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THE BRAIN DRAIN OF ITALIANS: ARE THE SOUTHERN REGIONS DOOMED?

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The Brain Drain of Italians: Are the Southern Regions Doomed?

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Abstract

This paper provides new evidence on the brain drain in Italy. Building on the framework proposed by Becker, Ichino, and Peri (2004), we measure brain drain through a comprehensive set of indicators. Unlike previous studies, we account for return migration — not just emigration — of Italians and assess brain drain as the net loss of human capital. We also explore the interplay between international and internal migration, with particular attention to the outflow of high-skilled workers from Southern to Northern Italy. The findings show that, over the period 2013–2023, the migration of highly qualified youth from the South to the North more than offset the international brain drain affecting the North, while significantly deepening the human capital depletion in the South. Finally, we exploit new data on the educational attainment of foreign immigrants, assessing their contribution to the dynamics of human capital at both national and regional level.

Keywords: *Brain drain, Italian migration, Mezzogiorno of Italy*

JEL codes: *J24, F22,R23*

1 Introduction

One of the most debated topics in migration economics is the phenomenon of *brain drain*—the emigration of highly educated or skilled individuals (such as engineers, scientists, physicians, and academics) from less developed to more advanced economies. It is typically viewed as a response to spatial disparities in returns to skills, employment opportunities, and institutional quality. From an economic perspective, the sustained outflow of high-skilled workers from low- and middle-income countries to richer economies raises serious concerns about human capital depletion and the long-term growth prospects of sending countries/regions. While destination countries/regions often gain from higher productivity, innovation, and labor market flexibility, source economies may face shortages of talent, weaker institutional capacity, and slower economic growth (Bhagwati and Hamada, 1974; Portes, 1976). The issue also has an ethical dimension: developing economies often bear the cost of educating individuals who subsequently enhance the productivity of wealthier economies — effectively constituting an implicit subsidy from poorer to richer economies (Massey, Arango, Hugo, Kouaouci, and Pellegrino, 1999).

Yet the consequences of skilled emigration are not universally negative. Under certain conditions, it can stimulate remittances, educational investment, and knowledge diffusion through diaspora networks or return migration—phenomena collectively referred to as *brain gain* or *brain circulation*. International mobility of graduates can serve as a phase of career advancement and skill acquisition: exposure to diverse research environments, frontier technologies, and international collaboration may translate, upon return, into productivity gains and enhanced innovative capacity at origin. Even before return, temporary and circular mobility can generate valuable diaspora externalities—mentoring ties, collaborative projects, and co-authorship networks—that produce spillovers across borders (Saxenian, 2005; Agrawal, Kapur, McHale, and Oettl, 2011). The magnitude of these gains, however, depends critically on country-specific factors such as the elasticity of education supply, the selectivity of emigrants (e.g., top-tier talent vs. average professionals), and the institutional ability to engage diasporas through investment, knowledge transfer, and return programs (Beine, Docquier, and Rapoport, 2001; Docquier and Rapoport, 2012a; Ghosh, 2006; Kugler and Rapoport, 2005; Mountford, 1997; Stark, Helmenstein, and Prskawetz, 1997; Straubhaar, 2000).

When high-skilled emigration becomes persistent and is not offset by comparable inflows or returns, countries experience a net loss of talent and a gradual erosion of both public and private investment in human capital. The withdrawal of young, educated workers—especially from knowledge-intensive sectors critical to long-term growth—can depress innovation, research output, and regional resilience (Schaef-

fer, 2005; Straubhaar, 2000). These losses are often nonlinear: once the stock of specialized skills falls below critical thresholds, local ecosystems may unravel—graduate programs decline, research departments shrink, and firms reduce high-value activities. Such threshold effects, consistent with theories of agglomeration and capability complementarity (Moretti, 2012; Duranton and Puga, 2004; Hidalgo and Hausmann, 2009), imply that identical outflow rates can produce disproportionately severe outcomes in smaller or already fragile regions (Atoyan, Christiansen, Dizioli, Ebeke, Ilahi, Ilyina, Mehrez, Qu, Raei, Rhee, et al., 2016).

Two additional asymmetries shape long-term outcomes. *Selection asymmetry* arises when emigrants are positively selected by ability or field (e.g., STEM PhDs), while compensating inflows are concentrated in other occupations or face underemployment due to credentialing barriers—limiting effective substitution even when headcounts appear balanced (Docquier and Rapoport, 2012a). *Timing asymmetry* occurs when emigration is rapid but return or compensating inflows are slow, creating temporary yet economically significant gaps in teaching, research, and innovation cycles. Both are amplified by institutional frictions that hinder return migration and the full integration of skilled immigrants (Czaika and Parsons, 2017).

A further consideration concerns the evolving nature of mobility. Remote and hybrid work, international doctoral training, and short-term research stays increasingly blur the boundary between "staying" and "moving," expanding opportunities for *brain circulation*. These forms of mobility can mitigate human capital losses if origin institutions reduce participation costs (e.g., through visiting schemes or micro-grants) and if immigration regimes support complementary inflows. Without such enabling policies, however, the benefits of circulation remain limited, while the cumulative costs of sustained outflows continue to grow.

Importantly, brain drain is not confined to international movements. Internal migration — especially from economically disadvantaged to more developed regions within the same country — can produce substantial spatial disparities in the distribution of human capital. Understanding the drivers and consequences of brain drain is therefore essential not only for designing effective migration and education policies but also for addressing broader issues of regional inequality, state capacity, and long-term development.

Building on Becker, Ichino, and Peri (2004), this paper examines the brain drain phenomenon in the Italian context, focusing on individuals aged 25–34—the cohort most represented among emigrants. We assess Italy's net loss of human capital through a refined set of indicators that incorporate both return migration and immigration dynamics. Departing from prior studies, we measure net brain drain as the

difference between outflows and inflows of highly educated youth, explicitly integrating return migration and immigration into the aggregate balance. Furthermore, we investigate whether internal migration operates as a compensatory mechanism or as a secondary channel of loss, with particular attention to South–North movements and their implications for human capital depletion in southern regions.

Our research questions are threefold: i) How large is Italy's brain drain once return migration is incorporated? ii) Does internal migration mitigate or amplify the loss of human capital? iii) Do foreign graduates arriving in Italy offset domestic skill losses, or are they too different in profile to ensure effective substitution?

The remainder of the paper is structured as follows. Section 2 presents the theoretical framework on brain drain and brain gain. Section 3 introduces the indicators used to measure net brain drain. Section 4 describes the data sources. Section 5 reports the empirical evidence. Section 7 concludes.

2 Theoretical framework: human capital theory, brain drain, and brain gain

The debate on the economic and demographic consequences of brain drain has a long tradition. Early theoretical contributions viewed skilled emigration primarily as a permanent loss of human capital and a waste of national investment in education (Grubel and Scott, 1966; Bhagwati and Hamada, 1974; Johnson, 1967). In this perspective, the departure of highly educated individuals erodes a country's innovative capacity and long-term growth potential, especially when not compensated by inflows of similarly skilled workers. More recent approaches, however, emphasize that under certain conditions the prospect of emigration can foster additional human-capital formation—a "beneficial brain drain" (Mountford, 1997). Migration decisions are often shaped by structural constraints at origin, such as limited career opportunities, macroeconomic instability, and weak incentives for high-skill employment, thereby underscoring the importance of policies aimed at talent retention and attraction (Kuznetsov, 2006).

Human capital theory provides the conceptual foundation for this debate. Originating with the seminal works of Schultz and Becker in the 1960s (e.g. Schultz, 1960; Becker, 1975), it views individuals' knowledge, skills, and education as forms of capital that enhance productivity and earnings. Education and training are thus interpreted as purposeful investments, analogous to investments in physical capital, generating returns in the form of higher wages and improved employment outcomes. Mincer (1974) formalized this relationship empirically through the Mincer earnings function, linking income to schooling

and work experience. Subsequent growth models incorporated human capital as a key driver of productivity and output (Lucas Jr, 1988), with per-capita income determined by the per-capita endowment of human, physical, and technological capital (Mankiw, Romer, and Weil, 1992). Within ideas-driven frameworks, rising educational attainment and research intensity are seen as fundamental sources of long-run growth (Jones, 2002).

Applied to migration, this framework implies that selective emigration of educated individuals reduces the average stock of human capital—"*brain drain*"—and may lower income levels or growth rates, while skilled immigration—"*brain gain*"—has the opposite effect, potentially raising productivity and innovation (Docquier and Rapoport, 2012b; Beine, Docquier, and Rapoport, 2008). The net impact depends on three key factors: (i) the degree of selection by education and experience (Borjas, 1987; Chiquiar and Hanson, 2005); (ii) the complementarity between human capital, physical capital, and technology, including innovation and patenting activity (Hunt and Gauthier-Loiselle, 2010); and (iii) the extent to which incoming skills match sectoral and regional labor-market needs (Card, 2001; Dustmann, Frattini, and Preston, 2013). Importantly, short-run and long-run effects may diverge: while emigration can relieve excess labor supply in the short term, over time it may weaken high-skill ecosystems; conversely, skilled immigration can generate agglomeration and knowledge-diffusion externalities that strengthen innovation capacity.

