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Brain Gain in the Age of Mass Migration

Francesco Giffoni* and Matteo Gomellini**

Abstract

The relationship between emigration and human capital is a hotly debated issue. Nowadays discussions focus mainly on the so called brain drain, i.e. the reduction in the human capital endowment of a country due to the emigration of more skilled people. Differently, this paper investigates whether and how the Italian emigration of the early twentieth century induced a domestic increase in school attendance rates. Many historical clues suggest that this actually happened in Italy at the turn of the nineteenth century. At least three rationales lie at the heart of such a relationship: first, emigration or its prospects increase the expected return to schooling thus making education more attractive; second, return migration could fuel a rise in school attendance via monetary and non-monetary channels; third, remittances could help in relaxing the budget constraint that prevented people to invest in education. Using a new dataset at the city level and different econometric techniques, we find quantitative support that primary school attendance rates have been positively correlated with (and, arguably, partially caused by) emigration and return migration. We also find that remittances had a positive effect on schooling.

JEL Classification: F22, N33, O15

Keywords: migration, brain gain, schooling

Contents

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1. Introduction[1]

The impact of migration on sending countries is relatively poorly studied (compared to the impact of migration in host countries). When analyzed, the stress is often put on the so called brain drain phenomenon: if people who move out of a country are the most skilled ones, migration could damage native countries because of human capital depletion. By emphasizing this point, traditional literature has shown that this could hamper the convergence in per capita income levels across countries (Bhagwati and Hamada 1974; Bhagwati and Wilson 1989; Ciriaci 2005; Katseli, Lucas and Xenogiani 2006; Piras 2007).

Nonetheless, some mechanisms could, at least in part, compensate these losses. Migration can, in fact, act as an equilibrating force, fostering convergence between regions and countries, with the effect of offsetting pre-existing disparities: thanks to the movements of people, relative prices tend to level off in different countries.[2]

As far as human capital, recent theoretical and empirical literature identifies the possibility of a brain gain induced by emigration, pointing out also the channels through which migration may positively influence the human capital endowment in source countries. In particular, three main channels could be identified (Mayr and Peri 2008; Docquier and Rapoport 2009): the first operates through migration or its prospects; the second through return migrants; the third through remittances. This paper is a first attempt of investigating along these lines in the case of Italy at the beginning of the twentieth century.

The analysis proceeds as follows. In section 2 we make a short review of the existing literature. In section 3 we describe the three pillars on which our analysis is built: a) solid qualitative historical evidences tell us about the possible mechanisms at work; b) a description of Italy's public education system; c) a new dataset that reports data at the city level. We also present some evidences about the patterns of outflows (inflows) from (to) Italian cities as well as on school attendance. In section 4 we describe our identification strategy and we get to the estimation of a reduced form empirical model. We divide this section in three subsections: in the first we test the relationship between school attendance rates and emigration (returns) in a specification where in- and out-migration are used as the only predictors for the attendance rate. Then, we try to deal with endogeneity by using an IV approach. In particular we exploit the shipping lines' transportation costs as instrument for migration and we also estimate a multivariate model with a GMM (General method of moments) technique. Section 4.3 turns estimated coefficients into numbers that tell us how many people the migration phenomenon was able to keep at school. Section 5 concludes.

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[1] We are grateful to Antonio Accetturo, Rita Anselmi, Alberto Baffigi, Federico Barbiellini Amidei, Elio Cerrito, Alfredo Gigliobianco, Claire Giordano, Francesco Manaresi, Cormac Ó Gráda, Antonella Pulimanti, Paolo Sestito, Francesco Vercelli, Eliana Viviano and Jeffrey Williamson for valuable comments and support. We are also grateful to an anonymous referee and to participants at the First CEPR Economic History Symposium, held in Perugia, April 2013. All errors are ours and the views expressed in the paper do not necessarily reflect those of the Bank of Italy.

[2] Gomellini and Ó Gráda (2013) calculate the emigration-induced gains that Italy had in early twentieth century, via the reduction of labor over-supply and the resulting increase in real wages. These gains persist also under the hypothesis of positive self-selection of emigrants.

The main results could be summed up in three points: a) for the first decade of the twentieth century migration and return migration caused part of the increase in primary school attendance; b) we detect a positive association between schooling and a rough proxy of remittances; c) we don't find differential effects between the South and the North of Italy.

2. Brain gain: how does it work?

This work focuses on the effects of emigration on education in sending countries. Three key channels could be at work:

(i) emigration and its prospects can boost the incentives for education in the source country. This happens because the usefulness of basic education is rightly perceived as having a great importance for different reasons (necessity of writing home, remittances bookkeeping, expected school-premia in wages, defense from being cheated);

(ii) return migrants could foster education to the extent that returnees, thanks to their experience abroad, are more sensitive to the importance of schooling;

(iii) remittances can play an important role in relaxing a possible budget constraint that prevents people to invest in education.

The first mechanism emphasizes the fact that potential migrants base their decision to leave on the comparison between future expected incomes abroad and at home (among other push and pull factors).[3] The strand of migration literature that investigated the brain gain dates at least as far back as Mountford (1997): he emphasized the "emigration prospects" transmission mechanism: the possibility of emigrating rises the expected return to schooling, spurring investments in education.

Historical and contemporary literature seems to agree that the magnitude of this incentive depends mainly on the income and/or wage gap between source and destination countries; the greater the gap, the stronger the motivation to leave.

What was the magnitude of this gap? Figure 1 plots the average unskilled salary in Italy between 1900 and 1913, compared to that in some other countries which at the time were the preferred destinations of Italian migrants. The Italian average wage was the lowest and the gap between Italy and the U.S. was wide. Furthermore, Betrán and Pons (2004) show that the skill premium, i.e. the ratio between skilled and unskilled wages, was much higher in the U.S than in Italy.

[3] See Hatton (2010) for a survey on the cliometrics of international migration. Gomellini and Ó Gráda (2013) propose an estimate of the determinants of emigration. Bertocchi and Strozzi (2008), emphasize, besides the role of economic and demographic factors, the role of institutional factors in the host countries in driving immigration. In their paper two separate sets of institutions are considered. The first set focuses on the political institutions, i.e. the level of democracy and the extension of suffrage; the second one focuses on migration institutions, i.e. the kind of citizenship laws, land distribution policy, public education policy, and immigration policy attitudes. They find that both political and migration institutions positively contribute to the level of attractiveness of a country.

In this respect, potential leavers commitment to acquire basic education before leaving was in order to get this possible wage increase once arrived at destination. In doing so, they could generate a brain gain since the probability to emigrate (for the most educated) is likely to be less than one.[4] Brain gain will come forth to the extent that the probability to migrate is large enough to activate the channel and sufficiently low to avoid a total escape of brains (Stark, Helmenstein and Prskawetz 1997; 1998; Beine, Docquier and Rapoport 2001; Lucas 2004; Docquier and Rapoport 2003, 2009; Egger and Felbermayr 2009).[5]

Part of the economic literature views migration as a permanent phenomenon, particularly if referred to highly-skilled individuals (Becker, Ichino and Peri 2004; Monteleone and Torrisi 2010; Biondo *et al.*, 2012). Differently, when migration is a transitory event, *return migration* can have a positive influence on sending regions (Borjas and Bratsberg 1996; Dustmann and Weiss 2007; Mayr and Peri 2008; Dustmann, Fadlon and Weiss 2011). Lalonde and Topel (1997) found that about one third of immigrants to the US between 1890 and 1957 returned home.

Dustmann and Weiss (2007) and Mayr and Peri (2008) suggest that the experience abroad increases the amount of individual human capital and therefore the level of productivity of the agents; as a result return migration can lead to a mitigation of the brain drain, or even to a brain gain when returnees bring enhanced skills. Furthermore Dustmann, Fadlon and Weiss (2011) extend the seminal work of Borjas (1989), introducing the idea that some countries can be seen as learning headquarters where individuals can acquire specific skills expendable in the native area. Under this assumption each returnee generates a human capital gain with beneficial impact on domestic income.

In the age of mass migration, though most of migrants were away a long time, a significant proportion returned. According to Giusti (1965), during the period 1811-1911 net migration was about one third of the gross flow. Bandiera, Rasul and Viarengo (2013), using the Ellis Island archive, point to an underestimation of returnees figures in official data. Gomellini and Ó Gráda (2013) show the relative importance of return migration in the cases of the United States and Argentina by comparing gross migration flows and the number of Italian-born residents as recorded in the census. They find that a gross migration of over 0.6 million

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[4] Theoretically and from the point of view of the source country, if return to education is greater in the latter than in the host country, then negative selection might be the result; vice versa, the greater the return-to-skill gap between sending and receiving economies, the more likely is the hypothesis that the more skilled will leave. Economic theory suggests, moreover, that the higher the fixed costs of migration the more plausible the hypothesis of a selective migration because skilled individuals will be able to amortize costs more quickly. In the age of mass migration the cost of voyage from Italy to U.S., included the cost to reach the port of embarkation, was not negligible at all, although affordable. See Commissariato generale dell'emigrazione (1926), Fenoaltea (2002), Gomellini and Ó Gráda (2013) for a more detailed analysis.

