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How Large is the Brain Drain from Italy?

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HOW LARGE IS THE "BRAIN DRAIN" FROM ITALY?

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Abstract

Using a comprehensive and newly organized dataset the present article shows that the human capital content of emigrants from Italy significantly increased during the 1990's . This is even more dramatically the case if we consider emigrating college graduates, whose share relative to total emigrants quadrupled between 1990 and 1998. As a result, since the mid-1990's the share of college graduates among emigrants from Italy has become larger than that share among residents of Italy. In the late nineties, between 3% and 5% of the new college graduates from Italy was dispersed abroad each year. Some preliminary international comparisons show that the nineties have only worsened a problem of "brain drain", that is unique to Italy, while other large economies in the European Union seem to experience a "brain exchange". While we do not search for an explanation of this phenomenon, we characterize such an increase in emigration of college graduates as pervasive across age groups and areas of emigration (the North and the South of the country). We also find a tendency during the 1990's towards increasing emigration of young people (below 45) and of people from Northern regions.

JEL Classification: F22.

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1 Introduction

Recently the Italian press, popular newspapers as well as more academic-oriented articles, have reported the uneasiness of many Italian college graduates forced to work abroad because of the lack of job and research opportunities in the country (see, for instance, Severgnini, 2001, ADI, 2001, and Dulbecco, 2002). Some people claim that part of the responsibility of this situation lies with the lack of financial support and appropriate incentives to research. In Italy, both in the public and in the private sector, resources devoted to research are both fewer and less productive than in other advanced economies (see, for example, Iavarone and Lasorella, 2000 and 2001, Roncone, 2000 and Abbot, 2001). However, the situation of the Italian research sector, that still employs a very small fraction of Italian college graduates, is not the only factor pushing "Italian brains" to emigrate or to remain abroad after studying in foreign universities. The Italian labor market exhibits a combination of institutions and traditions that protect those who already have a job and harm those who are looking for a job. These features are present also for the highly skilled segment of the labor market and affect mostly young graduates who are searching for their first job. It is, therefore, young people at the end of their studies who are most affected by the lack of competitiveness and transparence in hiring practices; personal and family contacts are still a prevalent instrument used in finding a first job.[1]

Nevertheless, in spite of widespread anecdotal evidence on the "brain drain" from Italy, a more precise statistical analysis is needed to quantify (and "qualify") the phenomenon. To our knowledge no one has tried to quantify, using representative and reliable data, the flow of highly educated Italians towards foreign countries. Due to lack of complete information, the size of this "drain" and its trend in the recent years are unknown to us. In the present study we aim at filling this vacuum, at least for the most recent decade (1990-1998). We assess the "drain" of human capital using a new dataset on Italians abroad, made available to us for the first time by the Register of Italians Abroad (AIRE). This database has information on personal characteristics such as schooling, region of origin, year of emigration and others, for all Italians who are currently abroad. It is the most complete database on Italian residents abroad and its access has been granted, for the first time, to us by the Italian Ministry of Domestic Affairs. The rest of the paper is organized as follows. Section 2 describes the indices used to measure the "drain" of human capital. Section 3 presents and analyzes the value of

[1] See, for example, Pistaferri (1999), Soro-Bonmati (2001), Checchi et. al. (1999), Fabbri and Rossi (1997), Schizzerotto and Bison (1996).

these indices for Italy from 1990 to 1998 considering the aggregate flow of emigrants. In Section 4 we deepen the analysis for emigrants who are college graduates dividing the data by geographical area and by age group. We discuss the trend within each group as well as the contribution of each group to the overall phenomenon. Using data from the Eurostat Labor Force Survey 1998 we also provide, a preliminary comparison of the stocks of non-resident college graduates across large countries in the European Union. Section 5 concludes the paper.

2 Indices of "Brain Drain"

2.1 Indices Based on Human Capital Theory

Even though net emigration in Italy (outward flow minus inward flow) has been negative since the mid 70's, a non negligible share of the population has continued to leave the country every year. During the 90's, emigrants were about 0.1% of the population (see Table 1). While the size of this flow is easily and objectively measurable, it is more difficult to measure the human capital embodied in it. This difficulty is due to the limited availability, for Italy, of data measuring human capital of any group, as well as to the methodological problems of defining a statistic that captures the loss of human capital due to emigration. In the present section we define two types of indices that capture the loss of human capital. The first couple of indices is based on the average years of schooling of emigrants while the second couple is based on the share of college-graduates among emigrants. The characterization of the trend in human capital content of emigration from Italy is similar using either type of index but is more dramatic if we concentrate on college educated[2] workers. In the rest of the paper we adopt the simplifying assumption of considering schooling as the only determinant of human capital. While clearly imperfect, this simplification is supported by large evidence in the labor and growth

[2]Note that together with the human capital lost with the flow of emigrants, there is also the human capital gained with the flow of immigrants. As we have stated, the immigrants outnumbered the emigrants starting in the mid 70's, and from then on their number has grown considerably. Nevertheless, the few existing estimates suggest that the total human capital from immigrants is limited. For example, according to the Ministry of Labour and Social Affairs, in 1999 85% of foreign non-EU immigrants who registered for unemployment did not have a degree of any kind and only 1.1% were college graduates. It is very likely that the level of education of foreign EU immigrants is considerably higher, but their share in the total stock of foreigners is very low (about 13% in the same year according to the Ministry of Domestic Affairs). In addition, the human capital of illegal immigrants is probably smaller than that of legal immigrants.

literature stressing the importance of schooling over other sources of human capital accumulation.

As economists we are interested in the "brain drain" out of Italy because, according to economic theory, human capital is one of the three fundamental factors of production, along with physical capital and technology (see Romer, 2001, Chapter 3). The growth rate of per capita income of a country, therefore, depends on the accumulation of human capital as well as of the other factors. According to the classic theory of growth, in a competitive economy in which production factors are paid their marginal product (see Solow, 1956 and later Mankiw et al., 1992), per capita income is a function of the per capita level of factors. Ceteris paribus, an increase in human capital per worker implies an increase in income per worker. In a recent study Jones (2002) attributes to increased schooling of workers about 30% of the post-war productivity growth in the United States. Consequently, if the emigration flow decreases (or reduces the growth of) human capital per worker, then income per worker decreases (or grows at a slower pace).[3] The classical model suggests a first index to capture the loss of human capital per worker due to emigration. Following the most diffused practice in the labor literature since Mincer we assume that the natural logarithm of productivity of workers (i.e. their wage) is linearly increasing in their years of schooling. This implies that their human capital is proportional to an exponential function of their schooling.

