the presence of wage differentials, total factor productivity growth is no longer constant; rather, it depends on two structural change terms:

$$MGROWTH = (1 - A)\frac{\dot{M}}{M} \approx \Delta M, \quad (3)$$

$$DISEQ = \frac{p}{1-p}(1 - A)\frac{\dot{M}}{M} \approx \frac{p}{1-p}\Delta M. \quad (4)$$

In these two equations, A is the share of agricultural employment in total employment, $M = 1 - A$ is the share of non-agriculture employment in total employment, $p = -\frac{\Delta A}{A}$ is "the proportion of agricultural workers who migrate in a given period" (Temple and Wößmann, 2006, p. 192) or the so-called "migration propensity," which depends on the wage ratio in the two sectors and measures the extent of structural change. Temple and Wößmann (2006) assume that the link between the (observed) migration propensity and the (unobserved) wage ratio is given by:

$$p = \frac{x}{1+x}, \quad (5)$$

where $x = \psi(\frac{w_M}{\kappa w_A} - 1)$, and ψ measures the speed of adjustment to the long-run equilibrium. From Eq. (5), we can easily see that $x = \frac{p}{1-p}$; hence, the following equation may be derived:

$$\frac{p}{1-p} = \psi\left(\frac{w_M}{\kappa w_A} - 1\right). \quad (6)$$

The left-hand side of Eq. (6) is the odds ratio for migration, which is increasing in the wage gap. By rearranging terms, we can easily obtain:

$$\frac{w_M}{w_A} = \kappa\left(1 + \frac{1}{\psi}\frac{p}{1-p}\right). \quad (7)$$

In the long-run equilibrium, $p = 0$, and Eq. (7) reduces to $w_M = \kappa w_A$. Therefore, this simple model enables to infer the extent of the current wage ratio from the structural change. Crucial for this result are the assumptions that the speed of adjustment ψ and the equilibrium differential κ are constant.

In the presence of structural change, g is no longer constant, and Eq. (2) generalizes to the following equation:

$$ln\frac{Y_t}{L_t} - ln\frac{Y_0}{L_0} = \omega + \left[\frac{(\kappa-1)\phi}{(1-\alpha-\beta)}MGROWTH + \frac{\kappa\phi}{(1-\alpha-\beta)\psi}DISEQ\right]t + \theta\gamma' X_t - \theta ln\frac{Y_0}{L_0}, \tag{8}$$

where $\phi = \frac{w_A L}{Y}$ is the labor share on output, and ω is a function of structural parameters. The two terms in square brackets are interpreted as a "growth bonus obtained by reallocating labor to a sector where its marginal productivity is higher" (Temple and Wößmann, 2006, p. 195). In detail, *MGROWTH* captures the effect on per capita output growth due to the change in the non-agriculture share of labor employment, whereas *DISEQ* catches the effect on growth due to the wage rate differential between agricultural and non-agricultural sectors *vis-a-vis* the corresponding labor marginal productivities (Kwan et al., 2018). Another interpretation of these two terms is that the change in the manufacturing employment share (ΔM) has a direct and an indirect impact on per capita output growth. The former (*MGROWTH*) is due to workers moving from the low-productivity agricultural sector to the high-productivity manufacturing sector. The latter (*DISEQ*) is again given by the change in the manufacturing employment share (ΔM) but is mediated by the odds ratio $\frac{p}{1-p}$, i.e., the higher the odds ratio, the higher the positive impact of ΔM on growth. In the empirical section, we use this last interpretation to elucidate the role of structural change on output.

Three further points regarding Eq. (8) are worth noticing. First, if there is no wage gap between sectors, then $\kappa = 1$, and the first term in brackets vanishes. Second, for a given wage gap the fastest the speed of adjustment of sectoral wages ψ, the less important the second term in brackets becomes. Third, the square bracket is multiplied by t; hence, *MGROWTH* and *DISEQ* are multiplied by t, and both variables should be treated as trending ones.

In this study, we extend this model by considering a four-sector economy wherein apart from the agricultural (A) and manufacturing (M) sectors, market service sector (MS) and nonmarket service sector (NMS) are considered.[2] We show in Appendix A that this theoretical extension leads to the following equations:

$$GROWTH_M = \Delta M \tag{3a}$$

$$GROWTH_{MS} = \Delta MS \tag{3b}$$

$$GROWTH_{NMS} = \Delta NMS \tag{3c}$$

as the counterpart of Eq. (3). Notice that ΔM is the change of the manufacturing employment share, ΔMS is the change of the market service employment share, and ΔNMS is the change of the nonmarket service employment share. Furthermore, we define $ODDS\_M = \frac{p_M}{1-p_M}$, $ODDS\_MS = \frac{p_{MS}}{1-p_{MS}}$, and $ODD\_NMS = \frac{p_{NMS}}{1-p_{NMS}}$, where $p_M = \frac{\Delta M}{M}$, $p_{MS} = \frac{\Delta MS}{MS}$, and $p_{NMS} = \frac{\Delta NMS}{NMS}$ respectively measure the proportional variations in employment shares in manufacturing, market and nonmarket service sectors, which can be interpreted as the short-run propensity to transfer from the agricultural sector to each one of these three sectors. Then, the following equations:

$$DISEQ_M = \frac{p_M}{1-p_M}\Delta M = ODDS_M \times \ \Delta M \tag{4a}$$

$$DISEQ_{MS} = \frac{p_{MS}}{1-p_{MS}}\Delta MS = ODDS_{MS} \times \ \Delta MS \tag{4b}$$

$$DISEQ_{NMS} = \frac{p_{NMS}}{1-p_{NMS}}\Delta NMS = ODDS_{NMS} \times \ \Delta NMS \tag{4c}$$

are the counterparts of Eq. (4). It follows that in the four-sector model, Eq. (8) can be presented as follows:

$$\begin{aligned} ln\frac{Y_t}{L_t} - ln\frac{Y_0}{L_0} = \omega + \Bigg[&\frac{(\kappa_M-1)\phi}{(1-\alpha-\beta)}GROWTH\_M \\ &+ \frac{\kappa_M\phi}{(1-\alpha-\beta)\psi_M}DISEQ\_M + \frac{(\kappa_{MS}-1)\phi}{(1-\alpha-\beta)}GROWTH\_MS \\ &+ \frac{\kappa_{MS}\phi}{(1-\alpha-\beta)\psi_{MS}}DISEQ\_MS + \frac{(\kappa_{NMS}-1)\phi}{(1-\alpha-\beta)}GROWTH\_NMS \\ &+ \frac{\kappa_{NMS}\phi}{(1-\alpha-\beta)\psi_{NMS}}DISEQ\_NMS\Bigg]t + \theta\gamma' X_t - \theta ln\frac{Y_0}{L_0}, \end{aligned} \tag{9}$$

where ψ_M, ψ_{MS}, and ψ_{NMS} measure the sector-specific speed of adjustment to the long-run equilibrium. Moreover, κ_M, κ_{MS}, and κ_{NMS} are the equilibrium wage differentials between the agricultural sector and, respectively, the manufacturing, the market service, and the nonmarket service sectors.

Four caveats are worth highlighting. First, in the two-sector model, the extent of structural change is measured simply by $p = -\frac{\Delta A}{A}$. In the four-sector model, things become complex because not only do workers move from agricultural to manufacturing but also move to the market and the nonmarket service sector. Thus, we have three possible sectoral destinations for agricultural workers willing to move. Second, in the real world, workers can also move from the manufacturing to the market or the nonmarket service sectors and from the market service sector to the nonmarket service sector. It could also be the case that workers move the other way round, and although this eventuality unlikely regards workers moving back to the agricultural sector (in the long-run historically, this has not happened), it cannot be ruled out for workers moving from the market and nonmarket service sectors to the manufacturing sector or between the two service sectors. Due to lack of data on workers moving across these sectors, the model excludes this possibility. Third, analogously to the Temple and Wößmann's (2006) two-sector model, if the sector-specific speed of adjustment of sectoral wages goes to infinity, then *DISEQ_M*, *DISEQ_MS*, and *DISEQ_NMS* do not exert any role on gross domestic product (GDP) growth. Similarly, if κ_M, κ_{MS}, and κ_{NMS} are equal one, then the three terms *GROWTH_M*, *GROWTH_MS*, and *GROWTH_NMS* vanish. Fourth, it is likely that these structural change terms are highly correlated. In such a situation, standard errors are empirically high, reflecting the impossibility to distinguish the contributions of these variables to the dependent variable. To cope with this issue, in Appendix B, we present results wherein *GROWTH_M*, *GROWTH_MS*, and *GROWTH_NMS*, on the one hand, and *DISEQ_M*, *DISEQ_MS*, and *DISEQ_NMS*, on the other hand, are entered separately into the regressions.

3. Data

To construct our regional dataset, we combine various sources. Data on GDP and total labor units are taken from Svimez (2011). Data on labor units disaggregated at the sectoral level come from the reconstructed series provided by Paci and Saba (1998). The saving rate (investment in physical capital) is computed as the ratio of gross fixed investment over GDP. From 1960 to 1970, gross fixed

[2] A three-sector model extension is provided by Kwan et al. (2018) to study the role of labor reallocation in China.

Table 1
Summary statistics.

Variable	Mean	Std. Dev.	Min	Max	Obs
GDP over labor units (constant €, base year 1970)	1012.91	422.01	255.25	2342.55	400
Investment share over GDP	0.26	0.06	0.17	0.67	400
Pupils registered in primary school over population	0.09	0.02	0.05	0.13	400
Pupils registered in lower-secondary school over population	0.03	0.01	0.01	0.05	400
Pupils registered in upper-secondary school over population	0.02	0.01	0.00	0.04	400
Employment share in agriculture	37.8	15.5	6.4	75.8	400
Employment share in manufacturing	28.8	9.1	11.0	54.6	400
Employment share in market services	22.1	6.6	6.6	41.0	400
Employment share in nonmarket services	11.3	4.1	4.5	27.5	400
Immigration rate (internal)	1.02	0.56	0.31	3.30	320
Emigration rate (internal)	1.21	0.47	0.47	3.13	320
Expatriation rate (international)	0.74	0.69	0.05	3.56	400
Repatriation rate (international)	0.43	0.37	0.04	1.92	400

investments have been taken from the reconstructed series made available by Paci and Saba (1998). No official regional data on gross fixed investment are available before 1960, hence from 1951 to 1959, we use the macro-area data provided by Svimez (2011) and impute to each region the corresponding value of the macro-area to which the region belongs. Specifically, Svimez (2011) computes gross fixed investment for the North-West (the corresponding regions are Piemonte, Valle d'Aosta, Liguria, and Lombardia), the North-East (Trentino Alto Adige, Veneto, Friuli Venezia Giulia, and Emilia Romagna), the Center (Marche, Toscana, Umbria, and Lazio), and the South (Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, and Sardegna). Although Svimez (2011) adopts standard statistical methodologies on the basis of different sectoral sources to reconstruct these series, the resulting estimates are probably not that accurate, which may affect the estimated coefficients.

As for investment in human capital, we use three proxies: the ratio of the number of pupils registered in primary school (ISCED 1), lower-secondary school (ISCED 2) or upper-secondary school (ISCED 3, 4, and 5) to midyear resident population. We also compute the three proxies as the ratio of the number of pupils registered in each school level over the corresponding age group population, and the results are qualitatively the same. Data on the number of pupils registered in school are taken from Istat (various years, a). Data on population by age groups also come from Istat (1983).

As regards regional internal migration flows, the Istat data warehouse provides data on the number of registered changes of residency, namely, registration and cancelation of internal migratory movement by region, from 1902 to 2014. Unfortunately, these series consider registered changes of residency toward other regions (*inter*regional flows) and inside the region (*intra*regional flows) and cannot be used to measure the regional net inflows and outflows. However, starting from 1955, Istat has collected data on bilateral provincial/regional flows, namely, from each origin province/region toward each destination province/region. Precisely, from 1955 to 1968, the data come from Istat (various years, b), whereas data for 1969 and 1970 are taken from Istat (1970) and Istat (1972), respectively. We compute the regional immigration (emigration) rate as the ratio of individuals registered (canceled) over the resident population. Finally, regional international migration flows are taken from the Istat data warehouse that reports expatriation and repatriation by region from 1876 to 2014.

