

# **Luxembourg Income Study Working Paper Series**

**Working Paper No. 365**

**Human Capital Content and  
Selectivity of Romanian Emigration**

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**December 2003**



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**Luxembourg Income Study (LIS), asbl**

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# Human Capital Content and Selectivity of Romanian Emigration\*

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## Abstract

This paper is one of the first attempts to analyse empirically the human capital embodied in recent emigration flows from Romania. The analysis is pursued along two lines. Indices on the skill content of outflows are being constructed using an original data set derived from official administrative registers on Romanian emigrants. Indicators on the self-selection of labour migrants are presented by way of a simple human capital model. Data from two waves of the *Romanian Integrated Household Survey* - provided through the *Luxembourg Income Study (LIS)* - were matched with German administrative data on employees recorded by the social insurance system (*IABS*).

JEL: F22, J24, J31

Keywords: international migration, Romania, brain drain

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\*Access to the Romanian Integrated Household Survey (RIHS) has been granted through the Luxembourg Income Study (LIS). The Romanian emigration data were provided by the National Institute for Statistics (INSSE) in the context of Phare project RO 9907-02-01 (Pre-Accession Impact Studies). Helpful insights on the data from Mr. Dorel Gheorghiu (INSSE) as well as valuable comments from Ira Gang, Annekatrin Niebuhr, Florin Vadean and the participants of the HWWA's PhD seminar are gratefully acknowledged. The usual disclaimer applies.

# 1 Introduction

Even though the "brain drain" from Eastern Europe (and other low income regions) is a prominent buzzword on both social scientific and policy agendas, there is only limited knowledge about precisely how pervasive is the outflow of highly-skilled East Europeans. The rare attempts to pinpoint the magnitude of the brain exodus after the collapse of the communist regimes deliver only an incomplete picture of the phenomenon. The reason is the paucity of data concerning the circulation of the highly trained between East European and more developed countries. On the one side, available emigration figures cover only a fractional amount of the gross outflows and do not include information on their human capital content. On the other side, relying solely on immigration data usually implies more or less scattered figures, i.e. covering only particular countries of destination and specific professions or selected human capital characteristics. Moreover, reliable assessments of human capital stocks in the sending countries are also very limited. These are indispensable for forming a correct estimate of the skills lost through emigration.

However, besides a growing body of theoretical literature on the impact of the brain drain on both sending and receiving economies<sup>1</sup> a number of studies have attempted to circumvent the problems of a lack of data<sup>2</sup>.

Two approaches have been followed. A first one relies on information derived from anecdotal evidence or obtained through migrant surveys at the group or individual level. In-depth analyses on mobility patterns involving highly skilled migrants exist already for Europe in general<sup>3</sup>, as well as for Eastern-Europe and Romania in particular<sup>4</sup>. While this sociological literature accounts for micro-level insights on the strategies of highly skilled migrants it delivers less evidence on the impact and magnitude of brain-drain migration. This last aspect is addressed in a second category of studies, which corroborate aggregate statistics on the

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<sup>1</sup>Comprehensive surveys of this literature are provided by Commander, Kangasniemi, Winters (2003), Faini (2003a,b). Kamath (1998) critically reviews the economic arguments used in older brain drain studies.

<sup>2</sup>There are nonetheless cases where detailed data for brain drain analyses are available. This happens particularly with inter-regional migration in North America, e.g. Ronald A. Wirtz (2003), or migration between Canada and the US, e.g. J.F. Helliwell (2003), or other immigration countries (New Zealand, Australia). These are however not so relevant for the development related debate on brain drain.

<sup>3</sup>Mahroum (2003), Salt(1999). Åkerblom(1999) provides a comprehensive analysis of sources for empirical evidence.

<sup>4</sup>E.g. Nedelcu (2002a,b, 2003).

human capital endowment in the sending areas and data on flows or stocks of immigrants in the receiving countries. Due to various degrees of skill-differentiation available in the immigration data, these studies usually infer the magnitude of the brain drain by making assumptions on the human capital stock of the sending countries. A paramount example for this type of research is Carrington and Detragiache (1998, 1999). They compare the characteristics of immigrants' stocks - derived, e.g., from US censuses and OECD migration statistics - with the human capital characteristics in the populations of the sending countries - using Barro-Lee (1993) data on educational attainment. The brain drain estimates of Carrington and Detragiache (1998) became, despite their shortcomings<sup>5</sup>, a benchmark for both empirical, e.g. Beine, Docquier and Rapoport (2001 and 2002), and more theoretical studies, e.g. Faini (2003a,b).

With regard to the emigration of highly skilled workers from Eastern Europe, Straubhaar and Wolburg (1999) apply a method akin to that of Carrington and Detragiache (1998). They investigate the degree to which the human capital stock in the East-European sending countries was lowered by means of emigration. They used Labour Force Survey data on Germany for constructing skill-ratios for the immigrants from selected East-European countries. Assuming an initial stock of human capital in each of these countries, they estimated the decrease in the average level of human capital due to emigration to Germany. The results demonstrate a relatively small effect of the brain drain on the stock of human capital in the sending countries, but significant negative repercussions on the productivity of those left behind, even after taking remittances into consideration.

More recently, Becher, Ichino and Peri (2003) employed a slightly different method for looking at the magnitude of the brain drain from Italy. Using refined data on Italian emigrants and micro-level evidence for the Italian labour force, they estimate the average (per capita) as well as the aggregated impact of emigration on the human capital stock of the total population.

The present analysis applies an analogical method to that of Becker, Ichino and Peri (2003), in that it addresses the issue of brain drain from a sending country's perspective, namely Romania's. Administrative data on Romanian emigrants were matched with other

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<sup>5</sup>See Commander, Kangasniemi and Winters (2003) for a discussion.

micro-data for looking at the human capital embodied in recent outflows and compare it to that of the total population.

The aim of comparing the characteristics of emigrants with those of sedentary residents is to figure out the *per capita* effect of permanent emigration in terms of productivity, formal education and, eventually, occupational skills. Some features of emigrants' selectivity are then depicted by comparing the performance of migrants to that of non-migrants abroad and in Romania.

Among the EU-candidates, Romania is not only one of the most populous countries but lags also far behind the EU's average in terms of per capita income and wages. Both its geographic and economic "distance from Brussels" are important determinants of the migration patterns emerging in the forerun to EU-membership. The ethnically dominated outflows in 1989-91<sup>6</sup> were followed by a steadily developing culture of circular mobility, involving back-and-forth movements and being often characterised by informality<sup>7</sup>. These mobility circuits slowly evolved into "institutionalised networks" (Lazaroïu 2003). While initially set up by lower skilled migrants and rooted in rural areas, the networks became the facilitator of information - e.g. on employment opportunities and labour market entry conditions, on dwellings and regularisation programmes at various destinations - for broader categories of potential emigrants in most parts of Romania. The varying mobile-livelihood strategies embarked upon by lower skilled, short-term, circular migrants on the one side, and by highly skilled, rather longer term migrants on the other, have been well documented in the literature<sup>8</sup>. Apart from this, there is a lack of reliable evidence on how these labour outflows impact on Romania's labour markets and development prospects. This is because no systematic account of the human capital outflows and of the self-selection of emigrants was possible until now. It is precisely this information gap which the present analysis tries to contribute filling in.

The remainder of the paper contains first a description of the methods applied for estimating the human capital indices (Section 2.1) and for undertaking the selectivity analysis

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<sup>6</sup>Ohliger (1999) describes the changing characteristics of Romania's emigration regime in the early 1990.

<sup>7</sup>Diminescu (1999, 2003), Diminescu and Lazaroïu (2002), Lazaroïu (2003).

<sup>8</sup>For circular migrants: Diminescu (2002, 2003), Diminescu, Lagrave (1999), Diminescu, Lazaroïu (2002), Lazaroïu (2002, 2003); for highly skilled migrants: Nedelcu (2002a,b, 2003).

(Section 2.2). Section 3 details the characteristics of the constructed data sets. Section 4 presents the estimated indices as well as the predicted wage differentials for the selectivity analysis. Section 5 summarises the results.

## 2 Method

The analysis undertaken in this paper will be carried out in two steps. In the first step, three sets of human capital indices will be constructed. Using analogous methods to those employed by Becker, Ichino and Peri (2003), two sets of indices will be calculated using years of schooling and the ratio of university graduates as indicators of the human capital content of emigration flows. The other indices will be calculated on grounds of data on the shares of different professional categories in the total (sedentary) population and among the emigrants. In the second step, for estimating the selectivity of emigration flows to Germany, wage functions will be first estimated for both the sedentary Romanians and for those who already left. Predicting the earnings functions of both groups in each of the two locations allows some insights into the selectivity patterns of Romanian migrants to Germany.

### 2.1 Indices on the human capital content of outflows

The method employed for estimating the outflows of human capital through emigration evolves around three possible ways for measuring skills: formal education (proxied by years of schooling and by the highest level of education achieved), the skill level of occupations and, the market value of human capital (expressed e.g. through earnings).

The first set of indices uses years of schooling as the relevant measure to compare the human capital of emigrants to that of the total populations. The importance of education for income growth has been emphasised both in the micro labour literature - where the individual returns to schooling are investigated<sup>9</sup> - and in the macro growth literature - where the level of education is related to the growth prospects of countries or regions<sup>10</sup>. More recently<sup>11</sup>,

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<sup>9</sup>Aschenfelter, Harmon, Hessel (1999) provide a quantitative review of the empirical literature on the relation between schooling and earnings.

<sup>10</sup>Aghion, Howitt (1998) for a classification of the progeny of Lucas (1988)-Uzawa(1965) and Romer (1990).

<sup>11</sup>See Krueger and Lindahl (2001) for a comprehensive survey.

attempts to bridge empirically these two separate traditions used an aggregation of the standard tool applied in the labour literature, the Mincerian wage equation. Formally, the aggregate equation - labelled as the "Macro-Mincerian" wage equation by Heckman and Klenow (1997) - is specified as:

$$\ln Y_{nt}^g = \beta_{0nt} + \beta_{1nt} h_{nt} + \varepsilon_n \quad (1)$$

where  $\ln Y_{nt}^g$  is the log of the geometric mean wage in country  $n$  at time  $t$ , and  $h_{nt}$  is the mean level of schooling in  $n$  at time  $t$ . Thus, the empirical evidence suggests a proportional relation between log output per capita and education, measured by years of schooling, implying  $Y_t \sim e^{\beta h_t}$ . Consequently, in order to capture the exponential impact of per capita human capital outflows in time period  $t$  the appropriate measure would be:

$$\psi_t = \frac{e^{\beta h_t^E}}{e^{\beta h_t^P}} = e^{\beta(h_t^E - h_t^P)} \quad (2)$$

where  $h_t^E$  and  $h_t^P$  are the mean years of schooling of emigrants and of the sedentary population:

$$h_t^E = \frac{\sum_j h_{jt}}{E_t}$$

$$h_t^P = \frac{\sum_i h_{it}}{P_t}$$

with  $i$  and  $j$  indexing individuals who belong at time  $t$  respectively to the total ( $P_t$ ) and to the emigrant ( $E_t$ ) population<sup>12</sup>.

A second set of indices uses the share of tertiary graduates in the total working-age population and among the emigrants:

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

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<sup>12</sup> $\psi_t$  takes thus only positive values. If  $\psi_t > 1$  the human capital productivity of the average emigrants is higher than that of the average residents. In this case, emigration induces a per capita loss of productive human capital. If  $\psi_t < 1$  the opposite is true: the residents are on average more productive than emigrants.