[5] The first laws on migration issued by the government of the Kingdom of Italy were inspired by a deliberately repressive philosophy, strongly limiting the possibility of leaving (the Ministerial circular issued by the Prime Minister, Mr. Menabrea in1868; the Lanza Ministerial circular, 1873). These limitations were supported by the concerns of industrial groups in the North of the country and of landowners in the South: a large number of expatriates could create a shortage of cheap labor and, therefore, stimulate the growth of real wages. Other restrictions were introduced later to avoid the emigration as a practice to escape the conscription introduced immediately after the Unification (the so called Crispi law, L. 30/12/1888, n. 5866). It was only with the law 31/1/1901, n. 23, backed by Luttazzi and Pantano (two Italian politicians), that emigration became finally a free choice of the individual. See Einaudi (2007) for more details.

Italians during the 1890s led to an increase in the number of Italian-born of only 0.3 million in the U.S. between 1890 and 1900 while a gross outflow of 1.2 million in 1896-1914 yielded increases in the numbers of Italian-born of about 0.4 million in Argentina in the same period.

Del Boca and Venturini (2003) argue that Italian emigrants did not settle permanently abroad. If during the first period of prevailingly transoceanic emigration (until 1895) the proportion of returns was relatively small, in a second phase (1896-1921) returns tended to be of sizable number. Yet, according to Coletti (1911) in the two-year period 1905-06 the proportion of returns in Italy was, on average, 46 percent (41 per cent in the South and 52 per cent in the North) with respect to migrants who left four years before.

This paper adds to existing literature new insights about the effects of migration on schooling in Italy in the first decade of the twentieth century. We embrace first the hypothesis according to which the prospect of emigration rises the expected income to schooling and as a consequence makes education more attractive. In second place we test the return migration transmission mechanism. Differently from the official sources commonly used to empirically evaluate the role of migration on Italy's development,[6] we use a unique dataset at the city level (more than 10,000 inhabitants). The detailed records on population and on education allows us to overcome many shortcomigs of the existing historical studies that fail at capturing the unobserved heterogeneity between units of analysis because of the use of cross-section regressions.

3. A three-pillars-based investigation

At the core of our analysis there is the attempt of evaluating the effects of outward and return migration on primary school attendance rate in Italy during the first decade of twentieth century. Our strategy is based on the following three pillars of information.

3.1 Historical evidences

The period that goes from the second half of the nineteenth century to the outbreak of World War I is often referred to as the age of mass migration from Europe to the New World (Hatton and Williamson 1998). In the early decades the phenomenon was mainly confined to migrants from North-West Europe and Italian emigration was limited. The progressive transport revolution made overseas trips safer and cheaper and co-determined a big surge of emigration to United States that lasted until the Great War. Between 1876 (when data on Italian emigration first become available) and 1914, Italy's emigration rate rose from 5 per thousand (of population) to nearly 25 per thousand. Nearly 14 million left and about two thirds left in the first decade of the twentieth century. Though a majority of migrants remained abroad, a significant but varying proportion returned. Official data on returnees, available from 1905, show that on average, between 1905 and 1913 the yearly share of returnees on migrants was around 30 percent (Gomellini and Ó Gráda 2013).

[6] Commissariato generale dell'emigrazione (1926), or the IPUMS dataset.

As far as brain gain is concerned, there are many qualitative evidences. Those given by Coletti (1911),[7] in particular, are striking. He argues that the migratory experience made explicit the usefulness of schooling to achieve higher salaries or reach better quality of life. Analyzing the overall impact of migration on Italy's development in the liberal age, he highlighted that:

> Migration is the best friend of literacy […] It is the experience of migration that provided strong evidence about the utility of primary education as a powerful tool of an upward social mobility and it is undoubtedly the most persuasive deterrent to dropping out of primary school. [...] Migration is the main cause of the school attendance rate rise.

This thesis is stressed also by Jarach[8] (Giunta parlamentare d'inchiesta sulle condizioni dei contadini nelle Province meridionali e nella Sicilia 1909), and Cipolla (1969), who argue that, notwithstanding the countless factors which hamper pupils in going to school, literary knowledge is crucial because of the need, once crossed the ocean, to send news on health and on the accumulation of savings to families at home. Many of these evidences about the relationship between migration and education are gathered at the regional level. With respect to Italy's region Abruzzi which, at the time, recorded high emigration rates and notable advancements in fighting against illiteracy, Jarach writes (*ibidem*, p. 57):

> The helpfulness of literacy is penetrated into the consciousness of the population. It has rapidly conquered the minds of farmers and shepherds because of the need, once crossed the ocean, to send news on health and on the accumulation of savings to the families at home, without relying on a stranger. From the U.S. come incitements to the wives to send children to school. [...] These facts are neither isolated nor rare.

In Sicily the number of enrollments in the primary school increased remarkably in the first decade of the twentieth century. The enrollment rate raised from 54.5 per thousand inhabitants in 1902 to 73.5 in 1907. Coletti (1911) writes:

> Since there are no other causes being able to explain the event, the reason must be sought in the consciousness of people. Despite the hostility of the environment in which people live and their financial straits, finally individuals make themselves more confident that literacy may be an effective weapon against poverty. This firm conviction emerges thanks to emigration.

Lucania was, at the time, the region with the highest emigration rate. The following words are drawn by Coletti (1911):

> In most municipalities there is a new common sense among peasants. They have a keen desire to send their children to school. To this end and very frequently, emigrants exhorted their own relatives at home in order to go to school.

In Calabria, where outflows were soaring, schools were becoming increasingly populated by pupils.

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[7] Francesco Coletti (1866-1940) was an Italian statistician and economist. The quotations that follow are in his 1911 publication, at pages 147-158.

[8] C. Jarach was a statistician. He was commissioned by the Ministry of Agriculture, Industry and Commerce, to carry on an inquiry into the economic conditions of the Abruzzi, one of the Italian regions.

> Mothers clean up their children, take them to school and ask the teacher for their children to learn as much as possible. This is because fathers write from the U.S. that their children have to be educated. Only through the migratory experience fathers realize the damage from being illiterate.

As regards northern Italy, Cipolla (1969), analyzing the high literacy rate of the population living in the Alpine areas on the border with Austria, Switzerland and France, argues that literacy is triggered off by emigration which forces potential migrants to become literate in order to keep in touch with relatives.

With respect to the second possible mechanism we mentioned, return migrants could be more capable of perceiving education as a tool to achieve success and prosperity. As a result they may foster school attendance of their pupils. The returnees channel is well documented too and Coletti (1911) writes:

> Who returns from America is a human being transformed and able to transform [...]. He embodies the old village-like soul which was renewed by the American economy and society so he can bring a new energy in the country to which he returns. The depth of the transformation that emigration will be able to cause in Italy will strongly depend on his physical and mental conditions […]. Emigration is a great school; it embodies [...] thousands of thousands of scholarships. It gets rid of the old rust from the mind, it inculcates ideas that otherwise would not be able to penetrate.

Return migrants were psychologically changed with respect to the time they left. Ease, fluency and manner of speaking, style of dress, greater awareness of their own dignity and their rights, no awe of the old employers, the desire to deal with municipal affairs, political and general interests are just a few traits of people who came back from abroad. Coletti (1911) clearly shows migrants' ability to learn from abroad experiences: "It is a miracle occurred thanks to migration. [...]. The awakening of the consciences promote the diffusion of literacy amongst peasants".[9]

The social life of a community is so closely tangled within its components that it is extremely difficult to isolate the determinants of a certain phenomenon from other possible causes. For this reason we need some additional clarifications to better identify our transmission channels.

According to the first channel, the prospects of emigration are incentives for both adults (parents) and children to go to school. This does not mean that children were able to make decisions on their own, but simply that parents, or somebody else, made decisions on behalf of children. We try to separate the impact of migration on children and on adults education by distinguishing the effect of migration both on the attendance rate of public schools and on the enrollment rate of evening classes (public primary school was entirely attended by children while evening schools were mainly attended by adults). More important: following

[9] Clearly the overall effect of returnees on the sending country depends also on the investments they implement in the native country and on the amount of savings accumulated abroad. For example Cerase (1967), in his research on returnees from USA, shows a discouraging scenario for the South. He finds out that 19 percent returned because their migratory project failed, 40 percent because their savings plans were reached, 26 percent for retirement and only 16 percent to invest in the area of origin. See Del Boca and Venturini (2003) and Bevilacqua, de Clementi and Franzina (2002).

the literature on brain gain, we argue that the agent's conjecture to emigrate in the future relies on what he or she observes (and has observed), i.e. the present (and past) outflows.