The summary statistics of all variables are reported in Table 1. As a final remark, before 1963, the Molise region did not exist because it was part of the Abruzzi region. Hence, for the period 1951–1963, data on Molise are those of the Campobasso Province, which corresponded to the entire territory of Molise (the other province - Isernia - was established in 1970).

4. Employment shares

Given our focus on structural change, determining how employment shares evolved during the period under analysis is important (Fig. 1).

In 1951, the regions with the highest employment shares in agricultural, manufacturing, market services, and nonmarket service sectors were, respectively, Molise (75.8%), Lombardia (46.3%), Liguria (30.6), and Lazio (19.5). The lowest employment shares were recorded in Lombardia (23.2), Basilicata (11.0), Molise (6.6), and Molise (4.5). In 1964, the starting period for the empirical investigation of Capasso et al. (2012), the ranking regarding the highest shares was unchanged with Molise (59.2%), Lombardia (53.4%), Liguria (37.0), and Lazio (26.2). By contrast, the lowest shares were recorded in Lombardia (9.7), Molise (17.1), Molise (14.2), and Piemonte (7.8). Finally, in 1970, the picture was identical to 1964 because the highest employment shares in the four sectors were recorded in Molise (49.4%), Lombardia (54.5%), Liguria (41.0), and Lazio (26.4). On the contrary, the lowest shares were in Lombardia (6.4), Molise (19.2), Molise (18.5), and Piemonte (9.5).

Looking at the average sector shares, Table 2 shows that in 1970, the agricultural sector share was 26.6 percentage points lower with respect to 1951, and 73% of such a reduction (19.4 percentage points) was recorded from 1951 to 1964. In a mirrored way, the other sectors recorded an increase in employment shares. In the manufacturing sector, an overall increase of 10.5 percentage points was registered, and almost 90% (9.0 points) of such an increase was already accomplished in 1964.

Similarly, in the market service sector, the overall variation of the labor share was 10.7 percentage points (seven points up to 1964, approximately 65% of total variation). A more limited increase was registered in the nonmarket service sector, i.e., 5.4 percentage points from 1951 to 1970 and 3.3 percentage points (over 60% of total variation) from 1951 to 1964.

All in all, structural change in Italy was rapid during the fifties and sixties of the last century, but it was during the 1951–1964 period that the most dramatic transformation of the country happened. One of the main aims of this study is to shed light on the role of structural change on growth and convergence during this unexplored period of recent Italian economic history.

5. Econometric methodology

The appropriate way of estimating Eq. (9) is through fixed effect (FE) dynamic panel data. An appealing characteristic of this methodology is that it allows coping with any form of unobserved heterogeneity even if some omitted variables are correlated with explanatory variables, provided they are constant. Using the lowercase letters notation for GDP over total labor units in region i at

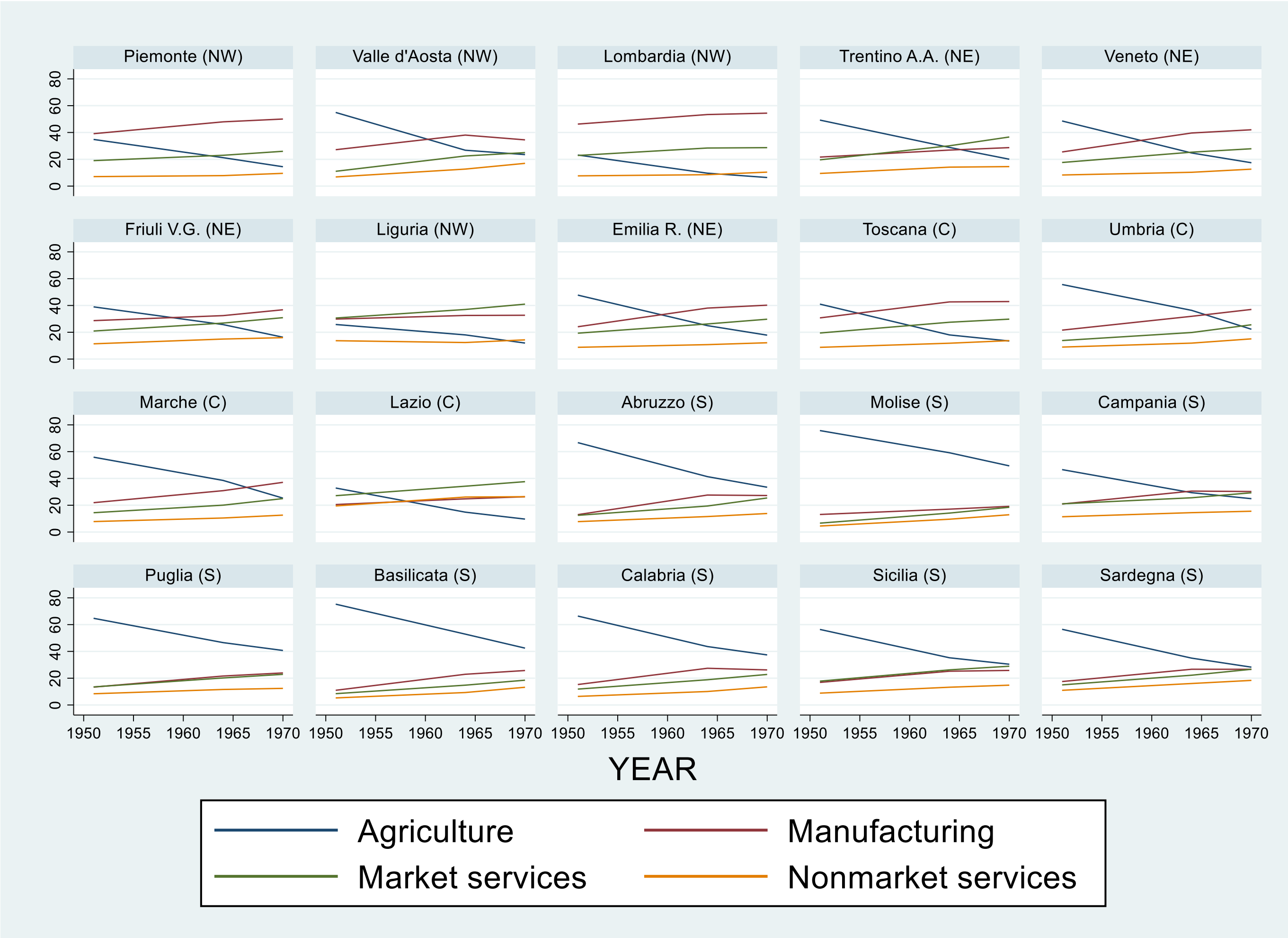

Fig. 1. Evolution of sectoral regional employment shares. Notes: NW = North-Western region, NE = North-Eastern region, C = Central region, *S* = Southern region.

Table 2
Employment shares.

Year		Agriculture	Manufacturing	Market service	Nonmarket service
1951	Max	75.8 (Molise)	46.3 (Lombardia)	30.6 (Liguria)	19.5 (Lazio)
	Min	23.2 (Lombardia)	11.0 (Basilicata)	6.6 (Molise)	4.5 (Molise)
	Mean	50.9	22.9	17.1	9.1
1964	Max	59.2 (Molise)	53.4 (Lombardia)	37.0 (Liguria)	26.2 (Lazio)
	Min	9.7 (Lombardia)	17.1 (Molise)	14.2 (Molise)	7.8 (Piemonte)
	Mean	31.5	31.9	24.1	12.4
1970	Max	49.4 (Molise)	54.5 (Lombardia)	41.0 (Liguria)	26.4 (Lazio)
	Min	6.4 (Lombardia)	19.2 (Molise)	18.5 (Molise)	9.5 (Piemonte)
	Mean	24.3	33.4	27.8	14.5
Variation of (mean) employment share					
Δ 1951–1970		−26.6	10.5	10.7	5.4
Δ 1951–1964		−19.4	9.0	7.0	3.3
Δ 1964–1970		−7.2	1.5	3.7	2.1

time t ($y_{it} = \frac{Y_{it}}{L_{it}}$) and SEC to denote manufacturing (M), market service (MS), and nonmarket service (NMS) sectors, we can write:

$$\begin{aligned}\ln y_{it} = {} & (1-\theta)\ln y_{i,t-1} \\ & + \sum_{j=1}^{3}\beta_j x_{it}^{j} + \sum_{SEC=1}^{3}\vartheta_{SEC} GROWTH\_SEC_{it} \\ & + \sum_{SEC=1}^{3}\xi_{SEC}(ODDS\_SEC_{it} \times GROWTH\_SEC_{it}) + \mu_i + \zeta_t + \upsilon_{it},\end{aligned} \tag{10}$$

where $(1-\theta) = e^{-\lambda t}$, β_j, ϑ_{SEC}, and ξ_{SEC} are parameters to be estimated, whereas x_{it}^{j} are the standard explanatory variables of the Mankiw et al. (1992) model—the natural logarithm of the two shares of output devolved to physical (s_K) and human (s_H) capital accumulations and of the effective depreciation rate ($n+g+\delta$). $GROWTH\_SEC_{it}$ are the three structural change terms given by Eqs. (3a)–(3c), whereas ($ODDS\_SEC_{it} \times GROWTH\_SEC_{it}$) represent the three structural change terms given by Eqs. (4a)–(4c).[3] In addition, μ_i are region-specific effects, ζ_t are time-specific effects, and υ_{it} is a zero-mean error term.

Notice that to assess the impact of $GROWTH\_SEC_{it}$ on y_{it}, the partial derivative

$$\frac{\partial(\ln y_{it})}{\partial GROWTH\_SEC_{it}} = \vartheta_{SEC} + \xi_{SEC} ODDS\_SEC_{it} \tag{11}$$

must be considered. As Eq. (11) clearly shows, the effect of $GROWTH\_SEC_{it}$ on $\ln y_{it}$ depends on $ODDS\_SEC_{it}$. More precisely, Eq. (11) is a semi-elasticity and can be interpreted as follows: For a given value of $\overline{ODDS\_SEC}$, if $GROWTH\_SEC_{it}$ increases by one unit, GDP over total labor units changes by 100 $\times$ $(\vartheta_{SEC} + \xi_{SEC}\overline{ODDS\_SEC})$%.

Two further issues deserve to be discussed before proceeding with the empirical analysis. First, Eqs. (8) and (9) show that the structural change terms are trending variables (both multiplied by t). Hence, the six structural change terms defined in Eqs. (3a)–(3c) and (4a)–(4c) should also be treated as trending ones. However, as a robustness check, we also perform the regressions without trending variables (available upon request), and all the main results remain unchanged. Second, considering that the correlation between the lagged dependent variable and the region-specific effects used to account for unobserved unit-specific heterogeneity leads to inconsistent and biased OLS estimates,[4] many studies on convergence rely on the system GMM estimator (Arellano and Bover 1995; Blundell and Bond, 1998), which accounts for these econometric problems and yields "consistent parameter estimates even in the presence of measurement errors and endogenous right-hand-side variables" (Bond et al., 2001, p. 14). In the GMM regressions, we treat all variables as potentially endogenous and instrument them. In addition, given that the system GMM estimator is consistent if no second-order autocorrelation is observed, then two diagnostic tests are reported: The Sargan test of overidentifying restrictions for the joint validity of the full instrument set and the Arellano–Bond test of first- and second-order autocorrelation.

[3] In Section 6.3, we consider internal migration flows and add immigration and emigration rates to the set of explanatory variables. We also look at the role of international migration flows, namely, expatriation and repatriation rates (results are reported in Tables B6 and B7 in Appendix B).

[4] Precisely, the OLS estimate of the lagged dependent variable is upward biased, whereas the fixed effect (FE) estimate is downward biased. For this reason, an unbiased estimator should yield a parameter estimate in between these two bounds.

6. Estimation results

In this section, we present the empirical analysis for the whole country and the Center-Northern and Southern regions separately. We also investigate the role of internal and international migration flows.

