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Emigration and development.

What are the links?

Marina Murat[1]

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[1] University of Modena and Reggio Emilia and
RECent, Research Centre for Economics
Address: Viale Berengario 51, 41121, Modena, Italy
Email: marina.murat@unimore.it

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Emigration and development. What are the links?

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Abstract. The 'mobility transition' hypothesis – with emigration first increasing and then decreasing as a country develops – (Zelinsky, 1971) is often interpreted as a stylised fact, which bears the implication that immigration into rich countries will grow as low-income countries develop. This paper tests the relationships between development and emigration from 130 developing countries during 25 years. Results, robust to different semiparametric and parametric specifications, show that emigration from low to middle-income countries declines as income increases, education improves or population growth slows down. The stage of development at home affects the main destinations of emigration. Immigration into rich economies increases from countries at intermediate levels of development. Policies supporting development in low-income countries reduce emigration, including that to rich economies.

JEL classification: F22, J11, O11

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* Corresponding author. Dipartimento di Economia 'Marco Biagi', Università di Modena e Reggio Emilia. Viale Berengario 51, Modena 41121, Italy. marina.murat@unimore.it. +390592056884. Skype: marina.murat. ORCID 0000-0002-5212-8626. I thank Clementina Crocè for her excellent work during the initial stage of this research. I also thank the participants at the 10th international conference on Economics of Global Interactions, Bari (Italy), September 2019 at the SIE 60ª RSA Conference at the University of Palermo, October 2019, and Marcel Smolka for useful suggestions.

1. Introduction

The recent public and academic debate on migration has increasingly focused on the 'mobility transition' hypothesis, which states that emigration rises during the first stages of development of countries and decreases afterwards. To it is related the prediction the immigration in Western countries will continue to grow as low-income countries develop. Despite the hypothesis lacks a strong empirical support, it tends to be widely accepted as a stylized fact (Clemens and Sandefur, 2015).

Some empirical studies using cross-sectional data that take income as a proxy of development find a bell-shaped relationship between income and emigration (a review is in Clemens, 2014), but the relationship fades in other investigations, based on different samples, econometric specifications or covariates (Hatton and Williamson, 2005; Lucas, 2006; Mayda 2010; Ortega and Peri, 2013; Hanson and McIntosh; 2016 Dao et al. 2018a). Overall, the results reached in these studies appear to be strongly related to the ways in which the links between emigration and development are defined and measured. Hence, starting from these approaches, this paper uses a wide dataset and different specifications to shed light on the links between emigration and development by. It aims at proving a unified and robust framework on this topic, which has important implications both for developing countries, rich economies and international policies.

During the second part of last century, the search of potential links between development and emigration was mostly based on the then scarce available data regarding demographic movements within or between countries. A frequently cited author, Zelinsky (1971), observed that internal and international migration appeared to increase during the early stages of development, to pause at mid-levels and decrease afterwards. He linked this bell-shaped relationship to a demographic mobility transition: the modernization of economies and societies initially was followed by increased birth rates and lower mortality, but after a certain stage of development, birth rates started to decrease, and the decrease was more rapid than the fall in mortality. Later, Hatton and Williamson (1994) also explained mass emigration from Europe with development and population changes in the home countries. In this

interpretation, the relationship between emigration and development was mainly driven by demography and education: industrialization led to population growth, which glutted labour markets and boosted geographical mobility, but industrialization also implied improvements in education, which had negative effects on birth rates. Then, lower population growth rates and the improved economic conditions at home associated with industrialization weakened the incentives to emigrate.

In more recent times, the transition mobility hypothesis is interpreted as a direct relationship between emigration and income rather than between emigration and the composite phenomenon of development, of which income is one but not the only component. In this interpretation, it is assumed that higher income in poor countries allows previously resource-constrained individuals to afford the costs of moving abroad, and therefore boosts emigration (a comprehensive review is in Clemens, 2014). However, a weakness of this assumption is that while it can justify the upward sloping part of an inverted-U path relating emigration and income, it does not provide an explanation for the peak and subsequent downward-sloping parts. Moreover, it omits the other potential effect of higher income at home, which is that it is for individuals an important reason to remain. This second potential consequence of income growth, together with the nonlinear effects of the other forces of development, may help to explain why the mobility transition hypothesis is not robustly supported by the empirical evidence.

This paper uses a dataset comprising emigration from 130 developing countries from 1991 to 2015. Following Zelinsky (1971), Hatton and Williamson (1994) and other studies, income, education, demography and their interactions are taken as indicators of countries' development levels. Preliminary, non-parametric tests show that emigration from countries having the same levels of income can follow entirely different and even opposite paths. In further, semi-parametric and parametric regressions, comprising education, population growth and several control variables, I find the relationship between emigration and income to be U-shaped from low to middle income levels, and to become bell-shaped only at higher levels of income. However, only the initial, descending part,

is robust to all specifications. Moreover, the relationship between emigration and income shifts with countries' education levels and population growth rates. The minimum turning points of the initial U-shaped paths occur at per capita income levels ranging from 1,400 $US (here and hereafter, US$ constant 2011) – in coincidence with low education and rapid population growth – to 2,200$US – with higher education and lower population growth –. Similarly, maximum turning points occur at income levels ranging from 10,400$ to 22,000$. Furthermore, I find that migration to developed economies increases from countries at middle levels of development. The rest of the paper is structured as follows. Section 2 summarizes previous studies; Section 3 presents the data and some initial results; Section 4 presents and discusses estimations findings; Section 5 focuses on emigration to developed economies. Section 6 concludes.

2. Literature.

According to the neoclassical model, with everything else given, emigration is driven by the difference in average income between destination and origin countries. Empirical evidence supporting the prediction of the negative relationship between emigration and income at home is provided, among others, in Hatton and Williamson (2005), Mayda (2010), Grogger and Hanson (2011), Ortega and Peri (2013), while results supporting the positive links with income abroad are in Hartog and Vriend (1989), Katseli and Glystos (1989), Lundborg (1991), Bauer and Zimmermann (1998).

Differently from the neoclassical model, the 'mobility transition' hypothesis (Zelinsky, 1971) links emigration to demographic changes in the home country driven by modernization and industrialization. In it, the extra availability of resources determined by modernization initially leads to an acceleration of population growth, to a consequent scarcity of resources in the countryside, and, consequently, to an increase in the number of people searching for job opportunities in the cities and abroad. Information about other locations prompts a self-sustaining and accelerating process of people's mobility from less advanced to more advanced regions and countries. At later stages of modernization, fertility declines, migration to more advanced locations ceases and eventually the

country becomes itself a magnet for immigration. In Hatton and Williamson (1994), the European mass emigration of past centuries follows a similar pattern. It increases in the early stages of industrialization, but industrialization leads to more education, which has a negative effect on fertility and, after a certain point, on emigration. Faini and Venturini (1993), focus on emigration from Southern Europe and particularly Italy. They find that mass emigration from the mid nineteenth century increased with income growth, to decrease, in the second part of the twentieth century, when Italy reached middle-income levels.

Other studies find that European mass emigrations from the second half of the nineteenth century were driven by technological progress through dramatic increases in global trade, and not just changes in demography. Cheap imports from distant regions of the world substituted agricultural products in big areas of Western Europe, pushing huge numbers of people out from the countryside and, in many cases, from the home countries. Lower transport costs made transcontinental migration easier (Baines, 1992). On the other hand, the spread of industrialization created job opportunities at home and weakened the incentives to emigrate from the regions where it arrived earlier. In the areas of Europe where industrialization arrived late, such as Ireland, the south of Italy or parts of Scandinavia –especially Sweden –, emigration movements continued to be subject to global competition on agricultural products. In years of bad crops, famine, or abundant crops in foreign countries and low agricultural prices, departures increased substantially (Lowell, 1987; Hatton and Williamson, 1997). Partly contradicting the thesis of a bell-shaped relationship between income and emigration from Italy, Faini and Venturini (1993) and Del Boca and Venturini (2005) find that emigration flows from the poorer and less developed regions in the South of the country lasted much longer than those from the rapidly industrializing regions of the North.