As far as the second channel is concerned, it hides at least two mechanisms. The first relies on the returnees that are richer than they were at the time they left: thanks to accumulated savings they can afford the cost of sending children to school. The second is based on the *awareness* rationale (Coletti 1911) that induce returnees to send their children at school (we have seen in footnote 9 that the first mechanism is less likely). We will not try to disentangle the two mechanisms in our empirical model.

3.2 Italy's education system (1861-1911)

Analyzing the structure and the working of Italy's education system is a necessary step in our investigation. Very recently the topic have been deeply studied (Bertola and Sestito 2013).

The Casati law (L. 13/11/1859, n. 3725) was the first law that regulated the education system in the new Kingdom of Italy (founded in 1861). It was inspired by the German system of nationally directed education and shaped Italy's education system up to 1877 (Zamagni 2002; Bertola and Sestito 2013). The law envisioned for free and compulsory primary school (starting from six years old) which was made up in two grades (high and low) each lasting two years. Most important for our purposes, funding of primary education was left to municipalities and the obligation to establish the high grade was limited to municipalities with over 4,000 inhabitants. De facto, only the low grade was mandatory.

Privately organized establishments were allowed to co-exist with public ones, but all were subject to a common regulatory framework. Matteucci (1867) illustrated that the claim of a national mandatory school ended up in an unavoidable failure because the Italian liberal State exempted from providing constructions and teachers remuneration by shifting both charges to cities without making sure of their disposable funds (Genovesi 2010; Vecchi 2011).

In 1877 the Coppino law (L. 15/7/1877, n. 3961) extended compulsory schooling from two to three years and introduced a five-year primary school curriculum, with provisions for enforcement and fines for non-compliant parents (Bertola and Sestito 2013). Buonazia (1873) highlighted both delays on the supply side of the education system and insufficient demand for schooling by households.[10] His investigation showed that primary school was still heavily dependent from income. The situation turned up in huge disparities in primary education performances and even in the quality of teaching throughout the country. Therefore, in the

[10] In northern Italy, in rural areas, there was a widespread practice of dropping out of school because of the use of children in farming and textile industries (Vecchi 2011). Between 1870 and 1900, in Piedmont, at the beginning of the harvest season, schools were deserted (Cipolla 1969). Because of their very low salaries, teachers were culturally and technically inadequate. In 1897, 4,009 teachers out of 17,940 did not have the legal authorization, many of them worked as tailors, sacristans and bell-ringers. In such an environment pupils dropped out of school, attended it listlessly or with great difficulty, anyway without being able to draw large payoffs from attending classes (see Genovesi 2010, for a detailed analysis on the economic conditions of teachers).

first decades after Unification the strong dependence of primary school on local resources crystallized the huge territorial differences inherited from the pre-unitary period (Bertola and Sestito 2013).

Between November 1903 and March 1914, part of the period known as Giolittian Age, the political climate shifted in more progressive directions. In 1904 the Orlando law (L. 8/7/1904, n. 407) extended compulsory education to twelve years old, reduced the primary school curriculum to four years and contemporaneously established the two-year professional training course (fifth and sixth grade). Actually, mandatory education could be accomplished by successfully completing the four-year program. The law also envisioned for the establishment of the evening classes for illiterate adults and in 1906 in the South was set up the Commissione Centrale per il Mezzogiorno to put up a fight against illiteracy.

Nonetheless, the ministerial inquiry carried out by Corradini (1910)[11] showed that the main problem of primary education system was the unsatisfactory actions realized by municipalities due to the lack of local resources (Cives 1990; Vecchi 2011). The system changed only when the cost of all personnel and materials for primary education shifted to the central State budget after 1911. This choice marked a substantial step forward in the fight against illiteracy (Genovesi 2010; Felice 2011).

All in all, the final judgment on the reforms implemented in the first fifty years after Italy's unification is almost clear: they had little or no effects in fostering on the attendance rate of primary school and in this sense they cannot represent a confounding factor for our identification strategy. Still, in our econometric exercise, we add controls for the possible effects of reforms.

3.3 A new dataset on Italian cities

Core of our analysis is the *Annuario Statistico delle Città italiane* (1906-1914), published every two years by the Unione Statistica delle Città italiane and inspired by the *Yearbook of German Cities*. The *Annuario* collects records on the social, political and economic life of the largest municipalities (with more than 10,000 inhabitants) by breaking down data in the following categories: territory and population, education, hygiene and health, industry and employment. The choice to sample more important municipalities was taken to guarantee the comparability among the Italian cities (and thus minimizes measurement errors).

The section "Public Education" includes information on the number of schools (public, private and evening classes), number of teachers and pupils as well as on attendance and learning results. Data on public spending on education are available too. The chapters "Taxes" and "Main Consumptions" contain, instead, details on council public finance and data on consumptions (in kilograms) carefully divided into many product groups from fish to coffee, from meat to beer. Current prices of goods are also reported. Most relevant for our study is that available information allows us to measure abroad migration outflows (inflows) from (to) each municipality. Record keeping, however, became less detailed from 1914 onwards, thus

[11] Camillo Corradini (1867-1928) was an Italian politician.

inadequate for our purpose: it contains only the net migration rate with no disentanglement between migration and returns.

Since our thesis is that in- and out-migration was correlated with higher levels of education, to begin with we present some empirical evidence on migration and schooling patterns from our municipalities dataset.

Figure 2 illustrates the cities distribution throughout Italy and shows that the municipalities in the sample are almost uniformly spread across national territory: out of 110 cities detected, 47 belong to the South and 63 to the North. Hence a potential distortion stemming from an over-represented area is avoided. Figure 3 shows the relationship between emigrants (returnees) and educated population at the city level. Correlation coefficients are all positive and statistically significant (except for Figure 3.c), at the 5 percent level.

Descriptive statistics are reported in Table 1. The values of the "Attendance rate" are the percentage of pupils (of those enrolled) who did not drop out primary school. On average this attendance rate is about 81 percent but it results from the significant heterogeneity between the municipalities situated in the South (76.3 percent) and those in the North.

"Migration" and "Returns" represent the abroad outflows and from-abroad inflows respectively, obtained by dividing the flows by the municipality population and then multiplied by 1,000. Both Table 1 and Figure 3 highlight the preponderance of returns in the North with respect to the South and show that southerners were much more likely to leave than northerners.

The attendance rate depends definitely on disposable income. At the city level yearly estimates of disposable income do not exist. Following Mortara (1913), Becker and Woessmann (2009), Ciccarelli and De Fraja (2014), we proxy income with a measure of tax proceeds. We choose as our best proxy the sum of the tax revenues accruing from a large variety of council taxes. Specifically the categories are: family tax; local property and business taxes; taxes on boats, cars and velocipedes; servant tax; livestock and pet tax; hotel patent tax and tax in sparkling water production.[12]

This wide range of taxes allows us to overcome two problems: the first is to avoid a possible skewness in the distribution of taxpayers going from the wealthiest households to the poorest ones so that we have a relative broad and representative basis; the second is that we do not need to account for special circumstances affecting only some municipalities, for example by distinguishing those with the city gates or as Ciccarelli and De Fraja (2014) suggest, those that had a major ports.

The correlation coefficient between per capita GDP, as estimated in Baffigi (2013), and our measure of per capita tax proceeds is 0.98, statistically significant at the 5 percent level.

"Expenditure" is the variable that proxies the education supply-side: it is the per capita public spending in primary education at the municipality level. By including this variable in equation (1) we catch the effect of different education policy decisions made by municipalities.

[12] For more details see the *Annuario Statistico delle Città italiane* (1906-1914) and Villani (2011).

Finally, "Remittances" is a rough proxy. It is the ratio between consumption tax proceeds and income tax proceeds, with the idea that an important part of not officially traced remittances is used for consumption although it does not appear in official income.

4. Identification strategy and empirical findings

The three pillars of information described so far (qualitative evidences, primary education system, new dataset) guide our identification strategy. The empirical model we estimated is the following:

$$y_{i,t} = \alpha + \beta_1 y_{i,t-1} + \beta_2 m_{i,t} + \beta_3 ret_{i,t} + \beta_4 exp_{i,t} + \beta_5 tax_{i,t} + \beta_6 rem_{i,t} + \upsilon_{i,t} \quad (1)$$

where $y_{i,t}$ is alternatively the (log of) public primary school attendance rate or the evening school enrollment rate[13] in year t, where t = 1904, 1906, 1908, 1911 in the city *i*, where I = 1,…87; $m_{i,t}$ and $ret_{i,t}$ are the logs of abroad migration rate and return migration rate, respectively, in year *t* in the city *i*; $exp_{i,t}$ is the log of per capita public expenditure on primary education, measured in current Italian lira; $tax_{i,t}$ is the proxy we use of the log of per capita income in year *t* in the city *i*. It is worth to note that using the attendance rate rather than the enrollment rate (in the case of public education) allows us to overcome the following problems: a) higher enrollment rate does not imply higher attendance rates; b) the use of enrollment rate tends to bias upward the education level of a given population. Cipolla (1969) and Vecchi (2011) suggest that the attendance rate is the best indicator to investigate literacy rate of Italian population.