6.1. Evidence for the whole country

Estimates for the whole country are reported in Table 3a. Looking at the general diagnostic tests of GMM regressions, we see that based on the Sargan test, the system GMM estimates reveal no concern about instrument validity. Furthermore, the AB(2) test rejects second-order serial correlation in the first-differenced residuals, hence estimates are consistent. As for regressors, the lagged dependent variable is always highly statistically significant and, as expected, the FE-estimated coefficients are always lower than the GMM ones.[5] The share of investment over GDP is never statistically significant, even though it displays the expected positive sign in the GMM regressions.

This result is not new in the literature on convergence in Italy (Piras, 1996; Paci and Pigliaru, 1995; Mauro and Podrecca, 1994). In our specific case, such a result can also be explained by the fact that the data provided by Svimez (2011) used for the 1951–1959 period, which refers to four macro areas, rather than to the 20 regions, are not precisely estimated. The effective depreciation rate is correctly signed and turns out mildly significant only in the FE estimates. The three proxies used to measure human capital investment show mixed results. On the one hand, the primary school enrollment rate is negative but statistically insignificant; on the other hand, the lower- and upper-secondary enrollment rates are positive, but they turn out statistically significant only in Column (3) and marginally at 10% statistical significance in Column (5). However, also this result is not new in the literature on Italian regions (Piras, 1996; Paci and Pigliaru, 1995; Mauro and Podrecca, 1994).

We now concentrate on the structural change terms. $GROWTH\_M$ is always significant at 1% statistical confidence across all estimates; apart from Column (2), $GROWTH\_NMS$ is highly statistically significant; $GROWTH\_MS$ turns out significant albeit with low levels of statistical relevance in Columns (2) and (6). The overall impact of the structural change terms, however, should be established by looking at Eq. (11) and evaluating it for different values of $ODDS\_SEC$ in the sample. Table 3b presents these overall effects derived from the regressions of Table 3a for different percentiles of $ODDS\_SEC$. The total effect of the three structural change terms $GROWTH\_M$, $GROWTH\_MS$, and $GROWTH\_NMS$ is almost always highly statistically significant across almost all percentiles of $ODDS\_SEC$. Furthermore, at each percentile, the semi-elasticities are not statistically different across the six estimates, whereas for a given regression sometimes (at the lowest and highest percentiles) a statistically different effect for $GROWTH\_M$, $GROWTH\_MS$, and $GROWTH\_NMS$ emerges (full results are available upon request). An example of the implied effects of the semi-elasticities reported in Table 3b can be found in Column (1), at the median value of $ODDS\_M$ if $GROWTH\_M$ increases by one unit, then GDP over total labor units changes by 0.36% over one year. One can also consider a one-unit simultaneous increase of $GROWTH\_M$, $GROWTH\_MS$, and $GROWTH\_NMS$, in which case GDP over total labor units changes by 1.14%.

As stated in Section 2, we also perform restricted GMM estimates to check whether, on the one hand, $GROWTH\_M$,

[5] In Column (6), the estimated coefficient of the lagged dependent variable is 1.022 thus pointing toward divergence, rather than convergence. However, the 95% confidence interval lies between 0.930 and 1.114, and a formal Wald test cannot reject the null hypothesis that the estimated coefficient equals one (p-value = 0.642).

Table 3a
Structural change and convergence across Italian regions.

Variable	(1) FE	(2) GMM	(3) FE	(4) GMM	(5) FE	(6) GMM
$\ln y_{t-1}$	0.808***	0.987***	0.737***	0.988***	0.789***	1.022***
	[0.037]	[0.066]	[0.039]	[0.022]	[0.038]	[0.047]
$\ln s_K$	−0.020	0.045	−0.027	0.038	−0.022	0.058
	[0.021]	[0.042]	[0.020]	[0.041]	[0.021]	[0.058]
$\ln s_H$ (primary school)	−0.011	−0.043				
	[0.027]	[0.067]				
$\ln s_H$ (lower-secondary school)			0.064***	0.046		
			[0.017]	[0.115]		
$\ln s_H$ (upper-secondary school)					0.025*	0.057
					[0.013]	[0.055]
$ln(n+g+\delta)$	−0.006*	0.012	−0.007**	0.010	−0.006*	0.003
	[0.003]	[0.009]	[0.003]	[0.009]	[0.003]	[0.009]
GROWTH_M	0.0009***	0.0012***	0.0009***	0.0011***	0.0010***	0.0009***
	[0.014]	[0.020]	[0.013]	[0.021]	[0.014]	[0.023]
GROWTH_MS	0.0006**	0.0007*	0.0006**	0.0007**	0.0006**	0.0006*
	[0.027]	[0.040]	[0.028]	[0.032]	[0.027]	[0.033]
GROWTH_NMS	0.0015***	0.0014*	0.0015***	0.0016**	0.0014***	0.0015***
	[0.034]	[0.077]	[0.033]	[0.066]	[0.033]	[0.038]
GROWTH_M	−0.0042*	−0.0055	−0.0032	−0.0039	−0.0043*	−0.0044
×*ODDS_M*	[0.214]	[0.366]	[0.206]	[0.333]	[0.218]	[0.345]
GROWTH_MS	0.0019	0.0046	0.0012	0.0028	0.0019	0.0025
×*ODDS_MS*	[0.234]	[0.438]	[0.255]	[0.379]	[0.233]	[0.309]
GROWTH_NMS	−0.0013	−0.0019	−0.0046	−0.0007	−0.0023	0.0005
×*ODDS_NMS*	[0.646]	[1.340]	[0.662]	[0.821]	[0.642]	[0.732]
R -squared	0.996		0.996		0.996	
AB(1) (p-value)		0.002		0.002		0.001
AB(2) (p-value)		0.117		0.100		0.071
Sargan (p-value)		0.612		0.580		0.403

Notes: Observations: 362. Heteroscedasticity-robust standard errors in brackets. In the GMM regressions, AB(1) and AB(2) are the first- and second-order Arellano–Bond test of autocorrelation, Sargan is the test of overidentifying restrictions for the joint validity of the full instrument set. Lagged levels dated t-2 of the lagged dependent variable along with lagged levels (dated t-1 and t-2) of all remaining dependent variables for the first-differenced equations, combined with the first differences of all variables, are used as instruments. The option *collapse* of the STATA user-written (Roodman, 2009) xtabond2 routine is used to reduce the instrument count. Number of instruments: 44.

Table 3b
Estimated effects of structural change on GDP over labor units.

	(1) FE	(2) GMM	(3) FE	(4) GMM	(5) FE	(6) GMM
ODDS_M			*GROWTH_M*			
5th percentile	0.0044***	0.0054***	0.0042***	0.0050***	0.0045***	0.0044***
p-value	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
25th percentile	0.0039***	0.0048***	0.0038***	0.0046***	0.0040***	0.0039***
p-value	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
median	0.0036***	0.0044***	0.0036***	0.0043***	0.0037***	0.0036***
p-value	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
75th percentile	0.0032***	0.0039***	0.0033***	0.0039***	0.0033***	0.0032***
p-value	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
95th percentile	0.0027***	0.0032***	0.0028***	0.0034***	0.0027***	0.0026***
p-value	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
ODDS_MS			*GROWTH_MS*			
5th percentile	0.0031*	0.0026	0.0034*	0.0037*	0.0031*	0.0034
p-value	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
25th percentile	0.0034**	0.0043**	0.0036**	0.0041**	0.0034**	0.0038**
p-value	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]
median	0.0036***	0.0047***	0.0037***	0.0044***	0.0035**	0.0040***
p-value	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.002]
75th percentile	0.0038***	0.0052***	0.0038***	0.0047***	0.0037***	0.0043***
p-value	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]
95th percentile	0.0041***	0.0060***	0.0040***	0.0052***	0.0041***	0.0047***
p-value	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
ODDS_NMS			*GROWTH_NMS*			
5th percentile	0.0044***	0.0043	0.0047***	0.0049**	0.0043***	0.0045***
p-value	[0.001]	[0.003]	[0.001]	[0.002]	[0.001]	[0.001]
25th percentile	0.0043***	0.0041*	0.0043***	0.0049**	0.0041***	0.0045***
p-value	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.001]
median	0.0042***	0.0040**	0.0040***	0.0048***	0.0039***	0.0046***
p-value	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.001]
75th percentile	0.0042***	0.0039***	0.0038***	0.0048***	0.0038***	0.0046***
p-value	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
95th percentile	0.0040***	0.0037**	0.0033***	0.0047***	0.0036***	0.0047***
p-value	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]

Notes: The values are semi-elasticities based on the estimated coefficients of Table 3a. Heteroscedasticity-robust standard errors are in brackets. See the main text for further details.

GROWTH_MS, and *GROWTH_NMS*, on the other hand, *DISEQ_M*, *DISEQ_MS*, and *DISEQ_NMS* are significant when entered alone into the regressions (restricted estimates). The results reported in Columns (1)–(3) of Table B1 (Appendix B) highlight the fundamental role of *GROWTH_M*, *GROWTH_MS*, and *GROWTH_NMS* in determining per worker GDP.

In addition, the results in Columns (4)–(6) show that *DISEQ_M* is still not significant, but *DISEQ_MS* and *DISEQ_NMS* turn out highly statistically significant.[6] These findings hint that the poor results of interaction terms in Table 3a are most likely due to multicollinearity. This is confirmed by Table B2 in the Appendix where correlations among the structural change terms are reported. At the nationwide level, correlation is high for *GROWTH_MS* and *DISEQ_MS* as well as for *GROWTH_NMS* and *DISEQ_NMS*. A similar pattern emerges for Center-Northern and Southern regions. For the latter, also *GROWTH_M* and *DISEQ_M* show a high correlation.

Overall, these estimates demonstrate that to fully understand the impact of structural change on growth and convergence in Italy during the years of the *miracolo economico*, the shifting of the labor force from agricultural to the market and the nonmarket service sectors was at least as important as the shifting to the manufacturing sector. This result extends backward and complements the findings of Paci and Pigliaru (1997) and Capasso et al. (2012). We can conclude that for the whole country, strong evidence exists for structural change effects connected with marginal product differentials across sectors.

6.2. Evidence for the Center-Northern and Southern regions

The long-standing divide between the Center-Northern and Southern regions that still characterizes Italy asks for further investigation to check whether, during the years of the *miracolo economico*, the role of structural change on growth and convergence was differentiated and whether these two macro areas of the country headed toward different long-run equilibria.

The prevailing literature has termed the years from 1951 and the first oil crisis, those in which a remarkable convergence process in Italy occurred, as the “the golden age” of convergence (Iuzzolino et al., 2011; Felice, 2018). During these years, the gap of per capita output of the Southern regions with respect to the Center-Northern ones “was narrowed from 53 percentage points in 1951 to 44 in 1961 and 33 in 1971″ (Iuzzolino et al., 2011; p. 33). “Industrial productivity also rose sharply, from 76.4 to 99.1 of that of the Center-North” (Iuzzolino et al., 2011; p. 34). This being the case, we aim to answer the following questions: What was the role of structural change in the Center-North *vis-à-vis* the South? Did it operate homogeneously or heterogeneously between these two macro areas of the country? Daniele and Malanima (2014, p. 172) suggest that during the 1951–1971 period, the reallocation of labor force within sectors and within regions induced “a rising convergence within the North and the South together with a rising divergence between these two areas.” They suggest this occurrence was attributable to some key factors, in particular to interregional labor and capital movements, which affected the disseminative effects of technological and structural change. In detail, Daniele and Malanima (2014) link the evolution of regional inequalities to the geographic concentration–dispersion of the manufacturing sector. An important question that remains to be explored is whether the persistence of two distinct club convergence areas—during the national convergence period—can be better understood by looking at the structural change process that also involved the market and the nonmarket service sectors.

Looking at the results reported in Columns (1)–(3) of Table 4a,[7] the structural change involved all sectors and was the main driver able to explain the evolution of per worker GDP among Center-Northern regions. For these regions, only *GROWTH_M*, *GROWTH_MS*, and *GROWTH_NMS* display statistically significant coefficients, whereas none of the standard explanatory variables (savings and depreciation rates) turn out significant.