We use H_t^P to define the total number of years of education completed by the resident population in working age at the beginning of year t and H_t^E to define the analogous measure for those who emigrate out of the country during year t. P_t and E_t denote the total population in working age and the total number of emigrants in year t, respectively. The ratio

$$h_t^P = \frac{H_t^P}{P_t}$$

measures the average number of years of education completed by the population at the beginning of year t and the ratio

$$h_t^E = \frac{H_t^E}{E_t}$$

is the analogous indicator for those who emigrate during year t. Consequently,

[3] Here and in the rest of the paper we assume that the human capital of emigrants and its return is completely lost for the country. This hypothesis could be too restrictive in the sense that the decision to emigrate is not final and that the remittances of Italian emigrants are significant.

the index:

$$\psi_t = \frac{e^{\beta h_t^E}}{e^{\beta h_t^P}} = e^{\beta(h_t^E - h_t^P)} \tag{1}$$

is the appropriate index to evaluate the relative human capital per worker of emigrants versus residents. The coefficient β is the effect of one year of schooling on the natural logarithm of productivity. Such coefficient is defined as "returns to schooling" by the labor literature. Several estimates of the coefficient β for the Italian economy exist. We choose the value of β to be 0.035. Such value is the average of the estimates of returns to education in Italy produced by five recent papers that use data for the late 1980's and early 1990's. Precisely these estimates are $\beta \in (0.031 - 0.039)$ in Flabbi (1997), $\beta \in (0.033 - 0.041)$ in Cobalti and Schizzerotto (1995), $\beta \in (0.017 - 0.028)$ in Erikson and Ichino (1995), $\beta \in (0.040 - 0.052)$ in Blau and Kahn (1995) and $\beta \in (0.036 - 0.040)$ in Lucifora and Reily (1990). While these estimates are significantly smaller than for the U.S. their value is in line with the widely used estimates of Psacharopoulos (1994) who calculates $\beta = 0.028$ for Italy. The index ψ_t measures the human capital related productivity of emigrants relative to residents. In particular, if $\psi_t > 1$, the average human capital of emigrants is larger than the average productivity of residents. Vice-versa if $\psi_t < 1$ the average human capital of emigrants is smaller than that of residents. A value of one for the index ψ_t is the threshold above which a country loses human capital per worker as an effect of migration.

In light of the classic growth model, and therefore in the absence of externalities, ψ_t is the relevant indicator to evaluate if emigration has negative consequences for per capita income. Even assuming away externalities of human capital (as in Lucas, 1988) and any permanent impact on technological innovation and growth (as in Romer, 1990, and Aghion and Howitt, 1992) a value of ψ_t larger than one implies a reduction of productivity due to the decrease in human capital per worker in the economy. The existence of any of those externalities would only amplify the impact of the human capital "drain" on productivity, by translating it into a permanent (negative) growth effect.

It is useful to have also an index that captures the aggregate loss of production due to the drain of human capital from emigrants, rather than the per capita relative loss. To this purpose we define the following index :

$$\Psi_t = 100 \frac{E_t e^{\beta h_t^E}}{P_t e^{\beta h_t^P}}. \tag{2}$$

This indicator measures the aggregate human capital of emigrants $E_t e^{\beta h_t^E}$ relative to the aggregate human capital of resident working age population

$P_t e^{\beta h_t^P}$ and expresses it in percentage terms. The index varies between 0 and 100 indicating a loss if it is positive. These two indices ψ_t and Ψ_t provide a natural measure, based on the theory of human capital and on Mincerian regressions, of the relative loss of productivity due to migration. The first index captures the productivity per worker lost with emigration and the second captures the aggregate production lost with emigration. In both cases the value is standardized for the corresponding value calculated on the resident population in working age. It is useful, as way of comparison, to define an index that measures the aggregate loss of pure labor due to emigration. Such an index is defined as:

$$\eta_t = 100 \frac{E_t}{P_t} \tag{3}$$

Its value is between 0 and 100 and it expresses the emigrants as a percentage of the resident working-age population. Having defined the above indices we have the following relationship among them: $\Psi_t = \eta_t * \psi_t$. This relationship will be useful to decompose the changes in aggregate human capital of emigrants Ψ_t into the changes of aggregate migration of workers (η_t) and the change in the human capital content of emigrants (ψ_t).

2.2 Indices Based on College Graduates

The average education for the Italian population in working age, still in 1998, was less than ten years (see Table 7 in the Appendix) so that emigration of high-school graduates resulted in loss of human capital per worker. However some economists believe that it is the loss of college graduates to be particularly harmful to the country. The importance of college graduates in research and innovation, the increasingly skill-biased direction of technological progress, the importance of managerial skills for technology adoption are all factors that contribute to making this group particularly important for developed economies. It is therefore useful to define indices that capture specifically the loss of college graduates through emigration both in "per worker" and aggregate terms. Let's denote the share of college graduates in the working-age population as:

$$g_t^P = \frac{G_t^P}{P_t}$$

where P_t is, as defined above, the working-age resident population at the beginning of year t and G_t^P is the number of college graduates in the resident population at the beginning of the same year. Similarly, we can define the

share of college graduates among those who emigrate, namely:

$$g_t^E = \frac{G_t^E}{E_t}$$

where E_t is, as defined above, the total number of emigrants during year t and G_t^E is the number of college graduates who leave the country in the same year. The ratio of g_t^e to g_t^p

$$\gamma_t = \frac{g_t^E}{g_t^P} \tag{4}$$

is the appropriate index to determine whether emigration determines a decrease in the share of graduates in the resident population. The index varies between 0 and $+\infty$ and the critical value, above which the economy suffers a decrease in the share of college graduate, is 1. If $\gamma_t > 1$, the share of college graduates among emigrants is larger than that in the resident population.

Similarly to what was done in the previous section we also define a measure of the aggregate loss of college graduates due to emigration. Using the notation introduced above, the appropriate indicator to capture the aggregate loss is:

$$\Gamma_t = 100\frac{G_t^E}{G_t^P} \tag{5}$$

This index varies between 0 and 100 and, if positive, it indicates that emigration causes a decrease in the aggregate number of college graduates. A similar relationship among the index Γ_t and γ_t exists as the one we saw in the previous section between ψ_t and Ψ_t. We can write, in fact,: $\Gamma_t = \gamma_t * \eta_t$.

In summary, the four indicators defined in this section, ψ_t, Ψ_t, γ_t, Γ_t, measure the loss of skills determined by emigration, each with a different emphasis, determined by the intersection of two different criteria. The first two indicators ψ_t, Ψ_t are based on the theory of human capital and assume that per capita productivity depends exponentially on years of schooling. The second two γ_t, Γ_t are based on the assumption that college graduates are a particularly important factor of production. In both sets the first index (ψ_t, γ_t) captures the skill content per worker embodied in emigrants relative to stayers, while the second index (Ψ_t, Γ_t) captures the aggregate skill content of emigrants.

Although, conceivably, there are other and more complex indicators of the loss of human capital determined by emigration, those proposed here allow us to evaluate, at least as a first approximation, the size of the phenomenon. The following section is devoted to the description of the findings based on these indicators.

3 Trends of the 90's

Using some simple graphs and tables we discuss in this section the evolution of the human capital content of emigrants from Italy during the nineties. The data used to construct the indices for the emigrant and resident population are described in detail in Appendix B.1 and B.2. Note that all indices refer to the population in working age (between 26 and 65 years old) both for emigrants and for residents. All data referring to emigrants have been obtained from a 5% random extract from the database of Italian residents abroad (AIRE).We have a total of almost 30'000 observations on emigrants from Italy in the period 1990-1998 and on their characteristics such as schooling, region of origin, age and year of emigration. This database has been made available exclusively to us by the Italian Ministry of Internal Affairs and is the only complete existing database with information on Italians currently living outside Italy. The data on Italian residents and on their characteristics (education, age, location) have been obtained from the *Survey of Household Income and Wealth (SHIW)* carried out every other year by the Bank of Italy. This second data set is more standard and better known and we leave the description of its details to the Appendix.