Recent studies that test the links of emigration with income, rather than with development, find inverted-U relationships between the two variables when considering between-countries variations (Martin and Taylor,1996; de Haas 2007, 2010, 2011; Vogler and Rotte, 2000; Clemens, 2014). These

relationships tend to become weaker, non-significant or even negative, when the tests include within-country variations and control for several cofactors (Dao et al. 2018a, 2018b; Ortega and Peri, 2013, Murat, 2020). However, despite this lack of robustness, an inverted-U relationship between emigration and income it is often taken as a stylized fact, from which follows the prediction of strong immigration into rich countries as poor economies grow (Clemens and Sandefur, 2015).

3. Data and descriptive statistics

3.1 Data.

The dataset comprises 130 developing countries and 25 years, from 1991 and 2015. Emigrant data are extracted from the United Nations Department of Economic and Social Affairs – Population Division. Since figures are available every 5 years, missing observations from each country have been imputed by taking the averages of the two nearest available figures. United Nations data comprise both overall and refugee emigration. In order to have a better proxy of net emigration, I have subtracted the number of refugees from the overall figure in each country-year. The emigrant rate is the stock of emigrants divided by the population of the origin country.[1] The proportion of emigrants moving to either developing or developed countries is the percentage of total emigrants from the origin country moving to each type of destination each year; these percentages are computed from UN data on emigration. A complete list of variables and sources is in Table A1.

3.2 Emigration and income. Preliminary evidence.

To gauge the relationship between emigration and income, I first consider nonparametric estimations based on between-country variations; subsequently, in the next Sections, I include more complete estimation specifications. Figure 1 depicts the relationship between emigration and per capita

[1] In Dao et al. (2018a) the emigration rate corresponds to the changes in emigrant stocks between 2000 and 2010 as a percentage of the resident population in 2000. Since the resident population may also vary between periods, I adopt the emigrant stock/population indicator, where numerator and denominator vary with time. A similar indicator is in Clemens (2014). Data on bilateral migrant flows would be also useful for this research, but its availability is limited to few countries.

income in the home country as a cross-section, with the values of the two variables in each country averaged over the period considered. Results show that the correlation between emigration and income is negative at very low income levels and afterwards approximates an inverted-U curve, but loses significance as income increases. This pattern roughly replicates findings of above cited studies on the emigration-income relationship (among them, de Haas 2007, 2010a, 2010b; Clemens, 2014; Dao et al. 2018a). The turning point in Figure 1 corresponds to an average income level of about 6,600 PPP US$ (2011)[2] (the average incomes of countries such as Albania, Indonesia, Paraguay, during the period considered). I find approximately the same value if I use per capita GDP rather that its natural log transformation and the variation of the emigrant stock ($Emigration\ stock_t - Emigration\ stock_{t-j})/Population_{t-j}$, as in Dao et al. (2018a), while I find a slightly higher value if I use the level of per capita GPD and the *Emigration stock/ Population* rate, as in Clemens (2014). Figures A1 and A2 in the Appendix depict both paths.[3]

Figure 2 presents the results of a different nonparametric specification, which concerns the relationship between changes in emigration and changes in income considered at five-year intervals. It allows to check whether the cross-section specification can be omitting important constant (or slowly changing) factors that affect both variables. As Figure 2 clearly shows, moderate increases in income are correlated with negative changes in emigration, while there is no significant correlation for wider income expansions (at the right of Figure 2). Hence, strong income increases and emigration variations can be negatively related and, more generally, the bell-shaped relationship between the two variables of Figure 1 can be spurious.

Observing the relationships between emigration and income disaggregated at the country level is also useful. Figure 3 depicts the non-parametric estimations of the correlations between emigration

[2] All figures in the paper regarding $US are $US 2011 PPP.

[3] Partly because of the lower availability of data from low-income countries, especially in the initial years of the period considered, I find the relationship between emigration and income to be less significant at very low levels of income. Dao et al (2018a) exclude countries with an average income below a certain threshold and at war while, as Clemens (2014) and other authors, they include developed countries.

and income run country by country.[4] The picture clearly evidences that emigration paths from countries with the same income levels can differ substantially. Moreover, while at low-income levels they tend to be downward-sloping – emigration decreases as income increases–, at higher income levels they show a higher heterogeneity: some paths are upward-sloping and others decreasing.

It is interesting to note that the left side of Figure 3 (as well as that of Figure 1) comprises many countries of Sub-Saharan Africa, while the right side includes several middle-income economies of Eastern Europe and of the former Soviet Union. Among low-income countries, a bell-shaped relationship in Rwanda might seem to support to the mobility transition hypothesis, but emigration from the country grew rapidly during war years, to decrease also rapidly afterwards. Emigration movements from Liberia, Mozambique, Burkina Faso, Central African Republic, Ethiopia, and other low-income countries are negatively correlated with income. The correlation is also negative in countries, such as Côte d'Ivoire, Gabon, Madagascar, Niger, Venezuela, Zimbabwe, where income contractions are accompanied by higher emigration. A distinct case is China, where an extremely high growth of income is accompanied by a substantially flat emigration rate. Among middle-income countries, emigration rates from Armenia, Bosnia, Albania, Kazakhstan are positively and strongly correlated with income, while those from Montenegro, Belarus, Azerbaijan, Turkmenistan, Uzbekistan are negatively correlated with it. This further suggests that unobserved omitted cofactors, which can be both time-invariant and time-varying, can be affecting the links between income and emigration. Together with income, other development indicators and cofactors are considered in the next Sections.

4. Emigration and development. Semiparametric and parametric estimations.

The results of Figures 1, 2 and 3 suggest that income alone would be a poor predictor of any potential relationship between emigration and development. The following specifications comprise

[4] Since time is not depicted, the paths of countries where income varied less during the 25 years considered are shorter, and vice versa.

further proxies of development – such as education and population growth– and their interactions, and controls for variables frequently used in the empirical literature on emigration.

4.1. Semiparametric estimation

I start from a semiparametric specification with countries fixed effects, based on Robinson (1988) and Verardi and Debarsy (2012), where *ln pcGDP* is the nonparametric component:

$$\begin{aligned}(Emigrant\ stock/Population)_{it} = {} & f(ln\ pcGDP_{it}) + \beta_1 School\ life\ expectancy_{it} + \\ & \beta_2 Population\ growth_{it} + \beta_3 (School\ life\ expectancy * Population\ growth)_{it} + \\ & \beta_4 Political\ terror_{it} + \beta_5 Unemployment_{it} + \beta_6 Inequality_{it} + \beta_7 Passport\ power_{it} + \\ & \beta_8 Climate\ change_{it} + \alpha_t + a_i + \varepsilon_{it}\end{aligned} \quad (1)$$

where $(Emigrant\ stock/Population)_{it}$ is the emigrant outward stock into the rest of the world from country *i* at time *t* – net of the corresponding refugee outward stock – divided by country *i*'s *Population* (number of people residing in country *i*) at time *t*; $f(ln\ pcGDP_{it})$ is a nonparametric function of the natural log of per capita GDP. No hypothesis is made on the form of $f(ln\ pcGDP_{it})$. *School life expectancy* is the expected years of schooling of the country's population. Its relation with emigration is not signed a priori; higher average levels of education may facilitate the emigration to developed countries (Dao et al. 2018a), but can also be associated with more skilled jobs at home and weaken the incentives to emigrate. Also, as seen above, education can be associated with lower fertility rates. The rate of *Population growth* should be positively correlated with emigration (Dao et al., 2018b), but the sign of the interaction between education and the population growth rate, *School life expectancy*Population growth*, is expected to be negative (Hatton and Williamson 1994). *Political terror*, an ordinal variable that varies from one to five – with five being the highest level of political terror – and a proxy for various factors concerning conflict, political unrest and war, should boost emigration, but its sign could be negative if the unrest impedes leaving the country (in Hatton, 2009, and Hatton, 2016, political terror strongly affects refugee emigration, but it can also be expected to

influence the emigration of people who do not apply for refugee status). The coefficient on the rate of *Unemployment* is expected to be positive. *Passport power*, the number of visa-free destinations that people from the origin country can freely access, is a proxy of the political, institutional, and economic links of the home country with foreign economies; stronger links should facilitate emigration.[5] The Gini index, *Inequality*, is used as a proxy of the country's degree of uneven income distribution, which is expected to be positively correlated with emigration (Katarzyna and Kliber, 2018). *Climate change,* measured as the deviation between the country's annual temperatures during the period considered and the averages during years 1901-24, is expected to encourage emigration (Coniglio and Pesce, 2015; Cattaneo and Peri, 2016; Beine and Parsons, 2017, Burzynski et al. 2019). α_t are time dummies and α_i are country effects; ε_{it} is the error term.