As expected, the lagged dependent variable is highly statistically significant and reports a point estimate higher than the ones in Columns (1) and (3).[8] Conversely, in Southern regions, among the structural change terms, only *GROWTH_M* and *GROWTH_NMS* × *ODDS_NMS* are statistically significant in all estimates reported in Columns (4)–(6). In Column (4), the investment rate in physical capital is positive and statistically significant, whereas in Columns (5) and (6), a statistically positive role for lower-secondary and upper-secondary school enrollment rates is found. Thus, for the Center-Northern regions, the engine of growth was structural change alone; for Southern regions, physical and human capital investment rates had positive impacts on growth.[9]

As performed for the whole country, Table 4b reports the estimated semi-elasticities based on Table 4a results to evaluate the overall impact of structural change on the two macro areas of the country. As presented in Columns (1)–(3), in the Center-Northern regions, *GROWTH_M* and *GROWTH_NMS* are always highly statistically significant across all percentiles of *ODDS_M* and *ODDS_NMS*, respectively. Except for the 5th percentile of *ODDS_MS* in Columns (1) and (3), this result also holds for *GROWTH_MS*. In the Southern regions—Columns (4)–(6) of Table 4b—the total effect of *GROWTH_M* is not significant at the 5th and 95th percentiles of *ODDS_M*; the total effect of *GROWTH_MS* is confirmed positive and statistically significant at all, except for the 5th percentile of *ODDS_MS*; finally, *GROWTH_NMS* is significant only at the 75th (in Columns (4) and (5)) and 95th percentiles of *ODDS_NMS*.

From the separate analysis of the two macro areas of the country, the structural change in the Center-Northern regions was widespread across all sectors, whereas in the Southern regions, its diffusion was less extensive. In the Southern regions, the increase of workforce in the nonmarket service sector was much less relevant, which might be due to low productivity in the said sector that encompasses the public sector. Thus, this result suggests that in the Center-Northern regions, the public sector, along with the private sector, acted positively to enhance growth; whereas in the Southern regions, it did not operate with analogous strength.[10] In addition, it should also be remembered that in those years, a mas-

[6] The results reported in Table B1 regarding the other covariates are overall worse than those obtained in Table 3a. None of the standard variables included in the neoclassical growth model *à la* Mankiw, Romer, and Weil appear relevant, whereas only the lagged dependent variable turns out significant with an estimated elasticity higher than one in five out of six estimates. Yet, even in these cases, a formal Wald test cannot reject the null hypothesis that the estimated coefficients are equal to one.

[7] For reasons of space and because GMM estimates tackle endogeneity issues, whereas FE ones do not, only the former are reported in Table 4a. However, the results are similar for FE estimates and available upon request.

[8] However, a formal Wald test cannot reject the null hypothesis that in both circumstances, the estimated coefficients equal one (*p*-values 0.613 and 0.386).

[9] When looking at the restricted GMM estimates for Center-Northern regions reported in Table B3 (see Appendix), a statistically significant positive effect is detected for *GROWTH_M*, *GROWTH_MS*, and *GROWTH_NMS* in Columns (1)–(3) and for *DISEQ_MS* and *DISEQ_NMS* in Columns (4)–(6). Once again, leaving the lagged dependent variable aside, none of the other regressors turn out significant. In Table B4, the restricted estimates for Southern regions reveal a positive effect of *GROWTH_M*, *GROWTH_MS*, and *GROWTH_NMS* in Columns (1)–(3); of *DISEQ_NMS* in Columns (4)–(6); and marginally, of a positive effect of *DISEQ_MS* in Column (5).

[10] Different possible explanations have been put forward to explain why this might have happened Mauro and Pigliaru (2013). argue that the efficiency of public investment and public employment is related to the local endowment of social capital. When social capital is low (as it happens in the Southern regions), public investment and public employment are less productive Scalera and Zazzaro (2010). stress the role of the poor skills of local bureaucracies in the South. In the same vein, Alesina et al. (2001) suggest that public employment productivity in the South

Table 4a
Structural change and convergence across the macro areas of Italy (GMM estimates).

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Center-Northern regions			Southern regions		
$\ln y_{t-1}$	1.009***	0.946***	1.027***	0.863***	0.882***	0.866***
	[0.018]	[0.044]	[0.031]	[0.064]	[0.070]	[0.045]
$\ln s_K$	0.005	0.006	0.017	0.059**	0.052	0.052
	[0.022]	[0.014]	[0.016]	[0.026]	[0.032]	[0.048]
$\ln s_H$ (primary school)	−0.058			0.109		
	[0.061]			[0.116]		
$\ln s_H$ (lower-secondary school)		−0.050			0.007*	
		[0.064]			[0.102]	
$\ln s_H$ (upper-secondary school)			0.035			0.129***
			[0.028]			[0.040]
$ln(n+g+\delta)$	−0.003	0.006	−0.005	0.001	0.003	0.006
	[0.005]	[0.005]	[0.005]	[0.016]	[0.013]	[0.015]
GROWTH_M	0.0009***	0.0009***	0.0009***	0.0019*	0.0019**	0.0018*
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]
GROWTH_MS	0.0007*	0.0007**	0.0006*	0.0014	0.0013	0.0016
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]
GROWTH_NMS	0.0015***	0.0015***	0.0018***	−0.002	−0.0005	−0.0004
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]
GROWTH_M	−0.0039***	−0.0020	−0.0028***	−0.0178	−0.0193	−0.0122
×*ODDS_M*	[0.001]	[0.001]	[0.001]	[0.022]	[0.019]	[0.024]
GROWTH_MS	0.0044	0.0040	0.0047	0.0002	0.0043	−0.0003
×*ODDS_MS*	[0.005]	[0.004]	[0.004]	[0.017]	[0.017]	[0.019]
GROWTH_NMS	−0.0023	0.0010	−0.0039	0.0370**	0.0420***	0.0296**
×*ODDS_NMS*	[0.008]	[0.010]	[0.008]	[0.015]	[0.011]	[0.014]
O bservations	222	222	222	140	140	140
AB(1) (*p*-value)	0.004	0.003	0.004	0.011	0.008	0.008
AB(2) (*p*-value)	0.401	0.279	0.199	0.608	0.983	0.909
Sargan (*p*-value)	0.221	0.292	0.214	0.906	0.739	0.434

Notes: See Table 3a and the main text for more details. Number of instruments: 44.

Table 4b
Estimated effects of structural change on GDP over labor units: Center-Northern regions versus Southern regions (GMM estimates).

	(1)	(2)	(3)	(4)	(5)	(6)
	Center-Northern regions			Southern regions		
ODDS_M			*GROWTH_M*			
5th percentile	0.0050***	0.0047***	0.0046***	0.0079	0.0083	0.0071
p-value	[0.001]	[0.001]	[0.001]	[0.006]	[0.005]	[0.006]
25th percentile	0.0045***	0.0044***	0.0043***	0.0060*	0.0062**	0.0058*
p-value	[0.001]	[0.001]	[0.001]	[0.003]	[0.003]	[0.003]
median	0.0042***	0.0043***	0.0041***	0.0046***	0.0047***	0.0048***
p-value	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]
75th percentile	0.0039***	0.0041***	0.0038***	0.0030***	0.0030***	0.0038***
p-value	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
95th percentile	0.0034***	0.0039***	0.0035***	0.0002	−0.0000	0.0019
p-value	[0.001]	[0.001]	[0.001]	[0.004]	[0.004]	[0.005]
ODDS_MS			*GROWTH_MS*			
5th percentile	0.0038	0.0041*	0.0031	0.0081	0.0071	0.0089
p-value	[0.003]	[0.002]	[0.002]	[0.007]	[0.007]	[0.008]
25th percentile	0.0043**	0.0045**	0.0037**	0.0081*	0.0079*	0.0088*
p-value	[0.002]	[0.002]	[0.002]	[0.005]	[0.004]	[0.005]
median	0.0046***	0.0048***	0.0040***	0.0082***	0.0085***	0.0088***
p-value	[0.002]	[0.001]	[0.001]	[0.003]	[0.003]	[0.003]
75th percentile	0.0050***	0.0051***	0.0044***	0.0082***	0.0089***	0.0088***
p-value	[0.001]	[0.002]	[0.001]	[0.002]	[0.002]	[0.003]
95th percentile	0.0059***	0.0059***	0.0054***	0.0082**	0.0096***	0.0087*
p-value	[0.001]	[0.001]	[0.001]	[0.004]	[0.004]	[0.004]
ODDS_NMS			*GROWTH_NMS*			
5th percentile	0.0044***	0.0041*	0.0053***	−0.0032	−0.0045	0.0034
p-value	[0.001]	[0.002]	[0.002]	[0.004]	[0.003]	[0.003]
25th percentile	0.0042***	0.0041***	0.0050***	0.0002	−0.0001	0.0006
p-value	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]
median	0.0041***	0.0042***	0.0048***	0.0030	0.0025	0.0015
p-value	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]
75th percentile	0.0040***	0.0042***	0.0046***	0.0053***	0.0051**	0.0034
p-value	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.002]
95th percentile	0.0037***	0.0044***	0.0042***	0.0093***	0.0097***	0.0066**
p-value	[0.001]	[0.002]	[0.001]	[0.003]	[0.003]	[0.003]

Notes: The values are semi-elasticities based on the estimated coefficients of Table 4a. Heteroscedasticity-robust standard errors are indicated in brackets. See the main text for further details.

sive State intervention occurred in the Southern regions through the state-owned *Cassa per il Mezzogiorno* (Felice, 2019). The *Cassa per il Mezzogiorno* financed many infrastructures in the South and contributed to the expansion of the manufacturing sector through state-owned enterprises that had to locate 60% of new investments and no less than 40% of total assets in the South. Yet, the positive role of the state intervention in the South was not confined to this area, as many firms located in the Center-North took an indirect advantage because the increased income levels in the South, generated by public investment, contributed to increasing the demands of final goods and services produced by Center-Northern firms (Iuzzolino et al., 2011).

To summarize, based on these results, we can argue that labor reallocation from the agricultural sector to the manufacturing, the market service, and the nonmarket service sectors played a crucial role in the growth process. This role was widespread and robust for the Center-Northern regions but, to some extent, less strong for the Southern regions. These results complement previous research by Daniele and Malanima (2014) and hint that these two macro areas followed partially different growth paths. Furthermore, they cast doubts regarding the so far generally agreed result that during the fifties and sixties of the last century, a nationwide conditional convergence process across the whole country took place. The standard capital deepening mechanism stressed by the one-sector neoclassical growth model was not the one that worked for convergence, rather structural change drove it. Its proof is that the structural change variables had a greater impact and a clear-cut role on convergence than the other traditional variables of the standard neoclassical growth model.

6.3. Internal migration

During the years under investigation, large internal (mainly from Southern toward Center-Northern regions) and international migration flows were recorded in Italy. According to Del Monte and Giannola (1978, p. 167–170), during the fifties and sixties of the last century, over four million southerners migrated to the Center-North region. The effect found regarding the role of structural change on growth possibly masked the role exerted by migration flows, hence this issue must be explored.

In the neoclassical growth model, the role of migration flows on growth and convergence can be positive, nil or negative, depending on the relative endowments of migrants' human capital with respect to the resident population's human capital (Piras, 2013; Barro and Sala-i-Martin, 2005 (Chapter 11); Dolado et al., 1994). This ambiguity is explained by there being a negative *quantity* effect of immigration and a positive *quantity* effect of emigration. However, a positive *quality* (or *composition*) effect of immigration and a negative *quality* effect of emigration also exist. Thus, the overall impact is a matter of empirical investigation being aware that the difficulty of assessing a clear role of migration flows on convergence may be due to the difficulties of gathering detailed data on human capital endowments of migrants and the resident population. Incidentally, this can be the reason why previous studies on the role of migration flows on convergence and growth found mixed results.

Simply adding internal immigration and emigration rates to an otherwise standard convergence equation (thus looking for quantity effects alone), Piras (1996) and Paci and Pigliaru (1995) find that migration flows did not affect regional convergence during the seventies and the eighties of the last century. Similarly, for the 1962–1989 period, Goria and Ichino (1994) find ambiguous and weak results for the regional immigration and emigration rates. On the contrary, Piras (2013) considers immigration and emigration rates along with human capital-adjusted immigration and emigration rates for the 1970–2005 period and finds that the quantity effect is negative for the immigration rate and positive for the emigration rate, whereas the composition effect is positive for immigration and negative for emigration.