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

whereby,  $G_t^E$  and  $G_t^P$  are the total number of tertiary graduates who emigrated in period  $t$  and, respectively, stay put.  $P_t$  denominates again the resident (sedentary) population and  $E_t$  the total number of emigrants over period  $t$ . The corresponding index<sup>13</sup> is defined as:

$$\gamma_t^E = \frac{g_t^E}{g_t^P}. \quad (3)$$

Additionally, it is also possible to compute an index for comparing the ratios of lower educated persons among the emigrants and in the total working age population:

$$\lambda_t = \frac{l_t^E}{l_t^P} \quad (4)$$

with

$$l_t^E = \frac{L_t^E}{E_t}$$

$$l_t^P = \frac{L_t^P}{P_t}$$

being the ratio of low educated (compulsory schooling) emigrants ( $l_t^E$ ) and residents ( $l_t^P$ )<sup>14</sup>.

Finally, a third set of indices captures the impact of emigration on the per capita distribution of professional skills. Using a standard classification of occupations (e.g. ISCO) it is possible to distinguish the high skilled professionals in the total population ( $S_t^P$ ) as well as the total number of emigrants in period  $t$  belonging to highly skilled professions ( $S_t^E$ ). The corresponding ratios

$$s_t^E = \frac{S_t^E}{E_t}$$

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<sup>13</sup>Values of  $\gamma_t$  above 1 indicate that the ratio of tertiary graduates is higher among emigrants than in the resident population. Values below 1 suggest on contrary, that there are fewer graduates among emigrants than among all the residents.

<sup>14</sup> $\lambda_t > 1$  signals higher shares of low educated among emigrants than in the resident population.  $\lambda_t < 1$  indicates that the share of low educated is smaller in the emigrant than in the resident population.



$$s_t^P = \frac{S_t^P}{P_t}$$

are used for computing the index<sup>15</sup>:

$$\sigma_t = \frac{s_t^E}{s_t^P}. \quad (5)$$

Similarly, an index evaluating the emigration rate of workers from professions with relatively low skill requirements is defined as

$$\zeta_t = \frac{z_t^E}{z_t^P} \quad (6)$$

where  $z_t^E$  and  $z_t^P$  are the ratios of untrained workers emigrating or remaining immobile<sup>16</sup>:

$$z_t^E = \frac{Z_t^E}{E_t}$$

and

$$z_t^P = \frac{Z_t^P}{P_t}.$$

## 2.2 Selectivity

In a simple human capital model of migration (e.g. Sjaastad 1962), the focus of the location choice of individuals lies on the earnings component of utility, i.e. an individual decides whether or not to move by comparing the expected earnings in another location, less migration costs, to the (present value of life time) earnings in the area of origin. That is, a Romanian worker will decide to migrate to Germany if his expected income, assuming he will be employed in Germany ( $y_{ger}$ ), will be higher than his foregone earnings in Romania ( $y_{rom}$ ) plus the migration costs ( $C$ ):

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<sup>15</sup> $\sigma_t > 1$  implies that the ratio of highly skilled emigrants is larger than the corresponding ratio of residents.  $\sigma_t < 1$  suggests on contrary, a lower ratios of highly skilled among emigrants than in the resident population.

<sup>16</sup> $\zeta_t$  takes values above 1 when the flows of emigrants include relatively more workers from low skilled professions than in the resident active population.

$$y_{ger} - y_{rom} - C > 0 \quad (7)$$

or

$$y_{ger} - y_{rom}(1 + c) > 0 \quad (8)$$

where  $C$  is the present value of the costs of moving from Romania to Germany, and  $c \equiv \frac{C}{y_{rom}}$ .

In the empirical literature the following index function<sup>17</sup> is usually defined for analysing the criteria of the migration decision making:

$$I \equiv \ln \left( \frac{y_{ger}}{y_{rom}(1 + c)} \right) \simeq \ln y_{ger} - \ln y_{rom} - C \quad (9)$$

that is, for individual  $i$  the criterion to migrate becomes:  $I_i > 0$ , and the criterion to stay immobile in the original location:  $I_i < 0$ . The log earnings in Romania and Germany are represented by linear semi-logarithmic functions, as proposed by Mincer (1974):

$$\ln y_{rom} = \beta_{rom}X + u_{rom} \quad (10)$$

$$\ln y_{ger} = \beta_{ger}X + u_{ger} \quad (11)$$

where  $\beta$  is the value placed respectively in Romania ( $\beta_{rom}$ ) and in Germany ( $\beta_{ger}$ ) upon observable socio-economic characteristics,  $X$ , like age, education, profession, gender, etc. In both equations, the disturbance terms  $u$  on the right-hand side capture the impact of unobservable characteristics (not included in the vector  $X$ ) on earnings in Romania ( $u_{rom}$ ) and in Germany ( $u_{ger}$ ).

The equations (10) and (11) cannot be estimated for all individuals: part of Romanians migrates and part stays put. For migrants it is possible to observe  $\ln y_{ger}$  but not  $\ln y_{rom}$ , for those who remain immobile, vice-versa,  $\ln y_{rom}$  is observable but  $\ln y_{ger}$  isn't. Therefore, both (11) and (10) will be estimated on "truncated samples". In terms of conditional expectations, the individual earnings functions in Germany and in Romania can be written as:

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<sup>17</sup>See e.g. Robinson and Tómes 1988, p.478.

$$E(\ln y_{j_{ger}} | X_j, I_j > 0) = \beta_{j_{ger}} X_j + E(u_{j_{ger}} | I_j > 0) \quad (12)$$

for those individuals,  $j$ , who emigrante ( $I_j > 0$ ), and as:

$$E(\ln y_{i_{rom}} | X_i, I_i < 0) = \beta_{i_{rom}} X_i + E(u_{i_{rom}} | I_i < 0) \quad (13)$$

for stayers ( $I_i < 0$ ).

For testing the responsiveness of individual migrants to earnings differentials between Germany and Romania opportunity wages are constructed, i.e. the log wages of migrants in Romania, had they stayed, and the log wages of sedentary Romanians in Germany, had they moved. Written in conditional expectations these would be:

$$E(\ln y_{j_{rom}} | X_j, I_j > 0) = \beta_{j_{rom}} X_j + E(u_{j_{rom}} | I_j > 0) \quad (14)$$

$$E(\ln y_{i_{ger}} | X_i, I_i < 0) = \beta_{i_{ger}} X_i + E(u_{i_{ger}} | I_i < 0) \quad (15)$$

Using (14) and (15) it is possible to estimate the "opportunity wage differentials" for both categories of individuals, i.e. what would be the relative wages in Romania of those who emigrated, compared to those who stay, and how would those who stayed perform in Germany, relative to those who actually moved:

$$\Delta_1 = E(\ln y_{i_{ger}} | X_i, I_i < 0) - E(\ln y_{j_{ger}} | X_j, I_j > 0) \quad (16)$$

$$\Delta_2 = E(\ln y_{j_{rom}} | X_j, I_j > 0) - E(\ln y_{i_{rom}} | X_i, I_i < 0) \quad (17)$$

The differentials  $\Delta_1$  and  $\Delta_2$  provide indicators of whether Romanian migrants and non-migrants were negatively or positively selected<sup>18</sup>.  $\Delta_1 < 0$  implies that Romanian emigrants working in Germany perform better than their sedentary counterparts would have done in case they had moved to Germany, i.e. the emigrants were positively selected with regard to the returns in Germany to their human capital accumulated in Romania. Alternatively,  $\Delta_1 > 0$

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<sup>18</sup>The usual prototype framework for undertaking analyses of self-selection is the Roy model (1951) as specified by Borjas (1987, 1990). Heckman and Honore (1990) provide a more general discussion of the empirical content of these types of models.

implies a negative selection: the sedentary Romanians would outperform those Romanians who actually migrated.  $\Delta_2 > 0$  means that the average emigrant is selected from the upper tail of Romania's earnings distribution, given the reference categories of the observable human capital characteristics.  $\Delta_2 < 0$  indicates that the human capital of the average emigrants is less valuable in Romania than the human capital of those who stay immobile, i.e. the emigrants were negatively selected when the returns to their human capital in Romania are taken into account.

### 3 Data

Three sources of data were used in this study: (i) first, administrative registers run by the Romanian Ministry of Internal Affairs and provided by the National Institute of Statistics and Economic Studies (INSSE), (ii) second, two waves of the *Romania Integrated Household Survey* (RIHS) provided by the *Luxemburg Income Study* (LIS) and, (iii) third, German administrative data on employees recorded by the German social insurance system, the *IAB Employment Subsample* (IABS).

#### 3.1 Administrative data on emigration

For the estimation of human capital indices an original data set has been constructed using data provided by the Romanian National Institute for Statistics and Economic Studies, henceforth INSSE data. The source of these data are administrative registers and border crossing records, maintained by the Romanian Ministry of Internal Affairs<sup>19</sup>, in which the individual characteristics of emigrants are being recorded. The data include all those emigrants who leave Romania on a permanent or long-term basis, i.e. the persons who officially give up their residence status in Romania for becoming long-term residents or citizens of other countries. Because of unharmonised systems of reporting, all the data before 1995 were considered to be unreliable, so that the period covered by the constructed data set is 1995-2001. Table 2 provides an overview of the constructed data set and the included

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<sup>19</sup>A systematic overview of Romanian administrative statistics on international migration is provided e.g. by the INSSE: <http://www.unece.org/stats/documents/2001/05/migration/2.add.11.e.pdf>.

variables. For each individual information on his socio-demographic characteristics - like age, gender, ethnicity, education, profession, region of origin in Romania (NUTS 3) - were reported together with the intended country of destination.

Figure 1 presents the trends of the total number of emigrants observed in the data set. Despite the overall number, two destinations have been aggregated: "EU", including all the 15 EU-member states and, "Overseas" including the US, Canada and Australia. For these destinations, the figure also depicts the total number of highly educated emigrants (tertiary education) as well as the number of highly (ISCO groups 1,2 and 3) and lower (ISCO groups 8 and 9) skilled emigrants in time series 1995-2001.

The major drawback of the INSSE data set is the fact that it contains only information on those emigrants who officially settle abroad permanently. This means that all types of temporary or informal movements are not included in the data, which obviously implies a dramatic underestimation of the magnitude of outflows.

Despite their shortcomings, there are however two arguments why the INSSE data might still be appropriate for gaining some quantifiable indicators of the Romanian brain drain. First, permanent emigrants are the most relevant subjects for a brain-drain analysis: the probability that their departure represents a permanent loss of human capital for the country of origin is much higher than for all other types of emigration - which are more likely to include return or circular migrations. Second, comparing the figures obtained with INSSE data with estimates from other studies shows that the former replicate rather well the generally observed trends of emigration from Romania. The INSSE data reveal similar patterns of emigration to those reported in aggregate-level studies - witness therefor are e.g. the SOPEMI country profiles for Romania - as well as in more dis-aggregated surveys: the data resemble e.g. the findings obtained by Diminescu and Lazaroiu (2002) from a large-scale community-level survey<sup>20</sup>. There are also some plausible justifications for this resemblance. One would be related to the incentives to officially declare the settlement abroad while the mobility strategy included from the beginning return migration: given the facilities offered

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<sup>20</sup>Both on national and, even more striking, on regional, i.e. county (NUTS3) level the emerging destinations of temporary circular migrants revealed by Diminescu and Lazaroiu (2002) appear to be almost the same with those of permanent emigrants.