3.1 Human Capital Content of Emigration

Let us first consider the human capital content of emigrants, relative to the resident population as revealed by the index ψ_t and by the index Ψ_t . Figure 1 represents the time series between 1990 and 1998 for the index ψ_t. The yearly values of the index are reported as small cirlces, while the solid line is the OLS estimate of the time trend and the dashed lines indicate the upper and lower bound of the 99% confidence band for the trend estimate. If we assume that the index has some zero-mean random measurement error, we can still reject the hypothesis that the observed trend is purely an effect of the random error. As it is clear from the data points and from the regression line, there is a significant upward trend in the time series. A formal F-test rejects at the 99% significance level the hypothesis that the value of ψ_{1998} is equal to ψ_{1990}. This is also clear from the fact that the lower bound of the 99% confidence interval in 1998 lies above the upper bound of the interval for 1990. Moreover, the values of ψ_t after 1994 all lie above the line $\psi_t. = 1$. This implies that since 1994 Italy has been suffering a loss of human capital per worker through emigration. While the fluctuations of ψ_t do not allow to formally rule out the hypothesis of $\psi_{1998} = 1$, at least since 1996 (the point estimate of) the trend lies above the threshold of one. Taken together these indications imply a significant increase of human capital content of emigrants

during the nineties with a potential negative effect on human capital per worker in Italy in the last two-three years of the interval.

The behavior of the index Ψ_t, that captures the aggregate human capital content of emigrants, is less clear. Figure 2 shows that fluctuations seem to prevail over a trend. In spite of a positive point estimate of the trend there is no significant evidence that the aggregate amount of human capital of emigrants has increased. The reason for this unclear aggregate effect becomes evident by inspecting Table 1. Recall that the index Ψ_t is equal to the product of ψ_t (relative human capital per worker) and η_t (percentage of working age population that emigrates). While the content of human capital of emigrants ψ_t has been growing over time, the number of emigrants (as share of the population) was simply subject to wide fluctuations in the 90's without showing a clear trend (see first column of Table 1). As a result the aggregate flow of human capital out of the country has shown large fluctuations but no clear growth. This is not reason to rejoice, though, as the human capital content of that fluctuating flow of emigrants has been consistently rising as evidenced by ψ_t.

3.2 The Emigration of College Graduates

Let's focus now on the relative and absolute emigration of college graduates in the 90's. As noted above, while emigration of human capital is harmful to a country in general, emigration of college graduates can be particularly damaging given their ability in doing research and in generating technological development. Figure 3 shows the value of the index γ_t for the period 1990-1998 and reports the estimated linear trend and the 99% confidence band for such a trend. In spite of some year to year fluctuation of the index the positive trend is very significant. A formal test rejects at the 99% confidence level the hypothesis that γ_{1990} is equal to γ_{1998}. Moreover now a formal test does reject, at the 99% confidence level, the hypothesis that γ_{1998}=1 against the alternative γ_{1998}>1. Since 1992 the share of college graduates among the emigrants has been larger than its share in the population ($\gamma_t > 1$). This means that since 1992 emigration has been a source of reduction in the percentage of college graduates in the working age population of Italy. Even a simple look at the values of γ_t in Table 1 column 4 reveals the dramatic increase of this index: it has quadrupled (from 0.44 to 1.61) between 1990 and 1998. Notice that the years 1996 and 1997 evidenced an even higher relative flow of college graduates. Their share among emigrants was more than twice their share in the resident Italian working age population.

The striking increase in emigration of college graduates is confirmed by looking at the index Γ_t, that captures absolute emigration of college-

graduates. Figure 4 shows the values and the positive trend for the index Γ_t between 1990 and 1998. The positive and significant trend implies that we can reject at the 99% confidence level that $\Gamma_{1990} = \Gamma_{1998}$. In spite of the fluctuations in the number of college graduates who emigrated relative to the Italian population, we can say with confidence that by year 1998 around 0.1 % of the total graduate population of Italy was migrating out of the country each year. Again, a look at values in Column 5 of Table 1 confirms that the share of college graduates who moved out of the country quadrupled in the period 1990-1998. The anecdotal impression of an increased brain drain in the nineties is certainly confirmed by these data on college graduates. An increasing tendency of the college educated to move out of Italy, in spite of a constant flow in overall emigration seems to be the trend that strongly emerges from our data for the 1990's. In the rest of the paper we focus on the college graduates who emigrate and we show decompositions by age and area of origin in order to better understand the characteristics of this phenomenon.

4 A Closer Look at the Drain of College Graduates

4.1 The North and the South

Given the large differences in per capita income and in the level of development between the North and the South of Italy it is insightful to decompose the phenomenon of college graduate emigration during the 1990's according to the area where the emigrants came from. In Table 2 we report the indices of overall emigration (η_t) and of relative (γ_t) and absolute (Γ_t) emigration of college graduates, separately for the North and the South[4] of the country. Each set of indices relative to the North or to the South is constructed using data relative to that part of the country as reference population. The original data from which Table 2 is derived can be found in the Appendix Tables 6 and 7. Two tendencies emerge from Table 2. First (see Columns 1 and 2) emigrants during the nineties came increasingly from the Northern regions. While in 1990 only 0.07% (η_{1990}) of the northern population moved out, as opposed to 0.14% of the southern population, in 1998 the percentages are almost reversed with 0.12% of the northern population moving abroad and only 0.07% of the southern population doing the same. Second (see Columns

[4] We consider the regions of Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia and Sardegna as South of the Country. The remaining regions are included in the North.

3 and 4) the share of college graduates among emigrants has been increasing both for the North and the South but more consistently for the North. In 1998 the share of southern graduates among emigrants was still only 50% of their share in the population of the southern regions ($\gamma_{1998} = 0.50$). Such index had increased from a low value of 0.20 in 1990 but was still well below the threshold of one. That implies a negative effect of emigration on the share of college graduates. To the contrary, for the emigrants from the northern regions the value of γ_{1998} was 1.90, up from 0.63 of 1990 and much larger than the threshold of one. These two tendencies combined imply that (see Column 5 and 6 of Table 2) the absolute outflow of college graduates from the north rose dramatically in the nineties (almost a factor of five) while the absolute flow of college graduates from the south remained basically unchanged. As the Northern part of Italy is more developed, more active and better connected to the rest of Europe than the South, we can interpret these differences as the result of increased mobility and opportunities across Europe for well educated workers residing in the north. Nevertheless, given that the North of Italy is the technological and productive engine for the whole country an increasing loss of highly skilled and creative workers may be harmful for long run growth. Alternatively, we may think that the North of the country has acted as an "attractor" for the educated workers from the rest of the country. Southern college graduates, rather than emigrating abroad, might have replaced the outflow of brains from the North. However, the very low rate of inter-regional migration in the nineties and the tendency of educated workers to remain in the South (confirmed by Goria and Ichino, 1994) does not seem to support this optimistic hypothesis.