The concept of brain drain has progressively evolved. Initially defined as the permanent outflow of highly skilled individuals, it now encompasses a broader spectrum of mobility forms — temporary, return, and circular migration — and emphasizes the need to account for both gross and net human-capital flows. Measurement approaches have diversified accordingly. Classical indicators track the share of tertiary-educated emigrants relative to the origin country's educated population (Docquier and Marfouk, 2006). More recent methods adjust for age at migration (Beine, Docquier, and Rapoport, 2008) and employ updated global datasets derived from Docquier and Marfouk (2006), allowing for refined estimates of skilled migration rates.

A more nuanced strand of the literature stresses the potential for "beneficial brain drain" effects. Emigration can generate positive externalities through remittances, knowledge diffusion, diaspora linkages, and the eventual return of skilled workers. Moreover, the expectation of migration can itself encourage educational investment when international wage differentials are salient (Mountford, 1997; Stark, Helmenstein, and Prskawetz, 1997; Beine, Docquier, and Rapoport, 2008; Vidal, 1998; Straubhaar, 2000). These insights have motivated analytical frameworks that consider the joint dynamics of brain drain, brain gain, and brain circulation (Saxenian, 2005; Kuznetsov, 2006), highlighting that mobility is multi-

directional and that outcomes depend on the balance between outflows, inflows, and returns.

Empirical research explores both international and internal dimensions. Within Europe, demographic decline, regional disparities, and structural labor-market weaknesses have emerged as major push factors for graduate emigration (Milio, Lattanzi, Casadio, Crosta, Raviglione, Ricci, and Scano, 2012; Kooiman, Latten, and Bontje, 2018). Peripheral and less-developed regions are disproportionately affected by the outflow of young graduates, while dynamic metropolitan areas concentrate human capital. From a brain-circulation perspective, temporary and circular mobility can be beneficial, facilitating knowledge transfer through return migration and diaspora networks. However, persistent outflows without commensurate inflows produce net losses that undermine innovation and long-term growth. Europe's demographic headwinds further amplify these dynamics: recent EU assessments identify numerous regions—Italy among the most affected—with shrinking working-age populations, low tertiary attainment, and net youth outflows (EC, 2023; OECD, 2024).

Immigration thus emerges as a key component of the overall human-capital balance. Studies on the United States and other advanced economies highlight the decisive contribution of foreign graduates and professionals to R&D and patenting, often cushioning losses from native outflows (Hunt and Gauthier-Loiselle, 2010; Kerr, Kerr, Özden, and Parsons, 2016). At the European level, immigration can play a compensatory role, though with large cross-country differences depending on the selectivity of inflows (Docquier and Rapoport, 2012b). In countries like Italy, earlier evidence documented sizeable graduate outflows in the late 1990s, limiting compensation at the time (Becker, Ichino, and Peri, 2004). More recent inflows indicate gradual improvements in immigrants' educational attainment—suggesting growing potential contributions—while standard indicators often under-capture return migration and lack the regional granularity needed to assess how immigration reshapes the geography of human capital (OECD, 2024).

In Italy, both international emigration of graduates and persistent internal migration from the South to the North contribute to a dual brain drain (Ciriaci, 2014). This combination risks reinforcing regional divergence, as southern regions are penalized twice—by the external loss of talent and by the internal pull of the North. However, most existing measures neglect return migration and only partially incorporate the role of foreign immigrants in regional human-capital dynamics. This paper advances the literature in two ways. First, it explicitly accounts for return migration in measuring brain drain among young Italians aged 25–34. Second, it leverages new data on the educational attainment of foreign immigrants to evaluate whether immigration compensates for, or reinforces, human-capital losses at both national and regional levels.

Building on Becker, Ichino, and Peri (2004), we develop a set of indicators to quantify Italy's net loss of human capital as the balance between outflows and inflows of highly educated youth, integrating return and immigration dynamics. We also explore substitution versus reinforcement mechanisms between international and internal migration—focusing in particular on South-to-North movements and their disproportionate depletion effects on southern regions—and discuss the policy implications of these patterns for retention, attraction, and diaspora-engagement strategies aligned with high-skill labor-market needs (Mountford, 1997; Kuznetsov, 2006).

3 Brain drain indicators

The analysis of Italy's brain drain requires a rigorous quantitative framework that incorporates comprehensive, data-driven insights. Such an approach is essential not only for quantifying the magnitude of the phenomenon but also for understanding the demographic and socioeconomic characteristics of the affected population, their destinations, and the broader implications for the labor market and economic growth. The purpose of this paper is to assess the loss of human capital by employing standard indicators first proposed by Becker, Ichino, and Peri (2004). Our analytical foundation is based on the Human Capital Theory, which identifies human capital — alongside physical capital and technology — as one of the three fundamental factors of production. From this perspective, emigration that reduces human capital per worker leads to lower or slower income growth, while immigration that increases human capital per worker leads to higher or faster income growth.

Let P_t denote the resident population at the beginning of year t, and E_t and R_t represent the number of emigrants and returnees during year t, respectively. The data at our disposal allow us to distinguish the population and the migration flows according to the level of education pursued by individuals: *a*) up to the primary school leaving certificate, *b*) up to the middle school leaving certificate, *c*) up to the high school diploma, and *d*) up to the university degree or beyond. Considering that it takes on average 5 years of study to acquire the primary school leaving certificate, 8 for the middle school leaving certificate, 13 for the high school diploma, and 18 for the university degree, we have calculated the total number of years of education completed by the resident population at the end of the year t, H_t^P, the total number of years of education completed by emigrants, H_t^E, and the total number of years of education completed by returnees, H_t^R, during year t. The three ratios:

$$h_t^p = \frac{H_t^p}{P_t}, \quad h_t^e = \frac{H_t^e}{E_t}, \quad h_t^r = \frac{H_t^r}{R_t} \tag{1}$$

measure the average number of years of education completed by the population at the end of year t and by the emigrants and immigrants during year t, respectively. Finally, following the Mincerian approach according to which human capital is modelled as an exponential function of years of schooling, the indices:

$$\psi_t^e = e^{\beta(h_t^e - h_t^p)} \qquad \psi_t^r = e^{\beta(h_t^r - h_t^p)} \tag{2}$$

measure the relative human capital per worker of emigrants and immigrants versus residents, respectively. The β parameter denotes the Mincerian return to schooling, i.e. the semi-elasticity of labor productivity with respect to an additional year of education. Following Becker, Ichino, and Peri (2004), we set $\beta = 0.035$, consistent with Italian estimates (approximately 5–7% in later studies), and check sensitivity across the 0.03–0.07 range (see Table A4.1 Annex). If $\psi_t^e > 1$, then the average human capital of emigrants is larger than that of residents (the country loses human capital per worker as a result of emigration), and there is a reduction in productivity due to the decrease in human capital per worker in the economy. Conversely, if $\psi_t^r > 1$, immigrants have higher average human capital than residents, leading to a gain in human capital per worker and an increase in productivity. A net change in human capital per worker is captured by $(\psi_t^e - \psi_t^r)$: if this value is positive, there is a net loss of human capital per worker; if negative, a net gain of human capital per worker in the economy.

In aggregate form, we define the following indices:

$$\Psi_t^e = 100 \times \frac{E_t e^{\beta h_t^e}}{P_t e^{\beta h_t^p}} = \mu_t^e \times \psi_t^e \quad where \quad \mu_t^e = 100 \times \frac{E_t}{P_t} \tag{3}$$

$$\Psi_t^r = 100 \times \frac{R_t e^{\beta h_t^r}}{P_t e^{\beta h_t^p}} = \mu_t^r \times \psi_t^r \quad where \quad \mu_t^r = 100 \times \frac{R_t}{P_t} \tag{4}$$

These indices vary between 0 and 100 and allow us to decompose changes in the aggregate human capital of migrants(Ψ_t) into two components: changes due to the aggregate migration of workers (μ_t) and changes due to the average human capital content of migrants (ψ_t). Specifically, Ψ_t^e measures the aggregate of human capital of emigrants as a percentage of the aggregate human capital of the population. In other words, it measures the aggregate production loss caused by emigration. The term μ_t^e measures the aggregate loss of pure labor due to emigration (i.e., emigration rate). On the other side, Ψ_t^r measures the aggregate human capital of immigrants as a percentage of the aggregate human capital of the population. In other words, this reflects the aggregate production gain from immigration and the term μ_t^r represents the pure labor gain from immigration (i.e. immigration rate). In essence, these indices quantify the impact of migration on productivity by considering both the number of migrants

and their relative human capital.