4.2. Results of semiparametric estimations.

Figures 4.a to 4.d depict the patterns of the emigration-income relationship resulting from the semiparametric regressions of equation (1), while the coefficients on cofactors are in Table 1. To save space, the coefficients related to Figures 4.a and 4.b, concerning country and country and time effects respectively, are not reported in Table 1. In it, column (1) comprises all cofactors plus time and country effects and is related to the emigration-income path of Figure 4.c; column (2) includes also the interaction between the variables *School life expectancy* and *Population growth* and is associated to Figure 4.d. Overall, the sequence in Figures from 4.a to 4.d, show that the correlation between emigration and income is always decreasing at low-income levels, and that, depending on the controls included into the regression, it can be flat or slightly bell-shaped at middle-income levels. Hence, the emigration-income relationship follows a sinusoidal path, where the U-shaped part is robust to the inclusion of the various cofactors, while the flat or bell-shaped part is not.

[5] Visas and passport power concern short-term travel, but they appear to be correlated with permanent migration in Mau et al. (2015), Czaika and de Haas (2017), Neumayer (2006).

Most coefficients in the parametric part of the regressions (columns 1 and 2, Table 1) have the expected signs. Among them, the country's international links with other economies, measured by *Passport power*, are strongly, positively and significantly correlated with emigration.[6] The coefficient on *School life expectancy* in column (1) is negative although non-significant, and, as expected, the coefficient of the interaction between the variable and population growth is negative and significant (column 2, Table 1). Hence, schooling can be associated with emigration directly, and indirectly through its negative association with the expansion of the country's population.

4.3. Parametric estimation

Further tests based on full parametric specifications are useful to check for the robustness of results and gain a deeper understanding of the interactions among the three proxies of development used in this study: income, education and demographics. Hence, in what follows I use a specification that comprises the income variable among the parametric regressors. The sinusoidal shape of the emigration-income correlation in Figures 4.a to 4.d suggests the inclusion of income into the equation as a third-degree polynomial. Moreover, since the literature on economic growth hypothesises a positive relationship between education and income, the specification includes the interaction between these two variables and, as above, that between schooling and population growth.

$$\begin{aligned} \textit{Emigrant stock/Population}_{it} = {} & \alpha_1 \textit{ln pcGDP}_{it} + \alpha_2(\textit{ln pcGDP}_{it})^2 + \alpha_3(\textit{ln pcGDP}_{it})^3 + \alpha_4((\textit{ln pcGDP}_{it})*\textit{School life expectancy}) + \alpha_5((\textit{ln pcGDP}_{it})^2*\textit{School life expectancy}) + \alpha_6((\textit{ln pcGDP}_{it})^3*\textit{School life expectancy}) + \beta_1 \textit{School life expectancy}_{it} + \beta_2 \textit{Population growth}_{it} + \beta_3(\textit{Population growth}*\textit{School life} \end{aligned} \quad (2)$$

[6] Potential endogeneity can make the coefficient on *Passport power* to be underestimated. Travel restrictions implemented by a country with respect to a specific foreign country are likely to deter immigration originating from the latter, but also overall emigration from it, and temporary and return migration. Czaika and de Hass (2017), find a detrimental effect of visa restrictions on permanent and circular migration. The opposite applies to travel liberalization.

$$expectancy)_{it} + \beta_4 Political\ terror_{it} + \beta_5 Unemployment_{it} + \beta_6 Inequality_{it} + \beta_7 Passport\ power_{it} + \beta_8 Climate\ change_{it} + \alpha_t + \alpha_i + \varepsilon_{it}$$

4.4. Results of parametric estimations

Columns (3) and (4) of Table 1 show that all coefficients on income are significant and have the expected signs; moreover, post estimation *t*-tests confirm the correctness of the polynomial specification. The predicted emigration-income paths resulting from the parametric regressions in columns (3) and (4) are in Figures 4.e and 4.f. As above, they are decreasing at low-income levels and, more neatly than in the semiparametric specifications, they increase and become bell-shaped at middle-income-levels. A comparison across specifications, from Figure 4.a to 4.f, evidences an overall uniformity of decreasing or U-shaped paths at low-income levels, and differences at higher income levels, regarding both the shapes of the curves and their significance. It can be also observed that minimum turning points occur at income levels ranging from 1,400$ (Figure 4.d) to 2,000$ US (Figure 4.f), while the maxima range between 18,000$ and 20,000$ in Figures 4.e and 4.f, but are undefined in the semiparametric specifications, from Figures 4.a to 4.d.

The coefficients on cofactors in the parametric regressions (columns 3 and 4, Table 1) are very similar to those in the semi-parametric tests (columns 1 and 2). The direct relationship between School *life expectancy* and emigration is the same of column (1), but now is significant (column 3). Higher education levels in the origin country are associated with less emigration. The levels of significance on *Political terror* and *Gini index* are higher in columns (3) and (4) than in the semiparametric regressions, while the positive and significant coefficients on *Passport power* are about the same in both specifications. The coefficients of the interactions between income and education are non-significant, but the negative coefficient on the interaction between *School life expectancy* and *Population growth* (column 4) is significant and similar to that in column (2). Higher education at home is also associated with lower population growth. Hence, education is negatively linked with emigration, both directly and indirectly, through a slower population expansion. This confirms the

overall robustness of results. Other robustness controls have been accomplished by running regressions that include another climate change indicator – built as the deviations between the country's annual rains with respect to the corresponding averages during years 1901-24 –, and the number of people affected by natural disasters (Naudé, 2010; Neumayer, 2005). In both cases, results were non-significant.

4.5 Emigration and development indicators. Simulations.

Results above show that the relationships between emigration and the main development indicators, such as income, education and population growth, are non-linear. Hence, it can be useful to consider how the migration-income relationships vary when education and population growth take different values. In Figure 5, emigration-income paths vary with *School life expectancy* and *Population growth* computed at different levels. Simulations are based on the coefficients of regression of column 4 in Table 1. Specifically, in Figures 5.a, b and c, population growth rates are computed at 2.6 percent, 1.6 percent and 0.6 percent, respectively. At the same time, in each Figure 5.a to 5.c, *School life expectancy* is computed at six, nine and 12 years. The values chosen for the simulations on population growth are centred around the sample mean rate, which is about of 1.6 percent (while the average rate of Sub-Saharan countries of 2.6 percent). On the other hand, the values chosen for the simulations on education levels are roughly centred on the mean value of school life expectancy in our sample, which is of 9.5 years. The mean values of these variables in different world regions are in Table A3, in the Appendix.

Figure 5 clearly shows that with low rates of population growth (typically associated with development reaching middle and upper levels), the U-shaped part of the emigration-income path — expands and shifts down, while the bell-shaped right side shrinks and shifts to the right (Figures 5.a to 5.c). Hence, with slower demographics, the relationship between emigration and income, which is negative at low income levels, remains negative along a longer range of levels of income. For example,

given a population growth rate of 2.6 percent (Figure 5.a) and a level of expected education of nine years, an increase in income from 1,400$ to 1,800$ is associated with a rate of emigration (*Emigrant stock/Population*) of 0.048 that remains constant with the increase in income. However, the same increase in income, with the same level of schooling (nine years), but a lower population growth rate, of 0.6 percent, is correlated with a substantially lower and decreasing rate of emigration: from 0.039 it becomes 0.038 (Figure 5.c).

The relationships of emigration with income also varies according to average education in the home country. In the range of middle-income levels, more years of expected education are associated with lower emigration rates (Figures 5.a to 5.c).[7] At the two extremes, of very low and very high average income, higher education appears to be correlated with more emigration, but these predicted paths are less realistic than the intermediate ones. In particular, there are very few countries having low income and high education levels, and the opposite is also rare. Hence, overall, the most representative paths in Figures 5.a to 5.c are the lowest one (corresponding to low education) at low-income levels, the intermediate one at middle-income levels, and the highest one at the upper middle-income levels.