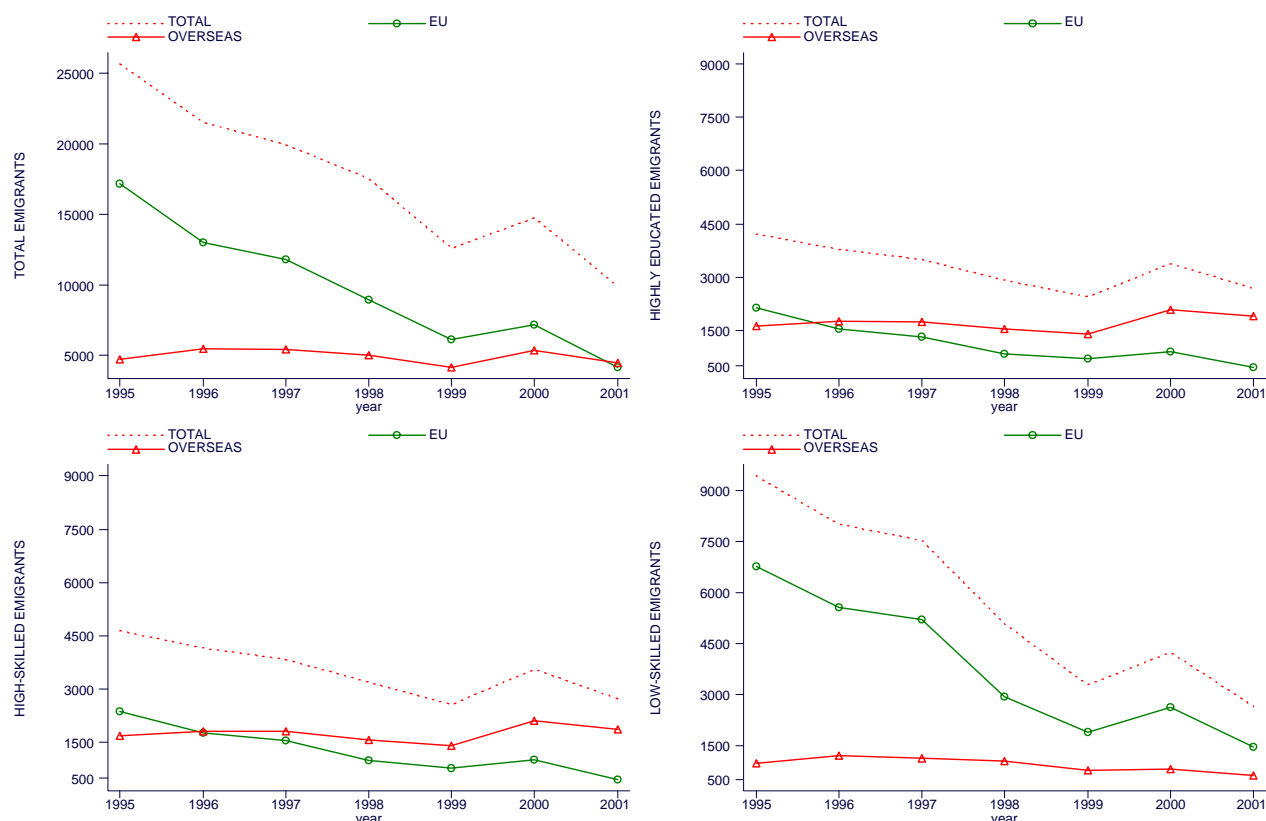


Figure 1: Numbers of observed emigrants in the INSSE.

for repatriates, e.g. avoiding customs duties and taxes for repatriated assets, migrants might temporarily give up their Romanian residence just for making use of these benefits when returning. Such patterns have been documented e.g. for returning Turkish guestworkers.

Since the present analysis is concerned with *per capita* indicators of the human capital content of outflows, the results will be relevant even in case of underestimated gross-outflows. This holds true if, as shown above, the sample of emigrants is not biased towards specific destinations or categories.

The indices on years of schooling and on tertiary graduates were calculated by combining the INSSE data with information from the Barro-Lee data set on educational attainments. A description of this data set, as well as of the methodologies employed for constructing it, are provided by Barro and Lee (2001). Indicators on the average years of schooling and on the average level of education for Romania's population were first extracted from the Barro-Lee

data. These were then matched with equivalent indicators for emigrants obtained from the INSSE data.

Eventually, the corresponding data for the indices on occupational skills were extracted from aggregated data of the Romanian labour force survey (LFS-AMIGO). These data were complemented with the distribution of occupational categories (ISCO-equivalent) in the Romanian population, calculated with data extracted through the Luxembourg Income Study from the Romanian Integrated Household Survey (henceforth LIS-RIHS data).

### 3.2 LIS-RIHS and IABS data

For analysing the selectivity of emigration flows from Romania, data from two waves of the LIS-RIHS were matched with two cross-sections extracted from the German Employment Sample (IABS).

The RIHS is the first large-scale nationally representative survey in Romania<sup>21</sup>. Due to its sampling methods and its sample size the coverage of the survey makes it representative for the overall population with permanent domicile in Romania. The RIHS collects detailed information on income and expenditure patterns, on housing, education and other socio-economic characteristics of persons and households. The 1995 wave comprises 31,574 interviewed households containing 93,205 individuals; that for 1997, 32,187 households and 92,334 individuals.

The income variable used as regressand in the analysis on selectivity refers to wage income, i.e. the dependent variable is gross monthly wage. Therefore, only salaried persons were included. Since it is not possible to control for the time effectively worked, only full-time employees were kept in the constructed data set.

The categorical variables on education and on occupation were re-coded in order to match the LIS-RIHS the German data. The education variable has been re-aggregated into 5 out of originally 11 categories in 1995 and 8 categories in 1997. For "occupation", the original ISCO-88 codes - 3-digit in 1995 and 1-digit in 1997 - were regrouped into 5 categories resembling those of the German IABS data.

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<sup>21</sup>Detailed descriptions of the methodologies employed for sampling and for collecting the data are provided online by the Luxembourg Income Study at: <http://www.lisproject.org/techdoc/ro/roindex.htm>

The second set of data used for the selectivity analysis has been extracted from the IAB employment subsample. Given its sample size, the included socio-economic characteristics and its panel-similar structure the IAB employment subsample (IABS) is the sole source of microdata fitting the aims of the present study: no other data sets would enable detailed analysis on the relatively small population of Central and East-European (CEE) immigrants in Germany.

The IABS data are derived from the notifying procedure for health insurance, statutory pension schemes and unemployment insurance in Germany. For the 21 years covered it contains 7,847,553 notifications for 559,540 persons<sup>22</sup>. It covers 1% of all employees registered by the social insurance system - representing nearly 80% of all employed persons in Western Germany.

The information at individual level includes: a person's identification code, the person's gender, year of birth, education, occupational status, job content and wages. The wage variable in the IABS - measuring gross labour income per day - is censored from above. This results from the upper limit for wages to which contributions to social security are paid proportionally. The variable for education classifies the achieved schooling and vocational training into eight categories. An occupational code delivers details on the job contents and covers 334 occupations<sup>23</sup>.

For the present analysis, two cross-sections have been extracted from the IABS for comparing the performance of newly entered CEE immigrants in Germany and of sedentary Romanians in Romania for the periods 1993-95 and 1995-97. In order to include only the newly entered CEEs, a variable to control for "experience in the German labour market" i.e. the years spent as a socially insured employee<sup>24</sup>, has been generated by using the year of the first spell in the IABS. The criterion for including a person in the constructed data set becomes thus that the time already spent in the German labour market should be shorter than 12 month. Using a similar approach to that employed in the present study, Bauer et al.

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<sup>22</sup>Bender et al. (2000).

<sup>23</sup>Detailed descriptions are provided by Bender et al. (1996) and Bender et al. (2000).

<sup>24</sup>It is impossible to capture from the IABS the time spent in Germany before being recorded by the German social insurance system; i.e. periods after arrival when the migrant was either not participating in the labour market, or marginally employed (*geringfügig beschäftigt*), or self-employed.



(2002) used the IABS data<sup>25</sup> to assess the economic performance of Portuguese migrants in Germany. They matched the IABS with Portuguese data in order to look at the selectivity of guest-workers' migration.

Table 3 presents the characteristics of the matched data set and the included variables. Summary statistics for both groups included in the matched data set are presented in Table 4.

## 4 Empirical results

This section summarises the findings of estimating the human capital indices as well as of predicting the wage differentials for the selectivity analysis.

All the indices have been estimated first for the overall outflows and then for aggregated destinations: the EU, including the emigrants settling to the 15 EU member countries and, Overseas, including emigrants who settle to either US, Canada or Australia. Eventually, indices for selected receiving countries are also included in the estimates in view of comparing the skill composition of outflows to the major destinations.

### 4.1 Indices on human capital

The first set of estimated indices refers to the human capital of Romanian emigrants, relative to the resident population. As described above, the index  $\psi$  captures the productivity impact of the per capita human capital outflows. For estimating  $\psi$  the average years of schooling for emigrants ( $h_t^E$ ) have been calculated using the INSSE data. The average years of schooling in the resident population ( $h_t^P$ ) have been obtained by averaging the years of schooling indicators from the Barro-Lee data set and the corresponding value obtained from the LIS-RIHS data. The results have been interpolated in order to cover all the years 1995-2001. Table 5 reports  $h_t^E$  and  $h_t^P$  as well as their difference,  $\Delta_t^h$ .

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<sup>25</sup>There are until now only few studies using the IABS data for migration research. Bauer (1998) uses cross-sectional data from the IABS to analyse the long term effects of immigration, Wolburg (1996) and Wolter and Wolburg (1996) used the IABS for examining empirically how the qualification level of foreign employees changes over time. Bender and Seifert (1996) searched for ethnicity and gender effects while Velling (1995) used IABS data for analysing the labour market discrimination of foreigners in Germany.

For estimating  $\psi$  using (2), the coefficient  $\beta$ , representing the "return to schooling", needs to be calculated. This has been done by averaging the results of several regressions run using the two available waves of the LIS-RIHS. For all possible specifications of earnings functions estimated with the 1995 and 1997 data of the RIHS the results show that  $\beta \in (0.03, 0.08)$ . Consequently, the chosen value of  $\beta$  for (2) is approximated to be  $\beta = 0.055$ <sup>26</sup>.

For this value of  $\beta$  the corresponding indices  $\psi$  for the total emigration flows are reported in Table 5. Table 6 helps to answer the question whether the differential of the mean years of schooling between emigrants and the total population changed with the intended destination and over time. The answer is that it clearly did, both over time and along different destinations. Whereas Table 5 shows that, for the period under investigation (1995-2001) the average education of emigrants appears to have grown with almost one year of schooling over the average of the total population, Table 6 reveals that these differentials were strongly varying over destinations. The average emigrants targeting one EU country had received about 1.5 less years of schooling than the average Overseas emigrants. For the EU itself, the pattern is also highly diverse: the UK, followed by France in recent years, appears to have attracted significantly higher educated emigrants than e.g. Germany or Austria. At the bottom part, the educational attainment of emigrants leaving to Italy and Spain sharply declined in the late 1990s. In productivity terms, these trends are reproduced in Table 7, in which the values of the index  $\psi$  are calculated for the main destinations.