We then compute the net aggregate human capital effect as:

$$\Psi_t^n = 100 \times \frac{E_t e^{\beta h_t^e} - R_t e^{\beta h_t^r}}{P_t e^{\beta h_t^p}} \tag{5}$$

A positive value of Ψ_t^n indicates a net loss of human capital in the economy, while a negative value implies a net gain.

Many economists argue that the emigration of college graduates is particular detrimental to a country's economy because they play a crucial role in research and innovation (Docquier and Rapoport, 2012a; Beine, Docquier, and Rapoport, 2008; Bhagwati and Hamada, 1974). College graduates are key drivers of the increasingly skill-biased technological progress and have managerial skills essential to use technology. To address this concern, it is useful to define specific indices that measure the loss of college graduates due to emigration, both on a "per worker" basis and on aggregate terms. These indices can provide a clearer understanding of the economic impact of the emigration of highly educated people. The following per-worker measures assess the relative concentration of university graduates among emigrants and returnees:

$$\gamma_t^e = \frac{g_t^e}{g_t^p} \qquad \gamma_t^r = \frac{g_t^r}{g_t^p} \tag{6}$$

where $g_t^p = \frac{G_t^p}{P_t}$, $g_t^e = \frac{G_t^e}{E_t}$, and $g_t^r = \frac{G_t^r}{R_t}$) are share of college graduates, respectively, in the residents population, and among emigrants and immigrants. If $\gamma_t^e > 1$, it implies that emigrants are disproportionately composed of university graduates relative to the resident population – suggesting a loss of high-skilled labour. The same logic applies to $\gamma_t^r > 1$. The difference $\gamma_t^e - \gamma_t^r$, measures the net loss or gain in the share of college graduates per worker due to migration flows.

Finally, to quantify the net aggregate effect of skilled migration, we define:

$$\Gamma_t^n = 100 \frac{G_t^e - G_t^r}{G_t^p}$$

This index expresses the balance between outflows and inflows of college graduates as a percentage of the total number of graduates in the population. A positive value of Γ_t^n denotes a net aggregate loss of university-educated individuals, while a negative value signals a net gain.

4 Data

In this study, we firstly use the aforementioned set of indicators to assess the loss or gain of human capital due to the international migration of young Italians aged 25–34 over the period 2013–2023. we consider the counteracting effect of internal migration from the South to the central and northern regions, which manages to compensate for the losses in the North and the Centre due to international migration, turning them into gains in human capital. Following this approach, we will evaluate the overall loss of human capital at the subnational level.

To carry out this analysis, we use official data based on changes in residence recorded in Municipality Population Registers. These data are collected at the municipality level by the Italian National Institute of Statistics (Istat). Individual data includes demographic information on migrants, such as age, educational attainment, and citizenship, as well as on the flows, such as country of origin and destination. For population estimates by educational attainment, we use data from the Labour Force Survey for the years up to 2017 and from the Permanent Census for the period 2018–2023. These sources allow us to consistently disaggregate both population stocks and migration flows by education level. In line with established practice in macroeconomics, we use years of schooling/educational attainment as a proxy for human capital (Hall and Jones, 1999; Barro and Lee, 2013; Mankiw, Romer, and Weil, 1992), while acknowledging the limitations discussed by Krueger and Lindahl (2001) and Hanushek and Woessmann (2008).

5 Brain Drain: Evidence

5.1 International Brain Drain

Drawing on the indices proposed by Becker, Ichino, and Peri (2004), we analyze the dynamics of human capital losses and gains among young Italians over the last decade (2013–2023), focusing on both expatriates and returnees. We first compute ψ_t^e and ψ_t^r, which measure, respectively, the relative human capital per worker of emigrants and returnees compared to residents (Figure 1). The evolution of ψ_t^e reveals a marked upward trend, increasing from 0.98 in 2013 to 1.03 in 2023. While from 2013 to 2018 emigrants had, on average, lower human capital than residents, values above 1 from 2019 onwards suggest that emigration is becoming increasingly self-selective: individuals with higher qualifications are more likely to emigrate.

Insert Figure 1 here

Insert Table 1 here

Conversely, ψ_t^r remained above 1 until 2021, indicating that returning migrants generally had higher human capital-related productivity than residents. Until 2019, this dynamic allowed Italy to gain more human capital per worker from returnees than it lost through emigration. However, this balance shifted between 2020 and 2023, when $\psi_t^e - \psi_t^r$ turned positive, pointing to a net loss of human capital per worker.

Focusing specifically on young university graduates, the pattern is even more pronounced. Throughout the decade, γ_t^e values have consistently exceeded 1, indicating that graduates are over-represented among emigrants. This ratio rose significantly after 2018, reaching 1.42. In contrast, although γ_t^r remained above 1, it declined gradually over the same period. Until 2019, the return of graduates compensated for the brain drain, but from 2020 onward the gap between γ_t^e and γ_t^r points to a net loss of human capital per worker.

In summary, Italy benefited from international exchanges of human capital up to 2019, gaining more human capital per worker than it lost. However, the trend reversed in the last four years of the sample, with increasing net losses.

Despite returnees generally having higher average human capital than emigrants ($\psi_t^r > \psi_t^e$), the greater magnitude of outflows ($\mu_t^e > \mu_t^r$) resulted in a consistent net loss of aggregate human capital ($\Psi_t^n > 0$), amounting to 0.3–0.6% of the population annually (Figure 2). Meanwhile, the share of graduates among emigrants nearly doubled between 2013 and 2023. Although the share of graduates among returnees also increased, the imbalance in the skill composition of flows remained, leading to a net loss of graduates equivalent to 0.4–0.9% of the young population annually. Thus, the loss from emigration was only partially offset by returns.

Insert Figure 2 here

The international brain drain indicators show similar patterns across the North and South, though with regional differences in severity. In both areas, recent emigrants have slightly above-average human capital. However, ψ_t^r declined in the South but remained above 1 in the North until 2022, contributing to an earlier onset of net losses in the South (positive $\psi_t^e - \psi_t^r$ since 2019 vs. 2021 in the North). In both regions, the gain of human capital from return migration (Ψ_t^r) only partially offsets the loss from emigration (Ψ_t^e), resulting in persistent net losses. These results are confirmed by the γ and Γ indicators, focused on the proportion of graduates.

Insert Table 2 here

Insert Table 3 here

5.2 Internal Brain Drain

Internal human capital flows are equally relevant, especially in a country like Italy, marked by deep regional disparities. The "*Southern Question*"[1] is a long-standing historical and socio-economic issue rooted in the marginalization of the South (*Mezzogiorno*) following Italy's unification in 1861. The resulting North-South divide is evident in development levels, employment, infrastructure, and access to public services. Despite numerous interventions — most notably the *Cassa per il Mezzogiorno*[2] — persistent administrative inefficiencies and organized crime have limited their success.

This regional gap is not merely economic; it involves identity and perceived exclusion from national progress. In recent decades, mass emigration — often of young, highly educated individuals — from the South to the North and abroad has deepened this divide, reinforcing socio-economic asymmetries (Istat, 2025; SVIMEZ, 2024).

The internal brain drain indicators confirm a net loss of human capital from the South: ψ_t^e for South-to-North migrants is consistently above 1, rising from 1.04 in 2013 to 1.07 in 2023 (Figure 3). Although ψ_t^r for returnees to the South also increases, it remains consistently below ψ_t^e, underscoring a net outflow of productive capacity. Notably, even the peak value of ψ_t^r (1.04 in 2023) does not allow to compensate for the higher value of ψ_t^e, indicating persistent depletion. The patterns for university graduates reinforce this narrative: γ_t^e (graduates leaving the South) is higher and more stable than γ_t^r (graduates returning), confirming that South to North flows extract a higher share of graduates than returns can replenish. As a result, internal migration continuously reallocates productivity-weighted human capital and graduate intensity from the South to the North. Selectivity spikes in 2019, and although returns improve thereafter, the net drain persists.

Insert Figure 3 here

The aggregate indices (Ψ_t^n and Γ_t^n) quantify the internal brain drain. The South loses between 1 and 1.8% of its young population annually in terms of average schooling years, and and between 1.7 and 3.4% in terms of young graduates, signalling a persistent and strengthening net loss of aggregate human capital (Figure 4).

[1] The term "*Southern Question*" (*Questione meridionale*) refers, in historical and political science literature, to the set of issues related to the persistent gap in economic, social, and civil development between Southern Italy and the Centre-North from the time of national unification to the present.

[2] The *Cassa per il Mezzogiorno* (Fund for the South) was established by Law No. 646 of 10 August 1950 as a public body tasked with financing and implementing extraordinary interventions for the economic and social development of Southern Italy. After several extensions, it was abolished and placed under liquidation in 1984.