The non-linear shape of these relationships may reflect the changing characteristics of emigration movements as home countries develop. In particular, the empirical evidence provided by international data shows that most emigrants originating from the less developed countries move to other developing economies. Often driven by push factors, such as bad crops, excessively low levels of resources or strong political instability, they move to nearby countries that often provide only slightly better economic or political conditions than those at home. Hence, more resources, slower demographics and higher average education in the origin country weaken these push factors. On the other hand, most emigrants from countries at higher levels of development move to rich economies.

[7] The fall is larger when population growth is still high (Figure 5.a), and smaller with slower demographics (Figures 5.b and 5.c). In the second case, emigration rates are already low.

For them, pull factors, such as better job or life opportunities, matter more. Higher average education levels at home can facilitate their movements, but reinforce also the incentives to remain.[8] Together with countries structural characteristics, which will be seen below, this can help to explain why, in Figure 3, emigration patterns from middle-income economies are more heterogeneous than from low-income countries.

4.6 Long-run factors

Several countries' characteristics that are fixed in time or vary very slowly may affect emigration, but they are not observed in the above regressions because they are 'absorbed' into the countries' fixed-effects. Hence, in what follows, the influence their influence is tested indirectly by regressing the fixed-effects coefficients of column (4) of Table 1 on long-run factors that are often significant in the emigration literature. Specifically, I consider whether the country is an oil producer, a former socialist economy, a former socialist country directly affected by the fall of the Berlin Wall, a former British or Portuguese colony, the average life expectancy and literacy rate of its population during the period considered, and the world area it is located in.

Figure 7 depicts the results of these correlations. Black continuous lines denote a coefficient significance above five percent, grey dotted lines denote a significance below 10 percent and their length is the size of the standard error. They show that, everything else given, less people than predicted choose to emigrate if the country is an oil producer. This can be due to the direct and indirect job opportunities that the oil sector provides. On the other hand, being a former socialist country increases the likelihood of emigration, and the propensity to emigrate from countries directly related to the fall of the Berlin Wall is even higher than that from the average of former socialist economies.

[8] The different main destinations of emigrants will be seen in greater detail below. Higher education levels in countries at the early stages of development may be associated with more opportunities at home – such as the growth of the industrial and services sectors – but still be not sufficient to significantly facilitate the access to developed countries. Differently, more education in countries at middle levels of development can ease the access of emigrants into the rich economies. The process is reversed when the home countries become themselves more attractive.

Interestingly, Figure 3 above shows that, among middle-income countries, decreasing slopes (emigration decreases with income) are more frequent among former republics of the Soviet Union that are also oil producers. Life expectancy levels are not significant. This can be due to their effects being already captured by time-varying cofactors – such as education levels – in the regressions. The coefficients on world areas show that predicted emigration from an average Eastern European country is above average values. This is consistent with the above results on former socialist countries linked to the Berlin Wall. A similar result applies for the average country in Central Asia. In this case, push factors, such as long-run political instability and poor institutions can help to explain the higher than expected propensity to emigrate. At the same time, emigration from either South America or Sub-Saharan Africa is significantly below predicted values. This can be explained by a prevalence of internal migration, especially within bigger countries, in these two regions.

4.7 Developed and developing destinations

Since the above dataset comprises emigration from each country to the rest of the world, emigration destinations are not considered. A different database, including bilateral data, could help to analyse this issue, but the number of observations, especially from low-income countries, would be substantially reduced.[9] Another possibility, common to many studies on migration, would be a dataset based only on immigration into OECD economies, on which more data are available, but it would also be biased because, as it will be seen below, it would select observations from origin countries.

An alternative way to answer this question is by splitting this paper's database according to the emigrants' main destinations: developing and developed. This information is provided by the UNESCO data source, on which this study's is based. In this paper's sample, on average, 51.7 percent of emigrants move to a developed destination. Hence, to consider the relationship between each type

[9] Data on bilateral migration are provided by the Global Bilateral Migration Database, published by the *World Bank*, but they are available only at 10-year intervals, from years 1960 to 2000.

of emigration and the level of development at home, the data are split into country-year observations falling below and above the 51.7 sample average, and the regression of equation (2) is re-run on each subsample. Figure 6 depicts the two predicted emigration-income paths; they intersect at an income level of 2,500 $US and rapidly diverge thereafter. At the left of the intersection, concerning countries the lowest income levels, both paths are downwards sloping: emigration diminishes as income at home increases. This supports the above interpretation that low-income countries' emigration is mostly dictated by push factors, and diminishes as conditions at home improve.

At the right of the intersection, both rates increase, but, at each income level, the increase is more rapid when the majority of emigrants move to developed destinations. As in Figure 3 above, the same income levels at home can be associated with very different emigration paths. In Figure 6, the divergence between the two paths is associated with substantially different values taken by the countries' development indicators.[10] Most emigrants move to developed destinations when the average level of schooling is 10.4 years, and the mean rate of population growth is 1.04 percent. On the other hand, most emigrants move to other developing countries when education levels are low and population growth is rapid; they are, respectively, 8.5 years and 2.5 percent. The geographical composition of countries is also different along the two paths. For example, the proportion of Sub-Saharan countries in the subsample with most emigrants moving to other developing countries is 55 percent, while in the subsample concerning emigration to developed destinations, it falls to 11 percent. At the right of the intersection between the two paths, the proportion of emigrants from Sub-Saharan Africa falls further, to a 4.4 percent. Hence, the positive relationship between emigration into developed countries and income at home concerns only marginally the Sub-Saharan countries. On the other hand, the proportion Eastern-European countries in the sample with most emigrants moving to developed destinations is 25 percent, and is one percent among the subset concerning emigration to

[10] The relative minimum of the continuous path – regarding economies where most emigrants move to other developing economies - takes place at an income of 2,700$, which is higher than that of the overall sample in Figure 4-f. This supports the finding that emigration from low-income and low-development countries diminishes as conditions in the home country improve.

developing destinations (Eastern European countries are the 13 percent of the overall sample).[11] More generally, immigration into the rich economies increases especially from countries at middle levels of development. At any given income level, their education levels are higher and their population growth rates are lower than the average developing country. The opposite applies to emigration into developing countries.[12]

The coefficients resulting from running the specification of equation (2) on the two subsamples are in Table 2. It is interesting to note that, while they are similar to those concerning the entire sample in Table 1, the interactions between population growth and education and between income and education are significant only when most emigrants move to other developing countries (column 2, Table 2). This supports the common finding of the development literature, of a positive relationship between education and income, and of a negative link between education and population growth. These same coefficients are not significant in countries with a majority of emigrants moving to developed destinations (column 4). As seen, in these origin countries, population growth rates are generally already low and school life expectancy is high. *Political terror* is another strong push factor in countries with emigrants moving to other developing economies, while the same variable has non-significant coefficients in column (4). On the other hand, when most emigrants move to the developed destinations, *Inequality* and *Passport power* have strong and significant coefficients.

4.8 Emigration rates and levels.

[11] For example, at an income of about 3,300$, the average country from which most emigrants move to another developing country (the lower path) is characterized by a school life expectancy of 7.7 years, a population growth rate of 2.3 percent, a level of political terror of 3.3, and a very low passport power, of 38. Countries with these characteristics are Angola, Bolivia, Nicaragua, Pakistan, Yemen. At the same income of 3,300$, the average country with most emigrants moving to a developed economy (the upper path) is characterized by a school life expectancy of 9.3 years, a population growth rate of 0.9 percent, a level of political terror of 2.8, and a passport power of 49. Among these countries are Moldova, Philippines, Honduras. The same exercise on income levels above the intersection value in Figure 6 produce similar results.

[12] Everything else equal, average schooling in the home country can affect emigration to developed economies because destination countries tend to officially recognize foreign academic degrees and skills of individuals originating from countries with at least similar educational levels and institutions.