In the present study, the data availability of internal migration flows starts from 1955, hence the regressions reported in Table 5 refer to the 1955–1970 period. Unfortunately, we do not have data on the human capital endowments of migrants and the resident population, and we cannot test whether migration flows during this period affected regional growth through the composition effect. For the same reason, we cannot pursue the goal of Capasso et al. (2012) to study the impact of migration on growth via their effect on structural change. All we can do is check whether migration flows affected regional growth solely via the quantity effect. To accomplish this, we introduce (the log of) regional immigration ($\ln$ immrate) and emigration ($\ln$ emirate) rates—defined as the percentage ratio of the number of individuals who changed residency in (or out of) an Italian region over resident population—to Eq. (10).

The main findings for the whole country, found in Table 3a, are confirmed in Table 5. Lower- and upper-secondary schools (two of the three human capital proxies) are now positive and statistically significant in Columns (3) and (5), respectively. The share of investment over GDP is always statistically insignificant. The effective depreciation rate loses most statistical relevance. The structural change terms *GROWTH_M*, *GROWTH_MS*, and *GROWTH_NMS* are always highly statistically significant, and the point estimates are close to what was previously found in Table 3a. At the same time, structural change terms $GROWTH\_M \times ODDS\_M$, $GROWTH\_MS \times ODDS\_MS$, and $GROWTH\_NMS \times ODDS\_NMS$ are barely statistically significant.

Finally, as regards migration flows, the immigration rate is never statistically significant, and the emigration rate is feebly statistically significant in Column (1). Therefore, internal migration had no role in convergence during these years, supporting Felice (2018, p. 58) who claims that massive migration flows during the fifties and sixties of the last century contributed in a minor way to the convergence process.[11]

To sum up, introducing internal and international migration flows does not alter the main results of previous analyses: the central role of structural change on growth and convergence is neither affected in any way by the movement of individuals across regions nor by expatriation or repatriation. Thus, notwithstanding during those years, huge flows of people moved from the South to the Center-North and from Italy to other countries, no impact on per worker GDP can be detected.

7. Conclusions

In this study, we investigate the role of structural change on convergence in Italy during the fifties and sixties of the last century, the years of the Italian economic miracle. In the footsteps of Temple and Wößmann (2006), we build a four-sector theoretical growth model to account for structural change inside of an otherwise standard neoclassical growth model (Mankiw et al., 1992). We

is lower than in the North and argue that wages in the public sector in the South can partially be seen as income redistribution Del Monte and Giannola (1997). hint at the possibility that public intervention was motivated to increase the size (and power) of local authorities, rather than to support investment and promote growth.

[11] Separate results for the Center-Northern and Southern regions, relegated in Table B5 in Appendix B, show similar results to those presented in Table 4a for the main variables and no role for the two migration flows rates. Furthermore, Tables B6, B7 in Appendix B report the results including international migration rates, namely, the natural logarithmic of repatriation rate (remrate) and expatriation rate (exprate). Once more, the results are like those referred to internal migration and hint that international migration flows did not influence regional growth.

Table 5
Structural change, internal migration flows, and convergence (Italy).

Variable	(1) FE	(2) GMM	(3) FE	(4) GMM	(5) FE	(6) GMM
$\ln y_{t-1}$	0.818***	0.975***	0.701***	0.970***	0.801***	0.949***
	[0.044]	[0.038]	[0.044]	[0.040]	[0.045]	[0.048]
$\ln s_K$	−0.018	0.050	−0.022	0.060	−0.017	0.058
	[0.023]	[0.042]	[0.020]	[0.043]	[0.022]	[0.045]
$\ln s_H$ (primary school)	−0.027	−0.039				
	[0.025]	[0.045]				
$\ln s_H$ (lower-secondary school)			0.102***	−0.045		
			[0.020]	[0.035]		
$\ln s_H$ (upper-secondary school)					0.028*	0.044
					[0.016]	[0.040]
$ln(n+g+\delta)$	−0.005	0.002	−0.007**	0.002	−0.005	−0.008
	[0.003]	[0.007]	[0.003]	[0.007]	[0.003]	[0.006]
GROWTH_M	0.0010***	0.0009***	0.0009***	0.0009***	0.0010***	0.0007***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
GROWTH_MS	0.0056**	0.0006*	0.0006**	0.0006*	0.0005**	0.0004
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
GROWTH_NMS	0.0014***	0.0011**	0.0015***	0.0012**	0.0013***	0.0008
	[0.000]	[0.001]	[0.000]	[0.001]	[0.000]	[0.001]
GROWTH_M	−0.0044**	−0.0054	−0.0040**	−0.0043*	−0.0046**	−0.0058*
×*ODDS_M*	[0.002]	[0.004]	[0.002]	[0.002]	[0.002]	[0.003]
GROWTH_MS	0.0021	0.0038	0.0005	0.0044	0.0023	0.0040
×*ODDS_MS*	[0.002]	[0.003]	[0.003]	[0.003]	[0.002]	[0.004]
GROWTH_NMS	−0.0017	0.0034	−0.0061	0.0016	−0.0023	0.0085
×*ODDS_NMS*	[0.007]	[0.010]	[0.007]	[0.011]	[0.007]	[0.010]
ln immrate	−0.002	0.004	−0.019	−0.001	−0.004	0.050
	[0.015]	[0.039]	[0.013]	[0.020]	[0.014]	[0.040]
ln emirate	0.016*	−0.008	0.001	−0.032	0.009	−0.022
	[0.009]	[0.036]	[0.008]	[0.033]	[0.008]	[0.043]
R-squared	0.996		0.996		0.996	
AB(1) (*p*-value)		0.002		0.002		0.001
AB(2) (*p*-value)		0.026		0.030		0.015
Sargan (*p*-value)		0.297		0.325		0.139

Notes: Observations: 302. See Table 3a and the main text for more details. Number of instruments: 45.

analyze the role of labor force reallocation from the agricultural to manufacturing, market service, and nonmarket service sectors. This historical period for Italy has never been explored. In addition, the four-sector perspective used here to investigate structural change, growth, and convergence has never been used in any other cross-country or cross-regional studies.

We demonstrate that structural change had a fundamental role in regional growth and convergence and that such a role was heterogeneous between the more advanced regions and the less developed ones. It was stronger for the Center-Northern regions than for the *Mezzogiorno*. Therefore, our findings contrast with the so far generally agreed result that during the fifties and sixties of the last century, a nationwide conditional convergence process across the whole country took place—it was the structural change that drove convergence, not the standard capital deepening mechanism. A similar result for the 1970–1992 period was already observed by Paci and Pigliaru (1997), whereas Capasso et al. (2012) fail to find a direct role for structural change in the 1964–2002 period and detect an indirect role through high-skilled migration flows.

What kind of policy consideration on the possible role of shifts toward high-productivity economic activities in favoring the economic growth of weak regions can be drawn from our results? Historically, countries that have achieved prolonged growth have experienced deep structural change. Inasmuch structural change is not simply a market-driven process, policy interventions are needed to provide tangible assets, such as physical infrastructures, and intangible assets, such as well-functioning institutions and public services. Referring to this point, our results regarding the differentiated role of the nonmarket service sector in the Center-Northern and the Southern regions seem to suggest that in Italy, during the time scrutinized in this paper, policy interventions have not had the same strength in these two macro areas of the country.

Author statement

I declare that the paper has not been submitted to any other Journal.

I declare that I am the only author of this paper.

I declare that the data used in the paper will be made available upon request.

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Appendix A. Derivation of the aggregate Solow residual and the structural change terms

Let us consider a four-sectors ($SEC = A, M, MS$, and NMS) economy with agriculture (A), manufacturing (M), market service sector (MS) and nonmarket service sector (NMS). Each sector produces output using capital (K_{SEC}) and labor (L_{SEC}) according to the following constant returns to scale production functions:

$$Y_A = A_A F^A(K_A,\ L_A) \tag{A1}$$

$$Y_M = A_M F^M(K_M,\ L_M) \tag{A2}$$

$$Y_{MS} = A_{MS} F^{MS}(K_{MS},\ L_{MS}) \tag{A3}$$

$$Y_{NMS} = A_{NMS}F^{NMS}(K_{NMS},\ L_{NMS}) \tag{A4}$$

where A_A, A_M, A_{MS} and A_{NMS} are sectoral total factor productivities. Total output equals to:

$$Y = Y_A + q_M Y_M + q_{MS}Y_{MS} + q_{NMS}Y_{NMS} \tag{A5}$$

where q_M, q_{MS} and q_{NMS} are relative prices with respect to the agriculture good which is the numeraire. Workers are paid their marginal productivity, hence:

$$w_A = A_A F_L^A \tag{A6}$$

$$w_M = q_M A_M F_L^M \tag{A7}$$

$$w_{MS} = q_{MS} A_{MS} F_L^{MS} \tag{A8}$$

$$w_{NMS} = q_{NMS} A_{NMS} F_L^{NMS} \tag{A9}$$

where F_L^{SEC} are the partial derivatives with respect to labor in sector SEC. Capital receives its marginal productivity in each sector:

$$A_A F_K^A = q_M A_M F_K^M = q_{MS} A_{MS} F_K^{MS} = q_{NMS} A_{NMS} F_K^{NMS} = r \tag{A10}$$

Where F_K^{SEC} are the partial derivatives with respect to capital in sector SEC, and r is the rental rate on capital. The aggregate labor (η) and capital (1-η) shares are:

$$\eta = \frac{w_A L_A + w_M L_M + w_{MS} L_{MS} + w_{NMS} L_{NMS}}{Y} \tag{A11}$$

$$(1-\eta) = \frac{rK}{Y} \tag{A12}$$

Denoting output shares in manufacturing, market service and nonmarket service sectors as $s_M = \frac{q_M Y_M}{Y_A + q_M Y_M + q_{MS} Y_{MS} + q_{NMS} Y_{NMS}}$, $s_{MS} = \frac{q_{MS} Y_{MS}}{Y_A + q_M Y_M + q_{MS} Y_{MS} + q_{NMS} Y_{NMS}}$ and $s_{NMS} = \frac{q_{NMS} Y_{NMS}}{Y_A + q_M Y_M + q_{MS} Y_{MS} + q_{NMS} Y_{NMS}}$, respectively, then aggregate output growth can be written as:

$$\frac{\dot{Y}}{Y} = (1 - s_M - s_{MS} - s_{NMS})\frac{\dot{Y}_A}{Y_A} + s_M\frac{\dot{Y}_M}{Y_M} + s_{MS}\frac{\dot{Y}_{MS}}{Y_{MS}} + s_{NMS}\frac{\dot{Y}_{NMS}}{Y_{NMS}} \tag{A13}$$

The aggregate Solow residual is given by:

$$\frac{\dot{Z}}{Z} = \frac{\dot{Y}}{Y} - \eta\frac{\dot{L}}{L} - (1-\eta)\frac{\dot{K}}{K} \tag{A14}$$

Plugging (A13) into (A14) we obtain:

$$\frac{\dot{Z}}{Z} = (1 - s_M - s_{MS} - s_{NMS})\frac{\dot{Y}_A}{Y_A} + s_M\frac{\dot{Y}_M}{Y_M} + s_{MS}\frac{\dot{Y}_{MS}}{Y_{MS}} + s_{NMS}\frac{\dot{Y}_{NMS}}{Y_{NMS}} - \eta\frac{\dot{L}}{L} - (1-\eta)\frac{\dot{K}}{K} \tag{A15}$$