Insert Figure 4 here

Insert Table 4 here

Insert Table 5 here

5.3 Total brain Drain: international plus internal

Throughout the observed period, the North experienced a net gain in human capital per worker from internal migration, which offset losses from international emigration. However, this net gain has progressively declined. The gap between ψ_t^e and ψ_t^r for the North narrowed from -0.04 in 2013 to 0.00 in 2023, while the difference in graduate ratios ($\gamma_t^e - \gamma_t^r$) shrank from -0.38 to -0.05. This decline is primarily driven by increased international brain drain, not by reduced internal inflows (Figure 5).

Insert Figure 5 here

Conversely, the South has consistently suffered net losses in human capital. From 2013 to 2018, there were signs of improvement ($\psi_t^e - \psi_t^r$ declined from 0.03 to 0.02, while $\gamma_t^e - \gamma_t^r$ decreased from 0.44 to 0.16), but the trend reversed from 2019, largely due to intensified international emigration.

The aggregate indicators show a severe and worsening total brain drain from the South. Ψ_t^n points to an annual net loss of 1.3–2.2% in terms of schooling years, while Γ_t^n signals a 2.0–4.2% annual loss in terms of young graduates (Figure 6).

Insert Figure 6 here

Insert Table 6 here

Insert Table 7 here

In a nutshell, the analysis conducted so far has highlighted the dramatic issue of brain drain in the Mezzogiorno of Italy. It seems that this region is destined to experience a significant loss of human capital, particularly among young graduates, both abroad and internally. Internal brain drain from the South appears to be constant over time, while international brain drain appears to be increasing in recent years, as does brain drain from the North. The latter area still manages to offset the net loss abroad with a strong net gain from the South. However, recent dynamics indicate that this compensation is decreasing, meaning that a total net brain drain may emerge for the North in the future (*ceteris paribus*).

6 The contribution of foreigner migrants

In recent years, the immigration of highly educated young foreigners has played a significant role in reshaping the dynamics of the brain drain. The new data released by Istat in 2025 for the first time expand the information base and allow a shift from a brain-drain–centered interpretation toward a brain- circulation perspective. In this light, the indicators previously computed for Italian nationals are recalibrated to include young foreign residents as well, providing a more comprehensive picture of talent flows into and out of the country.

Using a consistent reference population is essential to enable a clear comparison between Italians and foreigners and to decompose totals into group-specific contributions. All indices — per-capita (ψ, γ), aggregate (Ψ, Γ), and flow rates (μ) — should therefore be normalized to the same population (total young residents aged 25–34). With a common denominator, the aggregate indicators become additive by construction: the net human-capital content of total migration satisfies $\Psi(\text{total}) = \Psi(\text{Italians}) + \Psi(\text{Foreigners})$, and likewise for the graduate aggregate Γ. The per-capita net measures are then interpretable as flow-weighted differences, so that the total ψ and γ represent consistent weighted combinations of subgroup values. Conversely, if Italians were scaled to Italian residents and foreigners to foreign residents, neither additivity nor a meaningful Italian–foreign breakdown would hold, and aggregate totals could not be reconciled.

According to Istat data (2025)[3], between 2019 and 2023 the balance of the 25–34 population remained positive entirely thanks to young foreign immigrants, whose number increased by over 348,000 — more than offsetting the loss of about 119,000 Italians — for a net balance of just under 229,000. The contrast is even more striking among graduates aged 25–34: the overall balance is largely positive (+10,000) thanks to the foreign contribution (+68,000), whereas Italian graduates in the same age group decreased by more than 58,000 over five years.

Applying the common baseline to results for 2019–2023 highlights a sharp contrast between quality and quantity. At the national level, Italians display a persistently adverse aggregate net balance, with Ψ_t^n declining from 0.44 to 0.34 until 2022, and recovering slightly in 2023, indicating losses driven by both selectivity and scale. Foreigners, by contrast, show the opposite trend, with Ψ_t^n moving from about -0.86 to -1.24, signalling a substantial aggregate gain in human capital for Italy. When combined, the total (Italians plus foreigners) Ψ_t^n turns negative and becomes increasingly so over time (from around -0.42 to -0.96), meaning that foreign inflows more than compensate for Italian outflows, fully offsetting

[3] Data on the educational attainment of foreign migrants are available from 2019 onwards.

the loss of human capital described above.

Insert Table 8 here

At the regional level, the mechanism is even more pronounced. In the North, the combined total of Italians and foreigners shows an increase in aggregate productivity and skill content, with values exceeding national averages, largely thanks to the strong foreign component, which more than compensates for the erosion of human capital among young Italian residents. In the South, the contribution of foreigners is also positive but less pronounced than in the North, and the aggregate human capital losses of young Italians are only partially offset.

7 Conclusions

This paper develops an integrated measurement framework for brain drain that combines per-worker selection (ψ), flow scale (μ), and aggregate impact (*Psi*), with graduate-specific analogues (γ, Γ). We apply these indicators consistently to international outflows, return migration, internal South-to-North mobility for young adults aged 25–34 for the period 2013-2023 and, using recent available data for the period 2019-2023, for total population (Italians and foreigners). Read through this lens, Italy's recent experience is characterized by three concurrent dynamics: a deterioration in the international per-worker balance, a territorially asymmetric reallocation of human capital from the South to the North, and sizeable aggregate gains from foreign inflows that do not, however, close the per-worker quality gap created by positively selected Italian outflows.

On the international perspective, our analysis shows a turning point in the per-worker indices: until 2018, emigrants' human capital per worker (ψ_t^e) was slightly below residents and returnees' (ψ_t^r); since 2019 there has been a reversal of this trend and ψ_t^n became positive, indicating that, on average, Italians who leave the country have greater human capital than those who return. The graduates index tells the same story, with the net graduate composition (γ_t^n) worsening after 2019. International brain drain therefore materializes first as a problem of per-worker quality and then, on a large scale — as an aggregate loss when foreigners are not taken into account (*answer to RQ1*).

Including foreign migrants changes magnitudes but not mechanisms. Foreign inflows systematically deliver negative aggregate brain drain indicators, showing that their contribution more than offset Italians' aggregate losses when the two are summed (*answer to RQ3*).

Internal mobility magnifies territorial imbalances. For South-to-North movements, ψ_t^e exceeds one in every year and ψ_t^n is positive from the South's perspective: the per-worker loss is small but unre-

lenting. The college graduate index reinforces the point: γ_t^e is high and volatile (with a notable spike in 2019), γ_t^r is above one but smaller, and γ_t^n remains positive across the decade. Put differently, even as Italy loses human capital abroad, it rebalances internally toward its more dynamic poles. On the aggregate side, Ψ_t^n indicates a growing net aggregate loss for the South and a mirror-image gain for the North. The North partly insures itself against international losses by drawing from the South, which, by contrast, faces a double drain—external and internal—with clear implications for long-run divergence in productivity, innovation capacity, and technology absorption (*answer to RQ2*).

The crucial point is a quality–quantity trade-off: inflows are large enough to improve aggregates, including the stock of graduates, but not selective enough to overturn the per-worker disadvantage generated by who leaves.

These findings are consistent with a brain-circulation perspective rather than a pure brain-drain narrative. Italy is not short of inflows; it is short of the right combination of inflows and returns to counterbalance the selection embedded in outflows, and it continues to reallocate talent internally toward the regions that already lead. The policy implications therefore differ across margins. Nationally, the priority is to raise the quality and scale of returns and to recognize skills among foreign inflows. That requires career ladders that are credible at early stages (tenure-track-like pathways, competitive postdocs, multi-year return programs), rapid acknowledgement of skills acquired abroad, and targeted yet conditional incentives that reward durable attachment to the research system and high-productivity firms. For foreign inflows, the agenda is about matching and utilization: fast recognition of foreign degrees and professional credentials, streamlined access to regulated occupations, specialized job-matching for high-skill entrants, and mentoring bridges between universities and firms to prevent underemployment.

Territorially, the South needs place-based investments that tackle the drivers of selective internal outflows: more and better first jobs for graduates in the private sector, stronger capacity to absorb R&D and transfer technology (university–firm networks, industrial PhDs, clusters), and improvements in local institutions and services that make cities attractive for young adults. The North, which has benefited from internal rebalancing, should avoid relying structurally on inflows from the South and from abroad by deepening on-the-job training, raising within-region upskilling, and — above all — strengthening its ability to retain Italian graduates who currently choose to leave.

Methodologically, the indicators provide a decomposable scoreboard — by channel (international vs internal), citizenship (Italians vs foreigners), and territory (Italy, macro-areas) — that can be updated annually. Limitations remain: register data entail lags in residence updates and imperfect coverage of short-cycle circular moves; the Mincer mapping depends on an assumed return to schooling (β), which

should be stress-tested over plausible ranges; the indicators summarize educational quantity more than skills specificity. Future work should extend the framework to field of study and occupational quality, link it to innovation outcomes (patents, R&D employment, high-growth firms), and exploit longitudinal micro-data to map trajectories (sequence or multi-state models) that distinguish temporary spells from durable relocations.