The above results are robust to different specifications but concern emigration ratios and not levels. Hence, they do not rule out the possibility of an increase in the number of emigrants as ratios decrease, for example if population at home grows faster than emigration. Vice versa, emigration ratios could increase even with decreasing emigration numbers, if population decreases but emigration falls at a slower speed. The first case might apply to low-income countries, particularly in Africa, where population growth rates are high, and the second to Eastern European economies, where population growth can be negative.[13]

To check whether this study's main findings hold when the number rather than the ratio of emigrants is considered, I rerun the above regressions with the (log) of the number of emigrants as dependent variable. The specifications remain those of equations (1) and (2), but, to control for size, the (log) of countries' population is now included among regressors. Figure 8 shows that results support the above findings and add some further insights. In the first place, in both the semiparametric and parametric estimations of Figures 8.a and 8.b, the relationships between emigration and income are negative. This confirms this paper's main results along the range of low-income levels, but diverges from above for which concerns middle-income levels, where numbers are negative while ratios were positive (in Figures 4 and 5). The reasons of this discrepancy become more evident by considering emigration to the two main types of destination.

In Figure 8.c, emigration moving mostly to other developing countries decreases continuously with income, while emigration moving mainly to the developed economies is bell-shaped at middle income levels. Hence, emigration from middle-income countries to developed economies increases both in numbers and rates, while that to developing destinations decreases both as a ratio and in levels. The aggregate negative patterns in Figures 8.a and 8.b are driven by the rapidly decreasing path of the latter.

[13] Dao et al. (2018) predict a rapid growth of foreign population in Western economies as a consequence of high population growth in low-income countries, especially Sub Saharan Africa, while Kebede et al. (2019) find that increases in girls' schooling in Africa rapidly drives down fertility and population growth rates, as it previously happened in Asia and Latin America.

Hence, this study shows that that emigration from low-income countries tends to decrease with development, both as a ratio of the home country population and in levels, while the part from middle-income countries that is directed to the developed economies increases before reaching a maximum and declines afterwards.

5. Conclusions

This study investigated the links between development and emigration with a dataset comprising 130 developing countries and 25 years. Using semiparametric and parametric specifications and controlling for several cofactors and fixed effects, I found that emigration from low- to middle-income countries decreases as income grows, education improves or population growth slows down. A bell-shaped relationship with income emerges at middle-development levels, but it is not robust to all specifications. When emigrant numbers, rather than emigration rates, are considered, the relationship with income is downward-sloping along all income levels. Hence, emigration from countries with low- to middle-income levels decreases as countries develop, both as a ratio of the country's population and in numbers.

When countries rich a middle stage of development, defined by income, education and demographics, a growing part of emigration moves to rich countries. This growth persists only to the point that the origin country, with development, becomes a magnet of immigration itself. Hence, immigration into rich countries is predicted to grow from countries at middle-development levels, while policies aimed to boost development in low-income countries and international aid tend to reduce emigration.

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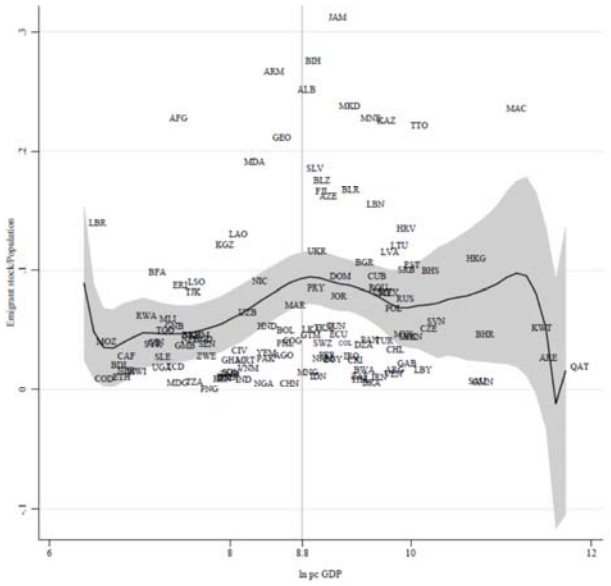
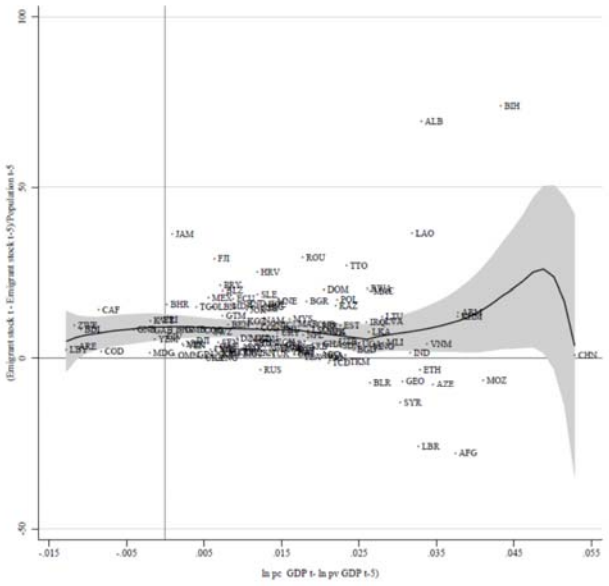
Figure 1. – Emigration and income



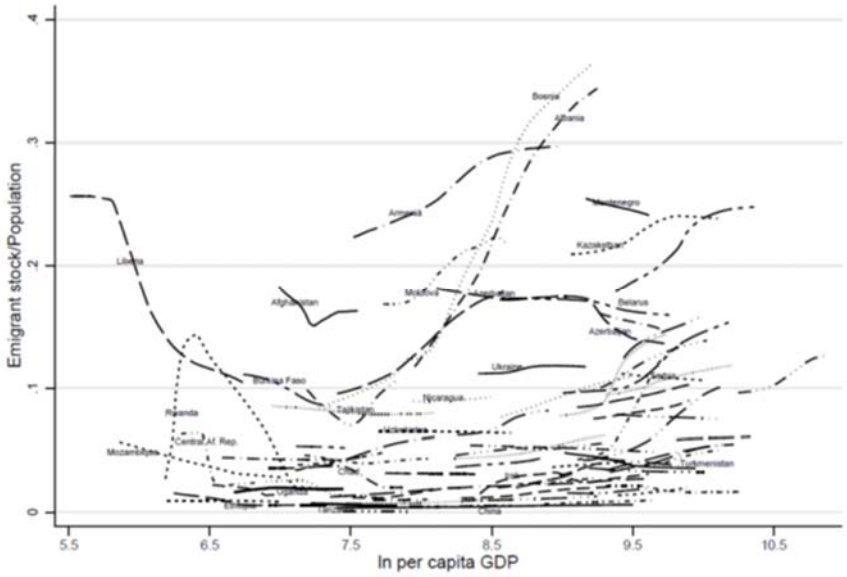
Note: Between-country variations, country means over 25 years. The sample is an unbalanced panel comprising 130 countries and 25 years. Non-parametric regression using Epanechnikov kernel (Epanechnikov 1969), local mean smoothing, bandwidth 1.61, degree 3, pwi 2.11.

Figure 2. – Variations in emigration and income



Note: 5 year variations: (Emigration stock t - Emigration stock t-5/Population t-5) and ln pc GDPt ln pc - GDP t-5. The sample is an unbalanced panel comprising 130 countries and 25 years. Non-parametric regression using Epanechnikov kernel, local mean smoothing, bandwidth 0.03, degree 3, pwidth 0.4.