The lagged dependent variable in the right-hand side of equation (1) tries to control for the following two issues:

- *the urbanization process*. Large cities are attractive poles where population relocates in search of the best work opportunities; if so, the attendance rate could be altered abruptly if a large number of people and their families moved on to the nearest city from the countryside. Thus attendance rate would pick up effects that would have nothing to do with international migration;
- *the natural dynamics of population*. As before, it is clear that the natural increase may be a common driver of both migration (Hatton and Williamson 1998) and attendance rate: the larger the shock on newborns (with respect to deaths) the larger the probability that primary school dropouts will change in the future.

As in Arellano and Bond (1991), the error term $\upsilon_{i,t}$ is a two-way error-component:

$$\upsilon_{i,t} = \lambda_t + \eta_i + \varepsilon_{i,t} \qquad i = 1, \ldots, I \qquad t = 1, \ldots, T \quad (2)$$

In (2), λ_t represents the municipality-invariant time-specific effect, η_i represents the time-invariant municipality-specific effects and $\varepsilon_{i,t}$ is a white noise, normally and independently distributed across cities and periods.

[13] When the dependent variable is the evening enrollment rate, the variable *exp* is dropped out since it only refers to public primary schools.

Hence, the proposed formulation in equation (1) has the substantial advantage of reducing the burden of omitted variables by including the dependent lagged variable as explanatory one as well as time and cities' fixed effects. In this way, the coefficients of $m_{i,t}$ and $ret_{i,t}$ are more likely to capture the vigor of transmission channels we are interested in.

To investigate the idea that sees emigration and returnees as drivers of schooling in Italy in the age of mass migration, we split this section into three parts: in the first part we test the relationship in the simplest possible way, namely, by testing a model with abroad outflows and from-abroad inflows as the only regressors (with dummies). Then we try to deal with the potential endogeneity between emigration and school attendance. In the second part we adopt an instrumental variable (IV) approach while in the third part we estimate equation (1) in a multivariate framework using a GMM technique.

4.1 Migration and schooling: basic formulation

The basic equations that we use in order to gauge our *incentive channels*, are the following:

$$y_{i,t} = \alpha_{0,i} + \alpha_1 m_{i,t} + \varphi_1 \lambda_t + \varepsilon_{i,t} \quad (3)$$

$$y_{i,t} = \beta_{0,i} + \beta_1 ret_{i,t} + \delta_1 \lambda_t + \varepsilon_{i,t} \quad (4)$$

where λ_t is a set of time dummy variables capturing shocks common to all cities (for instance the influence of educational reforms), while cities fixed effects catch unobservable time-invariant heterogeneity across municipalities.

The first column of Table 2 gives evidence of a positive relationship between the emigration rate and the attendance rate for public primary schools. A significant association between return migration and schooling comes to light as well: a 10 log-points increase in the outflows (inflows) is associated with a 0.19 (0.37) log-points increase in the attendance rate.

To control for the possibility that results are biased by geographical differences at higher level of aggregation than the city level, column (2) adds a complete set of interaction terms between geographical dummy variables at macro-area level and time dummy variables. More precisely we classify our cities as belonging to the North-West, the North-Est, the Center and to the South and we make time dummies interact with geographical ones. To the extent that there is unobserved macro-regional time-variant heterogeneity, these interaction dummies should be able to capture most of its essence. Hence, the equations we estimate are the following:

$$y_{i,t} = \alpha_{0,i} + \alpha_1 m_{i,t} + \varphi_1 \lambda_t + \varphi_2 (\lambda_t * \vartheta_{macro-areas}) + \varepsilon_{i,t} \quad (5)$$

$$y_{i,t} = \beta_{0,i} + \beta_1 ret_{i,t} + \delta_1 \lambda_t + \delta_2 (\lambda_t * \vartheta_{macro-areas}) + \varepsilon_{i,t} \quad (6)$$

The estimated association between in- and out-migration and schooling remains robust. Column (3) of Table 2 shows the robustness of the relationship between migration and the

attendance rate for a specification where outflows and inflows are jointly plugged into the same model: the coefficients are rather stable.

Table 3, columns (1), (2) and (3), reports the results obtained using the evening school enrollment rate as dependent variable. As in Table 2, the results are quite robust across different specifications although the values of the elasticities tends to be much higher both for out-migration and for returns. The elasticity of enrollment rate with respect to emigration (returns) is 0.161 (0.300). This may provide some weak evidence for the view that migration would have spurred adults education. In section 5 we will resume this point related to the values of the elasticities.

Several worries may emerge in evaluating the association between emigration and schooling in a causal sense where endogeneity is not properly considered. This can be due to a two-way relationship between the dependent and independent variables, to possible omitted variables or measurement errors. In particular, migration is likely to be one of the causes for people to go to school but at the same time the probability of migration depends on the achievement of a given educational requirement, at least for adults; that is, migrants are not randomly selected from the population of native countries.[14]

Can the enormous number of migrants leaving Italy in the early twentieth century be viewed as exogenous with respect to the level of education attained? Williamson (2006) compares literacy rates for five European countries (France, Britain, Italy, Spain and Portugal) among adult immigrants to the United States between 1899 and 1909 to the literacy rates of the adults at home in 1901 (those who stayed). He finds that literacy rates among immigrants were on average higher with respect to source population, implying a positive selection.[15] In this respect, Italy could be an exception. The observed lower literacy rate among Italian emigrants relative to the Italian population reflects the dominance of poor southern Italians in the immigrant inflow. Still, the selection process must be evaluated on a strictly local basis: the emigrants from the South of Italy could be not less educated than their 'neighbors'. Furthermore, the seemingly negative selection among Italian emigrants, measured in terms of education and literacy, does not imply the absence of a selection based on unobservables.

[14] Williamson (2006) gives an interesting piece of evidence supporting selective migration using Swedish clergymen evaluations of the intellectual abilities of their parishioners. From reverends' testimonies emerge that by comparing people who subsequently emigrated with those who remained, the former «had a higher intellectual level, did better at school, and had a wider view of the world». Under perfect positive selection the most educated individuals will emigrate with probability one (zero probability of leaving for the less able ones) and a brain gain via the adults' investment in education would be impossible because, in this case, all the people that invested in schooling will leave. Hence a necessary condition for a brain gain is that the less educated persons have a positive (but lower than 1) probability of emigration (Docquier and Rapoport 2009; Beine, Docquier and Oden-Defoort 2011).

[15] Williamson (2006) argues that in some respects a positive selection was inevitable. Immigrant were younger and, as there was a schooling revolution taking place in late nineteenth century in Europe (Cipolla 1969), literacy soared among the young movers compared with the old stayers. Moreover he adds that while there was certainly some positive screening, it probably did not translate into a big brain drain from Europe.

The other source of potential endogeneity that challenges our attempt of measuring the casual relationship between migration and schooling may arise from unobserved variables that affect both the independent variable and its covariates. The main candidate is obviously income. In poor families, very often economic conditions forced the head of the household to leave in order to look for best opportunities abroad; at the same time this could increase the school dropout rate because children were required to work in place of their fathers.[16]

In the next paragraphs we try to give an answer to this potential sources of endogeneity, first by recurring to Instrumental Variables (IV) technique; second, by estimating a multivariate model with a GMM technique.

4.2 IV and multivariate model

To deal with potential concerns about reverse causality, omitted variables and measurement error biases, we first make use of instrumental variable approach. We resort to a Two-Stage-Least-Squares (2SLS) strategy using the shipping lines' transportation costs as instrument. For each city *i* and for each year *t* we compute our instrument, $C_{i,t}$, as described by equation (7):

$$C_{i,t} = tc_{i,k} + sc_{k,t} \quad (7)$$

where $tc_{i,k}$ is the average cost of a third class rail travel from city *i* to the nearest embarkation port *k* and $sc_{k,t}$ is the averaged steerage cost from port k to the destination countries (Argentina, Brazil and the U.S.). Thus, $C_{i,t}$ have a straightforward interpretation: it is the amount of money the potential migrant needed to reach the Americas from the municipality of residence.

In order to construct the instrument, we have collected data from several sources. First, from the *Annuario statistico italiano* we have obtained the cost of the ticket to travel from each city in our sample to the nearest port of embarkation (by law emigrants were limited to leave from the ports of Genoa, Naples and Palermo. Only a tiny share departed from Messina). Second, we follow Cannon (2010) to calculate the steerage rates. The yearbook *Annuario statistico della emigrazione italiana dal 1876 al 1925* (Commissariato generale dell'emigrazione 1926) lists the annual price of steerage fares for the period 1902-1925 for all navigation lines to the U.S., Brazil and Argentina. From the ports of Genoa, Naples and Palermo, many European and American shipping companies offered regular service to the U.S. (Boston, Philadelphia and New York), Brazil and Argentina, including the three major Italian lines: Lloyd Italiano, La Veloce and Navigazione Generale Italiana. We averaged the annual steerage prices to reach the destination countries for the years 1904, 1906, 1908 and 1911.