Figure 2 shows the values of the index  $\psi$  and the estimated linear trends for these destinations and for the period 1995-2001. One clear feature is that the value of  $\psi$  is higher than 1 for each of the destinations and for all years observed. This is a decided indication that, over the whole period, Romanian emigrants were on average better educated than the sedentary population and thus, that the outflows induced a loss of per-capita human capital in Romania. The fitted values of  $\psi$  over time confirm the upward trend for the overall emigrants' outflows and varying trends for the separate destinations. The growth rates are similar for both Overseas emigration and emigration to EU countries, with the  $\psi$  values for Overseas outflows being significantly higher than for the EU. Within the EU destinations, the values of  $\psi$  for Germany and Austria are slightly growing over time but constantly un-

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<sup>26</sup>This value belongs also to the interval of usual estimates. See e.g. Aschenfelter, Harmon, Hessel (1999).

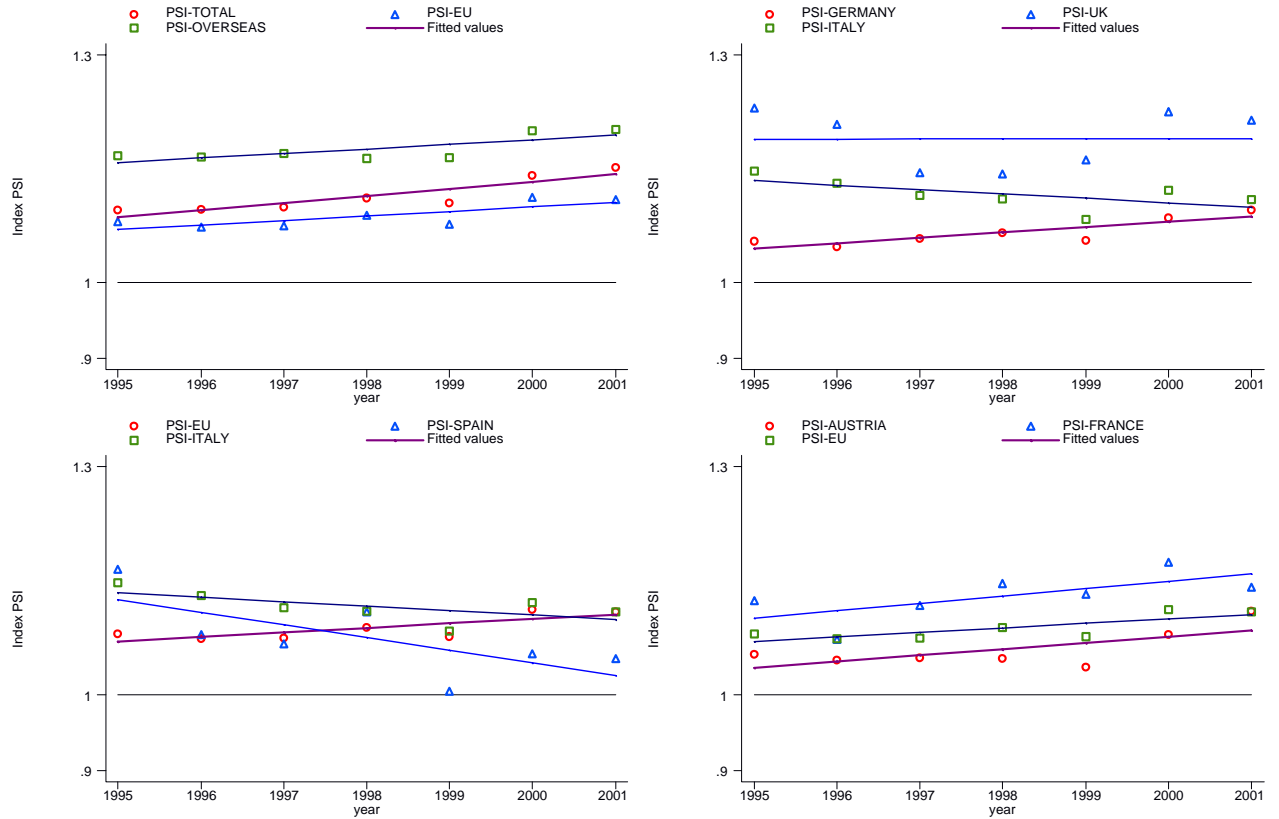


Figure 2: Values and trends of " $\psi$ " for selected destinations

der the EU-average and at a slower pace. While the time trend for the UK remains rather constant over time, it does so at a significantly higher level than for the rest of the EU. The rather positive trend of the  $\psi$  values for France contrasts the decline for Italy and Spain. For Spain however the results might not be as relevant - even if confirming the general finding that Spain emerged as an important magnet for rather lower skilled Romanian circular migrants and Arbeitstourists<sup>27</sup>, some of whom settled - given the large fluctuations and the small number of observations.

<sup>27</sup>See Diminescu, Lazaroïu (2002), Lazaroïu (2003).

## 4.2 Indices on outflows of graduates

Tertiary graduates are considered to be a crucial factor facilitating the adoption of new and more productive technologies<sup>28</sup>. Therefore, for completing the brain drain assessment obtained by looking solely at years of schooling, a second category of indices refers - as described in the methodological part - to the relative numbers of university and post-secondary education graduates who emigrate in a given period.

One aspect followed throughout the present analysis is how to compare the human capital distribution among emigrants to that among the resident population. The question would thus be, if there is a clear indication in the data that the distribution of human capital polarised towards both ends, i.e. if the ratios of both higher and lower educated grew faster for the emigrants than for the sedentary population. In order to investigate this, two indices have been calculated using the technique from (3) and (4).

The index  $\gamma$  is thus calculated as the ratio between the shares of tertiary graduates in the emigrant and in the sedentary population. Analogously,  $\lambda$  is estimated as the quotient between the shares of lower educated persons - counted as those who leave school after achieving the compulsory level of education - among emigrants and among the total population.  $\gamma$  and  $\lambda$  were calculated by using the INSSE data for emigrants and Barro-Lee estimates for the total population. The trend of the Barro-Lee estimates, adjusted to the values obtained from RIHS has been extrapolated: the observed ratio of tertiary graduates in the RIHS sample has been averaged with the ratio from the Barro-Lee data and then used for estimating the values of  $\gamma$  and  $\lambda$  for the missing years.

Table 8 presents the resulting values for both  $\gamma$  and  $\lambda$ , calculated first for the overall emigration flows. Secondly, Table 9 and Table 10 show the variation of respectively  $\gamma$  and  $\lambda$  across selected destinations.

As illustrated in Figure 3, for almost all of the observed destinations and years, the estimated values of  $\gamma$  lie clearly above the line  $\gamma = 1$ , i.e. the shares of tertiary graduates among emigrants exceeded the corresponding shares among the total population. Between

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<sup>28</sup>Particularly recent endogenous growth models emphasise the link between the number of university graduates and growth. For example, Romer (1990) suggests that societies with a larger stock of higher educated workers generate more innovations and grow faster, while Lucas' (1988) model implies that at steady state output and average human capital grow at the same rate.

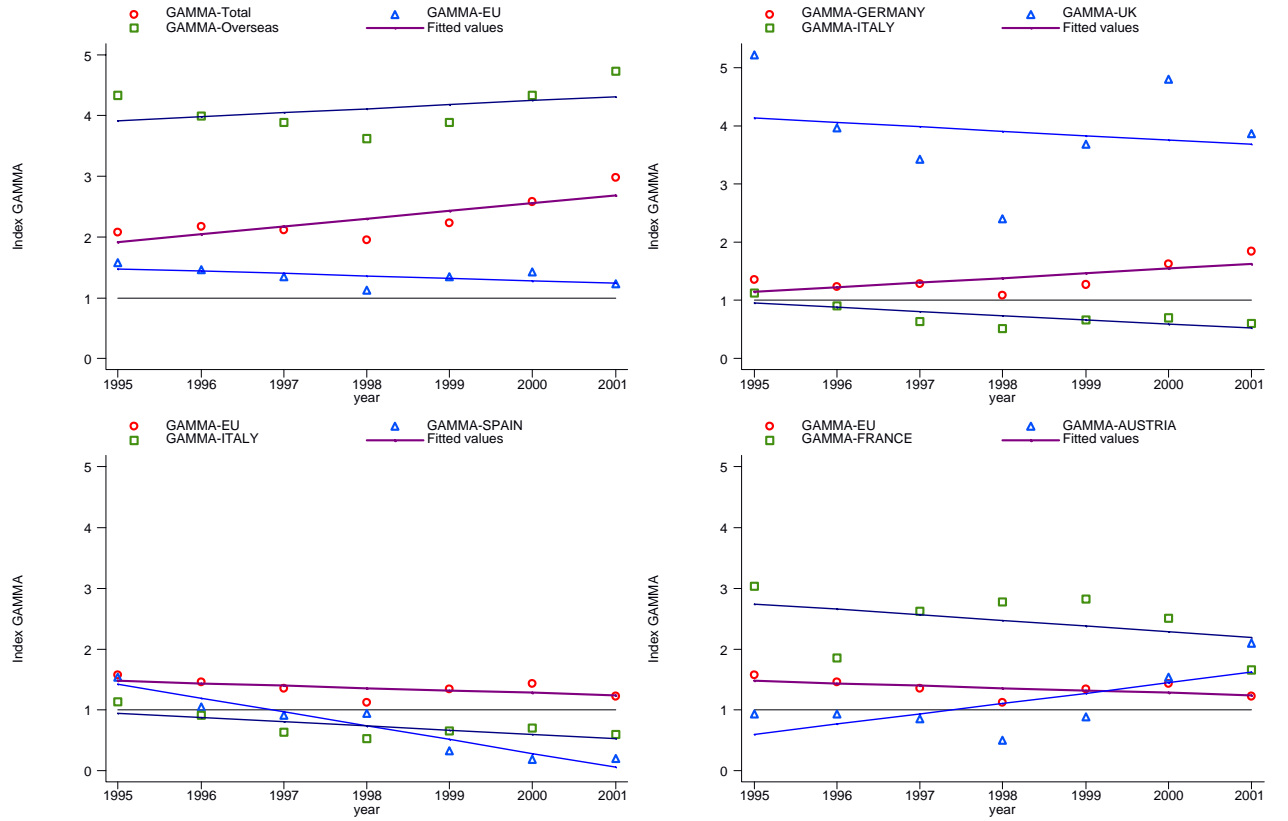


Figure 3: Values and trends of " $\gamma$ " for selected destinations

the destinations, exceptions are Italy, Spain and Austria, for which some values of  $\gamma$  are below 1: the values for Italy being constantly below 1, for Spain only after 1997, but declining<sup>29</sup>, whereas for Austria, the trend is upward and  $\gamma > 1$  for the last years observed.

The most striking feature of the time trends for  $\gamma$  remains however the large difference between the Overseas destinations and those belonging to the EU. The bulk of highly educated emigrants is clearly attracted by the US, Canada and Australia who encourage their immigration rather than by EU-countries, most of whom designed comparatively more restrictive immigration policies towards the highly skills. Whereas the trend for the Overseas destinations is constantly growing, the averaged  $\gamma$  for the EU-countries is slowly declining at a conspicuously lower level.

<sup>29</sup>For Spain, the fluctuations of  $\gamma$  are not as large as those of  $\psi$  but, given the small sub-sample of emigrants targeting Spain in the INSSE data, these values and the trend should be treated circumspectly.