Figure 3.- Emigration and income, by country



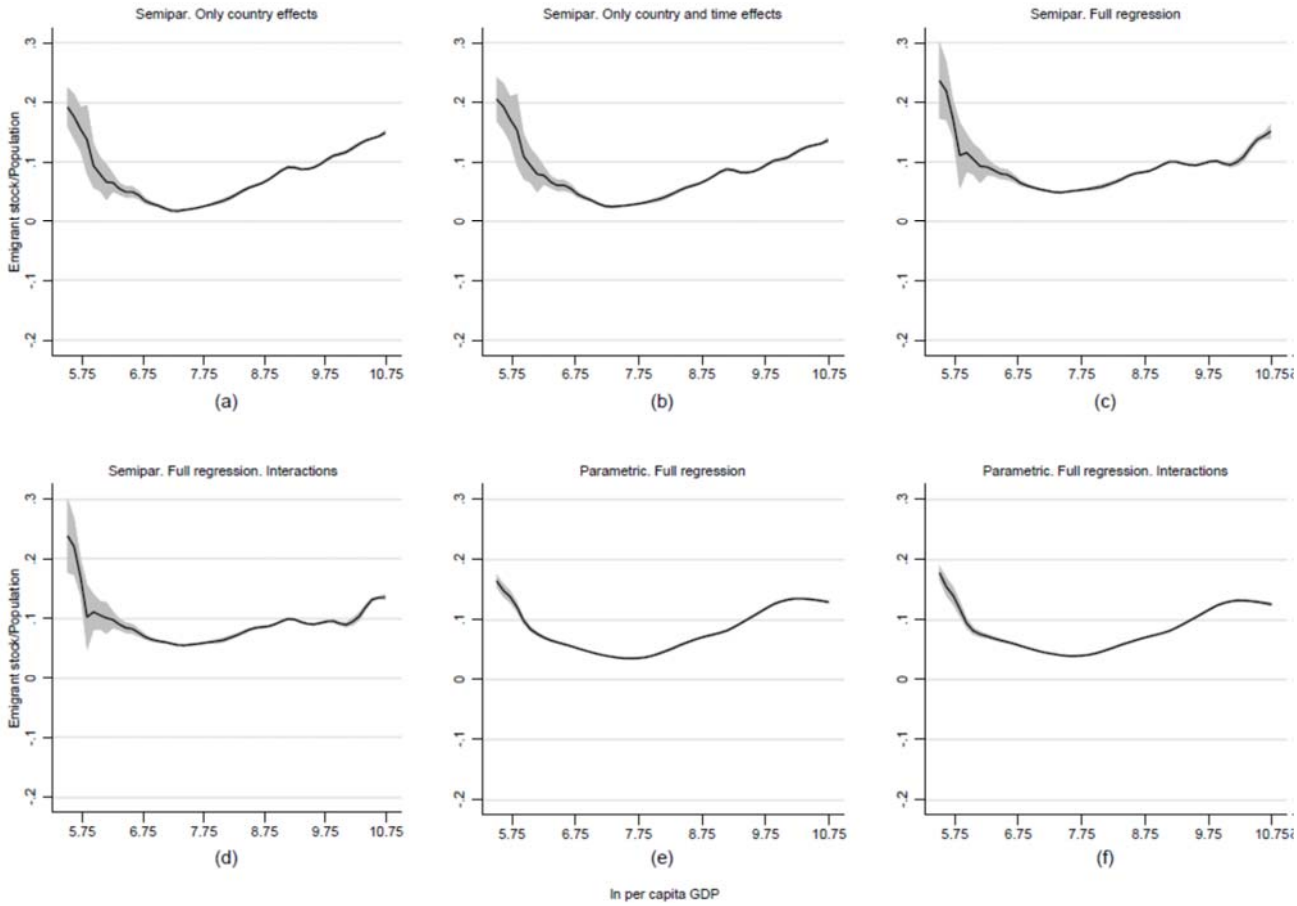
Note: Local polynomial smoothing. The sample is an unbalanced panel comprising 130 countries and 25 years.

Table 1. – Dependent variable: Emigration rates. Semiparametric and parametric estimations.

	Semiparametric		Parametric	
	(1)	(2)	(3)	(4)
ln pcGDP			-1.745***	-1.607***
			(0.184)	(0.287)
$(\ln pcGDP)^2$			0.208***	0.206***
			(0.023)	(0.035)
$(\ln pcGDP)^3$			-0.008***	-0.009***
			(0.001)	(0.001)
ln pcGDP*School life expectancy				-0.049
				(0.031)
$(\ln pcGDP)^2$*School life expectancy				0.004
				(0.004)
$(\ln pcGDP)^3$*School life expectancy				-0.000
				(0.000)
School life expectancy*Population growth		-0.002***		-0.002***
		(0.001)		(0.000)
School life expectancy	-0.002	0.002	-0.002***	0.171**
	(0.002)	(0.002)	(0.001)	(0.087)
Population growth	0.006*	0.022***	0.006***	0.022***
	(0.003)	(0.007)	(0.002)	(0.005)
Political terror	0.002	0.002	0.002**	0.002***
	(0.002)	(0.002)	(0.001)	(0.001)
Unemployment rate	-0.076	-0.085	-0.062***	-0.069***
	(0.054)	(0.054)	(0.020)	(0.020)
Gini index	0.023	0.015	0.018**	0.015*
	(0.019)	(0.021)	(0.007)	(0.008)
Passport power	0.086***	0.078**	0.091***	0.081***
	(0.032)	(0.032)	(0.011)	(0.011)
Temperature deviation	-0.000		-0.000	
	(0.001)		(0.001)	
Constant			4.797***	4.071***
			(0.489)	(0.773)
Time effects	yes	yes	yes	yes
Country effects	yes	yes	yes	yes
Observations	2,563	2,563	2,563	2,587
R-squared	0.927	0.930	0.936	0.939

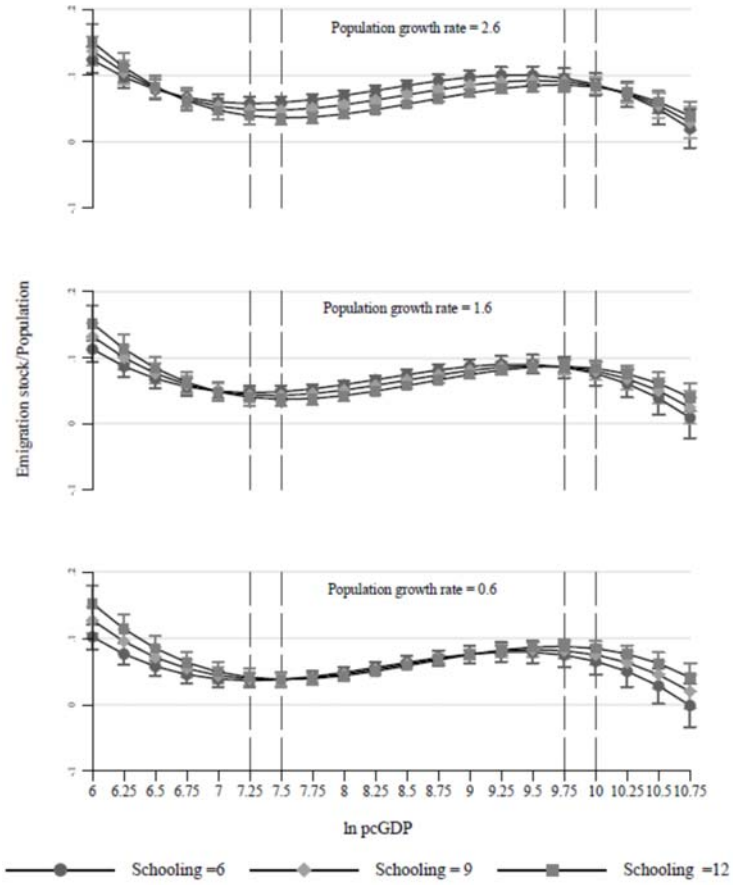
Note: The sample is an unbalanced panel comprising 130 countries and 25 years. Dependent variable*: Emigrant stocks*$_{it}$*/Population*$_{it}$. Standard errors, clustered at the country level, in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Columns 1-2: Fixed effects semiparametric. Columns 3-4 Fixed effects pooled OLS. Predicted patterns of *Emigration rates* are in Figure 4 (c)-(d).