By differentiating each sectoral production function with respect to time we get:

$$\frac{\dot{Y}_A}{Y_A} = \left(\frac{\dot{A}_A}{A_A}\right)\left[\frac{A_A F^A(\cdot)}{Y_A}\right] + \left[\frac{A_A F_K^A(\cdot)K}{Y_A}\right]\left(\frac{\dot{K}_A}{K}\right) + \left[\frac{A_A F_L^A(\cdot)L}{Y_A}\right]\left(\frac{\dot{L}_A}{L}\right) \tag{A16}$$

$$\frac{\dot{Y}_M}{Y_M} = \left(\frac{\dot{A}_M}{A_M}\right)\left[\frac{A_M F^M(\cdot)}{Y_M}\right] + \left[\frac{A_M F_K^M(\cdot)K}{Y_M}\right]\left(\frac{\dot{K}_M}{K}\right) + \left[\frac{A_M F_L^M(\cdot)L}{Y_M}\right]\left(\frac{\dot{L}_M}{L}\right) \tag{A17}$$

$$\frac{\dot{Y}_{MS}}{Y_{MS}} = \left(\frac{\dot{A}_{MS}}{A_{MS}}\right)\left[\frac{A_{MS} F^{MS}(\cdot)}{Y_{MS}}\right] + \left[\frac{A_{MS} F_K^{MS}(\cdot)K}{Y_{MS}}\right]\left(\frac{\dot{K}_{MS}}{K}\right) + \left[\frac{A_{MS} F_L^{MS}(\cdot)L}{Y_{MS}}\right]\left(\frac{\dot{L}_{MS}}{L}\right) \tag{A18}$$

$$\frac{\dot{Y}_{NMS}}{Y_{NMS}} = \left(\frac{\dot{A}_{NMS}}{A_{NMS}}\right)\left[\frac{A_{NMS} F^{NMS}(\cdot)}{Y_{NMS}}\right] + \left[\frac{A_{NMS} F_K^{NMS}(\cdot)K}{Y_{NMS}}\right]\left(\frac{\dot{K}_{NMS}}{K}\right) + \left[\frac{A_{NMS} F_L^{NMS}(\cdot)L}{Y_{NMS}}\right]\left(\frac{\dot{L}_{NMS}}{L}\right) \tag{A19}$$

Multiplying both sides of (A16) by $(1 - s_M - s_{MS} - s_{NMS})$ yields:

$$(1 - s_M - s_{MS} - s_{NMS})\frac{\dot{Y}_A}{Y_A} = (1 - s_M - s_{MS} - s_{NMS})\left(\frac{\dot{A}_A}{A_A}\right) + \left[\frac{rK}{Y}\right]\left(\frac{\dot{K}_A}{K}\right) + \left[\frac{w_A L}{Y}\right]\left(\frac{\dot{L}_A}{L}\right) \tag{A20}$$

Analogously, multiplying both sides of (A17), (A18) and (A19) by s_M, s_{MS} and s_{NMS}, respectively we get:

$$s_M\frac{\dot{Y}_M}{Y_M} = s_M\left(\frac{\dot{A}_M}{A_M}\right) + \left[\frac{rK}{Y}\right]\left(\frac{\dot{K}_M}{K}\right) + \left[\frac{w_M L}{Y}\right]\left(\frac{\dot{L}_M}{L}\right) \tag{A21}$$

$$s_{MS}\frac{\dot{Y}_{MS}}{Y_{MS}} = s_{MS}\left(\frac{\dot{A}_{MS}}{A_{MS}}\right) + \left[\frac{rK}{Y}\right]\left(\frac{\dot{K}_{MS}}{K}\right) + \left[\frac{w_{MS} L}{Y}\right]\left(\frac{\dot{L}_{MS}}{L}\right) \tag{A22}$$

$$s_{NMS}\frac{\dot{Y}_{NMS}}{Y_{NMS}} = s_{NMS}\left(\frac{\dot{A}_{NMS}}{A_{NMS}}\right) + \left[\frac{rK}{Y}\right]\left(\frac{\dot{K}_{NMS}}{K}\right) + \left[\frac{w_{NMS} L}{Y}\right]\left(\frac{\dot{L}_{NMS}}{L}\right) \tag{A23}$$

Let us define the shares of sectoral employment on total employment as:

$$b_A = \frac{L_A}{L} \tag{A24}$$

$$b_M = \frac{L_M}{L} \tag{A25}$$

$$b_{MS} = \frac{L_{MS}}{L} \tag{A26}$$

$$b_{NMS} = \frac{L_{NMS}}{L} \tag{A27}$$

Following Temple and Wößmann (2006), the extent of structural change in manufacturing, market service, and nonmarket service sectors is measured by:

$$p_M = \frac{\dot{b}_M}{b_M} \tag{A28}$$

$$p_{MS} = \frac{\dot{b}_{MS}}{b_{MS}} \tag{A29}$$

$$p_{NMS} = \frac{\dot{b}_{NMS}}{b_{NMS}} \tag{A30}$$

Notice that p_M, p_{MS}, and p_{NMS} can also be interpreted as the (short-run) propensity to move from agriculture to the other three sectors. In the long-run, it is assumed that wage rates satisfy the following relationship:

$$w_M = \kappa_M w_A;\quad \kappa_M \geq 1 \tag{A31}$$

$$w_{MS} = \kappa_{MS} w_A;\quad \kappa_{MS} \geq 1 \tag{A32}$$

$$w_{NMS} = \kappa_{NMS} w_A;\quad \kappa_{NMS} \geq 1 \tag{A33}$$

These assumptions imply that fixed-wage differentials emerge as a long-run migration equilibrium outcome. The rationale behind this assumption is well explained in Temple (2005) to whom the interested reader is referred. Out of the long-run equilibrium, the wage differentials from the agricultural sector to the manufacturing sector, the market service sector, and the nonmarket service sectors are expressed in terms of the propensity to transfer, also considering differentiated speeds of adjustment towards the long-run equilibrium. In the footsteps of Temple and Wößmann (2006), we assume:

$$p_M = \frac{x_M}{1+x_M} \text{where } x_M = \psi_M\left(\frac{w_M}{\kappa_M w_A} - 1\right) \tag{A34}$$

$$p_{MS} = \frac{x_{MS}}{1+x_{MS}} \text{where } x_{MS} = \psi_{MS}\left(\frac{w_{MS}}{\kappa_{MS} w_A} - 1\right) \tag{A35}$$

$$p_{NMS} = \frac{x_{NMS}}{1+x_{NMS}} \text{where } x_{NMS} = \psi_{NMS}\left(\frac{w_{NMS}}{\kappa_{NMS} w_A} - 1\right) \tag{A36}$$

where ψ_{SEC} are the sector-specific speeds of adjustment towards the long-run equilibrium. Rearranging terms we obtain:

$$\frac{w_M}{w_A} = \kappa_M\left(1 + \frac{1}{\psi_M}\frac{p_M}{1-p_M}\right) \tag{A37}$$

$$\frac{w_{MS}}{w_A} = \kappa_{MS}\left(1 + \frac{1}{\psi_{MS}}\frac{p_{MS}}{1-p_{MS}}\right) \tag{A38}$$

$$\frac{w_{NMS}}{w_A} = \kappa_{NMS}\left(1 + \frac{1}{\psi_{NMS}}\frac{p_{NMS}}{1-p_{NMS}}\right) \tag{A39}$$

$$\eta = \frac{w_A b_A L + w_A\kappa_M\left(1+\frac{1}{\psi_M}\frac{p_M}{1-p_M}\right)b_M L + w_A\kappa_{MS}\left(1+\frac{1}{\psi_{MS}}\frac{p_{MS}}{1-p_{MS}}\right)b_{MS}L + w_A\kappa_{NMS}\left(1+\frac{1}{\psi_{NMS}}\frac{p_{NMS}}{1-p_{NMS}}\right)b_{NMS}L}{Y} \tag{A45}$$

Combining (A12), (A21), and (A37) we can write:

$$s_M\frac{\dot{Y}_M}{Y_M} = s_M\left(\frac{\dot{A}_M}{A_M}\right) + (1-\eta)\left(\frac{\dot{K}_M}{K}\right) + \left[w_A\kappa_M\left(1+\frac{1}{\psi_M}\frac{p_M}{1-p_M}\right)\right]\left(\frac{L}{Y}\right)\left(\frac{\dot{L}_M}{L}\right) \tag{A40}$$

If we define $\phi = \frac{w_A L}{Y}$, add and subtract $\phi\frac{\dot{L}_M}{L}$ from the right-hand side and rearrange terms we get:

$$s_M\frac{\dot{Y}_M}{Y_M} = s_M\left(\frac{\dot{A}_M}{A_M}\right) + (1-\eta)\left(\frac{\dot{K}_M}{K}\right) + \phi\frac{\dot{L}_M}{L}$$
$$+(\kappa_M - 1)\phi b_M\left(\frac{\dot{L}_M}{L_M}\right) + \phi\kappa_M\left(\frac{1}{\psi_M}\frac{p_M}{1-p_M}\right)b_M\left(\frac{\dot{L}_M}{L_M}\right) \tag{A41}$$

Similarly, combining (A12), (A22), and (A38) we obtain:

$$s_{MS}\frac{\dot{Y}_{MS}}{Y_{MS}} = s_{MS}\left(\frac{\dot{A}_{MS}}{A_{MS}}\right) + (1-\eta)\left(\frac{\dot{K}_{MS}}{K}\right)$$
$$+\phi\frac{\dot{L}_{MS}}{L} + (\kappa_{MS}-1)\phi b_{MS}\left(\frac{\dot{L}_{MS}}{L_{MS}}\right)$$
$$+\phi\kappa_{MS}\left(\frac{1}{\psi_{MS}}\frac{p_{MS}}{1-p_{MS}}\right)b_{MS}\left(\frac{\dot{L}_{MS}}{L_{MS}}\right) \tag{A42}$$

And using (A12), (A23) and (A39):

$$s_{NMS}\frac{\dot{Y}_{NMS}}{Y_{NMS}} =$$
$$s_{NMS}\left(\frac{\dot{A}_{NMS}}{A_{NMS}}\right) + (1-\eta)\left(\frac{\dot{K}_{NMS}}{K}\right)$$
$$+\phi\frac{\dot{L}_{NMS}}{L} + (\kappa_{NMS}-1)\phi b_{NMS}\left(\frac{\dot{L}_{NMS}}{L_{NMS}}\right)$$
$$+\phi\kappa_{NMS}\left(\frac{1}{\psi_{NMS}}\frac{p_{NMS}}{1-p_{NMS}}\right)b_{NMS}\left(\frac{\dot{L}_{NMS}}{L_{NMS}}\right) \tag{A43}$$

Plugging (A20), (A41), (A42) and (A43) into (A13) and observing that $\dot{K} = \dot{K}_A + \dot{K}_M + \dot{K}_{MS} + \dot{K}_{NMS}$ and $\dot{L} = \dot{L}_A + \dot{L}_M + \dot{L}_{MS} + \dot{L}_{NMS}$, we find:

$$\frac{\dot{Y}}{Y} = (1 - s_M - s_{MS} - s_{NMS})\left(\frac{\dot{A}_A}{A_A}\right) + s_M\left(\frac{\dot{A}_M}{A_M}\right)$$
$$+s_{MS}\left(\frac{\dot{A}_{MS}}{A_{MS}}\right) + s_{NMS}\left(\frac{\dot{A}_{NMS}}{A_{NMS}}\right)$$
$$+(1-\eta)\frac{\dot{K}}{K} + \phi\frac{\dot{L}}{L} + (\kappa_M - 1)\phi b_M\left(\frac{\dot{L}_M}{L_M}\right)$$
$$+\phi\kappa_M\left(\frac{1}{\psi_M}\frac{p_M}{1-p_M}\right)b_M\left(\frac{\dot{L}_M}{L_M}\right) + (\kappa_{MS}-1)\phi b_{MS}\left(\frac{\dot{L}_{MS}}{L_{MS}}\right)$$
$$+\phi\kappa_{MS}\left(\frac{1}{\psi_{MS}}\frac{p_{MS}}{1-p_{MS}}\right)b_{MS}\left(\frac{\dot{L}_{MS}}{L_{MS}}\right) + (\kappa_{NMS}-1)\phi b_{NMS}\left(\frac{\dot{L}_{NMS}}{L_{NMS}}\right)$$
$$+\phi\kappa_{NMS}\left(\frac{1}{\psi_{NMS}}\frac{p_{NMS}}{1-p_{NMS}}\right)b_{NMS}\left(\frac{\dot{L}_{NMS}}{L_{NMS}}\right) \tag{A44}$$

Inserting (A37), (A38) and (A39) into (A11) and recalling Eqs. (A24)–(A27), we can write:

Use $\phi = \frac{w_A L}{Y}$ and $b_A = 1 - b_M - b_{MS} - b_{NMS}$ to obtain:

$$\eta = \phi[1 + b_M(\kappa_M - 1) + b_{MS}(\kappa_{MS} - 1)$$
$$+b_{NMS}(\kappa_{NMS} - 1) + b_M\kappa_M\left(\frac{1}{\psi_M}\frac{p_M}{1-p_M}\right)$$
$$+b_{MS}\kappa_{MS}\left(\frac{1}{\psi_{MS}}\frac{p_{MS}}{1-p_{MS}}\right) + b_{NMS}\kappa_{NMS}\left(\frac{1}{\psi_{NMS}}\frac{p_{NMS}}{1-p_{NMS}}\right)\Big] \tag{A46}$$

Subtract ϕ from both sides to get:

$$\eta - \phi = \phi[b_M(\kappa_M - 1) + b_{MS}(\kappa_{MS} - 1)$$
$$+b_{NMS}(\kappa_{NMS} - 1) + b_M\kappa_M\left(\frac{1}{\psi_M}\frac{p_M}{1-p_M}\right)$$
$$+b_{MS}\kappa_{MS}\left(\frac{1}{\psi_{MS}}\frac{p_{MS}}{1-p_{MS}}\right) + b_{NMS}\kappa_{NMS}\left(\frac{1}{\psi_{NMS}}\frac{p_{NMS}}{1-p_{NMS}}\right)\Big] \tag{A47}$$

Observe that $\phi\frac{\dot{L}}{L}$, which appears in (A44), can be written as:

$$\phi\frac{\dot{L}}{L} = \eta\frac{\dot{L}}{L} - (\eta - \phi)\frac{\dot{L}}{L} \tag{A48}$$

Plugging (A47) and (A48) into (A44) and rearranging terms, after some algebra, we arrive at:

$$\frac{\dot{Y}}{Y} = (1 - s_M - s_{MS} - s_{NMS})\left(\frac{\dot{A}_A}{A_A}\right) + s_M\left(\frac{\dot{A}_M}{A_M}\right)$$
$$+s_{MS}\left(\frac{\dot{A}_{MS}}{A_{MS}}\right) + s_{NMS}\left(\frac{\dot{A}_{NMS}}{A_{NMS}}\right) + (1-\eta)\frac{\dot{K}}{K} + \eta\frac{\dot{L}}{L}$$

$$+(\kappa_M-1)\phi b_M\left(\frac{\dot{L}_M}{L_M}-\frac{\dot{L}}{L}\right)+\phi\kappa_M\left(\frac{1}{\psi_M}\frac{p_M}{1-p_M}\right)b_M\left(\frac{\dot{L}_M}{L_M}-\frac{\dot{L}}{L}\right)$$

$$+(\kappa_{MS}-1)\phi b_{MS}\left(\frac{\dot{L}_{MS}}{L_{MS}}-\frac{\dot{L}}{L}\right)+\phi\kappa_{MS}\left(\frac{1}{\psi_{MS}}\frac{p_{MS}}{1-p_{MS}}\right)b_{MS}\left(\frac{\dot{L}_{MS}}{L_{MS}}-\frac{\dot{L}}{L}\right)$$

$$+(\kappa_{NMS}-1)\phi b_{NMS}\left(\frac{\dot{L}_{NMS}}{L_{NMS}}-\frac{\dot{L}}{L}\right)$$

$$+\phi\kappa_{NMS}\left(\frac{1}{\psi_{NMS}}\frac{p_{NMS}}{1-p_{NMS}}\right)b_{NMS}\left(\frac{\dot{L}_{NMS}}{L_{NMS}}-\frac{\dot{L}}{L}\right) \tag{A49}$$

Differentiating Eqs. (A24)-(A27) leads to:

$$\frac{\dot{b}_M}{b_M}=\left(\frac{\dot{L}_M}{L_M}-\frac{\dot{L}}{L}\right) \tag{A50}$$

$$\frac{\dot{b}_{MS}}{b_{MS}}=\left(\frac{\dot{L}_{MS}}{L_{MS}}-\frac{\dot{L}}{L}\right) \tag{A51}$$

$$\frac{\dot{b}_{NMS}}{b_{NMS}}=\left(\frac{\dot{L}_{NMS}}{L_{NMS}}-\frac{\dot{L}}{L}\right) \tag{A52}$$

which can be inserted into (A49) to find:

$$\frac{\dot{Y}}{Y}=(1-s_M-s_{MS}-s_{NMS})\left(\frac{\dot{A}_A}{A_A}\right)+s_M\left(\frac{\dot{A}_M}{A_M}\right)+s_{MS}\left(\frac{\dot{A}_{MS}}{A_{MS}}\right)$$

$$+s_{NMS}\left(\frac{\dot{A}_{NMS}}{A_{NMS}}\right)+(1-\eta)\frac{\dot{K}}{K}+\eta\frac{\dot{L}}{L}+(\kappa_M-1)\phi b_M\left(\frac{\dot{b}_M}{b_M}\right)$$

$$+\phi\kappa_M\left(\frac{1}{\psi_M}\frac{p_M}{1-p_M}\right)b_M\left(\frac{\dot{b}_M}{b_M}\right)+(\kappa_{MS}-1)\phi b_{MS}\left(\frac{\dot{b}_{MS}}{b_{MS}}\right)$$

$$+\phi\kappa_{MS}\left(\frac{1}{\psi_{MS}}\frac{p_{MS}}{1-p_{MS}}\right)b_{MS}\left(\frac{\dot{b}_{MS}}{b_{MS}}\right)+(\kappa_{NMS}-1)\phi b_{NMS}\left(\frac{\dot{b}_{NMS}}{b_{NMS}}\right)$$

$$+\phi\kappa_{NMS}\left(\frac{1}{\psi_{NMS}}\frac{p_{NMS}}{1-p_{NMS}}\right)b_{NMS}\left(\frac{\dot{b}_{NMS}}{b_{NMS}}\right) \tag{A53}$$

Finally, inserting (A53) into (A14) it is easy to see that:

$$\frac{\dot{Z}}{Z}=(1-s_M-s_{MS}-s_{NMS})\left(\frac{\dot{A}_A}{A_A}\right)+s_M\left(\frac{\dot{A}_M}{A_M}\right)+s_{MS}\left(\frac{\dot{A}_{MS}}{A_{MS}}\right)$$

$$+s_{NMS}\left(\frac{\dot{A}_{NMS}}{A_{NMS}}\right)+(\kappa_M-1)\phi b_M\left(\frac{\dot{b}_M}{b_M}\right)+\phi\kappa_M\left(\frac{1}{\psi_M}\frac{p_M}{1-p_M}\right)b_M\left(\frac{\dot{b}_M}{b_M}\right)$$

$$+(\kappa_{MS}-1)\phi b_{MS}\left(\frac{\dot{b}_{MS}}{b_{MS}}\right)+\phi\kappa_{MS}\left(\frac{1}{\psi_{MS}}\frac{p_{MS}}{1-p_{MS}}\right)b_{MS}\left(\frac{\dot{b}_{MS}}{b_{MS}}\right)$$

$$+(\kappa_{NMS}-1)\phi b_{NMS}\left(\frac{\dot{b}_{NMS}}{b_{NMS}}\right)$$

$$+\phi\kappa_{NMS}\left(\frac{1}{\psi_{NMS}}\frac{p_{NMS}}{1-p_{NMS}}\right)b_{NMS}\left(\frac{\dot{b}_{NMS}}{b_{NMS}}\right) \tag{A54}$$

which corresponds to Eq. (12) of Temple and Wößmann (2006) and provides the decomposition of the aggregate Solow residual in the four-sectors model. Letting:

$$GROWTH\_M=b_M\left(\frac{\dot{b}_M}{b_M}\right)\approx\Delta M \tag{A55}$$

$$GROWTH\_MS=b_{MS}\left(\frac{\dot{b}_{MS}}{b_{MS}}\right)\approx\Delta MS \tag{A56}$$

$$GROWTH\_NMS=b_{NMS}\left(\frac{\dot{b}_{NMS}}{b_{NMS}}\right)\approx\Delta NMS \tag{A57}$$

and:

$$DISEQ\_M=\frac{p_M}{1-p_M}b_M\left(\frac{\dot{b}_M}{b_M}\right)\approx\frac{p_M}{1-p_M}\Delta M \tag{A58}$$

$$DISEQ\_MS=\frac{p_{MS}}{1-p_{MS}}b_{MS}\left(\frac{\dot{b}_{MS}}{b_{MS}}\right)\approx\frac{p_{MS}}{1-p_{MS}}\Delta MS \tag{A59}$$

$$DISEQ\_NMS=\frac{p_{NMS}}{1-p_{NMS}}b_{NMS}\left(\frac{\dot{b}_{NMS}}{b_{NMS}}\right)\approx\frac{p_{NMS}}{1-p_{NMS}}\Delta NMS \tag{A60}$$

we have shown how to recover the structural change terms corresponding to:

$$MGROWTH=(1-A)\frac{\dot{M}}{M}\approx\Delta M$$

and:

$$DISEQ=\frac{p}{1-p}(1-A)\frac{\dot{M}}{M}\approx\frac{p}{1-p}\Delta M$$

shown by Temple and Wößmann (2006), page 196.

Appendix B. Additional results

Table B1
Structural change and convergence across Italian regions: restricted GMM estimates.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
$\ln y_{t-1}$	1.017***	0.974***	1.015***	1.006***	1.003***	1.023***
	[0.078]	[0.032]	[0.068]	[0.082]	[0.039]	[0.065]
$\ln s_K$	0.017	0.017	0.048	0.068	0.066	0.076
	[0.053]	[0.052]	[0.066]	[0.059]	[0.055]	[0.067]
$\ln s_H$ (primary school)	0.038			-0.023		
	[0.057]			[0.069]		
$\ln s_H$ (lower-secondary school)		0.101			0.044	
		[0.084]			[0.097]	
$\ln s_H$ (upper-secondary school)			0.071			0.066
			[0.046]			[0.068]
$ln(n+g+\delta)$	0.000	0.002	-0.004	0.014	0.012	-0.000
	[0.012]	[0.010]	[0.010]	[0.012]	[0.012]	[0.014]
GROWTH_M	0.0009***	0.0009***	0.0007***			
	[0.000]	[0.000]	[0.000]			
GROWTH_MS	0.0008***	0.0007***	0.0007***			
	[0.000]	[0.000]	[0.000]			
GROWTH_NMS	0.0016***	0.0017***	0.0016***			
	[0.000]	[0.000]	[0.000]			
DISEQ_M				0.0014	0.0019	0.0003
				[0.005]	[0.005]	[0.004]
DISEQ_MS				0.0096**	0.0080**	0.0060**
				[0.004]	[0.003]	[0.003]
DISEQ_NMS				0.0327***	0.0345***	0.0319***
				[0.009]	[0.008]	[0.007]
AB(1) (p-value)	0.002	0.002	0.001	0.003	0.003	0.002
AB(2) (p-value)	0.102	0.083	0.068	0.133	0.119	0.091
Sargan (p-value)	0.376	0.433	0.309	0.238	0.252	0.073

Notes. Observations: 362. See Table 3a and the main text for more details. Number of instruments: 35.

Table B2
Correlations between structural change terms.