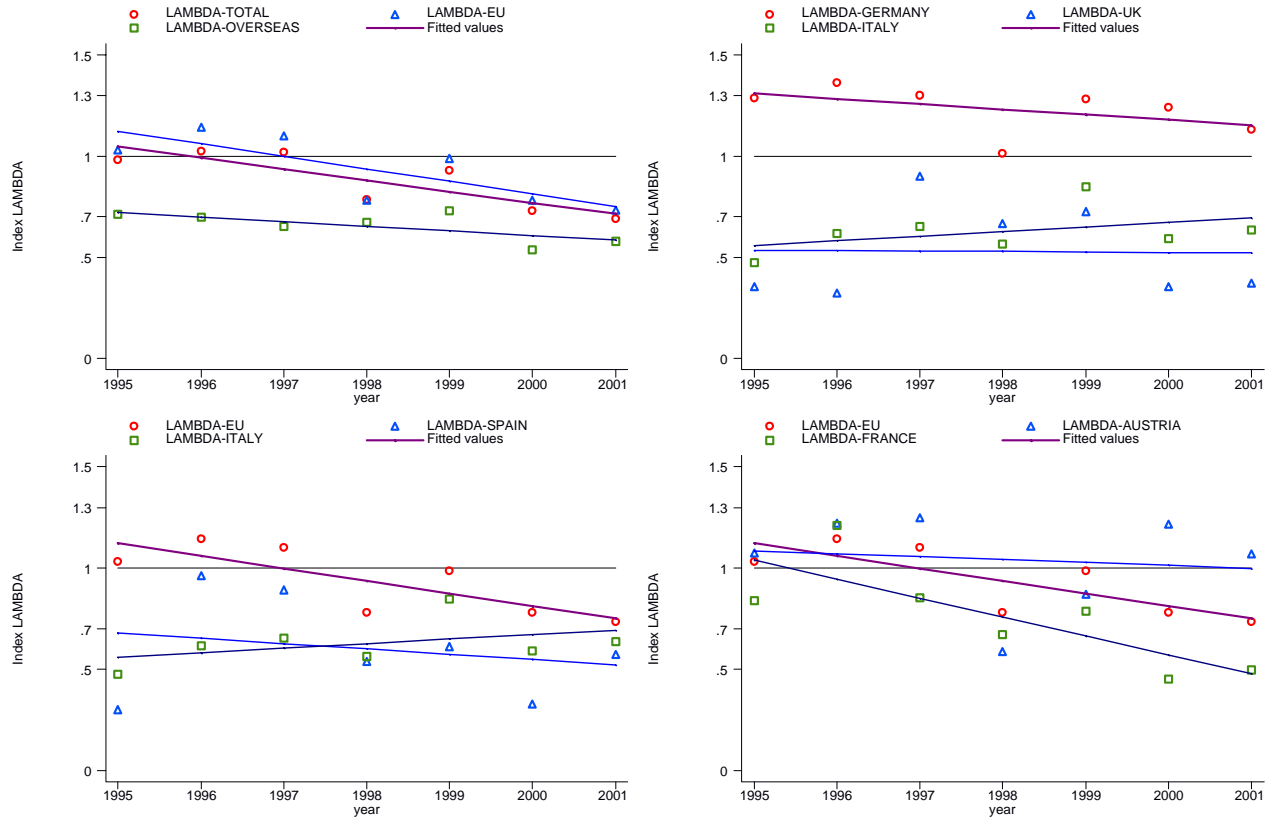


Figure 4: Values and trends of " $\lambda$ " for selected destinations

Among the EU member countries, France and the UK display values of  $\gamma$  clearly above the average. Germany, still an important EU destination country for Romanians but replaced as first destination by Italy, receives a similar share of tertiary graduates among its Romanian emigrants like the EU-average, but with a slightly positive trend.

Interestingly, there is a nontrivial obverse of the featured values of  $\gamma$ : the values of the complementary index  $\lambda$  show a different pattern than that expected to follow from the distribution of  $\gamma$ .

Figure 4 depicts the values of the index  $\lambda$  which are reported in Table 10 as well as the time trends for the main destinations of Romanian emigrants.  $\lambda$  measures the degree to which specific destinations have been the target of emigrants with lower educational attainment than the sedentary Romanians. This means that values of  $\lambda > 1$  imply a larger share of low educational attainment among the emigrants than in the total population. Therefore, one

would expect the values of  $\gamma$  and  $\lambda$  to display complementary courses: falling values of  $\lambda$  for destinations with growing values of  $\psi$ . This holds true for destinations like Overseas and UK - which seem to attract highly educated and to discourage low educated migrants - but not for all of the EU destinations. On the one side, prominently Germany and Austria show values higher than 1 for both  $\gamma$  and  $\lambda$ , i.e. appear to attract both higher and lower educated Romanian emigrants. On the other side, Italy and Spain display low and decreasing values for both  $\gamma$  and  $\lambda$ , i.e. the emigrants they received were rather average in terms of educational attainment.

### 4.3 Indices on the skill content of occupations

One alternative to take the above described polarisation of the human capital composition of outflows under closer scrutiny would be to address the occupational skills of emigrants.

For the indices  $\sigma$  and  $\zeta$  to be calculated like set up in the definitional equations (5) and (6), information on the occupations of emigrants has been extracted from the INSSE data. These include equivalent occupational categories to that of the International Standard Classification of Occupations (ISCO-88). The data on the occupations of emigrants have been matched subsequently with data on the occupational skills of the total population. For the years which were not covered by the RIHS, indicators on the distribution of occupational skills among the residents were constructed using data from the Romanian Labour Force Survey (LFS - AMIGO)<sup>30</sup>.

The index  $\sigma$  relates thus the ratio of highly skilled (ISCO-88 categories 1, 2 and 3, i.e. managers and senior officials, professional and, technicians and associate professionals) among the permanent emigrants to the ratio of highly skilled in the total population. Analogously,  $\zeta$  measures the quotient between the shares of low skilled emigrants (ISCO-88 categories 8 and 9, i.e. plant and machine operators and, elementary occupations) and the equivalent share of low skilled among the resident population.

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<sup>30</sup>The LSF-AMIGO is the single important source of inter-censuses information on the Romanian labour force. The data used in this study were yearly averages calculated on the basis of quarterly labour force surveys. More details on the data, as well as the descriptive statistics are available e.g. in INSSE (2002). For a comparative description of available sources for and main features of microeconomic data from CEE countries, see Filer and Hanousek (2002).

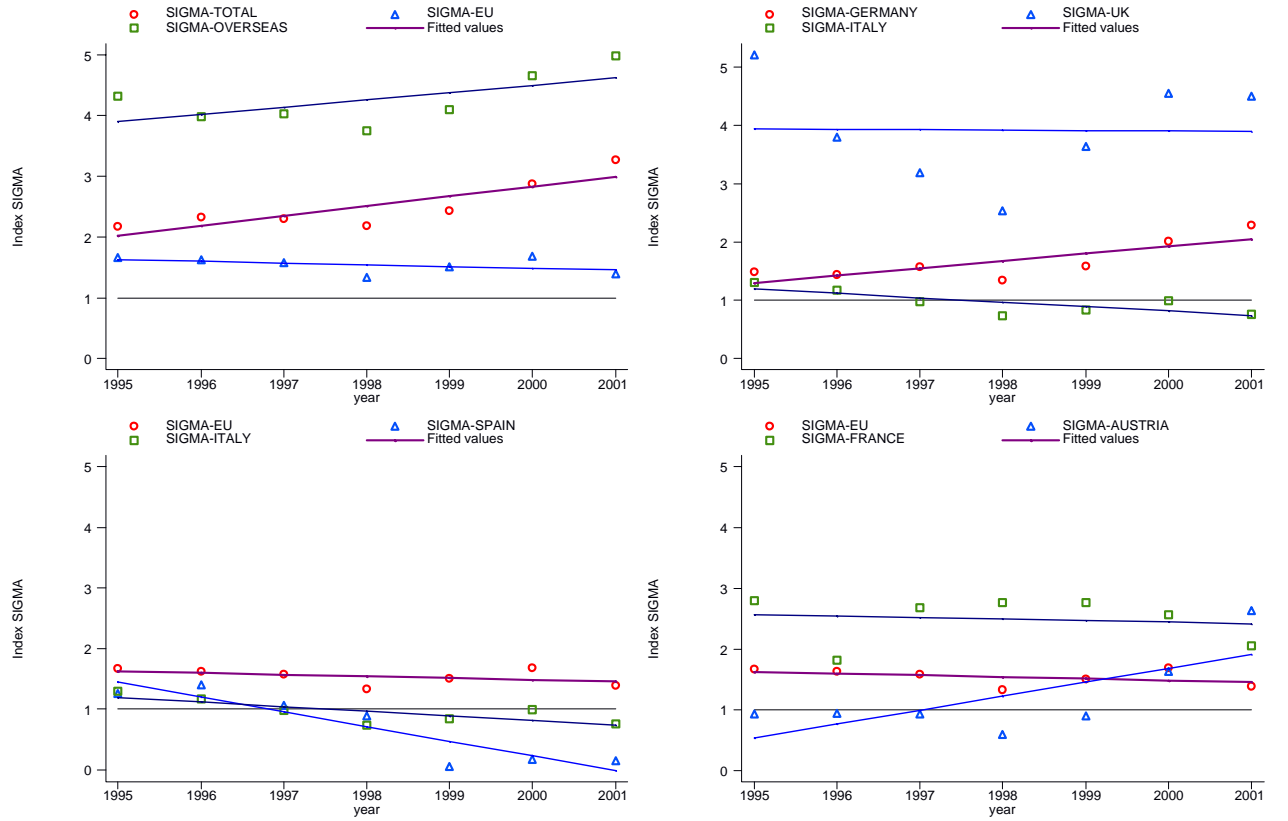


Figure 5: Values and trends of " $\sigma$ " for selected destinations

Table 11 presents the shares of highly and of lower skilled for both the emigrant and the total population as well as the corresponding values of  $\sigma$  and  $\zeta$  for the investigated years. Table 12 and Table 13 decompose then the  $\sigma$  and  $\zeta$  values, respectively, by the main destinations.

The pattern revealed is, as expected, very similar to that described by the indices on human capital ( $\psi$ ) and on the number of graduates. The differences between destinations appear however to be more pronounced in the case of  $\sigma$  and  $\zeta$  than for the other indices.

Figure 5 and Figure 6 illustrate the course of  $\sigma$  and  $\zeta$  values as well as the fitted time trends for the main destination countries.

The values of  $\sigma$  are almost identical to the values of  $\gamma$ , on the numbers of graduates, with a slightly faster growing distance between Overseas and the EU for  $\sigma$  than for  $\gamma$ .