Figure 4. Emigration rates and income. Semiparametric and parametric estimations



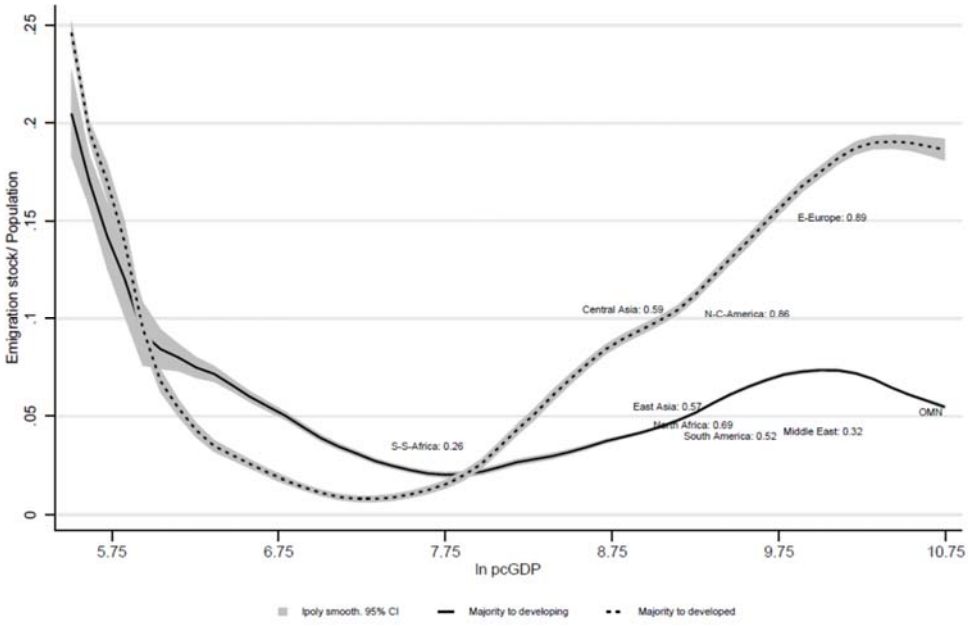
Note: The sample is an unbalanced panel comprising 130 countries and 25 years. Predicted emigration from semiparametric estimations in Figures (a)-(d), with ln pc GDP non parametric. In Figures (a) and (b), the only regressors are country and country and time fixed effects. Figures (c) and (d) derive from the semiparametric regressions of columns 1 and 2 in Table 1; Figures (e) and (f) from the parametric regressions of columns 3 and 4 in Table 1. The paths minima correspond to income levels, in the semiparametric regressions (a, b, c, d) of about 1,400 US$, in the parametric regressions (e, f) of about 2,000 US$. The maxima, parametric regressions take place at income levels of about 22,000 us$.

Figure 5. – Emigration and income. Different levels of education and population growth rates



Note: The sample is an unbalanced panel comprising 130 countries and 25 years. Predicted emigration rates, 95% CIs, from column 4, Table 1, with *Population growth* rates at 0.6, 1.6 and 2.6, and *School life expectancy* at 6, 9 and 12 years. the two segments between vertical lines correspond to income levels between 1,400 US$ and 1,800 US$, and between 17,000 US$ and 22,000 US$.

Figure 6. – Main destinations of emigration: developed economies and developing countries



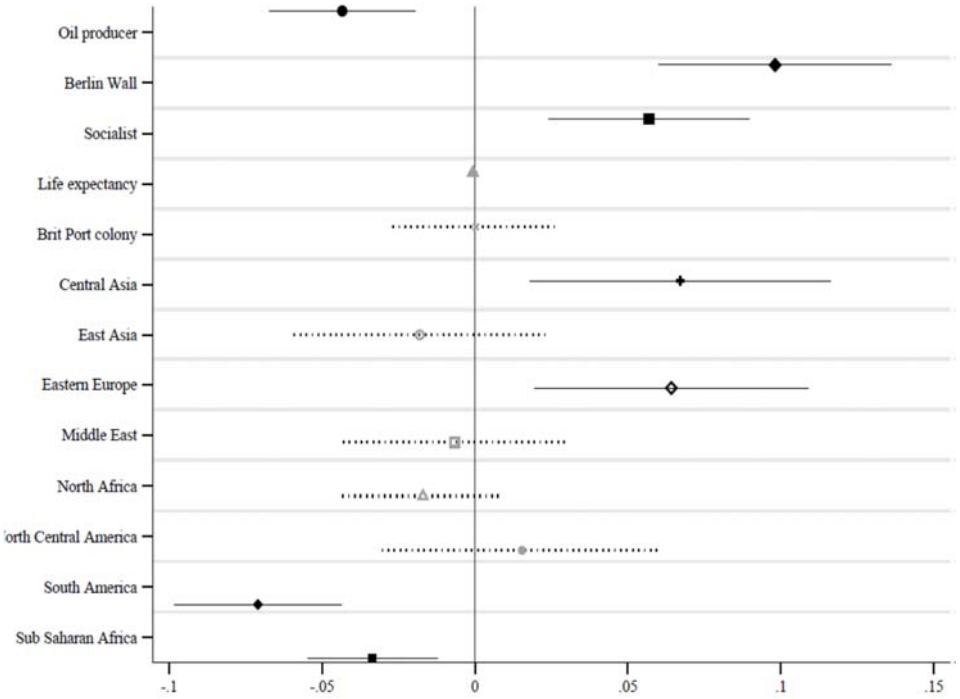
Note: Local polynomial smoothing of predicted emigration rates, 95 percent CIs, from columns (2) and (4) of Table 3. The sample is an unbalanced panel comprising 130 countries and 25 years; split into two subsamples: one with proportion of emigration to developed economies $\geq$ 51.7 percent, the other with proportion < 51.7 percent. Coordinates of world regions: mean ln pc GDP and emigration rates; related figures: average proportion of emigration from the region to developed countries. The paths minima correspond to income levels: --- 1,100 US$, __ 2,400 US$, and the maxima --- 22,000, __ 18,000 US$.

Table 2.- Dependent variable: emigration share to developed and developing economies

	(1)	(2)	(3)	(4)
	Most to developing		Most to developed	
ln pcGDP	-1.371***	-0.844**	-2.522***	-5.489***
	(0.185)	(0.359)	(0.530)	(1.845)
$(\ln pcGDP)^2$	0.158***	0.106**	0.306***	0.697***
	(0.023)	(0.043)	(0.063)	(0.221)
$(\ln pcGDP)^3$	-0.006***	-0.004**	-0.012***	-0.029***
	(0.001)	(0.002)	(0.002)	(0.009)
ln pcGDP*School life expectancy		-0.098**		0.193
		(0.040)		(0.186)
$(\ln pcGDP)^2$*School life expectancy		0.011**		-0.027
		(0.005)		(0.022)
$(\ln pcGDP)^3$*School life expectancy		-0.000**		0.001
		(0.000)		(0.001)
School life expectancy*Population growth		-0.002***		-0.001
		(0.000)		(0.001)
School life expectancy	-0.002**	0.299***	-0.002*	-0.448
	(0.001)	(0.112)	(0.001)	(0.529)
Population growth	0.007***	0.025***	-0.001	0.008
	(0.002)	(0.005)	(0.001)	(0.007)
Political terror	0.004***	0.005***	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Unemployment rate	-0.029	-0.027	-0.110***	-0.121***
	(0.018)	(0.017)	(0.033)	(0.034)
Gini index	-0.016**	-0.014*	0.076***	0.071***
	(0.008)	(0.009)	(0.017)	(0.018)
Passport power	0.035***	0.029***	0.121***	0.113***
	(0.012)	(0.010)	(0.015)	(0.016)
Constant	3.910***	2.175**	6.747***	14.098***
	(0.502)	(0.978)	(1.450)	(5.126)
Time effects	yes	yes	yes	yes
Country effects	yes	yes	yes	yes
Observations	1,243	1,243	1,344	1,344
R-squared	0.836	0.857	0.954	0.955