[16] This is the main mechanism that could affect the relationship between migration and schooling in a negative way. On the contrary, as said, Cipolla (1969) argued that literacy could be triggered off by poverty.

The validity of this instrument requires that it must be uncorrelated with the dependent variable (school attendance rate in 1904-1911), other than through its relation with the independent variable (i.e, city emigration at time *t*). Specifically, to solve the identification problem, $C_{i,t}$ must satisfy two conditions. First, it must be exogenous in equation (5). We believe this assumption is likely to be met, since it is implausible that the transportation costs could have affected directly intra-city schooling choices or these costs were affected by unobserved factors at the city level. Second, it must be correlated with emigration at time *t*, once the other exogenous variables have been netted out. The literature on migration agrees that transportation costs were an important determinant of emigration. At the turn of the nineteenth century there was a dramatic decline in freight shipping which could have impacted migrant flows. During the peak period of Italian emigration in the early twentieth century there is evidence of a significant (negative) correlation between the fluctuations in steerage fares and the rate of emigration to America at least until 1910 when the cartel agreement of 1909 between shipping companies began to take effect. Deltas, Sicotte and Tomczak (2008) show that shipping cartels tend to reduce passengers flows by 20 to 25 percent. Thus, we use $C_{i,t}$ as an exogenous variation to predict migration at the city level.

Column (4) of Table 2 reports the IV estimate of the effect of abroad migration (and returns) on schooling, where migration is instrumented in the way just described.[17] The positive effect of outflows (and of returns) on schooling is highly robust across the models. The point estimates go from 0.020 in fixed effect (FE) specification, to 0.027 in IV model. Column (4) of Table 3 reports the IV estimate of the effect of abroad migration (and returns) on evening school enrollment rates. Estimated coefficients double in IV specification (from 0.161 to 0.348) while the coefficients on returns remain steady around 0.3. Our results present a number of common features. First, the instrument is very strong: the first stage F-statistics is 41.2 in Table 2 and 23.9 in Table 3. According to the thresholds of Stock and Yogo (2005), we can be assured that weak instruments problems do not apply. Second, the IV estimate generates an upward correction in the coefficients with respect to LS estimates. This possibly stems from measurement error bias and from the negative relationship between migration and income (omitted variable) that produces downward biased estimates.

As a further check of our choice (resorting to an IV procedure to estimate the effect of migration on education), the control function approach can help us to determine whether or not migration suffers from endogeneity. This approach requires to take the estimated residuals of the first stage regression and plug them into the equation 5 as an explanatory variable. The inclusion of this error term controls for endogeneity of $m_{i,t}$. Specifically, if the coefficient on the residuals is not statistically significant, that is the null-hypothesis is not rejected, then $m_{i,t}$ is exogenous in equation (5) and as a consequence we do not need IV;

[17] In column (4) we treat returns as exogenous, since the hypothesis of a two-way relationship between return and schooling it is quite implausible. For example it is difficult to argue that the improvement of the education system in Italy in the period 1904-1911 encouraged migrants to return; ministerial inquiries about the condition of the Italian school system contradict this thesis. Likewise, the hypothesis that the dynamics of the Italian income attracted migrants is questionable. For more details on the causes of return migration see Cerase (1967).

if residuals enter significantly, there is evidence that migration is endogenous and the IV method is necessary.

The last rows in Table 2 and in Table 3 present the results of this exercise for the attendance rate in the public primary schools and for the enrollment rate in the evening classes, respectively. In both cases the coefficient on the residuals is statistically different from zero, suggesting endogeneity and thus IV regressions is appropriate.

Last, we move to the multivariate version of the empirical model proposed in equation (1). The GMM estimation procedure is required to deal with the dynamic panel structure of the model. Table 4 reports our results; each column shows the results of an alternative specification for the estimation of equation (1). The third and the fourth columns are our benchmark specifications. We estimate equation (1) by using the difference GMM method (GMM-dif). Namely, we use both one-step and two-step GMM-dif estimators (column headed GMM1 and GMM2, respectively).[18] The instruments proliferation (over- identification) and over-fitting are the main drawbacks of GMM methods. S-test of Sargan (1958; 1988) and J-test of Hansen (1982) provide guidance on possible excess of instruments.[19] We use this approach in the following analysis. In Table 4, abroad migration and returnees contributions are statistically significant in most of the proposed specifications and the associated coefficients are in general robust. An increase in the outflows has a positive impact on attendance in primary schools; return migration effects match the qualitative literature claims. The magnitude of their elasticities ranges from 0.023 to 0.032 for migration and from 0.046 to 0.050 for returnees; similar results are found in other studies focused on present time (Beine, Docquier and Rapoport 2003; Docquier and Rapoport, 2009; Fratesi and Percoco 2009).

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[18] GMM-dif (Holtz-Eakin, Newey and Rosen 1988; Arellano and Bond 1991) treats the model as a system of equations, one for each time period. The equations differ only in their moment condition sets. The predetermined and endogenous variables in first-difference are instrumented with suitable lags of their own levels. Strictly exogenous regressors enter the instrument matrix in first differences, with one column per instrument. Compared to GMM-dif, the Anderson and Hsiao (1982) estimator (IV2SLS in Table 4) is consistent but it is not efficient because it does not exploit all the moment conditions and its instrument matrix; it uses the second lag of the dependent variable as instrument for its first differences. We have one and two-step variants with two-step estimates asymptotically more efficient, although simulation studies suggest very modest efficiency gains from two-step, even in presence of heteroskedasticity (Blundell, Bond and Windmeijer 2000). In two-step GMM estimator there is an extra variation because the optimal weight matrix depends on estimated parameters. Asymptotic standard errors do not take into account of this extra variation in small sample; as a result inference in small sample is unreliable. Thus the two-step asymptotic standard errors are too small and t-statistics too big; in other words there is an over-fitting bias in small sample (this extra variation is negligible in large sample). In this sense the t-tests based on the one-step procedure are more accurate. Anyway, Windmeijer (2005) provides corrected standard errors and t-tests that are reliable as those based on the one step GMM estimator.

[19] S-test of Sargan (1958; 1988) in the homoskedastic case and J-test of Hansen (1982) in the heteroskedastic case test the validity of the instruments set. The statistics is distributed as a chi-square with degree of freedom equal to the number of moment conditions. Under the null over-identification restrictions are valid. We fail to reject it (p-values are reported in the Table 4) so our instruments set is valid. Note also that in the command *xtabond2*, used to carry out the estimations in Stata, the R-squared is not available. We compute it as the squared correlation coefficient between actual and fitted values.

The positive and significant coefficients on council taxes (our proxy for income) catch the relationship between education and income. In contrast, we fail to find any evidence on the contribution of per capita municipal expenditure. This result fits with different hypothesis: the ineffectiveness of expenditure, the lack of an adequate variable to proxy public policy or the correlation with income.

Many scholars have emphasized the influence of remittances on alleviating the budget constraint that prevents people to invest in education. We test this hypothesis in the last row of Table 4. If we believe the coefficients in regressions (3) and (4), then a 10 percent increase in the remittances is associated with a 0.48 and a 0.38 percent increase in the attendance rate.

In columns (5) and (6), equation (1) is modeled by introducing the log of the lagged abroad migration rate, while the columns (7) and (8) report the estimation of the model obtained by simply excluding current migration as regressor but keeping up lagged outflows. The lagged emigration rate is never significant even when we remove current emigration. This may be due to two reasons. The first is that the time span between subsequent surveys in the panel we use is large enough to allow the coefficient of $m_{i,t}$ to pick up past shocks on migration; the second is that the influence on schooling we have come to expect from lagged migration is gathered up by the $y_{i,t-1}$ coefficient. The latter hypothesis is plausible since in an unreported regression we estimate a model by excluding the lagged attendance rate: the abroad migration and the lagged abroad migration rate coefficients are both positive and significant.

In Table 5 we repeat the regressions of Table 4 for the enrollment rate in evening schools, that are attended mainly, if note exclusively, by adults. We drop out the variable *exp* since it only refers to public primary schools. Again, the connection between migration and enrollment rate in evening schools is much bigger than the connection between migration and the attendance rate in ordinary schools.

A 10 percent increase in outflows leads to a 3 percent higher entry in evening classes. Income has the expected positive sign; in contrast the effect of remittances and the effect of returns are not statistically significant. Some theoretical studies on migration (Mountford 1997; Beine, Docquier and Rapoport 2001) predict non-linear effects of migration prospects on human capital formation and as a consequence on education. More precisely, these models suggest that a greater positive brain gain should be observed mostly in the poorest countries. The idea is that in such countries the motivation to invest in schooling are extremely low unless substantial external options are offered to potential migrants (Beine, Docquier and Rapoport 2001).