The difference between overseas and European destinations appear even more stringent



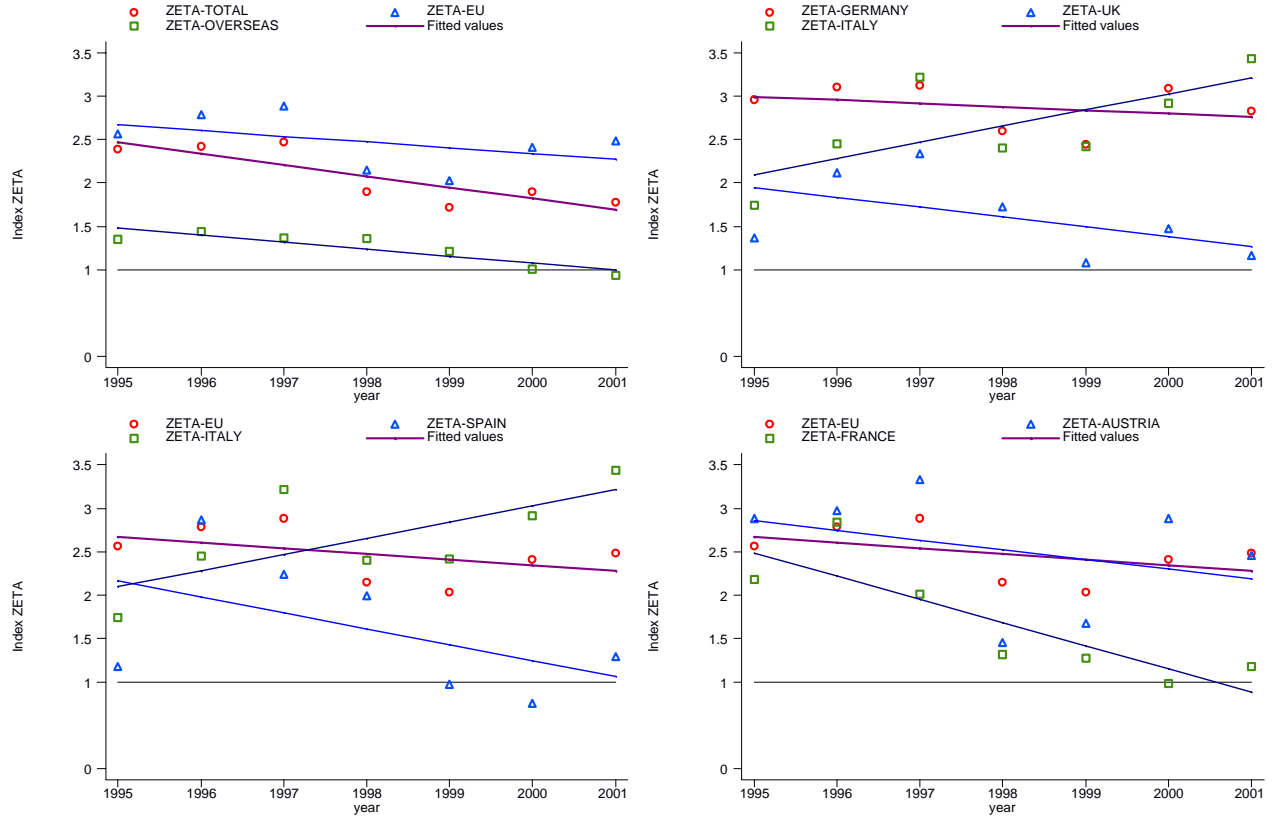


Figure 6: Values and trends of " $\zeta$ " for selected destinations

when looking at the values of the index  $\zeta$ . The values of  $\zeta$  for emigration flows towards overseas destinations are relatively small and clearly declining to values below 1, i.e., for this countries, the ratio of low skilled is smaller among the emigrants than in the total sedentary population. For the EU-average emigrants,  $\zeta$  is also declining but comparatively with a lower slope and almost twice as high values than those for overseas emigrants.

It is worth noting that Germany displays high values of both the  $\sigma$  and  $\zeta$  index over the whole period. This pattern is also confirmed by the German administrative data: compared to the German population, immigrants from Eastern Europe in general appear to have a much flatter distribution of skills than their native counterparts, i.e. more unskilled and, simultaneously, relatively more highly skilled workers.

The curves sketched in Figure 7 attempt to illustrate this polarisation of the skill distribution of emigrants in comparison to that of the total population. The thicker curve in

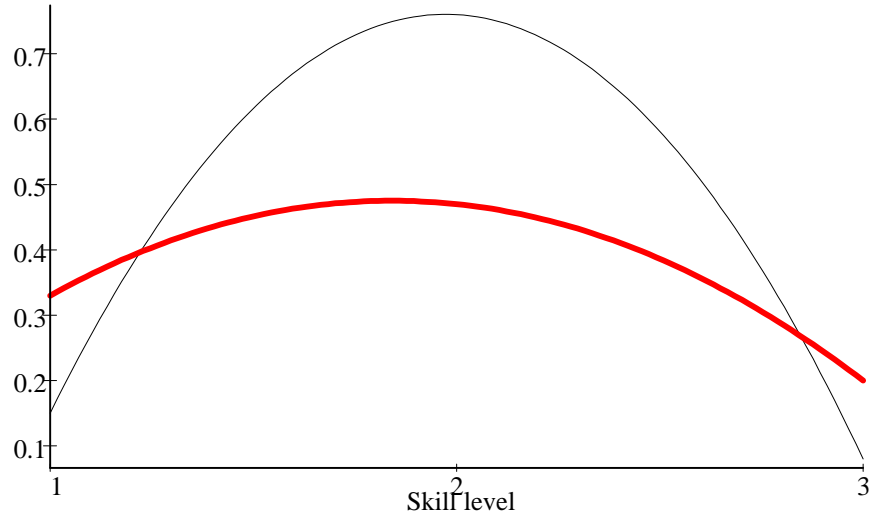


Figure 7: Skill densities (fitted) of the total population and of emigrants (1=low, 2=medium and 3=highly skilled; own estimation, averaged data 1998-2000)

Figure 7 represents the outlined density function for the skills of emigrants, the thin curve that for the total population.

The curves have been drawn such as they fit the probability values of the discrete skill distribution to a continuum of skills - between the lowest level (1) and the highest level (3) - for both the emigrants and the sedentary population. The values of the discrete distribution have been calculated as average for the period 1998-2000.

For concreteness, the ISCO-88 categories 1 to 3 and respectively 8 to 9 in the INSSE data for each of the years 1998-2000 have been averaged to obtain the probability values for respectively the lowest - defined as 1 - and the highest - defined as 3 - level of skills for the emigrants. The ISCO-88 categories in-between 3 and 8 were used for defining the medium level of skills - 2. Exactly the same technique has been used for the skill densities of the total population as depicted for LIS-RIHS and LSF-AMIGO data.

The shapes of the curves sketched in Figure 7 illustrate thus that the propensity to emigrate from Romania is as higher as closer one persons skill-level is to either the lower or the upper end of the skill-distribution.

## 4.4 Selectivity

The empirical specification used for estimating (12) and (13) is, as suggested by Mincer (1974), given by:

$$\begin{aligned} \ln y_{rom} = & \beta_{i_{rom}} \cdot \left( \sum_{i=1}^5 EDUCATION \right) + \beta_{6_{rom}} \cdot age + \beta_{7_{rom}} \cdot age^2 + \\ & + \beta_{(7+j)_{rom}} \cdot \left( \sum_{j=1}^5 OCCUPATION \right) + \beta_{(12+l)_{rom}} \cdot \left( \sum_{l=1}^2 GENDER \right) + k_{rom} \end{aligned} \quad (18)$$

for sedentary Romanians in Romania, and by:

$$\begin{aligned} \ln y_{ger} = & \beta_{i_{ger}} \cdot \left( \sum_{i=1}^5 EDUCATION \right) + \beta_{6_{ger}} \cdot age + \beta_{7_{ger}} \cdot age^2 + \\ & + \beta_{(7+j)_{ger}} \cdot \left( \sum_{j=1}^5 OCCUPATION \right) + \beta_{(12+l)_{ger}} \cdot \left( \sum_{l=1}^2 GENDER \right) + k_{ger}, \end{aligned} \quad (19)$$

for migrants in Germany.  $\ln y_{ger}$  and  $\ln y_{rom}$  are the logs of gross monthly wage earnings of sedentary Romanians in Romania and of migrants in Germany and, the dummies - written in capital letters - capture the occurrences of the categorical variables. For estimating the wage equations, the lowest values of the categorical variables were used to construct the reference groups, i.e. low educated male workers employed in occupations requiring the minimal level of skills (Blue Collar 1).

Both equations were estimated only on full-time employees, older than 25 and younger than 65. For estimating (18) employees belonging to ethnic minorities - about 10% in the LIS-RIHS samples -, which are arguably most likely to have different preferences over mobility than Romanians, were not included into the constructed sub-sample.

Given the censoring of wages, a Tobit model was used for estimating the equation (19). Although, for foreigners, there is no indication in the IABS data on the time spent in Germany, a variable has been generated to control for the time spent in the German labour market. This is used as a proxy for the date of arrival in Germany too. For the estimation, only those CEE-immigrants have been taken into consideration, who entered employment in

Germany during the year 1993 and, respectively, 1995.

One relatively strong assumption of this analysis is that the East-Europeans who entered employment in the German labour market in this period form a homogenous group with regard to the country of origin. Concretely, due to the anonymisation of individual data, it is not possible to distinguish between Romanians and other CEE-nationals in the IABS, like e.g. Bulgarians, Czechs, Hungarians and Slovaks. Therefore, the entire group of CEE-employees was assumed to be representative for the Romanians too. There is a double argumentation that make this assumption rather plausible. On the one side, as demonstrated by previous studies - e.g. Straubhaar and Wolburg (1999), Hönekopp (1999) - if workers from Poland, former Yugoslavia, Albania and, the successor states of the former USSR are exempt - as is the case in the IABS<sup>31</sup> - the differences between the remaining East-European nationality groups are rather small in terms of both occupational distribution and level of education. On the other side, the Romanians are the most populous group of newly entering the German labour market by the mid 90s<sup>32</sup>.

The results of estimating equations (18) and (19) are presented in Table 14 and Table 15. Further, using the estimated coefficients, the opportunity wages for sedentary Romanians, assuming they have moved to Germany, as well as for the migrants, assuming they have stayed, have been estimated following (14) and (15).

The differentials defined in (16) and (17) were calculated as:

$$\Delta_{ger} = \frac{\hat{\beta}_{ger} \cdot X_{rom} - \ln \hat{Y}_{ger}}{\ln \hat{Y}_{ger}} \cdot 100 \quad (20)$$

$$\Delta_{rom} = \frac{\hat{\beta}_{rom} \cdot X_{ger} - \ln Y_{rom}}{\ln Y_{rom}} \cdot 100 \quad (21)$$

whereby,  $\hat{\beta}_{ger}$  and  $\hat{\beta}_{rom}$  are the estimated coefficients of the wage equations for migrants in Germany and Romanians in Romania,  $X_{rom}$  and  $X_{ger}$  are the characteristics of Romanians in Romania and of migrants in Germany and,  $Y_{rom}$  and  $Y_{ger}$  are the wages of Romanians in Romania and of migrants in Germany.  $\hat{\beta}_{ger} \cdot X_{rom}$  and  $\hat{\beta}_{rom} \cdot X_{ger}$  represent thus the predicted

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<sup>31</sup>Ethnic Germans from Eastern Europe (Aussiedler) do not belong to the group of CEEs in the IABS, but to that of German nationals.

<sup>32</sup>See Hönekopp (1999), Dietz (2002).

wages of non-migrants assuming they moved to Germany and, respectively, the predicted wages of migrants, assuming they stayed in Romania. Given the censoring of wages in the IABS,  $\hat{Y}_{ger}$  is predicted using the Tobit estimates<sup>33</sup>.

The estimated values of (20) and (21) are presented in Table 16 for the total population and, separately, for selected categories.