Even with these caveats, the evidence is unambiguous. For the country as a whole, foreign inflows generate tangible aggregate gains — including in graduates — but the per-worker disadvantage persists because the Italians who leave are highly selected and the premium of returnees has narrowed. For the South, international outflows compound a persistent internal drain, producing a structural net loss. Italy's challenge is therefore not merely "how many arrive", but "who leaves", "who returns", and "where internal movers go". Progress will be measured by whether policies can shift those three levers—retention, return, and internal allocation — so that mobility becomes genuine circulation of knowledge rather than a one-way extraction of talent.

Appendix

The index ψ relies on a return-to-schooling β parameter, interpreted as the wage premium associated with an additional year of education in a Mincer regression. Using β to weight education groups serves two purposes. First, it recognizes that tertiary graduates and lower-secondary graduates do not contribute equally to productive capacity. Second, it allows migration flows to be compared not only in terms of their size, but in terms of the economic value they represent. As shown in Becker, Ichino, and Peri (2004) and Caselli (2005), this adjustment is standard in human-capital-based comparisons across populations.

Varying the assumed return to education over a wide range — from conservative EU-based estimates ($\beta = 0.03$), to the baseline value used in the literature (0.035), up to higher-return OECD assumptions (0.05) and even an upper-bound stress-test for high-wage-inequality countries (0.07) — produces only marginal adjustments in both per-worker and aggregate indices (see Table A1). In all cases, ψ^e and ψ^r rise mechanically with β, as expected from the exponential reward function, but they do so in parallel, such that the gap between emigrants and residents remains effectively unchanged. This indicates that the assessment of relative selection is not an artefact of the chosen wage premium.

A similar pattern emerges for the aggregate indices (Ψ). Even when the wage return is doubled relative to the baseline, the aggregate balance shifts by less than 0.002 points — a difference too small to alter any substantive conclusion about whether outflows and inflows compensate or exacerbate one

another. In short, the direction and magnitude of Italy's brain-drain patterns are structurally robust, not parametrically fragile. What drives the results is the composition of movers rather than the reward assigned to their schooling. This strengthens the credibility of the findings and suggests that policy discussion should focus less on modelling assumptions and more on the persistent asymmetries in mobility profiles.

References

AGRAWAL, A., D. KAPUR, J. MCHALE, AND A. OETTL (2011): "Brain drain or brain bank? The impact of skilled emigration on poor-country innovation," *Journal of Urban Economics*, 69(1), 43–55.

ATOYAN, M. R., L. E. CHRISTIANSEN, A. DIZIOLI, M. C. EBEKE, M. N. ILAHI, M. A. ILYINA, M. G. MEHREZ, M. H. QU, M. F. RAEI, M. A. RHEE, ET AL. (2016): *Emigration and its economic impact on Eastern Europe*. International Monetary Fund.

BARRO, R. J., AND J. W. LEE (2013): "A new data set of educational attainment in the world, 1950–2010," *Journal of development economics*, 104, 184–198.

BECKER, G. S. (1975): *Human capital: A theoretical and empirical analysis*. National Bureau of Economic Research.

BECKER, S. O., A. ICHINO, AND G. PERI (2004): "How large is the" Brain Drain" from Italy?," *Giornale degli economisti e annali di economia*, pp. 1–32.

BEINE, M., F. DOCQUIER, AND H. RAPOPORT (2001): "Brain drain and economic growth: Theory and evidence," *Journal of Development Economics*, 64(1), 275–289.

BEINE, M., F. DOCQUIER, AND H. RAPOPORT (2008): "Brain drain and human capital formation in developing countries: winners and losers," *The Economic Journal*, 118(528), 631–652.

BHAGWATI, J., AND K. HAMADA (1974): "The brain drain, international integration of markets for professionals and unemployment: a theoretical analysis," *Journal of Development Economics*, 1(1), 19–42.

BORJAS, G. J. (1987): "Self-selection and the earnings of immigrants," Discussion paper, National Bureau of Economic Research.

CARD, D. (2001): "Immigrant inflows, native outflows, and the local labor market impacts of higher immigration," *Journal of labor economics*, 19(1), 22–64.

CASELLI, F. (2005): "Accounting for cross-country income differences," *Handbook of economic growth*, 1, 679–741.

CHIQUIAR, D., AND G. H. HANSON (2005): "International migration, self-selection, and the distribution of wages: Evidence from Mexico and the United States," *Journal of political Economy*, 113(2), 239–281.

CIRIACI, D. (2014): "Does university quality influence the interregional mobility of students and graduates? The case of Italy," *Regional Studies*, 48(10), 1592–1608.

CZAIKA, M., AND C. R. PARSONS (2017): "The gravity of high-skilled migration policies," *Demography*, 54(2), 603–630.

DOCQUIER, F., AND A. MARFOUK (2006): "International migration by education attainment, 1990–2000," *International migration, remittances and the brain drain*, pp. 151–199.

DOCQUIER, F., AND H. RAPOPORT (2012a): "Globalization, brain drain, and development," *Journal of economic literature*, 50(3), 681–730.

DOCQUIER, F., AND H. RAPOPORT (2012b): "Globalization, brain drain, and development," *Journal of Economic Literature*, 50(3), 681–730.

DURANTON, G., AND D. PUGA (2004): "Micro-foundations of urban agglomeration economies," in *Handbook of regional and urban economics*, vol. 4, pp. 2063–2117. Elsevier.

DUSTMANN, C., T. FRATTINI, AND I. P. PRESTON (2013): "The effect of immigration along the distribution of wages," *Review of Economic Studies*, 80(1), 145–173.

EC (2023): "Harnessing talent in Europe's regions: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions," Discussion paper, European Commission (COM(2023) 32 final).

GHOSH, B. (2006): *Migrants' remittances and development: myths, rhetoric and realities*. International Organization for Migration (IOM).

GRUBEL, H. B., AND A. D. SCOTT (1966): "The international flow of human capital," *The American Economic Review*, 56(1/2), 268–274.

HALL, R. E., AND C. I. JONES (1999): "Why do some countries produce so much more output per worker than others?," *The quarterly journal of economics*, 114(1), 83–116.

HANUSHEK, E. A., AND L. WOESSMANN (2008): "The role of cognitive skills in economic development," *Journal of economic literature*, 46(3), 607–668.

HIDALGO, C. A., AND R. HAUSMANN (2009): "The building blocks of economic complexity," *Proceedings of the national academy of sciences*, 106(26), 10570–10575.

HUNT, J., AND M. GAUTHIER-LOISELLE (2010): "How much does immigration boost innovation?," *American Economic Journal: Macroeconomics*, 2(2), 31–56.

ISTAT (2025): *International and internal migration in Italy*.

JOHNSON, H. G. (1967): "Some economic aspects of brain drain," *The Pakistan Development Review*, 7(3), 379–411.

JONES, C. I. (2002): "Sources of US economic growth in a world of ideas," *American economic review*, 92(1), 220–239.

KERR, S. P., W. KERR, Ç. ÖZDEN, AND C. PARSONS (2016): "Global talent flows," *Journal of Economic Perspectives*, 30(4), 83–106.

KOOIMAN, N., J. LATTEN, AND M. BONTJE (2018): "Human capital migration: A longitudinal perspective," *Tijdschrift voor economische en sociale geografie*, 109(5), 644–660.

KRUEGER, A. B., AND M. LINDAHL (2001): "Education for growth: Why and for whom?," *Journal of economic literature*, 39(4), 1101–1136.

KUGLER, M., AND H. RAPOPORT (2005): "Skilled emigration, business networks and foreign direct investment," Discussion paper, CESIFO working paper.

KUZNETSOV, Y. (2006): *Diaspora networks and the international migration of skills: How countries can draw on their talent abroad*. World Bank Publications.

LUCAS JR, R. E. (1988): "On the mechanics of economic development," *Journal of monetary economics*, 22(1), 3–42.

MANKIW, N. G., D. ROMER, AND D. N. WEIL (1992): "A contribution to the empirics of economic growth," *The quarterly journal of economics*, 107(2), 407–437.

MASSEY, D. S., J. ARANGO, G. HUGO, A. KOUAOUCI, AND A. PELLEGRINO (1999): *Worlds in motion: understanding international migration at the end of the millennium: understanding international migration at the end of the millennium*. Clarendon Press.

MILIO, S., R. LATTANZI, F. CASADIO, N. CROSTA, M. RAVIGLIONE, P. RICCI, AND F. SCANO (2012): "Brain drain, brain exchange and brain circulation. The case of Italy viewed from a global perspective," *National interest*.

MINCER, J. (1974): *Schooling, experience, and earnings*. Columbia University Press, New York.