In order to quantify the importance of each of the aforementioned tendencies on the overall phenomenon of increased emigration of college graduates, we decompose the increase of the index γ_t for the whole country between 1990 and 1998 in two parts. The first part measures the effect of the increased emigration flows from the North while the second part measures the effect of the increased share of college graduates in the flows of emigrants from both the North and the South. In particular we can decompose for each year t the index γ_t relative to Italy as follows:

$$\gamma_t^{ITA} = \frac{\left(g^E_{NORTH}\right)_t}{\left(g^P_{ITA}\right)_t}\left(Sh^E_{NORTH}\right)_t + \frac{\left(g^E_{SOUTH}\right)_t}{\left(g^P_{ITA}\right)_t}\left(Sh^E_{SOUTH}\right)_t \tag{6}$$

g^E_{NORTH} is the share of college graduates among the emigrants from the North and g^E_{SOUTH} is the same share among the emigrants from the south. These two measures are both taken relative to the average share of college graduates in the overall Italian population g^P_{ITA}. Finally Sh^E_{NORTH} is the

share of emigrants coming from the north of the country relative to all emigrants and Sh^E_{SOUTH} is the share of emigrants from the South. Using this decomposition we can write the change in the index γ_t^{ITA} between 1990 and 1998 ($\Delta\gamma^{ITA}$) in the following way:

$$\Delta\gamma^{ITA} = \sum_{i=N,S} \frac{(g_i^E)_{1990}}{(g^P_{ITA})_{1990}} \Delta Sh_i^E + \sum_{i=N,S} \Delta \left(\frac{g_i^E}{g^P_{ITA}} \right) (Sh_i^E)_{1990} + \sum_{i=N,S} \Delta \frac{g_i^E}{g^P_{ITA}} \Delta Sh_i^E \tag{7}$$

The first term in the right hand side of (7) captures the increase[5] of the index due to a change in the proportion of migrants from the North relative to the proportion from the South. The second term captures the contribution from an increased intensity of college graduates among emigrants from both areas. The third term captures the interaction of the two terms. Using the data in Table 1 to get $\Delta\gamma^{ITA}$ and those in Tables 6 and 7 to calculate the other terms in (7) we obtain the following decomposition. Of the total (100%) increase in the index γ^{ITA} between 1990 and 1998 which is equal to 1.17, only 9% (0.10) is explained by the increase in the share of migration from the North (first term) while a remarkable 72% (0.84) is due to the increase in the share of graduates in the emigration flows from both the North and the South (second term). The interaction term explains the remaining 19% of the increase.

In short, two tendencies have been outlined in this section for the nineties. One is the increasing overall migrations from the North relative to the South, the other is an increasing percentage of college graduates among emigrants both from the North and the South. However, the second phenomenon has been quantitatively much more dramatic and harmful to the total human capital of Italy than the first.

4.2 Young and Old Emigrants

A second interesting dimension for our analysis of the emigration of college graduates is the decomposition across age groups. In order to maintain a representative size for each group we only split the data between two age groups: the "young" workers, aged between 26 and 45 and the "old" workers, aged between 45 and 65. For each of the two groups Table 3 displays the values of the indices capturing total emigration (η_t in Columns 1 and 2), relative emigration of college graduates (γ_t in Columns 3 and 4) and aggregate emigration of college graduates (Γ_t in Columns 5 and 6). Two tendencies are clear from the examination of these data. First a (mild) tendency towards

[5] The operator Δ applied to the variable x implies $\Delta x = x_{1998} - x_{1990}$

increasing migration of young workers as opposed to a tendency towards decreasing migration of old workers. Second a (strong) tendency of both young and old workers, possibly stronger for old workers, towards higher share of college graduates among emigrants. While in 1998 0.14% of all Italian young workers emigrated, as opposed to 0.11% in 1990, for older workers the percentage was 0.05%, down from 0.08% in 1990. More strikingly, there was a three-fold increase in the share of college graduates among young migrants (γ_t^{YOUNG} went from 0.43 to 1.27 in the considered years) and a stunning six-fold increase in the share of college graduates among old migrants (γ_t^{OLD} increased from 0.38 to 2.44). For both groups, during the second half of the 1990's the share of college graduates among emigrants was larger than the share among residents (γ_t^{YOUNG} and γ_t^{OLD} both larger than one after 1995). Finally the aggregate loss of college graduates through emigration (Γ_t) almost quadrupled for both groups in the 1990's. In order to summarize the importance of each of these two tendencies in the overall increase of College Graduates' emigration we decompose the increase of γ_t^{ITA} between 1990 and 1998 just as we did in the previous section. Using expression (7) we consider now the two groups of "young" and "old" workers and we calculate the following contributions: first, the increase in γ_t^{ITA} due to increased share of young emigrants relative to old; second, the contribution of increased share of college graduates both among young and old emigrants and finally the interaction of these two terms. Using data from Tables 6 and 7 we decompose the total (100%) change $\Delta\gamma^{ITA} = 1.17$ into the following components: the first term, capturing the contribution of a shift of migration towards young workers explains 5% (0.06) of the total increase. The increased share of college graduates in both groups explain 94% (1.10) of the increase. The remaining 1% is due to the interaction between the terms. In this case, it is even more clear that it is the increasing share of graduates within each of the two groups of migrants to generate the overall effect. All in all we can say that it is the very strong tendency towards an increase in the share of migrants with a college degree in *each* of the four group considered (from the North, from the South, young and old), rather than a change in composition of the flow of emigrants among these groups, that determined the strong and significant increase of γ_t during the 1990's.

4.3 Comparisons of Foreign College Graduates across EU Countries

In order to put the phenomenon of increased emigration of Italian college graduates into perspective, we present here some comparisons on the per-

centage of college-graduates working abroad for five large EU countries. The data used in this section are obtained from the Eurostat Labor Force Survey and kindly provided to us by Adriana Kugler and Joshua Angrist with the permission of Eurostat. A detailed description of the Data is in the Appendix B.3. In general, the Labor Force Survey collects data on people in working age resident of one of the European Union (EU) countries. We use data from the EU12 countries.[6] For each year between 1992 and 1999 we consider the population of college graduates in each of the EU12 countries and we consider the nationality of these individuals as their country of emigration. By so doing we can track the stock of people currently residing in each of the EU12 countries who emigrated there from any other country. Due to return migration and migration from third countries it is hard to recover the yearly flows and we will not try to do it. These data allow us to measure the stock of Italian college-graduates, residing in EU12 countries, other than Italy, during the 90's relative to the their stock in Italy. In table 4 we report this index for Italy as well as for other comparably large EU countries such as France, Germany, Spain and the UK.[7] Conversely table 5 reports the share of college graduates coming from other EU12 countries, relative to all college graduates in the country itself, again for Italy, France, Germany, Spain and the UK. The first index increases with the past cumulated emigration of college graduates from the country considered, into other EU countries. The second index increases with past cumulated immigration of college graduates into the country considered.

These values provide an important background in order to evaluate the increasing emigration of college graduates from Italy during the 1990's. If, say, the stock of Italian college graduates abroad were particularly low for European standards in the 90's, then we could consider increased emigration of "brains" during the 90's as a way of catching up with other countries' graduates' mobility within the EU. Alternatively, if a larger stock of Italian college graduates abroad corresponded to a larger stock of foreign college graduates in Italy this might simply imply higher degree of openness of Italy to movement of skilled workers. Unluckily the data on stocks of college graduates in the 1990's do not support either of the two optimistic views

[6] Note that until 1995, the Eurostat Labour Force Survey data only comprised the 12 then EU member countries (henceforth abbreviated by EU12). From 1995/96 on, data collection was extended to the three 1995-accession countries Austria, Finland and Sweden as well as to the following non-EU member countries: Iceland, Norway and Switzerland. In order to ensure comparability over all of the 1990s, we restrict attention to the EU12 countries.

[7] The other small EU12 countries may have more college graduate abroad simply as a consequence of their small size.

expressed above: to the contrary they emphasize the anomaly of the Italian case. Already in 1992 and throughout the period Italy had by far the largest share of college graduates residing abroad. Italian college graduates resident in one of the other EU12 countries are 2.2%-2.3% of those resident in Italy during the 92-99 period. The corresponding value for French college graduates is between 0.9% and 1.1% and for German college graduates it is between 0.4% and 0.6%. Even Spain, arguably a smaller and less developed economy than Italy, counts only 0.7-0.8% of its graduates abroad. At the same time the share of foreign (EU12) college graduates residents in Italy in 1999 was an abysmal 0.3% of the total resident college graduates. In the same year that share was 1.7% for the UK, 1.4% for France and Germany and 0.5% for Spain. While for the other four countries the percentage of college graduates abroad in 1999 was roughly similar to or smaller than the percentage of foreign graduates in the country, for Italy the percentage of college graduates abroad was seven times the percentage of foreign college graduates residing in the country!