As regards returns, historical economic literature offers us a plausible explanation for additional effects. Del Boca and Venturini (2003) argue that the various constraints to start-up new enterprises limited the development of the local economies. Specifically only in the North-East a positive influence of returns seems to come out because return migration was encouraged and supported. In the South returning migrants faced severe difficulties in finding a job and in finding support for their investments. Cerase (1967) shows that people who returned were unable to implement their plans partly because of the hostility of the local bureaucracy.

Coletti (1911) observes that in Friuli the savings accumulated abroad were used differently from the South: they were used to establish small businesses; moreover he predicts

that if this practice had been possible in the Mezzogiorno, Italian migration would have been more successful for the whole country.

To deal with this issues we modified the equation (1) as follows:

$$y_{i,t} = \alpha + \beta_1 y_{i,t-1} + \beta_2 m_{i,t} + \beta_3 ret_{i,t} + \beta_4 exp_{i,t} + \beta_5 tax_{i,t} +$$

$$\beta_6 rem_{i,t} + \beta_7 (m_{i,t} * South) + \beta_8 (ret_{i,t} * South) + \upsilon_{i,t} \quad (8)$$

where South is a dummy variable which equals 1 if municipality belongs to the South and equals 0 otherwise. Under specification (8) the interaction terms give the differential effects at the South with respect to the North. According to the literature quoted above, the coefficient of $m_{i,t} * South$ should be positive and significant and the coefficient of $ret_{i,t} * South$ should be negative and significant. We report the results obtained in columns headed (1) in Table 6.

In contrast to Beine, Docquier and Rapoport (2001) and Coletti (1911) but accordingly to Beine, Docquier and Rapoport (2003) and Docquier and Rapoport (2009) the interaction coefficients display the expected signs but they are not statistically significant (Table 6, column 1). Therefore, conditionally to our sample, estimation suggests no evidence of non-linear effects of outflow and inflows on education: the South does not seem to get additional effects (this could be due to the effectiveness of fixed effect in removing cities' heterogeneity). The coefficients on migration and returns remain significantly positive and their values are quite similar to those on Table 4 in the columns (3) and (4); this confirms the robustness of the results obtained in the linear specifications. Historical documents emphasize the importance of private schools and evening classes in educating adults especially in the largest cities (as those in our sample). Figures related to public schools are obviously not able to catch these possible channels.[20] In Table 6 we check the presence of non-linearity by estimating the equation 8 also using the enrollment rate in evening schools as a dependent variable (column 2). As we already found in column (1), the elasticities on the interaction terms are not statistically different from zero. We take these results as a suggestion that, at least as far as the effects of returnees on evening schools are concerned, more investigation is needed.

Finally we used the literacy rate as dependent variable rather than schooling rates. Literacy data, in the *Annuario Statistico delle Città italiane*, derive from marriage registers. It is the share of brides and grooms who were able to sign their marriage certificates. Although the magnitude of the "Migration" and "Returns" coefficients are quite similar to previous estimations and have the expected signs, they are not statistically significant (column 3). We explain this result by considering that literacy is a more general concept than dropout or attendance rates and it is a more comprehensive measure of accumulated human capital rather than schooling (Becker and Woessmann 2009); as a consequence, it is very plausible that outflows and inflows are not able to catch up the whole phenomenon. Furthermore, as argued by Cipolla (1969) and Vecchi (2011) higher levels of attendance do not imply higher

[20] For instance in 1906 in Turin, Milan, Rome and Naples there were 8,000, 11,000, 10,000 and 15,000 people enrolled in private schools, respectively. Unfortunately the dataset does not report their age.

levels of literacy. In 1829, in Naples, out of 2,000 girls who regularly attended the school only a fifth actually learned to read. In 1870, in the province of Turin (the most developed in terms of literacy) education meant being able to read just a little and write incorrectly; in fact after a few years that students have completed the school, many of these were no longer capable to understand what they read, nor to write their own name correctly.

4.3 Back of the envelope

A useful way to interpret the effect of migration on schooling is to translate the estimates we have got so far into numbers that express their magnitudes.

We start with some stylized facts about migration and school attendance which are more likely to fit this kind of exercise. Overall, in our sample 72,015 people left in the years 1904, 1906, 1908, 1911 (18,003 per annum on average); whereas in the same time span 19,856 individuals returned (4,964 per annum). Therefore in our sample the proportion of returnees is a bit less than one third of those who left in the same period. As we have already noted, on average, the public primary school attendance rate is about 81 percent. Furthermore, in the years under analysis the number of students enrolled in schools are, on average, 495,940; therefore the stock of people that did not drop out is 401,710. The average flow of the new students is instead 49,162 of which 39,821 did not drop out.

What was the actual effect of the big surge of migrants on school attendance? In particular, how many people stayed at school and did not leave their classrooms, because of migration? Let's recall equation (1):

$$y_{i,t}=\alpha+\beta_1 y_{i,t-1}+\beta_2 m_{i,t}+\beta_3 ret_{i,t}+\beta_4 exp_{i,t}+\beta_5 tax_{i,t}+\beta_6 rem_{i,t}+\upsilon_{i,t}$$

From the equation above we can calculate the implied long run elasticities of abroad emigration and return migration, i.e. the elasticities that would prevail in the long run, computed, supposing that the model is in a steady state equilibrium. We interpret the 1904-1911 elasticities as percentage changes in the attendance rate that would follow a permanent change in outflows and inflows so that $y_{i,t}=y_{i,t-1}$. Given the empirical model, this long run abroad emigration and return migration elasticities are respectively $\beta_2/(1-\beta_1)$ and $\beta_3/(1-\beta_1)$ where β_2 and β_3 are the impact multipliers. In the case of public primary schools the estimated elasticity of the attendance rate to migration ranges from 0.019 to 0.032 (Table 2, col. 1 and Table 4, col. 4). To this estimate corresponds a long run elasticity that goes from 0.013 to 0.022.[21] Similarly, the elasticity with respect to returnees ranges from 0.035 to 0.060 (Table 2 col. 2 and Table 4, col. 8); the steady state elasticity ranges from 0.024 to 0.040.

By translating these figures in the number of people, we have that each 100 people who additionally left, kept at school a number of individuals going from 4 to 7 in the short term and a number ranged from 3 to 5 in the long run. Following the same line of reasoning, our results suggest that every 100 additional returnees, increased the number of non-dropping out pupils

[21] We choose β_1= -0.48 deriving from col. 4 in Table 4.

in a range from 8 to 11 as impact, and a number from 5 to 9 in the "steady state". For evening schools, the elasticity of the enrollment rate to Migration ranges from 0.16 to 0.35 (Table 3, col. 1 and Table 3, col. 4) as impact and from 0.30 to 0.38 in steady state (the coefficients of "Returns" are not different from zero in the multivariate model: Table 5). Although elasticities are very high, we found "reasonable" magnitudes since evening enrollments are very little. So, according to our calculations, 100 more migrants pushed into evening schools from 11 to 14 individuals both as impact and in steady state. This is a reassuring upshot since previous empirical studies on brain gain are in line with these results (e.g. Docquier and Rapoport 2009).

Conclusions

The emigration-induced brain gain has been lately investigated by many scholars. It is well documented for Italy by historical qualitative evidences. This paper is a first attempt of measuring the phenomenon for the Italian case in the so called "age of mass migration". We investigated whether emigration and return migration, via different channels, raised school attendance rates in Italy in the first decade of the twentieth century. Results are obtained by using a unique dataset at the municipal level that allowed us to overcome some of the problems deriving from the lack of suitable data. We estimated the effect of migration and return migration on school attendance rate, controlling for fixed effects at the city level and using an IV strategy based on a measure of transportation costs as instrument for migration. We also resorted to a GMM estimation framework and tested its robustness with respect to different aspects.

Our results empirically support the existence of a brain gain, fueled by outward emigration and return migration in Italy in the first decade of the twentieth century. Translating our results into number of people, according to our estimates every 100 additional people who left, from 4 to 7 more children were kept at school. Return migration had a stronger impact on primary schooling but did not affect the education of the adults. Differently, migration prospects stimulated schooling responses of adults. Finally, we tested the effects of a rough proxy of remittances and we also investigated possible heterogeneity at the macro-area level: no differences emerged between the North and the South.

Thus the mechanism of human capital pauperization via a possible brain drain has some countervailing forces since emigration, through different channels, can exert also a positive effect on schooling in source countries (brain gain). In this work we have shown that in the case of Italy at the beginning of twentieth century, some of these channels were probably at work.