MORETTI, E. (2012): *The new geography of jobs*. Houghton Mifflin Harcourt.

MOUNTFORD, A. (1997): "Can a brain drain be good for growth in the source economy?," *Journal of development economics*, 53(2), 287–303.

OECD (2024): *Return, Reintegration and Re-migration*. OECD Publishing.

PORTES, A. (1976): "Determinants of the brain drain," *International Migration Review*, 10(4), 489–508.

SAXENIAN, A. (2005): "From brain drain to brain circulation: Transnational communities and regional upgrading in India and China," *Studies in comparative international development*, 40(2), 35–61.

SCHAEFFER, P. (2005): "Human capital, migration strategy, and brain drain," *Journal of International Trade & Economic Development*, 14(3), 319–335.

SCHULTZ, T. W. (1960): "Capital formation by education," *Journal of political economy*, 68(6), 571–583.

STARK, O., C. HELMENSTEIN, AND A. PRSKAWETZ (1997): "A brain gain with a brain drain," *Economics letters*, 55(2), 227–234.

STRAUBHAAR, T. (2000): "International mobility of the highly skilled: Brain gain, brain drain or brain exchange," *HWWA Discussion Paper*, 88.

SVIMEZ (2024): *Rapporto SVIMEZ 2024*. SVIMEZ, Rome.

VIDAL, J.-P. (1998): "The effect of emigration on human capital formation," *Journal of population economics*, 11(4), 589–600.

Table 1: Indicators International Migration, Italy

Year	ψ_e	μ_e	Ψ_e	γ_e	Γ_e	ψ_r	μ_r	Ψ_r	γ_r	Γ_r	$\psi_e - \psi_r$	$\Psi_e - \Psi_r$	$\gamma_e - \gamma_r$	$\Gamma_e - \Gamma_r$
2013	0.98	0.45	0.45	1.15	0.52	1.02	0.08	0.08	1.58	0.13	-0.04	0.36	-0.43	0.39
2014	0.97	0.49	0.47	1.12	0.55	1.02	0.10	0.10	1.68	0.16	-0.05	0.38	-0.57	0.38
2015	0.99	0.56	0.55	1.13	0.63	1.01	0.10	0.11	1.44	0.15	-0.02	0.44	-0.31	0.48
2016	0.99	0.67	0.66	1.09	0.74	1.02	0.15	0.15	1.55	0.23	-0.04	0.51	-0.46	0.51
2017	0.98	0.69	0.68	1.05	0.73	1.02	0.17	0.17	1.49	0.25	-0.04	0.51	-0.44	0.48
2018	0.98	0.73	0.71	1.04	0.76	1.02	0.19	0.20	1.45	0.28	-0.04	0.52	-0.41	0.48
2019	1.01	0.72	0.72	1.35	0.97	1.02	0.25	0.26	1.38	0.35	-0.01	0.47	-0.03	0.62
2020	1.02	0.75	0.77	1.35	1.02	1.01	0.24	0.24	1.33	0.32	0.01	0.53	0.02	0.70
2021	1.02	0.59	0.60	1.30	0.77	1.00	0.33	0.33	1.22	0.40	0.02	0.28	0.09	0.37
2022	1.03	0.66	0.67	1.41	0.92	0.99	0.28	0.28	1.11	0.31	0.03	0.39	0.30	0.61
2023	1.03	0.80	0.82	1.42	1.13	0.97	0.25	0.24	1.02	0.26	0.06	0.57	0.40	0.87

Table 2: Indicators International Migration, North

Year	ψ_e	μ_e	Ψ_e	γ_e	Γ_e	ψ_r	μ_r	Ψ_r	γ_r	Γ_r	$\psi_e - \psi_r$	$\Psi_e - \Psi_r$	$\gamma_e - \gamma_r$	$\Gamma_e - \Gamma_r$
2013	0.97	0.53	0.51	1.12	0.59	1.01	0.10	0.10	1.57	0.15	-0.04	0.42	-0.45	0.44
2014	0.96	0.55	0.53	1.13	0.62	1.02	0.12	0.12	1.65	0.19	-0.05	0.41	-0.52	0.42
2015	0.98	0.61	0.60	1.09	0.67	1.00	0.12	0.12	1.43	0.18	-0.03	0.48	-0.34	0.49
2016	0.98	0.73	0.72	1.06	0.78	1.02	0.18	0.18	1.54	0.27	-0.04	0.54	-0.48	0.50
2017	0.97	0.75	0.73	1.01	0.75	1.02	0.20	0.20	1.48	0.29	-0.05	0.53	-0.48	0.46
2018	0.97	0.81	0.78	0.98	0.79	1.01	0.25	0.25	1.37	0.34	-0.04	0.53	-0.39	0.45
2019	1.01	0.71	0.71	1.34	0.95	1.02	0.30	0.31	1.43	0.43	-0.02	0.40	-0.09	0.51
2020	1.02	0.79	0.81	1.36	1.07	1.02	0.27	0.28	1.37	0.37	0.00	0.53	-0.02	0.70
2021	1.02	0.63	0.64	1.32	0.83	1.00	0.37	0.37	1.24	0.46	0.02	0.27	0.08	0.38
2022	1.03	0.71	0.73	1.43	1.01	1.00	0.31	0.31	1.16	0.35	0.03	0.42	0.27	0.65
2023	1.03	0.87	0.90	1.43	1.25	0.98	0.27	0.27	1.07	0.29	0.05	0.63	0.36	0.95

Table 3: Indicators International Migration, South

Year	ψ_e	μ_e	Ψ_e	γ_e	Γ_e	ψ_r	μ_r	Ψ_r	γ_r	Γ_r	$\psi_e - \psi_r$	$\Psi_e - \Psi_r$	$\gamma_e - \gamma_r$	$\Gamma_e - \Gamma_r$
2013	0.98	0.36	0.35	1.10	0.40	1.01	0.06	0.06	1.42	0.09	-0.03	0.29	-0.31	0.31
2014	0.96	0.41	0.39	1.01	0.41	1.00	0.07	0.07	1.59	0.11	-0.04	0.33	-0.58	0.30
2015	0.99	0.47	0.47	1.13	0.53	1.00	0.08	0.08	1.30	0.10	-0.01	0.39	-0.17	0.43
2016	0.99	0.59	0.58	1.12	0.66	1.01	0.10	0.10	1.41	0.15	-0.02	0.48	-0.29	0.51
2017	0.99	0.61	0.61	1.12	0.68	1.01	0.13	0.13	1.39	0.18	-0.02	0.48	-0.27	0.51
2018	0.99	0.62	0.61	1.13	0.69	1.01	0.12	0.12	1.45	0.17	-0.02	0.49	-0.33	0.52
2019	1.01	0.73	0.74	1.38	1.01	0.98	0.18	0.17	1.01	0.18	0.03	0.57	0.37	0.83
2020	1.02	0.70	0.71	1.31	0.92	0.99	0.20	0.20	1.14	0.22	0.03	0.52	0.18	0.69
2021	1.01	0.53	0.54	1.22	0.65	0.98	0.26	0.26	1.06	0.28	0.03	0.28	0.16	0.37
2022	1.01	0.58	0.59	1.31	0.75	0.98	0.25	0.24	0.93	0.23	0.04	0.34	0.37	0.52
2023	1.01	0.67	0.68	1.31	0.87	0.95	0.21	0.20	0.84	0.18	0.06	0.48	0.47	0.70

Table 4: Indicators Internal Migration, North

Year	ψ_e	μ_e	Ψ_e	γ_e	Γ_e	ψ_r	μ_r	Ψ_r	γ_r	Γ_r	$\psi_e - \psi_r$	$\Psi_e - \Psi_r$	$\gamma_e - \gamma_r$	$\Gamma_e - \Gamma_r$
2013	0.97	0.39	0.37	0.92	0.35	1.01	1.11	1.12	1.40	1.55	-0.05	-0.75	-0.48	-1.20
2014	0.96	0.37	0.36	0.96	0.36	1.00	1.04	1.04	1.32	1.37	-0.04	-0.68	-0.36	-1.01
2015	0.96	0.34	0.33	0.87	0.30	1.00	1.01	1.01	1.24	1.26	-0.04	-0.68	-0.37	-0.96
2016	0.96	0.35	0.33	0.87	0.30	1.00	1.09	1.09	1.24	1.34	-0.04	-0.75	-0.36	-1.04
2017	0.96	0.33	0.32	0.87	0.28	1.00	1.10	1.11	1.24	1.36	-0.04	-0.79	-0.37	-1.08
2018	0.96	0.32	0.31	0.86	0.28	0.99	1.21	1.20	1.09	1.33	-0.02	-0.89	-0.24	-1.05
2019	0.99	0.37	0.37	1.03	0.38	1.04	1.41	1.46	1.47	2.08	-0.04	-1.09	-0.44	-1.70
2020	0.99	0.38	0.37	1.03	0.39	1.04	1.12	1.16	1.41	1.58	-0.04	-0.79	-0.38	-1.19
2021	1.00	0.38	0.37	1.05	0.39	1.04	1.13	1.18	1.42	1.62	-0.04	-0.80	-0.38	-1.22
2022	1.00	0.38	0.38	1.07	0.40	1.04	1.41	1.48	1.48	2.09	-0.04	-1.10	-0.41	-1.69
2023	1.00	0.38	0.38	1.08	0.41	1.04	1.34	1.39	1.43	1.92	-0.03	-1.01	-0.35	-1.52