This preliminary international comparison suggests that the 90's have simply worsened the role of Italy as a net "exporter" of brains. Moreover, the already existing and increased tendency of Italian college graduates to move abroad does not seem to be balanced by a corresponding tendency of foreign college graduates to move into the country. All in all the emigration flows out of Italy during the 90's looks more like a "brain drain" than like a "brain exchange".

4.4 Discussion

It is indisputable, in light of the data presented thus far, that the loss of human capital related to emigration increased during the 90's. The absolute size of this loss, however, could be regarded as small. For instance, in 1998 only 0.164% of the total college graduate population between 26 and 65 years of age emigrated from Italy. However, the magnitude of the flow of college graduate emigrants appears to be much larger if, as a term of comparison, we use the increase in the total stock of college graduates rather than its level. This flow can be indicated, using the above notation, as $\Delta(G_t^P) + G_t^E$ and it represents the total variation of college graduates in the country if none of them were to emigrate.[8] Therefore the ratio $\frac{G_t^E}{\Delta(G_t^P)+G_t^E}$ gives the percentage of the net flow of "new college graduates" who choose to go abroad in the year. Using the data in Tables 6 and 7 we calculate the above fraction as equal to 5.2% in 1996 and to 3.5% in 1998. Even more spectacularly this

[8] Where the symbol Δ indicates the change over one period of the variable that follows.

value for the North of the country is equal to 7% in 1996 and to 4% in 1998.

In this perspective, the loss of college graduates due to emigration is a percentage between 3% and 5% of the "new" human capital created in Italy. Keeping in mind that Italy is one of the OECD Countries with the lowest share of college graduates (see for example OECD, 2000), this loss seems even more significant and possibly worrisome.

5 Conclusion

We have increasingly witnessed during recent years the presence, in the Italian and international press, of articles about cases of Italian graduates, Italian researchers and Italian professors who are forced to work and do research abroad because of the lack of appealing opportunities in Italy. These anecdotal cases, however, do not allow a real assessment of the "brain-drain" phenomenon and could simply be extremely visible and exceptional cases of a marginal or decreasing phenomenon. In this article we have exploited a new dataset made available to us, with the aim of evaluating if these anecdotes are the tip of a troublesome iceberg or simply occasional events with little aggregate implications.

The results obtained leave little margin to doubt. During the 1990's, Italy lost human capital at a growing rate through its emigration flow. In particular it lost an increasing share of its college graduates and their overall flow abroad is rather large when compared to the net flow of freshly graduated people that the Italian University system has produced. A percentage varying between 3% and 5% of new college graduates created in Italy has gone abroad since 1996. The flows of college graduates during the nineties seems to worsen an already grim situation as revealed by the "stock" of Italian college graduates abroad relative to foreign college graduates in Italy. While 2.3% of Italian college graduates was abroad in the 1990's, only 0.3% of college graduates resident in Italy were from a foreign EU country. Such value is in stark contrast with the data from other large European Economies, such as Germany, France, the UK and even Spain! In these countries the percentage of foreign college graduates in the country is always larger than or equal to the percentage of national college graduates abroad.

Two further elements contribute to make the overall picture rather bleak. The first is that the loss of college graduates to foreign countries is widespread and growing across all age groups and across regions of origin (North and South). The second is that the relative trend of overall emigration flows is towards an increase of young emigrants relative to old emigrants and towards more emigrants leaving the North relative to those leaving the South of the

country. Given that young workers and workers in the North have higher productivity than their counterparts (old workers and those living in the South), these tendencies add to the harm caused by the drain of college graduates.

To add a further consideration, taken from our experience with a much smaller case study, we think that emigration seems to characterize in particular the people who studied in the best Italian universities and in highly productive fields such as economics, finance and engineering. For instance, more than 9% of the 1997 graduating class of Bocconi University (data are from a recent survey) now works or does research abroad. Relative to the percentage of 3.5% of all graduates leaving the country each year, estimated in this work, we see a much larger tendency of Bocconi graduates to work abroad. If the selection works towards biasing graduates of more competitive universities towards choosing to work abroad, our present work is simply assessing a lower bound for the loss due to the emigration of college graduates.

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A Figures and Tables

This Section contains the Figures and Tables of the Paper.

Figure 1: Index ψ_t (psi) for $\beta = 0.035$. Estimated Trend and 99% Confidence Band (psi_high-psi_low)

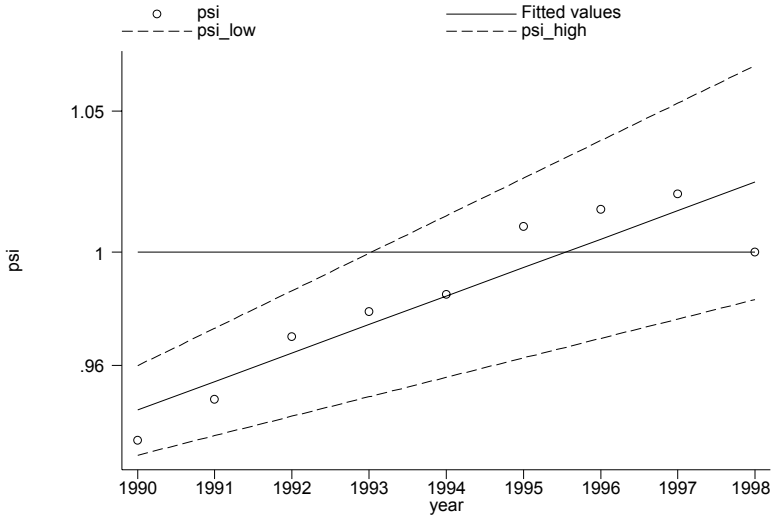

Figure 2: Index Ψ_t (PSI) for $\beta = 0.035$. Estimated Trend and 99% Confidence Band (PSI_HIGH-PSI_LOW)