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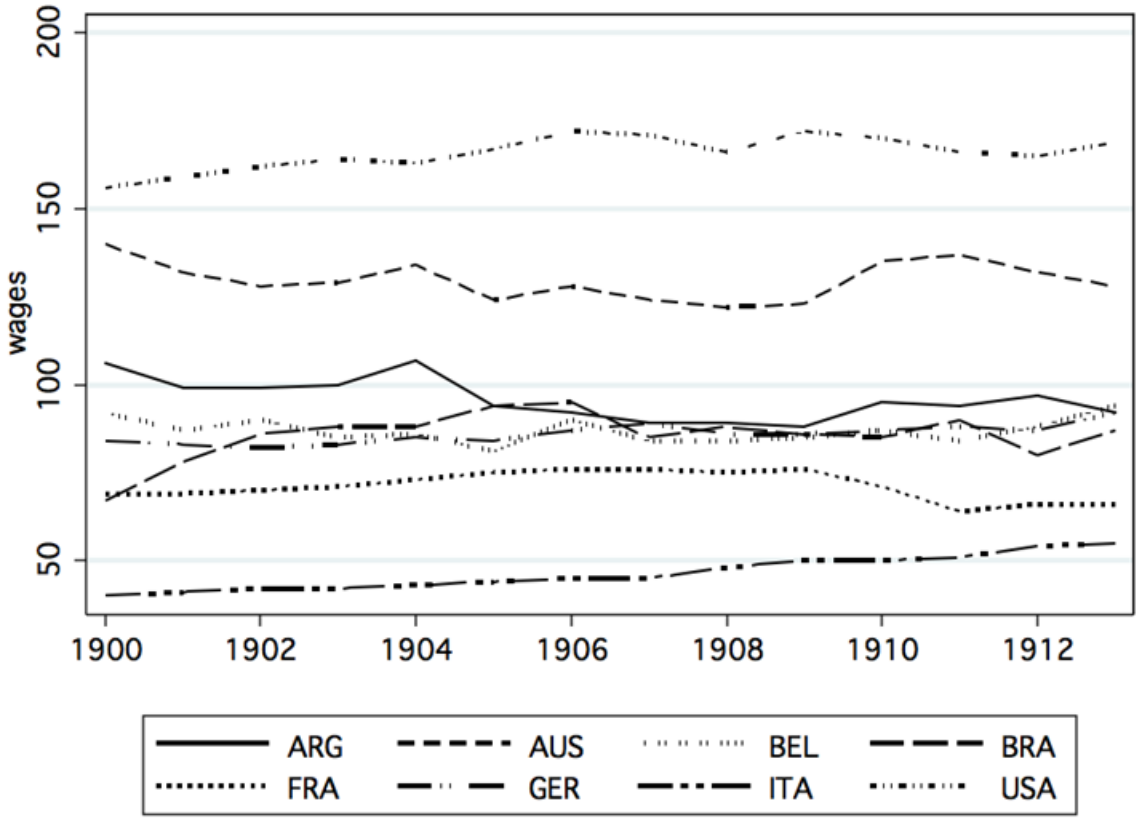
Figures and Tables

Figure 1

International (unskilled) real wage index



Source: Williamson (1995).

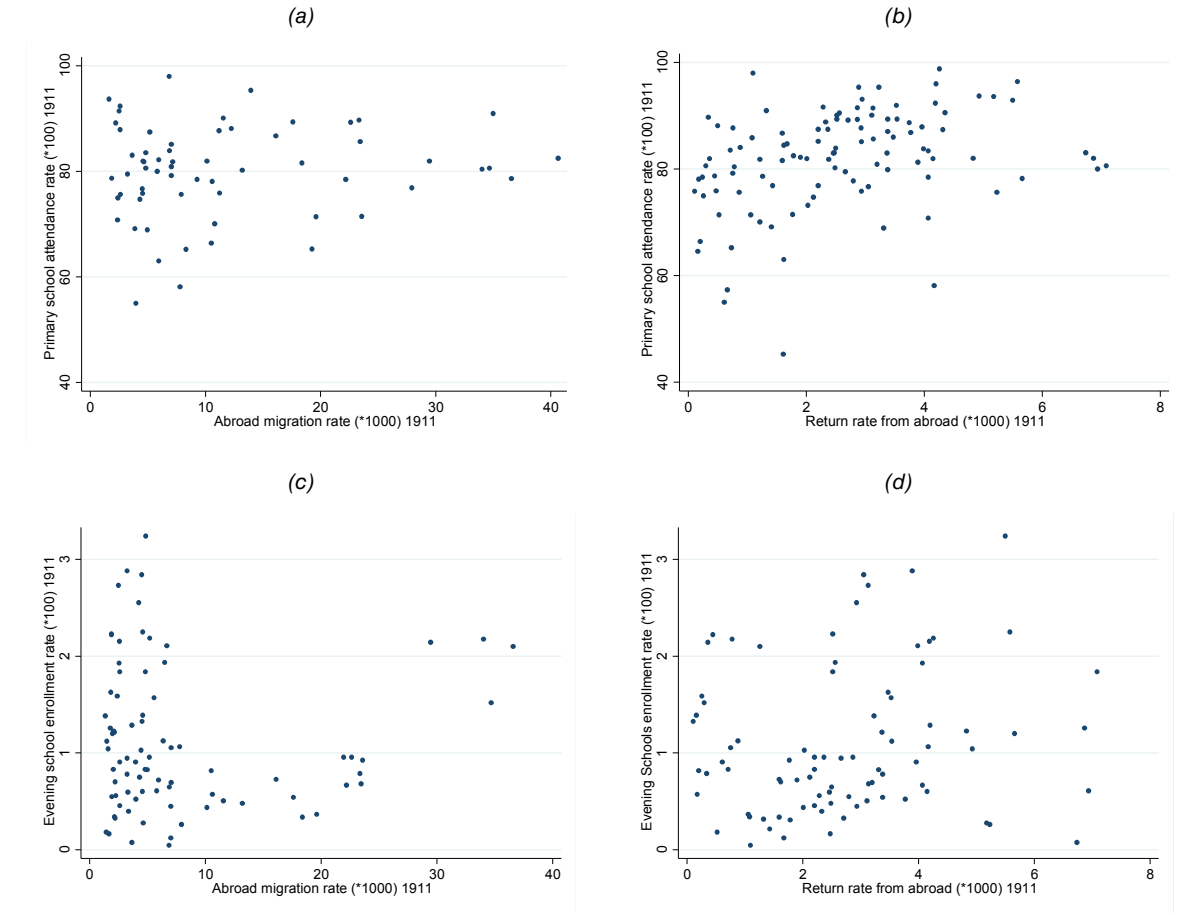
Figure 2

The distribution of the sampled cities on Italian territory

Source: Annuario Statistico delle Città italiane (1906-1914).

Figure 3

The Cross-City Patterns of Migration and Education, 1911



Source: see text.

Table 1

Descriptive statistics, 1904-1911 (1)

Variable	Mean	Std. dev.	Min.	Max.
Sample				
Attendance rate (2)	81.40	9.04	45.20	98.80
Enrollment rate of evening schools (3)	9.37	7.39	0.00	35.30
Literacy rate (4)	75.80	19.7	22.00	100.00
Migration (5)	6.87	4.10	0.29	40.60
Returns (6)	2.65	1.63	0.11	7.54
Expenditure (7)	3.89	2.16	0.93	17.70
Council taxes (8)	2.21	1.11	0.10	20.50
Remittances (9)	13.60	8.20	0.30	41.50
Transport Costs (10)	186.70	34.30	157.00	227.20
South				
Attendance rate	76.30	10.50	45.20	98.00
Enrollment rate of evening schools	7.34	5.65	0.00	22.20
Literacy rate	53.80	13.60	22.00	90.40
Migration	11.20	9.50	0.29	40.60
Returns	1.23	1.07	0.11	5.66
Expenditure	2.60	1.20	0.93	7.30
Council taxes	2.14	0.59	0.10	4.65
Remittances	19.40	7.98	0.83	41.50
Transport Costs	185.00	36.30	157.00	216.30
North				
Attendance rate	83.70	7.10	57.20	98.80
Enrollment rate of evening schools	10.20	7.86	0.00	35.30
Literacy rate	85.70	12.8	43.70	100.00
Migration	4.82	4.26	1.01	25.00
Returns	3.31	1.41	0.52	7.54
Expenditure	4.48	2.26	1.18	17.80
Council taxes	2.24	1.29	0.86	20.40
Remittances	11.70	8.14	0.30	38.70
Transport Costs	187.40	34.90	157.00	227.20

Source: see text.
(1) Descriptive statistics on municipalities are based on annual data relative to 84 cities for the years 1904, 1906, 1908 and 1911. Total number of observations is thus equal to 337. We split the sample into the cities belonging to the South and the North as well. – (2) Attendance rate in public primary school. – (3) Enrollment rate in evening classes. – (4) Literacy rate is the share of brides and grooms who were able to sign their marriage certificates. – (5) Abroad migration rate. – (6) Return migration rate. – (7) Per capita public expenditure on primary education. – (8) Per capita council taxes. – (9) Per capita remittances. – (10) Transportation costs.