Table 5: Indicators Internal Migration, South

Year	ψ_e	μ_e	Ψ_e	γ_e	Γ_e	ψ_r	μ_r	Ψ_r	γ_r	Γ_r	$\psi_e - \psi_r$	$\Psi_e - \Psi_r$	$\gamma_e - \gamma_r$	$\Gamma_e - \Gamma_r$
2013	1.04	1.62	1.68	1.68	2.73	0.99	0.56	0.56	1.10	0.62	0.05	1.13	0.58	2.11
2014	1.03	1.50	1.54	1.57	2.35	0.99	0.54	0.53	1.14	0.61	0.04	1.01	0.43	1.74
2015	1.03	1.47	1.51	1.53	2.25	0.99	0.50	0.49	1.08	0.54	0.04	1.02	0.46	1.71
2016	1.03	1.56	1.61	1.51	2.35	0.99	0.50	0.49	1.06	0.53	0.04	1.12	0.44	1.82
2017	1.03	1.59	1.64	1.51	2.41	0.99	0.47	0.47	1.06	0.50	0.04	1.17	0.45	1.90
2018	1.02	1.76	1.80	1.44	2.53	1.00	0.47	0.46	1.13	0.53	0.03	1.33	0.31	2.00
2019	1.07	2.10	2.24	1.97	4.13	1.03	0.55	0.56	1.38	0.76	0.04	1.68	0.59	3.37
2020	1.07	1.72	1.83	1.82	3.12	1.02	0.58	0.59	1.33	0.77	0.04	1.24	0.49	2.35
2021	1.07	1.76	1.88	1.82	3.20	1.03	0.58	0.60	1.34	0.78	0.04	1.28	0.48	2.42
2022	1.07	2.26	2.43	1.87	4.25	1.03	0.60	0.62	1.36	0.82	0.04	1.81	0.52	3.43
2023	1.07	2.21	2.37	1.86	4.11	1.04	0.62	0.64	1.40	0.87	0.03	1.72	0.46	3.24

Table 6: Indicators Total Migration, North

Year	ψ_e	μ_e	Ψ_e	γ_e	Γ_e	ψ_r	μ_r	Ψ_r	γ_r	Γ_r	$\psi_e - \psi_r$	$\Psi_e - \Psi_r$	$\gamma_e - \gamma_r$	$\Gamma_e - \Gamma_r$
2013	0.97	0.91	0.89	1.03	0.94	1.01	1.21	1.22	1.41	1.71	-0.04	-0.33	-0.38	-0.76
2014	0.96	0.92	0.88	1.06	0.97	1.00	1.15	1.16	1.35	1.56	-0.04	-0.27	-0.29	-0.59
2015	0.97	0.96	0.93	1.01	0.97	1.00	1.13	1.14	1.26	1.43	-0.03	-0.20	-0.25	-0.46
2016	0.97	1.08	1.05	1.00	1.08	1.00	1.26	1.27	1.28	1.61	-0.03	-0.22	-0.28	-0.54
2017	0.97	1.08	1.05	0.96	1.04	1.01	1.30	1.31	1.27	1.66	-0.03	-0.26	-0.31	-0.62
2018	0.97	1.13	1.09	0.95	1.07	0.99	1.46	1.45	1.14	1.66	-0.02	-0.36	-0.20	-0.60
2019	1.00	1.08	1.08	1.23	1.33	1.03	1.71	1.77	1.47	2.51	-0.03	-0.69	-0.23	-1.18
2020	1.01	1.17	1.18	1.25	1.46	1.03	1.39	1.44	1.40	1.95	-0.02	-0.26	-0.15	-0.49
2021	1.01	1.01	1.02	1.22	1.23	1.03	1.50	1.55	1.38	2.07	-0.02	-0.53	-0.16	-0.85
2022	1.02	1.08	1.10	1.30	1.41	1.03	1.72	1.78	1.42	2.44	-0.02	-0.68	-0.12	-1.03
2023	1.02	1.25	1.28	1.32	1.65	1.03	1.62	1.66	1.37	2.21	-0.00	-0.38	-0.05	-0.56

Table 7: Indicators Total Migration, South

Year	ψ_e	μ_e	Ψ_e	γ_e	Γ_e	ψ_r	μ_r	Ψ_r	γ_r	Γ_r	$\psi_e - \psi_r$	$\Psi_e - \Psi_r$	$\gamma_e - \gamma_r$	$\Gamma_e - \Gamma_r$
2013	1.03	1.98	2.04	1.58	3.13	0.99	0.63	0.62	1.13	0.71	0.03	1.41	0.44	2.42
2014	1.01	1.91	1.94	1.45	2.77	0.99	0.61	0.60	1.19	0.72	0.03	1.34	0.26	2.04
2015	1.02	1.94	1.98	1.44	2.78	0.99	0.58	0.57	1.11	0.64	0.03	1.40	0.33	2.14
2016	1.02	2.15	2.19	1.40	3.01	0.99	0.60	0.60	1.12	0.67	0.02	1.59	0.28	2.34
2017	1.02	2.20	2.25	1.40	3.09	1.00	0.60	0.60	1.13	0.68	0.02	1.65	0.27	2.41
2018	1.01	2.37	2.41	1.36	3.22	1.00	0.59	0.58	1.19	0.70	0.02	1.82	0.16	2.52
2019	1.05	2.83	2.98	1.82	5.14	1.02	0.73	0.74	1.29	0.94	0.04	2.24	0.53	4.20
2020	1.05	2.42	2.54	1.67	4.03	1.02	0.77	0.78	1.28	0.99	0.04	1.76	0.39	3.04
2021	1.05	2.29	2.41	1.68	3.86	1.01	0.85	0.86	1.25	1.06	0.04	1.56	0.43	2.79
2022	1.06	2.84	3.02	1.76	5.00	1.01	0.85	0.86	1.23	1.05	0.05	2.15	0.53	3.95
2023	1.06	2.88	3.04	1.73	4.98	1.01	0.83	0.84	1.26	1.04	0.04	2.20	0.47	3.94

Table 8: Indicators international net migration of Italian and foreigners aged 25-34

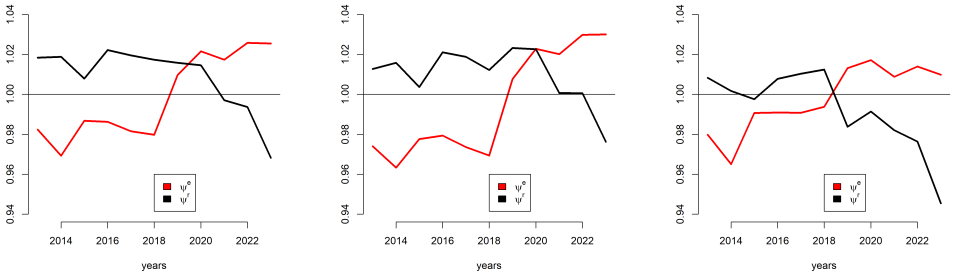
	Italians+Foreigners				Italians				Foreigners			
	ψ^n	Ψ^n	γ^n	Γ^n	ψ^n	Ψ^n	γ^n	Γ^n	ψ^n	Ψ^n	γ^n	Γ^n
	Italy											
2019	0,05	-0,42	0,32	-0,12	-0,02	0,44	-0,09	0,57	0,06	-0,86	0,41	-0,69
2020	0,07	-0,25	0,57	0,21	0,01	0,46	0,03	0,65	0,07	-0,70	0,54	-0,45
2021	0,06	-0,62	0,38	-0,24	0,02	0,24	0,09	0,34	0,04	-0,86	0,29	-0,58
2022	0,08	-0,90	0,63	-0,17	0,03	0,34	0,33	0,57	0,05	-1,24	0,30	-0,74
2023	0,09	-0,96	0,68	-0,19	0,02	0,49	0,22	0,77	0,07	-1,45	0,46	-0,96
	North											
2019	0,04	-0,72	0,29	-0,41	-0,03	0,36	-0,17	0,46	0,07	-1,08	0,46	-0,88
2020	0,07	-0,43	0,56	0,06	0,00	0,44	-0,01	0,64	0,07	-0,87	0,57	-0,57
2021	0,06	-0,81	0,37	-0,41	0,02	0,23	0,09	0,34	0,04	-1,04	0,28	-0,75
2022	0,08	-1,11	0,62	-0,32	0,03	0,35	0,30	0,60	0,05	-1,46	0,32	-0,91
2023	0,09	-1,15	0,68	-0,32	0,02	0,52	0,20	0,83	0,07	-1,67	0,48	-1,15
	South											
2019	0,07	0,11	0,52	0,50	0,02	0,58	0,33	0,80	0,05	-0,47	0,19	-0,31
2020	0,09	0,08	0,68	0,51	0,03	0,49	0,18	0,68	0,07	-0,41	0,50	-0,17
2021	0,08	-0,28	0,49	0,13	0,03	0,26	0,17	0,36	0,05	-0,54	0,32	-0,23
2022	0,10	-0,51	0,71	0,17	0,04	0,32	0,39	0,51	0,06	-0,83	0,32	-0,34
2023	0,10	-0,59	0,72	0,14	0,02	0,44	0,27	0,64	0,08	-1,04	0,45	-0,50

Notes: Our elaborations on Istat data.