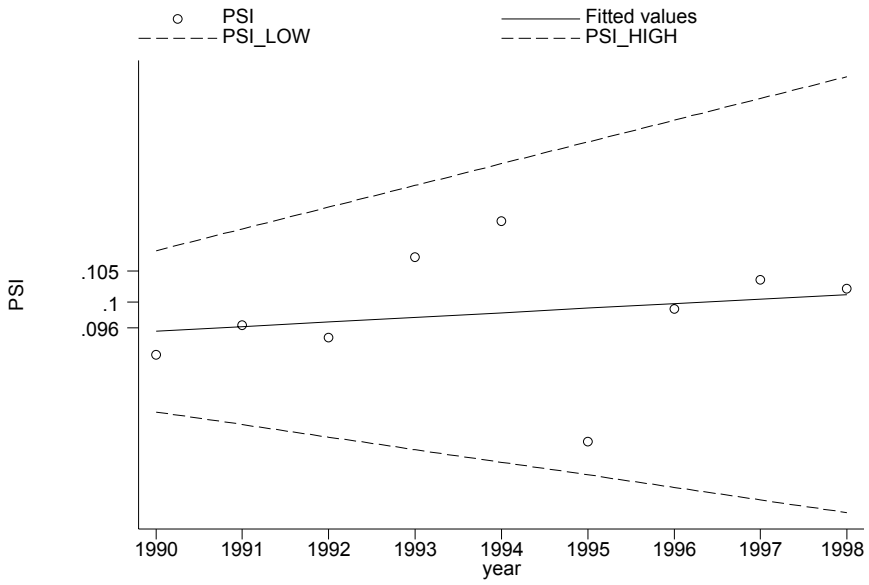

Figure 3: Index γ_t (gamma), Estimated Trend and 99% Confidence Band

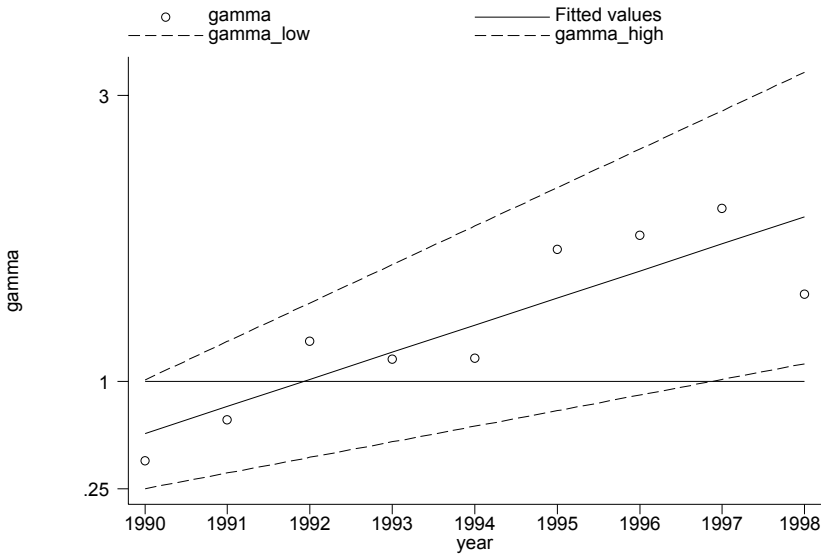

Table 1: Indices of the "Brain Drain" from Italy.

	η_t	ψ_t	Ψ_t	γ_t	Γ_t
1990	0.098	0.93	0.09	0.44	0.04
1991	0.101	0.95	0.09	0.72	0.07
1992	0.097	0.97	0.09	1.28	0.12
1993	0.109	0.98	0.10	1.15	0.13
1994	0.114	0.98	0.11	1.16	0.13
1995	0.077	1.00	0.08	1.92	0.15
1996	0.097	1.01	0.10	2.02	0.20
1997	0.101	1.02	0.10	2.21	0.22
1998	0.102	1.00	0.10	1.61	0.27

The table shows the values for the following indicators, using the SHIW and AIRE data:

- $\eta_t = 100\frac{E_t}{P_t}$ is the percentage ratio between total emigrants E_t and total population P_t (emigration rate);
- $\gamma_t = \frac{g_t^E}{g_t^P}$ is the ratio between the share of college graduates among emigrants g_t^E and the share of college graduates in the population g_t^P;
- $\Gamma_t = 100\frac{G_t^E}{G_t^P}$ is the percentage ratio of college graduates who emigrates G_t^E and college graduates in the population G_t^P;
- $\psi_t = \frac{e^{0.035h_t^E}}{e^{0.035h_t^P}}$ is the ratio of average human capital among emigrants $e^{0.035h_t^E}$ and average human capiltal in the population $e^{0.035h_t^P}$;
- $\Psi_t = 100\frac{E_t e^{0.035h_t^E}}{P_t e^{0.035h_t^P}}$ is the percentage ratio of total human Capital for the emigrants $E_t e^{0.035h_t^E}$ and total human capital for the population $P_t e^{0.035h_t^P}$.

All indices are relative to the Italian population in the 26-65 age range.

Table 2: Indices of the "College Graduates Drain" by area of emigration.

	$\eta_t = 100\frac{E_t}{P_t}$		$\gamma_t = \frac{g_t^E}{g_t^P}$		$\Gamma_t = 100\frac{G_t^E}{G_t^P}$	
	North	South	North	South	North	South
1990	0.07	0.14	0.63	0.20	0.05	0.02
1991	0.07	0.15	1.07	0.39	0.08	0.06
1992	0.10	0.09	1.82	0.28	0.18	0.02
1993	0.11	0.11	1.55	0.41	0.17	0.04
1994	0.11	0.12	1.65	0.34	0.18	0.04
1995	0.08	0.07	2.50	0.73	0.19	0.05
1996	0.10	0.09	2.62	0.60	0.27	0.05
1997	0.12	0.07	2.70	0.38	0.31	0.02
1998	0.12	0.07	1.90	0.50	0.23	0.03

The table shows the values for the following indicators, using the SHIW and AIRE data:

- η_t is the percentage ratio between total emigrants E_t and total population P_t (emigration rate);
- γ_t is the ratio between the share of college graduates among emigrants g_t^E and the share of college graduates in the population g_t^P;
- Γ_t is the percentage ratio between college graduates who emigrate G_t^E and college graduates in the population G_t^P;

Table 3: Indices of the "College-Graduates Drain" by age group

	$\eta_t = 100\frac{E_t}{P_t}$		$\gamma_t = \frac{g_t^E}{g_t^P}$		$\Gamma_t = 100\frac{G_t^E}{G_t^P}$	
	Young	Old	Young	Old	Young	Old
1990	0.11	0.08	0.43	0.38	0.04	0.03
1991	0.13	0.07	0.67	0.58	0.09	0.04
1992	0.13	0.07	1.30	0.48	0.16	0.03
1993	0.14	0.08	1.16	0.59	0.16	0.04
1994	0.14	0.08	0.93	1.67	0.13	0.13
1995	0.10	0.05	1.53	2.73	0.15	0.13
1996	0.12	0.07	1.61	2.88	0.20	0.19
1997	0.14	0.06	1.83	2.82	0.25	0.16
1998	0.14	0.05	1.27	2.44	0.18	0.13

The table shows the values for the following indicators, using the SHIW and AIRE data:

- η_t is the percentage ratio between total emigrants E_t and total population P_t (emigration rate);
- γ_t is the ratio between the share of college graduates among emigrants g_t^E and the share of college graduates in the population g_t^P;
- Γ_t is the percentage ratio between college graduates who emigrates G_t^E and college graduates in the population G_t^P;

Figure 4: Index Γ_t (GAMMA), Estimated Trend and 99% Confidence Band

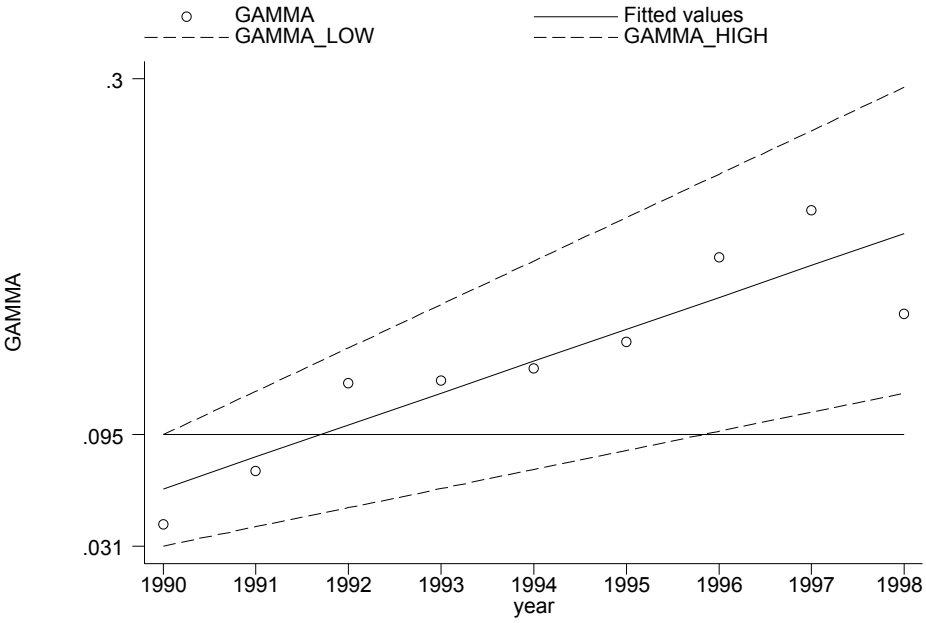

Table 4: Share of National College Graduates residing abroad

	1992	1994	1996	1999
Italy	2.2%	2.2%	2.5%	2.3%
France	0.9%	0.8%	1.0%	1.1%
Germany	0.4%	0.5%	0.6%	0.6%
Spain	0.7%	0.6%	0.7%	0.8%
UK	1.2%	1.2%	1.2%	0.9%