The results demonstrate first that, with regard to their performance in Germany, migrants were positively selected, i.e. the non-migrants would have received on average lower wages, if they had migrated to Germany, than the actual migrants did:  $\Delta_{ger} < 0$ . As shown in Table 16, this positive selection indicator applies for almost all categories identifiable in the data. Exceptions are workers who either achieved a secondary level of education, or were older than 50 or, eventually, those employed in White Collar 2 jobs, i.e. high skilled professionals. This is an almost predictable outcome for basically two reasons. First, migrants belonging to the three named categories are the most likely to face relatively significant losses from migration regarding the returns to their human capital. For both the workers with a secondary level of education and those employed in higher skilled occupations, the formal qualifications acquired at home would be downgraded at least in the first years after migration due to the lacking transferability of their skills and the higher probability of "glass ceiling" or indirect discrimination of the type "equal pay to equal work, but unequal work". The same would obviously apply to migrants older than 50 years, who accumulated their occupational skills almost entirely under a centrally-planned regime. Second, and for similar reasons, these categories of workers are also relatively less deprived under the Romanian income distribution. The results of estimating the Romanian earnings functions in Table 14 and Table 15 apparently indicate that, for these groups, the remuneration of their skills is potentially much higher in Romania than in Germany.

Secondly, the results of predicting  $\Delta_{rom}$  would seemingly contradict the first finding. Since for the average population, as well as for almost all sub-groups, the predicted values of  $\Delta_{rom}$  are negative, migrants from Romania, assuming they had stayed immobile, would have earned less than the sedentary population. There are basically two explanations for why

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<sup>33</sup>A similar approach has been used by Bauer et al. (2002) for addressing the selection patterns of Portuguese migrants in the German labour market.

this negative differential ( $\Delta_{rom} < 0$ ) is not necessarily contradicting the positive selection hypothesis suggested by predicting  $\Delta_{ger}$ . The first one is related to the different return to the skill-mix possessed by emigrants, as opposed to that of non-migrants. Particularly since the estimates do not account for unobservable characteristics, a negative  $\Delta_{rom}$  could be due to unequal prices of the combination of human capital characteristics (observable and unobservable) rather than due to a lower level of human capital.

The second possible explanation for  $\Delta_{rom} < 0$  is related to the diverse distributions of skills among emigrants when compared to the sedentary population. For the subgroups taken into consideration in Table 16 - likewise for the whole samples - holding one characteristic as constant might well lead to a negative  $\Delta_{rom}$  if the remaining characteristics display differently skewed densities for emigrants as compared to non-migrants.

This would be then the case, when - given the relatively more polarised skills of emigrants (e.g. like in Figure 7) - for emigrants the skill densities will tend to be rather positively skewed, whereas non-migrants will display rather negatively skewed ones.

## 5 Conclusions

The empirical evidence brought out in this analysis shows that permanent emigration from Romania clearly induced a decrease of the per capita endowment with human capital. It also confirms the positive selection hypothesis for Romanian emigrants in the second half of the 1990s. Even under so strong an assumption as that of a homogenous group of East-European immigrant workers in Germany, the sketched selectivity analysis shows that Romanian emigrants are very likely to be positively selected, both with regard to observable and to unobservable characteristics. This is particularly the case when contemplating their performance in the German labour market: actual migrants perform clearly better in Germany than non-migrants would have done if they moved.

Despite these rather predictable findings, the results also sustain the view - depicted in other studies too<sup>34</sup> - that emigrant flows from Romania tended to polarise towards either the upper or the lower end of the human capital distribution. The brain-drain indices calculated

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<sup>34</sup>E.g. Diminescu, Lazaroiu (2002).

on grounds of educational attainment ( $\psi$ ) demonstrate a steady upward trend in the average education of emigrants (Figure 2). This is concomitant with growing ratios of higher educated ( $\gamma$  in Figure 3) and relatively stable ratios of lower educated emigrants ( $\lambda$  in Figure 4). The polarisation becomes even more striking when considering the indices based on occupational skills. E.g. Germany, one of the main European destination of Romanian migrants, receives flows characterised by large ratios of higher ( $\sigma$  in Figure 5) as well as lower skilled ( $\zeta$  in Figure 6) migrants. The Romanian emigrants tended thus to be either "highly skilled and highly motivated or, highly motivated" (Lazaroiu 2003).

However, when considering flows disaggregated by destinations, the patterns described become more differentiated. Most striking in the obtained values of the brain drain indices is the increasing difference between overseas and European destinations. The results leave little doubts that permanent emigrants targeting overseas destinations are on average increasingly higher skilled than thier counterparts who chose EU-countries as their destination.

The obtained results are limited to the case of permanent emigrants. Given the relatively lower probability of return migration, these are however the most relevant for an assessment of the Romanian brain-drain. Nevertheless, taking also temporary, circular, migrants into consideration might even sharpen the difference between overseas and European destinations. This is because the vast majority circular migrants targeting European countries - particularly "newer" destinations<sup>35</sup> like Italy, Spain, Portugal, or even Ireland - are relatively less trained.

With regard to a prospective EU-membership for Romania, and eventually granting the free movement for Romanian workers in the EU, two important questions remain largely open. First, how will the anticipated, and eventually the de-facto, free circulation affect the mobile livelihoods of both higher or less higher trained migrant workers? Second, will the free movement manage to divert some highly skilled flows, currently targeting overseas destinations, towards EU-countries?

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<sup>35</sup>Support for this provide Chiuri, De Arcangelis and Feri (2002), Chiuri and Feri (2001) from the receiving countries' perspective, as well as Diminescu and Lazaroiu (2002), Serban and Grigoras (2000) Potot (2000) using surveys or ethnographic evidence from the sending regions.

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# Appendix

## A Constructed data sets

Table 1: OBSERVED EMIGRANTS IN THE INSSE DATA

	1995	1996	1997	1998	1999	2000	2001
<i>Total</i>	<i>25675</i>	<i>21526</i>	<i>19945</i>	<i>17536</i>	<i>12594</i>	<i>14753</i>	<i>9921</i>
Austria	2276	915	1551	941	468	270	167
France	1438	2181	1143	846	696	809	463
Germany	9010	6467	5807	3899	2370	2216	854
Italy	2195	1640	1706	1877	1415	2142	1486
Spain	410	223	158	161	210	615	616
UK	257	209	109	137	128	152	74
<i>EU-15</i>	<i>17154</i>	<i>12998</i>	<i>11789</i>	<i>8947</i>	<i>6132</i>	<i>7162</i>	<i>4137</i>
<i>CEE-4</i>	<i>2612</i>	<i>1621</i>	<i>1327</i>	<i>1415</i>	<i>830</i>	<i>988</i>	<i>694</i>
US	2292	3181	2861	2868	2386	2723	1876
Canada	2286	2123	2331	1945	1626	2518	2483
Australia	136	165	207	206	124	143	79
<i>Overseas</i>	<i>4714</i>	<i>5469</i>	<i>5399</i>	<i>5019</i>	<i>4136</i>	<i>5384</i>	<i>4438</i>
Israel	316	418	554	563	326	433	279
Others	879	1020	876	1592	1170	786	373

CEE-4: Hungary, Bulgaria, Czech Republic, Poland

Overseas: US, Canada, Australia

Source: own aggregation, INSSE data

Table2: CONSTRUCTED DATA SET ON ROMANIAN EMIGRANTS

<i>Variables</i>	<i>Categories</i>
Country of destination	EU-15: each of the EU-member countries CEE: Hungary, Bulgaria, Poland, Czech Republic Overseas: US, Canada, Australia Israel, Others
Educational Attainment	University Vocational Secondary Low, compulsory
Occupations	Engineers, Architects Artists, Musicians Medical doctors, pharmacists Technicians, Foreman Professors, Teaching Other services Economists Unskilled workers
Age	25-55 years
Gender	Male Female
Ethnicity	Romanian Hungarian German Other
Region of origin	NUTS-3

Table 3: CONSTRUCTED DATA SET, LIS\_RIHS and IABS

<i>Variables</i>	<i>Categories</i>
Wage	gross monthly wages (ROL and, respectively DM)
Age	25-65
Gender	Male Female
Education	Low, compulsory Secondary University Vocational Pos-secondary
Occupation	Blue Collar1 (ISCO 7-9) Blue Collar2 (ISCO 5-6) White Collar1 (ISCO 3-4) White Collar2 (ISCO 2) White Collar3 (ISCO 1)
Years	1993-95 Romania N=20663 Germany N=718 1995-1997 Romania N=19851 Germany N=365

Table 4: SUMMARY STATISTICS, LIS-RIHS and IABS

	1993-95		1995-97	
	Romania	Germany	Romania	Germany
$\ln wage^*$	10.1416	4.5544	11.6005	4.5519
Education				
Low	21.42	47.49	13.75	46.28
Vocational	24.87	42.48	33.91	44.34
Secondary	32.88	3.69	31.45	3.24
Post-Sec.	7.99	0.79	8.39	0.32
University	12.84	5.54	12.50	5.83
Age	39.391	35.308	39.597	34.922
Occupation				
BlueCollar1	58.24	65.96	64.95	68.28
BlueCollar2	10.54	18.47	14.11	16.83
WhiteCollar1	19.46	7.39	10.88	7.77
WhiteCollar2	10.34	7.39	8.65	6.80
WhiteCollar3	1.43	0.79	1.41	0.32
Gender				
Female	42.16	30.08	43.15	30.42
Male	57.84	69.92	56.85	69.58
N	20663	718	19793	365

\* log monthly gross wages, in ROL for Romania and DM for Germany

## B Indices

Table 5: "Brain drain" indices based on years of schooling

Year	$h_t^E$	$h_t^P$	$\Delta_t^h = h_t^E - h_t^P$	$\psi_t$
1995	11.0321	9.375	1.6571	1.0954
1996	11.0800	9.402	1.6780	1.0966
1997	11.1529	9.429	1.7239	1.0994
1998	11.3665	9.456	1.9105	1.1108
1999	11.2936	9.483	1.8106	1.1047
2000	11.9165	9.510	2.4065	1.1415
2001	12.1050	9.537	2.5680	1.1517

Source: own calculation; INSSE, Barro-Lee and LIS-RIHS data

Table 6: Indices on years-of-schooling-differentials, by destinations

Year	$\Delta_{eu}^h$	$\Delta_{ger}^h$	$\Delta_{ita}^h$	$\Delta_{spa}^h$	$\Delta_{fra}^h$	$\Delta_{aus}^h$	$\Delta_{uk}^h$	$\Delta_{overseas}^h$
1995	1.4036	0.9647	2.4954	2.7805	2.1311	0.9449	3.7547	2.8190
1996	1.2858	0.8357	2.2310	1.3899	1.2826	0.8061	3.4371	2.7785
1997	1.3135	1.0269	1.9712	1.1832	2.0152	0.8571	2.4610	2.8570
1998	1.5401	1.1573	1.9006	1.8773	2.4894	0.8451	2.4282	2.7532
1999	1.3451	0.9789	1.4592	0.0836	2.2632	0.6523	2.7312	2.7645
2000	1.9353	1.4890	2.0794	0.9545	2.9164	1.3855	3.6900	3.3173
2001	1.8799	1.6644	1.8847	0.8486	2.4167	1.9017	3.5275	3.3408