	Italy		
	GROWTH_M	*GROWTH_MS*	*GROWTH_NMS*
DISEQ_M	0.31	0.10	0.16
DISEQ_MS	-0.03	0.82	0.22
DISEQ_NMS	0.18	0.35	0.75
	Center-Northern regions		
	GROWTH_IN	*GROWTH_MS*	*GROWTH_NMS*
DISEQ_M	0.26	0.09	0.20
DISEQ_MS	-0.08	0.82	0.18
DISEQ_NMS	0.23	0.38	0.72
	Southern regions		
	GROWTH_IN	*GROWTH_MS*	*GROWTH_NMS*
DISEQ_M	0.57	0.14	0.08
DISEQ_MS	0.15	0.84	0.32
DISEQ_NMS	0.06	0.29	0.81

Table B3
Structural change and convergence across Center-northern regions: restricted GMM estimates.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
$\ln y_{t-1}$	1.017***	0.956***	1.042***	0.957***	0.891***	0.915***
	[0.029]	[0.031]	[0.068]	[0.071]	[0.065]	[0.065]
$\ln s_K$	0.002	-0.005	0.016	-0.020	-0.012	-0.020
	[0.026]	[0.022]	[0.036]	[0.022]	[0.024]	[0.040]
$\ln s_H$ (primary school)	-0.001			-0.079		
	[0.073]			[0.067]		
$\ln s_H$ (lower-secondary school)		-0.030			-0.045	
		[0.065]			[0.054]	
$\ln s_H$ (upper-secondary school)			0.031			0.016
			[0.033]			[0.063]
$ln(n+g+\delta)$	-0.005	-0.001	-0.011**	-0.019	-0.008	-0.018
	[0.006]	[0.007]	[0.005]	[0.014]	[0.010]	[0.017]
GROWTH_M	0.0009***	0.0008***	0.0008***			
	[0.000]	[0.000]	[0.000]			
GROWTH_MS	0.0009***	0.0010***	0.0009***			
	[0.000]	[0.000]	[0.000]			
GROWTH_NMS	0.0016***	0.0015***	0.0017***			
	[0.000]	[0.000]	[0.000]			
DISEQ_M				-0.0018	0.0003	0.0003
				[0.002]	[0.003]	[0.003]
DISEQ_MS				0.0062***	0.0058**	0.0046**
				[0.002]	[0.002]	[0.002]
DISEQ_NMS				0.0269*	0.0313***	0.0286*
				[0.016]	[0.011]	[0.017]
AB(1) (p-value)	0.004	0.004	0.005	0.009	0.005	0.017
AB(2) (p-value)	0.404	0.326	0.266	0.414	0.285	0.429
Sargan (p-value)	0.254	0.351	0.347	0.078	0.207	0.074

Notes. Observations: 222. See Table 3a and the main text for more details. Number of instruments: 35.

Table B4
Structural change and convergence across Southern regions: restricted GMM estimates.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
$\ln y_{t-1}$	0.883***	0.948***	0.923***	0.905***	0.971***	0.919***
	[0.050]	[0.058]	[0.046]	[0.069]	[0.084]	[0.065]
$\ln s_K$	0.025	0.035	0.016	0.041	0.056	0.045
	[0.036]	[0.038]	[0.054]	[0.031]	[0.041]	[0.095]
$\ln s_H$ (primary school)	0.140*			0.145		
	[0.073]			[0.143]		
$\ln s_H$ (lower-secondary school)		-0.104			-0.150	
		[0.157]			[0.27]	
$\ln s_H$ (upper-secondary school)			0.025			0.088
			[0.046]			[0.132]
$ln(n+g+\delta)$	0.011	0.018**	0.020***	0.002	0.004	0.007
	[0.010]	[0.007]	[0.007]	[0.013]	[0.010]	[0.011]
GROWTH_M	0.0015***	0.0018***	0.0018***			
	[0.000]	[0.000]	[0.000]			
GROWTH_MS	0.0016**	0.0018**	0.0019**			
	[0.001]	[0.001]	[0.001]			
GROWTH_NMS	0.0014*	0.0016*	0.0014			
	[0.001]	[0.001]	[0.001]			
DISEQ_M				-0.0006	-0.0006	0.0042
				[0.015]	[0.014]	[0.016]
DISEQ_MS				0.0136	0.0165*	0.0143
				[0.010]	[0.010]	[0.013]
DISEQ_NMS				0.0357***	0.0397***	0.0316***
				[0.012]	[0.010]	[0.011]
AB(1) (p-value)	0.015	0.010	0.013	0.016	0.008	0.014
AB(2) (p-value)	0.412	0.763	0.795	0.476	0.739	0.672
Sargan (p-value)	0.768	0.787	0.687	0.427	0.245	0.146

Notes. Observations: 140. See Table 3a and the main text for more details. Number of instruments: 35.

Table B5
Structural change, internal migration flows, and convergence across macro-areas of Italy (GMM estimates).

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Center-Northern regions			Southern regions		
$\ln y_{t-1}$	1.037***	0.953***	1.027***	0.940***	0.659***	0.820***
	[0.076]	[0.055]	[0.059]	[0.076]	[0.159]	[0.057]
$\ln s_K$	0.006	-0.010	0.013	0.012	0.015	0.044
	[0.020]	[0.022]	[0.030]	[0.039]	[0.030]	[0.039]
$\ln s_H$ (primary school)	-0.134			0.153		
	[0.141]			[0.101]		
$\ln s_H$ (lower-secondary school)		-0.002			0.310	
		[0.066]			[0.205]	
$\ln s_H$ (upper-secondary school)			0.048*			0.103**
			[0.028]			[0.045]
$ln(n+g+\delta)$	-0.007	-0.004	-0.009**	0.004	0.007	0.011
	[0.005]	[0.006]	[0.004]	[0.018]	[0.008]	[0.011]
GROWTH_M	0.0009***	0.0087***	0.0009***	0.0020**	0.0017*	0.0019**
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]
GROWTH_MS	0.0007**	0.0006*	0.0005	0.0021*	0.0009	0.0011
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]
GROWTH_NMS	0.0012***	0.0015***	0.0018***	-0.0003	-0.0007	-0.0004
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]
GROWTH_M	-0.0042***	-0.0030*	-0.0027*	-0.0167	-0.0155	-0.0145
$\times$*ODDS_M*	[0.001]	[0.002]	[0.002]	[0.018]	[0.022]	[0.023]
G ROWTH_MS	0.0051	0.0040	0.0052	-0.0022	0.0124	0.0080
$\times$*ODDS_MS*	[0.005]	[0.005]	[0.005]	[0.015]	[0.014]	[0.013]
G ROWTH_NMS	-0.0005	-0.0005	-0.0044	0.0362***	0.0359***	0.0325**
$\times$*ODDS_NMS*	[0.008]	[0.009]	[0.008]	[0.013]	[0.012]	[0.013]
ln immrate	-0.025	0.008	-0.005	0.119	-0.145	-0.085*
	[0.042]	[0.012]	[0.016]	[0.103]	[0.091]	[0.050]
ln emirate	0.006	0.022	0.018	-0.015	-0.032	0.003
	[0.022]	[0.014]	[0.029]	[0.065]	[0.039]	[0.036]
Observations	186	186	186	116	116	116
AB(1) (p-value)	0.005	0.005	0.005	0.027	0.076	0.024
AB(2) (p-value)	0.726	0.747	0.340	0.315	0.537	0.826
Sargan (p-value)	0.428	0.196	0.370	0.788	0.161	0.118

Notes. See Table 3a and the main text for more details. Number of instruments: 45.

Table B6
Structural change, international migration flows and convergence (Italy).

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	FE	GMM	FE	GMM	FE	GMM
$\ln y_{t-1}$	0.801***	0.968***	0.726***	0.950***	0.786***	0.922***
	[0.037]	[0.069]	[0.041]	[0.092]	[0.038]	[0.068]
$\ln s_K$	-0.022	0.063	-0.027	0.053	-0.022	0.066
	[0.021]	[0.042]	[0.019]	[0.042]	[0.021]	[0.042]
$\ln s_H$ (primary school)	-0.023	-0.017				
	[0.027]	[0.066]				
$\ln s_H$ (lower-secondary school)			0.073***	0.082		
			[0.019]	[0.053]		
$\ln s_H$ (upper-secondary school)					0.023*	0.007
					[0.012]	[0.012]
$ln(n+g+\delta)$	-0.007**	0.010	-0.007**	0.012	-0.006*	0.008
	[0.003]	[0.009]	[0.003]	[0.008]	[0.003]	[0.009]
GROWTH_M	0.0009***	0.0011***	0.0009***	0.0010***	0.0009***	0.0010***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
GROWTH_MS	0.0006**	0.0007**	0.0006**	0.0007**	0.0006**	0.0009***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
GROWTH_NMS	0.0014***	0.0017***	0.0015***	0.0019***	0.0014***	0.0016***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
GROWTH_M	-0.0037*	-0.0050	-0.0035	-0.0029	-0.0040*	-0.0043
$\times$*ODDS_M*	[0.002]	[0.004]	[0.002]	[0.004]	[0.002]	[0.003]
G ROWTH_MS	0.0017	0.0037	0.0013	0.0030	0.0019	0.0031
$\times$*ODDS_MS*	[0.002]	[0.004]	[0.003]	[0.003]	[0.002]	[0.003]
G ROWTH_NMS	-0.0010	-0.0067	-0.0051	-0.0050	-0.0019	-0.0097
$\times$*ODDS_NMS*	[0.007]	[0.011]	[0.007]	[0.010]	[0.007]	[0.012]
ln remrate	0.006	-0.020	-0.003	-0.028	0.004	-0.029
	[0.005]	[0.029]	[0.005]	[0.033]	[0.005]	[0.029]
ln exprate	0.001	0.000	-0.007	0.010	-0.003	-0.010
	[0.008]	[0.032]	[0.008]	[0.025]	[0.008]	[0.025]
R-squared	0.996		0.997		0.996	
AB(1) (p-value)		0.002		0.002		0.002
AB(2) (p-value)		0.135		0.107		0.204
Sargan (p-value)		0.643		0.654		0.566

Notes. Observations: 362. See Table 3a and the main text for more details. Number of instruments in the GMM regressions: 48.

Table B7
Structural change, international migration flows, and convergence across macro-areas of Italy (GMM estimates).

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Center-Northern regions			Southern regions		
$\ln y_{t-1}$	1.010***	1.002***	1.007***	0.669***	0.865***	0.830***
	[0.017]	[0.053]	[0.046]	[0.129]	[0.074]	[0.099]
$\ln s_K$	0.023	0.029**	0.030*	0.057***	0.054*	0.036
	[0.016]	[0.012]	[0.017]	[0.008]	[0.031]	[0.046]
$\ln s_H$ (primary school)	-0.016			-0.006		
	[0.030]			[0.129]		
$\ln s_H$ (lower-secondary school)		-0.041	-0.008		-0.059	0.111**
		[0.060]	[0.040]		[0.088]	[0.048]
$\ln s_H$ (upper-secondary school)						
$ln(n+g+\delta)$	-0.006	0.008	-0.005	-0.003	-0.001	0.003
	[0.010]	[0.006]	[0.006]	[0.015]	[0.012]	[0.014]
GROWTH_M	0.0010***	0.0011***	0.0010***	0.0017**	0.0019***	0.0017**
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]
GROWTH_MS	0.0006	0.0009	0.0007	0.0010	0.0011	0.0014
	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]
GROWTH_NMS	0.0017***	0.0018***	0.0017***	0.0004	-0.0002	-0.0000
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]
GROWTH_M	-0.0045***	-0.0040***	-0.0043***	-0.0140	-0.0178	-0.0096
×*ODDS_M*	[0.001]	[0.001]	[0.001]	[0.016]	[0.016]	[0.021]
G ROWTH_MS	0.0038	0.0033	0.0030	0.0040	0.0035	-0.0013
×*ODDS_MS*	[0.007]	[0.006]	[0.005]	[0.013]	[0.016]	[0.018]
G ROWTH_NMS	-0.0061	-0.0066	-0.0066	0.0232	0.0370***	0.0200
×*ODDS_NMS*	[0.009]	[0.010]	[0.011]	[0.020]	[0.009]	[0.025]
ln remrate	-0.037	-0.017	-0.034	-0.031	-0.018	-0.039
	[0.040]	[0.027]	[0.025]	[0.029]	[0.025]	[0.036]
ln exprate	0.031	0.018	0.027	-0.041	0.006	0.025
	[0.035]	[0.020]	[0.022]	[0.038]	[0.032]	[0.027]
Observations	222	222	222	140	140	140
AB(1) (p-value)	0.004	0.003	0.007	0.020	0.008	0.014
AB(2) (p-value)	0.612	0.357	0.695	0.807	0.975	0.979
Sargan (p-value)	0.020	0.042	0.023	0.849	0.760	0.399

Notes. See Table 3a and the main text for more details. Number of instruments: 48.

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