The indices are calculated as the stock of college graduates, national of each country, but resident in another EU12 country, relative to the stock of college graduates residing in the country. Using nationality as the country of emigration, the indices capture in each year the stock resulting from past emigration of college graduates from the country. The data are from the Eurostat LFS.

Table 5: Share of foreing College Graduates in a Country

	1992	1994	1996	1999
Italy	0.5%	0.3%	0.3%	0.3%
France	1.3%	1.5%	1.4%	1.4%
Germany	1.3%	1.5%	1.5%	1.4%
Spain	0.4%	0.5%	0.5%	0.5%
UK	1.5%	1.5%	1.6%	1.7%

The indices are calculated as the stock of foreign college graduates (i.e. national of one of the other EU12 countries) relative to the total stock of college graduates residing in the country. Using nationality as the country of immigration, the indices capture in each year the stock resulting from past immigration of college graduates from other EU12 country. The data are from the Eurostat LFS.

B The Data

The data used in this study come from three sources: *the Census of Italian residents abroad* (AIRE), the *Survey of Household Income and Wealth* (SHIW) done by the Bank of Italy and The Eurostat Labor Force Survey data set (LFS). Using the first two of these sources of data we can compare the indicators of human capital of emigrants with those of the population of origin. The third data base is used for some international comparisons among the stock of non-nationals resident in EU countries.

B.1 The AIRE data

The AIRE is a database run by the Ministry of Internal Affairs. It contains information on Italians who left the country after 1989 and are currently residents of foreign countries. Before 1989, the information on those who left the country was obtained in a decentralized way from Italian municipalities and reported independently to ISTAT (Italian Statistical Office)[9]. The reliability of the data is therefore greater for those who left the country after 1989. For this reason our study is limited to the 1990's

[9]The AIRE was created with the law n. 470 October 22, 1988 and later regulated by the DPR n. 323, Sp. 6, 1989.

In theory, the dataset should collect information on all emigrants, but in practice registration with AIRE is voluntary. This problem is lessened by the strong incentive that emigrants have to register with AIRE. Registration, in fact, implies exemption from paying income tax on revenue earned abroad.

The extract of the data made available to us is a 5% random sample from the whole AIRE database. Data refer to the stock of individuals registered with AIRE at the end of the year 2000 and born between the 1st and the 20th of May of each year. This stock may slightly underestimate the number of those who effectively left the country during the years considered because some emigrants could have later died or returned to Italy, cancelling themselves from AIRE and therefore not appearing in the stock of those registered at the end of the year 2000. For this reason the number of emigrants in a given year, according to ISTAT, is greater than the number of individuals registered with AIRE in the same year. To avoid this problem we have "re-weighted" the number of emigrants from our sample proportionally, in each year, to make it correspond to the number of emigrants registered with ISTAT.[10] Moreover, we have restricted the analysis to individuals between 26 and 65 years old, at the moment of expatriation. This represents the population that had enough time to complete university and was still active in the job market when moving abroad.

The information relative to the emigrants' years of schooling needed some adjustment as well. The AIRE registration form requires, in fact, the education title with the following options: no title, elementary school, middle school, high school, and college degree. Nevertheless, during the 1990's this information is missing for about 30% of individuals between the ages of 26 and 65. To solve this problem we assumed that the missing information was distributed randomly between the different schooling degrees. There does not seem to be a reason to assume a different distribution of the missing information.[11]

Based on the these data we calculated the indicators reported in Table 6, or rather, the number of emigrants E_t, the share of emigrants with a college degree g_t^E, the number of emigrants with a college degree G_t^E, the average number of years of schooling completed by the emigrants h_t^E, and the total number of years of schooling completed by the emigrants h_t^E. Each of these indicators was calculated for the total number of emigrants and for

[10] The ISTAT data include foreigners moving out of Italy. This should not cause an overestimate of the emigrants' human capital, though, as also the data from Banca d'Italia, on which we estimate the stock of resident population, include foreigners.

[11] We also found, in some municipalities, an unreasonably high share of people with no schooling. As these values were not in line with the share of illiterates in Italy during the 1990's we classified them as having an elementary degree.

four relevant sub-groups: immigrants from the North, from the South, young emigrants (aged 26-45) and older emigrants (over 45).

Note that because of the adjustments described above, the level indicators (namely E_t, G_t^E and H_t^E) may exhibit a greater degree of approximation in estimating the real value of the corresponding variable. While the level indicators may be affected by a proportional bias, the ratios $g_t^E = G_t^E/E_t$ and $h_t^E = H_t^E/E_t$ are instead more reliable. Additionally, as long as the adjustments were made each year, even if the levels are equally biased, the temporal trend should reflect the real trend.

B.2 The SHIW data

The *Survey of Household Income and Wealth* (SHIW) carried out by the Bank of Italy contains information on representative samples of the Italian population interviewed in 1990, 1992, 1994, 1996 and 1998. In each of these years about eight thousand families were interviewed for a total of about twenty-five thousand individuals.[12] The information on the schooling levels used in this study refers to the situation as of the first of January of each year (1990, 1992, 1994, 1996 and 1999). For the first four of these years we can compare the information on the emigrants during each year with the information on the stock of the population at the beginning of the year.

As we did for AIRE data, we weighted the observations in the SHIW sample in order to make it representative of the entire population. The indicators reported in Table 7, computed on the weighted data, are the total population P_t, the percentage of college graduates in the entire population g_t^P, the number of college graduates in the population G_t^P , the average number of years of education completed in the population h_t^P and the total number of years of education completed in the population H_t^E. For the intermediate years (1991, 1993, 1995 and 1997) we have interpolated the data on P_t, G_t^P and H_t^E. Also for the SHIW data, each indicator was calculated for the entire population (aged 26-65)and for the four relevant sub-groups, i.e. the residents of the North, the South, young people and older people.