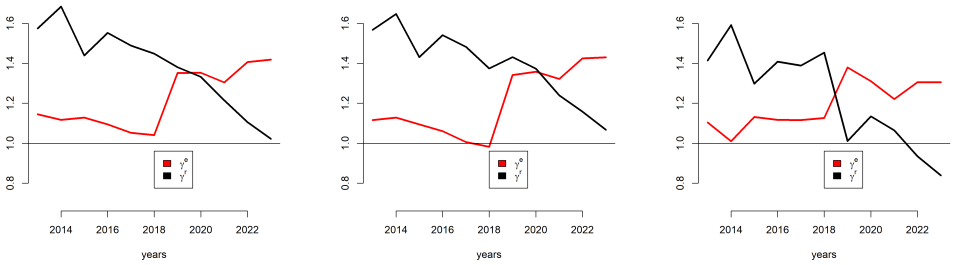
Table A1: Sensitivity of indices to alternative return-to-education assumptions (β)

β	Source/Scenario	ψ^e	ψ^r	Ψ^e	Ψ^r	Interpretation
0.030	Lower-bound from EU evidence	1.002	1.003	0.707	0.263	Minimal variation in both per-worker and aggregate indices; overall picture unchanged.
0.035 (baseline)	Becker et al. (2004) — benchmark in the chapter	1.003	1.003	0.707	0.263	Reference case; virtually identical to the low-return scenario.
0.050	OECD / Psacharopoulos higher-return estimate higher-return estimate	1.004	1.005	0.708	0.264	Slight mechanical increase in both aggregates; economically negligible.
0.070	Upper-bound for high-wage-inequality countries	1.005	1.007	0.709	0.264	Stress-test: but in parallel; per-worker levels increase, aggregate balance remains almost unchanged.

Notes: The Beta parameter is the average beta value for the period (2013-2023) and it refers to the international movements.

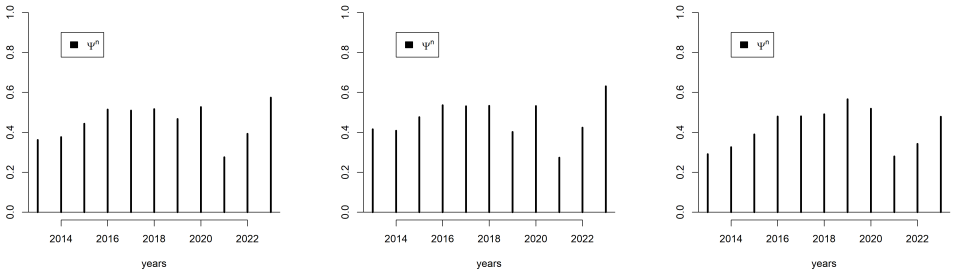


(a) Italy (b) North (c) South

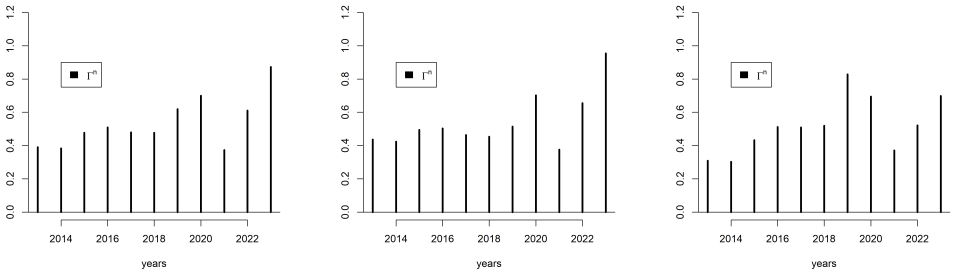


(d) Italy (e) North (f) South

Figure 1: International brain drain: per worker indices

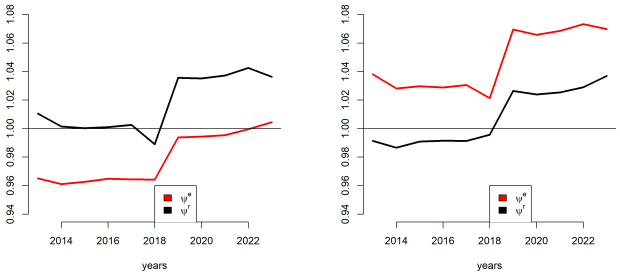


(a) Italy (b) North Centre (c) South

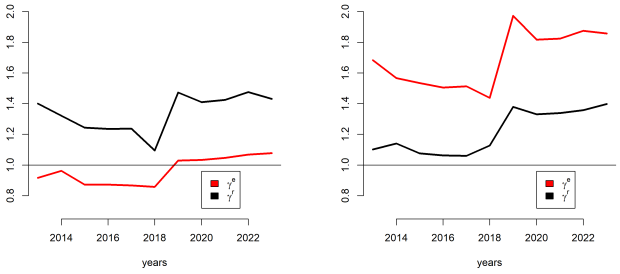


(d) Italy (e) North Centre (f) South

Figure 2: International brain drain: aggregate loss of human capital

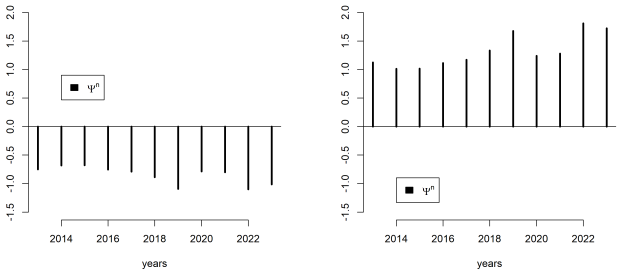


(a) North Centre (b) South



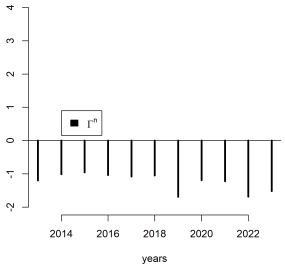
(c) North Centre (d) South

Figure 3: Internal Brain Drain: per worker indices

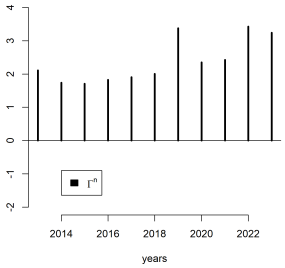


(a) North Centre

(b) South



(c) North Centre



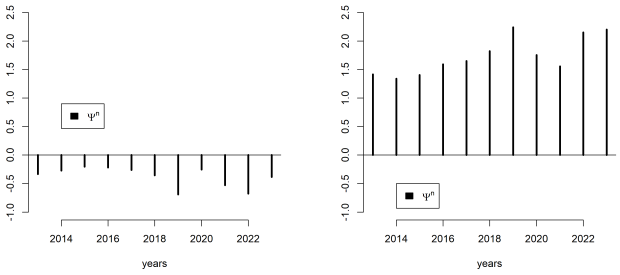
(d) South

Figure 4: Internal brain drain: aggregate loss of human capital

(a) North Centre (b) South

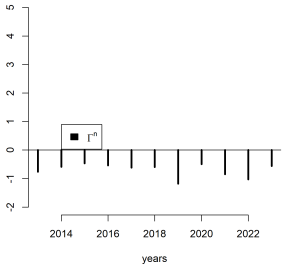
(c) North Centre (d) South

Figure 5: Total brain drain: per worker indices

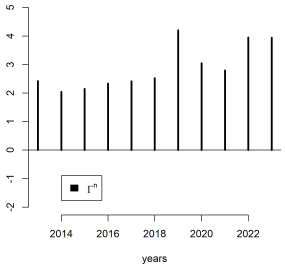


(a) North Centre

(b) South



(c) North Centre



(d) South

Figure 6: Total brain drain: aggregate loss of human capital