Table 2

Public primary schools: the impact of migration and returns on the attendance rate at the city level, 1904-1911

Dependent variable: log of the attendance rate	(1)		(2)		(3)	(4)
	FE	FE	FE	FE	FE	IV
Migration$_t$	0.019** (2.16)		0.020** (2.07)		0.020** (2.36)	0.027** (2.26)
Returns$_t$		0.037** (2.30)		0.035** (2.11)	0.035** (2.13)	0.040** (2.15)
Fixed effect city	yes	yes	yes	yes	yes	yes
Fixed effect year	yes	yes	yes	yes	yes	yes
Nine interaction terms (year*macro-regions)			yes	yes	yes	yes
R-squared	0.157	0.167	0.200	0.206	0.219	0.222
Observations	337	337	337	337	337	318
First stage						
Log of instrument						-1.089*** (-6.87)
F-statistics						47.2
Testing Endogeneity						
Estimated coefficent on the residuals						0.010* (2.01)

Numbers in parentheses denote heteroskedasticity-robust t-statistics. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the city level. Migration is instrumented in column IV. The control function approach is used to test the endogeneity of migration.

Table 3

Evening classes: the impact of migration and returns on the enrollment rate at the city level, 1904-1911

Dependent variable: log of enrollment rate	(1)		(2)		(3)	(4)
	FE	FE	FE	FE	FE	IV
Migration$_t$	0.162*		0.149*		0.161*	0.248**
	(1.90)		(1.77)		(1.73)	(1.83)
Returns$_t$		0.261*		0.286**	0.300**	0.310*
		(1.87)		(2.04)	(2.15)	(1.75)
Fixed effect city	yes	yes	yes	yes	yes	yes
Fixed effect year	yes	yes	yes	yes	yes	yes
Nine interaction terms (year*macro-regions)			yes	yes	yes	yes
R-squared	0.123	0.132	0.182	0.195	0.206	0.288
Observations	296	296	296	296	296	296
First stage						
Log of instrument						-1.04***
						(-5.81)
F-statistics						33.73
Testing Endogeneity						
Estimated coefficent on the residuals						0.120**
						(2.37)

Numbers in parentheses denote heteroskedasticity-robust t-statistics. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the city level. Migration is instrumented in column IV. The control function approach is used to test the endogeneity of migration.

Table 4

The impact of migration on the attendance rate: multivariate model (public primary schools), 1904-1911

Dependent variable: log of the attendance rate	(1) FE	(2) IV2SLS	(3) GMM1	(4) GMM2	(5) GMM1	(6) GMM2	(7) GMM1	(8) GMM2
Attendance$_{t-1}$	-0.271***	-0.536	-0.49**	-0.48**	-0.44**	-0.51***	-0.524***	-0.61***
	(-4.16)	(-1.53)	(-2.82)	(-2.40)	(-2.18)	(-3.45)	(-2.66)	(-3.14)
Migration$_t$	0.021**	0.040	0.024**	0.032***	0.023**	0.030***		
	(2.32)	(1.61)	(1.92)	(2.73)	(2.27)	(2.70)		
Migration$_{t-1}$					-0.012	-0.013	-0.015	-0.132
					(-1.38)	(-1.45)	(-1.53)	(-1.06)
Returns$_t$	0.089*	0.163**	0.046*	0.050**	0.042*	0.047**	0.043*	0.060**
	(1.75)	(2.28)	(1.90)	(2.30)	(1.79)	(2.07)	(1.80)	(2.22)
Expenditure$_t$	-0.014	0.100	-0.020	0.005	-0.022	0.002	-0.017	-0.023
	(-0.42)	(0.73)	(-0.58)	(0.16)	(-0.66)	(0.01)	(-0.50)	(-0.72)
Council Taxes$_t$	-0.001	0.083	0.061***	0.057**	0.066**	0.067**	0.069**	0.076
	(-0.05)	(0.63)	(2.67)	(1.97)	(2.50)	(2.08)	(2.27)	(1.62)
Remittances$_t$	0.043*	0.029	0.048*	0.038*	0.041*	0.040**	0.047**	0.060**
	(1.79)	(0.48)	(1.85)	(1.84)	(1.87)	(1.96)	(2.08)	(2.32)
Fixed effects city	yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects year	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.302	0.008	0.390	0.377	0.285	0.263	0.215	0.263
J-statistic (p-value)	-	-	0.703	0.703	0.752	0.752	0.221	0.221
Observations	201	104	104	104	104	104	104	104

Numbers in parentheses are heteroskedasticity-robust t-statistics. *** p<0.01, ** p<0.05, * p<0.1 Past values of attendance rate, migration, taxes and remittances used as instruments in column FE2SLS, and in every specification headed GMM1 or GMM2. $C_{i,t}$ as defined in equation 7 is used as instrument as well. We use the finite sample correction for the asymptotic variance of the two-step GMM estimator (Windmeijer, 2005). J-stat ~ x^2.

Table 5

The impact of migration on the attendance rate: multivariate model (public primary schools), 1904-1911

Dependent variable: log of enrollment rate	(1) FE	(2) IV2SLS	(3) GMM1	(4) GMM2	(5) GMM1	(6) GMM2	(7) GMM1	(8) GMM2
$Enrollment_{t-1}$	-0.067	0.020	0.124	0.143	0.077	0.096	0.084	0.167
	(-0.91)	(0.15)	(0.52)	(0.46)	(0.36)	(0.32)	(0.36)	(0.45)
$Migration_t$	0.167*	0.373	0.340*	0.300*	0.284**	0.255*		
	(1.72)	(1.06)	(1.82)	(1.68)	(1.97)	(1.71)		
$Migration_{t-1}$					-0.120	-0.095	-0.114	-0.060
					(-1.13)	(-0.75)	(-0.99)	(-0.37)
$Returns_t$	0.447	0.285	0.156	0.148	0.257	0.230	0.237	0.238
	(1.42)	(0.84)	(0.67)	(0.65)	(1.03)	(0.99)	(0.96)	(0.68)
Council $Taxes_t$	0.387**	0.485	0.622*	0.435**	0.577*	0.939**	0.549*	0.942**
	(2.30)	(1.83)*	(1.80)	(2.35)	(1.84)	(2.23)	(1.70)	(1.96)
$Remittances_t$	0.076	-0.103	-0.053	-0.092	-0.067	-0.086	-0.039	-0.011
	(0.88)	(-0.29)	(-0.34)	(-0.52)	(-0.43)	(-0.23)	(-0.26)	(-0.57)
Fixed effects city	yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects year	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.225	0.296	0.276	0.277	0.295	0.288	0.283	0.293
J-statistic (p-value)	-	-	0.261	0.261	0.254	0.254	0.222	0.222
Observations	207	85	85	85	85	85	85	85

Numbers in parentheses denote values of heteroskedasticity-robust t-statistics. *** p<0.01, ** p<0.05, * p<0.1 Past values of enrollment rate, migration, taxes and remittances used as instruments in column FE2SLS, and in whatever specification headed GMM1 or GMM2. $C_{i,t}$ as defined in equation 7 is used as instrument as well. We use the finite sample correction for the asymptotic variance of the two-step GMM estimator suggested by Windmeijer (2005). J-stat ~ x^2; p-value is reported. R^2 is computed as the squared correlation coefficient between actual and fitted values.

Table 6

Multivariate model, 1904-1911; Robustness Analysis

Dependent variable:	Attendance rate (1)		Enrollment rate (2)		Literacy rate (3)	
	GMM1	GMM2	GMM1	GMM2	GMM1	GMM2
Attendance rate$_{t-1}$	-0.447**	-0.462***				
	(-2.49)	(-2.27)				
Enrollment rate$_{t-1}$			0.051	0.012		
			(0.20)	(0.03)		
Literacy rate$_{t-1}$					-0.264*	-0.259**
					(-1.70)	(-2.43)
Migration$_t$	0.020*	0.024**	0.321*	0.294*	0.020	0.011
	(1.75)	(2.03)	(1.66)	(1.70)	(0.98)	(0.55)
Returns$_t$	0.066*	0.056*	0.196	0.153	0.039	0.028
	(1.70)	(1.81)	(1.46)	(0.92)	(0.98)	(0.56)
Expenditure$_t$	-0.015	-0.021			0.048	0.047
	(-0.47)	(-0.63)			(0.93)	(0.81)
Council Taxes$_t$	0.049**	0.038*	0.546**	0.799*	-0.030	-0.027
	(2.16)	(1.64)	(2.15)	(1.81)	(-0.75)	(-0.04)
Remittances$_t$	0.050**	0.052**	(-0.116)	(-0.027)	0.020	0.0244
	(2.16)	(1.97)	(-0.82)	(-0.14)	(1.08)	(1.01)
South*Migration$_t$	0.070	0.079	0.292	0.145		
	(1.49)	(1.54)	(0.93)	(0.13)		
South*Returns$_t$	-0.066	-0.078	-0.664	-0.820		
	(-1.07)	(-1.22)	(-1.02)	(-0.92)		
Fixed effects city	yes	yes	yes	yes	yes	yes
Fixed effects year	yes	yes	yes	yes	yes	yes
R-squared	0.277	0.243	0.330	0.352	0.088	0.073
J-statistic (p-value)	0.751	0.751	0.252	0.252	0.828	0.828
Observations	104	104	85	85	104	104

Note: see Table 5.

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