B.3 The Eurostat LFS Data

The data from the Eurostat Labor Force Survey (LFS) that we use were kindly provided to us by Joshua Angrist and Adriana Kugler with the permission of Eurostat. This data set is documented in Eurostat (1998) and in a

[12] For more details on this survey see Banca d'Italia (1991, 1993, 1995, 1997 e 2000) and Brandolini (1999).

variety of memos released with these data. Also in Angrist and Kugler (2001) further details and description of the data can be found. The LFS surveys are carried out by national statistical agencies according to guidelines issued by the European Community. The sampling frame in all countries covers only private households and not group quarters. This should not be a limitation when looking at EU nationals only, who are unlikely to live in group quarters. Sampling rates, sample sizes, and interview methods (e.g., use of CATI/CAPI) vary from country to country. The LFS samples are stratified in a variety of ways, but the sample statistics we received from Eurostat were already weighted to population counts. We used these population weights to aggregate cell statistics where necessary (e.g., to combine age groups). Our estimates treat country statistics as population parameters, that is, we did not weight to adjust for differences in country size. Angrist and Kugler experimented with alternate weighting schemes and found weighted-by-population estimates to be similar. Response rates vary from a low of 55-60 percent in the Netherlands to 98 percent in Germany, with the median response rate at 87 percent. Labor force status is defined using a consistent definition based on "actual status in the reference week".

The data we use here are for the years 1992 through 1999 and are aggregated to cells giving the number of people by year, country of residence, nationality, gender, age group, working status, country of birth, number of years of residence in the host country, and education levels. The LFS extract includes information on the size of three schooling groups, categorized by International Standard Classification of Education (ISCED) levels 0-2, 3-4, and 5 and above. ISCED level 5 denotes college education, which we take as our definition of college-graduates.

Note that until 1995, the Eurostat Labour Force Survey data only comprised the 12 then EU member countries (henceforth abbreviated by EU12). From 1995/96 on, data collection was extended to the three 1995-accession countries Austria, Finland and Sweden as well as to the following non-EU member countries: Iceland, Norway and Switzerland. In order to ensure comparability over all of the 1990s, we restrict attention to the EU12 countries.

Table 6: Data and Indices for working-age Emigrants.

	1990	1991	1992	1993	1994	1995	1996	1997	1998
All Emigrants									
E_t	29,354	30,460	29,229	33,015	34,699	23,358	29,485	30542	30,583
g_t^E	3.77	6.06	10.37	9.14	9.02	15.48	16.88	20	15.71
G_t^E	1,106	1,847	3,032	3,018	3,129	3,615	4,977	6,108	4,805
h_t^E	6.89	7.33	7.99	8.22	8.38	9.2	9.51	9.93	9.63
H_t^E	202,211	223,367	233,489	271,574	290,666	214929	280,449	303465	294,468
Emigrants from Northern Italy									
E_t	16,062	15,079	19,396	21,527	21,787	15,585	20,336	23,468	23,387
g_t^E	5.57	9	14.45	12.23	12.77	20.2	22.25	25.02	19.15
G_t^E	895	1,357	2,803	2633	2,781	3,156	4,525	5,873	4,478
h_t^E	8.60	8.80	9.48	9.44	10	10.9	11.25	11.36	10.91
H_t^E	138,107	133,568	183,954	203,359	219,112	170,680	228,793	266,658	255,147
Emigrants from Southern Italy									
E_t	13,291	15,381	9,833	11,487	12,912	7,772	9,149	7,073	7,196
g_t^E	1.58	3.18	2.33	3.35	2.69	5.9	4.95	3.32	4.55
G_t^E	211	490	229	385	348	459	452	235	328
h_t^E	4.82	5.83	5.04	5.93	5.54	5.69	5.65	5.2	5.46
H_t^E	64,104	89,799	49,535	68,214	71,554	44,248	51,656	36,807	39,321
Young Emigrants (26-45)									
E_t	17,280	20,458	19,860	22,387	24,041	16,778	20,389	22,537	23,309
g_t^E	5.03	7.55	14.11	12.05	9.26	15.73	17.01	20.84	15.46
G_t^E	869	1,545	2,803	2,697	2,225	2,639	3,469	4,699	3,604
h_t^E	7.60	7.64	8.74	8.83	8.84	9.58	9.76	10.1	9.73
H_t^E	131,288	156,489	173,658	197,771	212,506	160,809	199,007	227,814	226,749
Older Emigrants (46-65)									
E_t	12,073	10,002	9,369	10,628	10,659	6,579	9,097	8,005	7,274
g_t^E	1.96	3.01	2.44	3.02	8.48	14.82	16.58	17.61	16.52
G_t^E	237	302	229	321	904	975	1,508	1,409	1,201
h_t^E	5.87	6.68	6.39	6.94	7.33	8.22	8.95	9.44	9.31
H_t^E	70,923	66,878	59,831	73,802	78,160	54,119	81,443	75,651	67,719

The following indices use data from AIRE: E_t = number of migrants; $g_t^E = 100G_t^E/E_t$ percentage of college graduates among migrants; G_t^E = number of college graduates among emigrants; h_t^E = average years of schooling of emigrants; $H_t^E = H_t^E/E_t$ Total years of schooling of emigrants.

Table 7: Data and Indices for working-age Residents

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total Population									
P_t	29,890	29,968	30,047	30,168	30,289	30,266	30,243	30090	29,937
g_t^P	8.50	8.31	8.10	7.92	7.80	8.05	8.40	9.05	9.80
G_t^P	2,549	2,490	2,431	2,390	2,350	2,437	2,525	2,723	2,921
h_t^P	8.86	8.86	8.86	8.83	8.80	8.94	9.08	9.35	9.62
H_t^P	264,833	265,488	266,142	266,326	266,510	270,574	274,637	281,298	287,958
Residents in Northern Italy									
P_t	20,401	20,075	19,749	19,946	20,143	20,046	19,949	19,886	19,824
g_t^P	8.78	8.37	7.96	7.84	7.74	8.07	8.42	9.26	10.11
G_t^P	1,791	1,681	1,572	1,565	1,558	1,618	1,679	1,842	2,005
h_t^P	9.15	9.14	9.14	9.08	9.04	9.18	9.33	9.63	9.95
H_t^P	186,616	183,520	180,423	181,250	182,077	184,054	186,030	191,613	197,185
Residents in Southern Italy									
P_t	9,490	9,894	10,299	10,223	10,147	10,220	10,294	10,203	10,113
g_t^P	7.98	8.17	8.35	8.07	7.80	8.01	8.22	8.63	9.06
G_t^P	758	808	859	825	792	819	846	881	916
h_t^P	8.24	8.28	8.32	8.32	8.32	8.46	8.61	8.79	8.98
H_t^P	78,217	81,968	85,720	85,076	84,433	86,520	88,608	89,690	90,773
Young Residents (26-45)									
P_t	15,571	15,696	15,822	16,295	16,768	16,588	16,408	16,472	16,536
g_t^P	11.62	11.21	10.81	10.35	9.93	10.23	10.54	11.37	12.19
G_t^P	1,810	1,760	1,711	1,688	1,665	1,697	1,730	1,873	2,016
h_t^P	10.28	10.31	10.36	10,25	10.15	10.32	10.50	10.70	10.92
H_t^P	160,035	161,969	163,902	167,056	170,210	171,224	172,238	176,394	180,550
Older Residents (46-65)									
P_t	14,319	14,272	14,226	13,874	13,522	13,678	13,835	13,618	13,401
g_t^P	5.16	5.11	5.06	5.06	5.06	5.40	5.75	6.24	6.76
G_t^P	739	729	720	702	685	740	795	850	905
h_t^P	7.32	7.25	7.19	7.15	7.12	7.26	7.40	7.70	8.01
H_t^P	104,799	103,520	102,240	99,270	96,300	99,349	102,399	104,903	107,407

The indices are constructed using SHIW data: P_t = total resident population in thousands; $g_t^P = G_t^P/P_t$ share of college graduates in resident population; G_t^P = number of college graduates in resident population in thousands; h_t^P = Average years of schooling of resident population; $H_t^P = H_t^P/P_t$ total years of schooling of resident population in thousands.

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