Source: own calculation; INSSE, Barro-Lee and LIS-RIHS data

Table 7: Indices of "brain drain" based on years of schooling, by destinations

Year	$\psi_{eu}$	$\psi_{ger}$	$\psi_{ita}$	$\psi_{spa}$	$\psi_{fra}$	$\psi_{aus}$	$\psi_{uk}$	$\psi_{overseas}$
1995	1.0802	1.0544	1.1471	1.1652	1.1243	1.0533	1.2293	1.1677
1996	1.0732	1.0470	1.1305	1.0794	1.0730	1.0453	1.2080	1.1651
1997	1.0749	1.0581	1.1145	1.0672	1.1172	1.0482	1.1449	1.1701
1998	1.0884	1.0657	1.1101	1.1087	1.1467	1.0475	1.1428	1.1634
1999	1.0767	1.0553	1.0835	1.0046	1.1325	1.0365	1.1620	1.1642
2000	1.1123	1.0853	1.1211	1.0539	1.1739	1.0791	1.2250	1.2001
2001	1.1089	1.0958	1.1092	1.0477	1.1421	1.1102	1.2141	1.2017

Source: own calculation; INSSE, Barro-Lee and LIS-RIHS data

Table 8: "Brain drain" indices based on educational attainment

Year	$g_t^E$	$g_t^P$	$\gamma_t$	$l_t^E$	$l_t^P$	$\lambda_t$
1995	0.1642	0.079	2.0795	0.2378	0.242	0.9828
1996	0.1757	0.081	2.1702	0.2439	0.238	1.0249
1997	0.1753	0.083	2.1124	0.2295	0.234	1.0192
1998	0.1661	0.085	1.9542	0.1805	0.230	0.7852
1999	0.1945	0.087	2.2360	0.2100	0.226	0.9292
2000	0.2293	0.089	2.5772	0.1619	0.222	0.7294
2001	0.2709	0.091	2.9773	0.1507	0.218	0.6917

Source: own calculation; INSSE, Barro-Lee and LIS-RIHS data

Table 9: Emigration indices, high educational attainment by destinations

Year	$\gamma_{eu}$	$\gamma_{ger}$	$\gamma_{ita}$	$\gamma_{spa}$	$\gamma_{fra}$	$\gamma_{aus}$	$\gamma_{uk}$	$\gamma_{overseas}$
1995	1.5754	1.3529	1.1303	1.5436	3.0281	0.9343	5.2209	4.3366
1996	1.4617	1.2351	0.9108	1.0518	1.8566	0.9309	3.9577	3.9978
1997	1.3500	1.2884	0.6356	0.9150	2.6246	0.8544	3.4265	3.8873
1998	1.1216	1.0892	0.5202	0.9499	2.7812	0.5000	2.4044	3.6191
1999	1.3421	1.2755	0.6579	0.3284	2.8240	0.8841	3.6817	3.8851
2000	1.4323	1.6275	0.7029	0.1826	2.5138	1.5397	4.8048	4.3366
2001	1.2245	1.8400	0.5989	0.1962	1.6614	2.1056	3.8610	4.7293

Source: own calculation; INSSE, Barro-Lee and LIS-RIHS data

Table 10: Emigration indices, low educational attainment by destinations

Year	$\lambda_{eu}$	$\lambda_{ger}$	$\lambda_{ita}$	$\lambda_{spa}$	$\lambda_{fra}$	$\lambda_{aus}$	$\lambda_{uk}$	$\lambda_{overseas}$
1995	1.0317	1.2864	0.4744	0.3023	0.8390	1.0748	0.3537	0.7109
1996	1.1436	1.3643	0.6174	0.9609	1.2098	1.2214	0.3216	0.6960
1997	1.1012	1.2989	0.6538	0.8925	0.8524	1.2509	0.9017	0.6522
1998	0.7804	1.0136	0.5651	0.5401	0.6732	0.5867	0.6664	0.6722
1999	0.9878	1.2807	0.8474	0.6110	0.7883	0.8698	0.7259	0.7296
2000	0.7805	1.2419	0.5930	0.3295	0.4510	1.2178	0.3556	0.5362
2001	0.7340	1.1333	0.6359	0.5733	0.4953	1.0712	0.3719	0.5788

Source: own calculation; INSSE, Barro-Lee and LIS-RIHS data



Table 11: "Brain drain" indices based on occupational skills

Year	$s_t^E$	$s_t^P$	$\sigma_t$	$z_t^E$	$z_t^P$	$\zeta_t$
1995	0.1806	0.0829	2.1795	0.3673	0.1539	2.3867
1996	0.1931	0.0831	2.3238	0.3720	0.1535	2.4235
1997	0.1921	0.0833	2.3070	0.3777	0.1530	2.4688
1998	0.1820	0.0835	2.1806	0.2894	0.1525	1.8977
1999	0.2035	0.0837	2.4314	0.2611	0.1520	1.7181
2000	0.2413	0.0839	2.8769	0.2874	0.1515	1.8974
2001	0.2752	0.0841	3.2731	0.2676	0.1510	1.7722

Source: own calculation; INSSE, LFS-AMIGO and LIS-RIHS data

Table 12: Emigration indices, high occupational skills by destinations

Year	$\sigma_{eu}$	$\sigma_{ger}$	$\sigma_{ita}$	$\sigma_{spa}$	$\sigma_{fra}$	$\sigma_{aus}$	$\sigma_{uk}$	$\sigma_{overseas}$
1995	1.6665	1.4914	1.3024	1.2651	2.8017	0.9380	5.2099	4.3245
1996	1.6294	1.4365	1.1666	1.4030	1.8207	0.9469	3.8001	3.9782
1997	1.5619	1.5670	0.9781	1.0637	2.6887	0.9365	3.1939	4.0290
1998	1.3345	1.3422	0.7337	0.8926	2.7604	0.5981	2.5350	3.7438
1999	1.5060	1.5879	0.8358	0.0568	2.7637	0.8935	3.6402	4.0932
2000	1.6874	2.0062	0.9904	0.1744	2.5635	1.6333	4.5480	4.6533
2001	1.3891	2.2834	0.7601	0.1544	2.0545	2.6344	4.4991	4.9834

Source: own calculation; INSSE, LFS-AMIGO and LIS-RIHS data

Table 13: Emigration indices, high occupational skills by destinations

Year	$\zeta_{eu}$	$\zeta_{ger}$	$\zeta_{ita}$	$\zeta_{spa}$	$\zeta_{fra}$	$\zeta_{aus}$	$\zeta_{uk}$	$\zeta_{overseas}$
1995	2.5632	2.9560	1.7406	1.1727	2.1824	2.8834	1.3652	1.3466
1996	2.7861	3.1037	2.4509	2.8629	2.8436	2.9689	2.1196	1.4413
1997	2.9259	3.1222	3.2181	2.2338	2.0128	3.3332	2.3385	1.3643
1998	2.1503	2.6017	2.4035	1.9957	1.3176	1.4564	1.7231	1.3626
1999	2.0320	2.4455	2.4177	0.9711	1.2760	1.6728	1.0793	1.2104
2000	2.4118	3.0888	2.9151	0.7512	0.9790	2.8847	1.4764	1.0065
2001	2.4836	2.8304	3.4360	1.2901	1.1728	2.4586	1.1634	0.9371

Source: own calculation; INSSE, LFS-AMIGO and LIS-RIHS data

## C Wage equations

Table 14: WAGE EQUATIONS FOR 1993-95

	Romania			Germany		
	Coeff.	t-ratio	p< t	Coeff.	t-ratio	p< t
Education						
Vocational	.1986	13.85	0.000	.0822	2.34	0.020
Secondary	.3066	18.98	0.000	-.1477	-0.56	0.574
Post-Sec.	.4512	20.99	0.000	.0483	-0.03	0.973
University	.6221	17.71	0.000	.3274	3.42	0.001
Age	.0616	12.48	0.000	-.0001	0.58	0.559
Age <sup>2</sup>	-.001	-11.11	0.000	-.0000	-0.45	0.653
Occupation						
BlueCollar2	-.1677	-8.81	0.000	.0656	0.47	0.638
WhiteCollar1	.0693	3.96	0.000	.1996	3.13	0.002
WhiteCollar2	.1234	3.38	0.001	.1503	2.82	0.005
WhiteCollar3	.3278	7.84	0.000	.6431	4.65	0.000
Gender						
Female	-.4744	-28.42	0.000	-.1994	-5.39	0.000
Constant	8.9143	87.55	0.000	4.5447	2.16	0.031
R <sup>2</sup>		0.248				
Pseudo-R <sup>2</sup>					0.230	
N		20663			718	
Note1: Reference groups: low educated, male, BlueCollar1.						
Note2: pseudo-R <sup>2</sup> was calculated after McKlevey, Zavonia 1975.						

Table 15: WAGE EQUATIONS 1995-97

	Romania			Germany		
	Coeff.	t-ratio	p< t	Coeff.	t-ratio	p< t
Education						
Vocational	.2356	13.83	0.000	.1831	2.69	0.007
Secondary	.4066	21.05	0.000	.0472	0.12	0.906
Post-Sec.	.5599	22.00	0.000	-.0796	-1.12	0.262
University	.7329	17.98	0.000	.5499	6.01	0.000
Age	.0786	14.39	0.000	.0111	0.35	0.728
Age <sup>2</sup>	-.001	-12.86	0.000	-.0000	-0.21	0.832
Occupation						
BlueCollar2	-.1380	-7.68	0.000	.0276	0.32	0.751
WhiteCollar1	.0055	0.26	0.798	.2069	2.33	0.021
WhiteCollar2	.0404	0.96	0.335	.1065	2.43	0.016
WhiteCollar3	.3243	7.18	0.000	.8137	3.69	0.000
Gender						
Female	-.4339	-24.38	0.000	-.2274	-4.65	0.000
Constant	9.5432	84.65	0.000	4.1998	2.34	0.020
R <sup>2</sup>	0.232					
Pseudo-R <sup>2</sup>				0.315		
N	19851			365		
Note1: Reference groups: low educated, male, BlueCollar1.						
Note2: pseudo-R <sup>2</sup> was calculated after McKlevey, Zavonia 1975.						

## D Selectivity

Table 16: Predicted wage differentials between Romanian migrants and non-migrants

	1993-95		1995-97	
	$\Delta_{ger}$ Germany <sup>a</sup>	$\Delta_{rom}$ Romania <sup>b</sup>	$\Delta_{ger}$ Germany <sup>a</sup>	$\Delta_{rom}$ Romania <sup>b</sup>
Total	-.9164	-.7678	-1.7080	-.6667
Low Education	-1.006	.4956	1.5652	-.2055
Vocational	-.8967	.4106	-.05589	-.0357
Secondary	2.2198	-.4657	3.9528	-.7965
University	-.1647	-.1453	-2.6293	-.4883
Age under 35	-1.9347	-.8505	-1.9203	-1.3338
Age 35-50	-.5496	-.6466	-3.2735	-1.6505
Age above 50	.5771	-.6634	-2.6548	-1.0921
Blue Collar1	-1.5046	-.5323	-1.4500	-.9249
Blue Collar2	-3.1021	1.6556	-2.4796	-.7460
White Collar1	-3.6738	-.9252	-3.9605	-1.7451
White Collar2	3.5371	-1.736	-4.8328	-2.936
White Collar3	-1.8507	.1013	-5.9171	-3.4155
Female	-1.0511	-.7183	-1.1634	-1.6690
Male	-.1163	-1.075	-1.1149	-1.4415

Notes:

<sup>a</sup> predicted wages in Germany for Romanian nonmigrants (assuming they've moved) minus those of CEE migrants already in Germany.

<sup>b</sup> predicted wages in Romania for Romanian migrants (assuming they've stayed) minus those of sedentary Romanians.

All numbers are expressed as percentage of mean predicted log-wages for Romanian workers in Germany and Romania respectively.

Source: own calculation, LIS-RIHS and IABS data