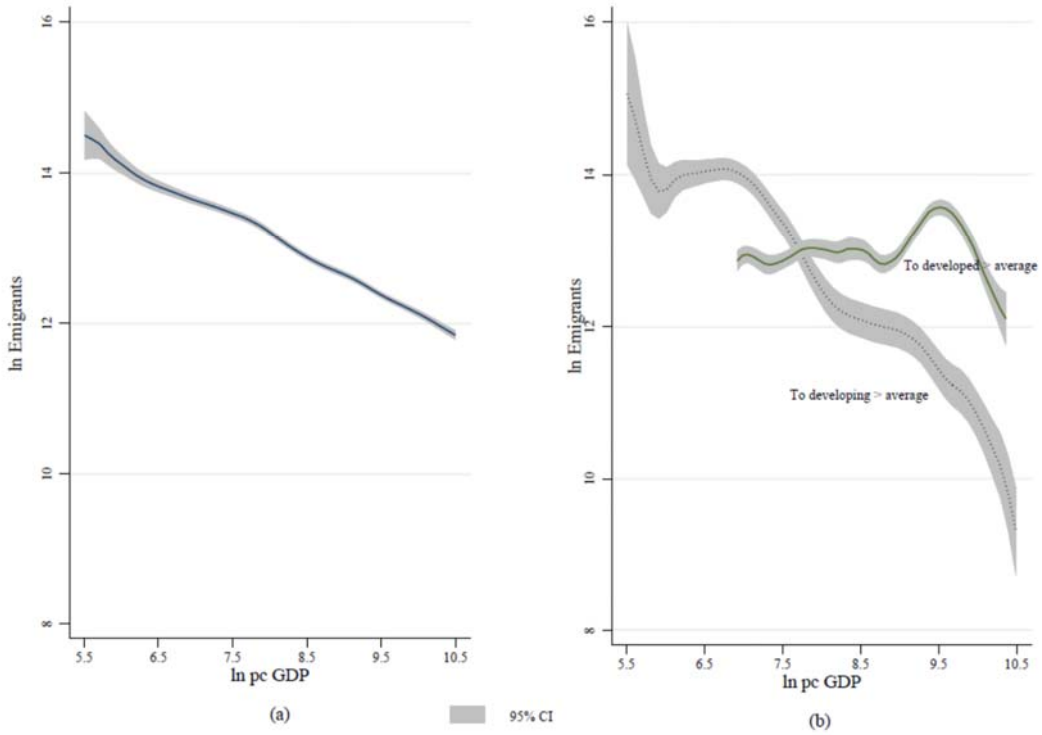
Robust standard errors, clustered at country levels, in parentheses *** p<0.01, ** p<0.05, * p<0.1. The sample is an unbalanced panel comprising 130 countries and 25 years. Subsamples: proportion of emigrants to developed economies < 51.7 percent (columns 1 and 2); and proportion of emigrants to developed economies $\geq$ 51.7 percent (columns 3 and 4).

Figure 7. – Countries' characteristics and fixed effects coefficients



Note: Each variable is regressed on FE coefficients from column (4) of Table 1. Significance: ◆ at or above 5%; ◈ below 10%; ——standard errors. *Oil producers*: binary variable with value one for oil producers and zero otherwise. *Berlin wall* and *Socialist*: binary variables, with, respectively, value one for Eastern European former socialist countries and zero otherwise, and value one for former socialist economies and zero otherwise. Life expectancy: average life expectation at year of birth. *Brit Port colony*: binary variable with value one for former British and Portuguese colonies and zero otherwise.

Figure 8. – Number of emigrants and average income (in logs)



Note: Local polynomial smoothing, 95 percent CIs. The sample is an unbalanced panel comprising 130 countries and 25 years. (a) Ln Emigrants to the rest of the world. (b) Subsamples: proportion of emigrants to developed economies > 51.7 percent; to developing: proportion to developed ≤ 51.7 percent. Predicted values deriving from equation (2), with dependent variable ln Emigrants, all cofactors plus ln population, and time and country fixed effects. The maximum in Figure (b) corresponds to a per capita income level of 13,500 US$.

APPENDIX

Appendix I. Tables and Figures

Table A1. - Variables and sources

Variable	Description	Source
Emigrant outward stock	Number of people who emigrated from origin country.	UN Department of Economic and Social Affairs – Population Division, International migration stock: The 2015 revision.
Emigrant rate	Emigrant outward stock/Population of origin country	Population: World Bank, Health, Nutrition and Population statistics - Population, total.
Refugee outward stock	Number of people who have fled a certain country and have been recognized as refugees.	UNHCR, Population statistics, Time Series - Refugee data. Data utilized to obtain the net emigrant stock.
Per capita GDP, PPP	Gross domestic product per capita, converted to constant 2011 international dollars using purchasing power parity rates.	World Bank, Economy and growth data - GDP per capita, PPP (constant 2011 international $).
Population growth rate	$(Population_t – Population_{t-1})/ Population_{t-1}$	Population: World Bank, Health, Nutrition and Population statistics - Population, total.
School life expectancy	Expected number of years of education that a child can expect to receive in the future.	UNESCO Statistics
Passport power	Ranking of world's passports according to the number of destinations their holders can access without a prior visa. Based on data from the International Air Transport Association (IATA). Data before 2006 are imputed from subsequent figures.	Henley passport index https://www.henleypassportindex.com/passport-index
Unemployment	Share of labour force that is unemployed but available for employment.	ILO STAT - Unemployment rate, by sex and age.
Political Terror Scale (PTS)	Index that shows the level of state political violence and terror, ranging between 1 (minimum terror) and 5 (maximum terror), based on U.S. State Department Country Reports on Human Rights Practices.	Gibney M, Cornett L, Wood R, Haschke P, Arnon D (2016) The Political Terror Scale 1976- 2015. Data retrieved from the Political Terror Scale website.
Temperature	Temperature in country *j* at time *t* minus average temperature in country *j* during 1901-1924.	World Bank Climate Change Data Portal - historical climate data
Rain	Rain in country *j* at time *t* minus average rain in country *j* during 1901-1924.	World Bank Climate Change Data Portal - historical climate data
Oil producing countries, Berlin Wall affected countries, Socialist countries, Former British or Portuguese former colonies.	Dummies taking values zero or one.	Bertocchi and Strozzi (2004). The Citizenship Law Database.

Disasters	Number of people that lost their lives (or are missing) during a natural/technological disaster, summed to the number of the 'total affected', which are the people requiring immediate assistance, injured, or homeless because of the disaster.	Centre for Research on the Epidemiology of Disasters, International Disaster Database
Life expectancy	Life expectancy at birth.	World Bank statistics

Countries: Afghanistan Albania Algeria Angola Argentina Armenia Azerbaijan Bahamas Bahrain Bangladesh Belarus Belize Benin Bolivia Bosnia and Herzegovina Botswana Brazil Bulgaria Burkina Faso Burundi Cambodia Cameroon Central African Rep. Chad Chile China Hong Kong Macao Colombia Congo Costa Rica Cote d'Ivoire Croatia Cuba Czech Rep. Dem. Rep. of the Congo Djibouti Dominican Rep. Ecuador Egypt El Salvador Eritrea Estonia Ethiopia Gabon Gambia Georgia Ghana Guatemala Guinea Guinea-Bissau Honduras Hungary India Indonesia Iran Iraq Jamaica Jordan Kazakhstan Kenya Kuwait Kyrgyzstan Lao Latvia Lebanon Lesotho Liberia Libya Lithuania Madagascar Malawi Malaysia Mali Mauritania Mexico Mongolia Montenegro Morocco Mozambique Namibia Nepal Nicaragua Niger Nigeria Oman Pakistan Panama Papua New Guinea Paraguay Peru Philippines Poland Qatar Rep. of Moldova Romania Russian Federation Rwanda Saudi Arabia Senegal Serbia Sierra Leone Slovakia Slovenia Somalia South Africa Sri Lanka Sudan Swaziland Syrian Arab Rep. Tajikistan Thailand The former Yugoslav Republic of Macedonia Togo Trinidad and Tobago Tunisia Turkey Turkmenistan Uganda Ukraine United Arab Emirates Tanzania Uruguay Uzbekistan Venezuela Viet Nam Yemen Zambia Zimbabwe.

Table A2.- Descriptive statistics. Full sample and emigration to developed or developing destinations

	Full sample			Emigrants to developed, above sample mean			Emigrants to developed, below sample mean		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Emigration rate	2,963	0.068	0.072	1,462	0.093	0.086	1,501	0.044	0.044
Emigrants stock (thousand)	2,963	1,036	1,852	1,462	1,226	2,062	1,501	850	1,600
Per capita GDP	2,963	10,213	15,823	1,462	10,257	7,516	1,501	10,171	20,961
School life expectancy	2,672	9.5	2.4	1,336	10.4	1.6	1,336	8.6	2.6
Population growth r.	2,962	1.79	1.63	1,462	1.07	1.28	1,500	2.49	1.62
Political terror	2,906	2.85	1.03	1,428	2.70	0.94	1,478	2.99	1.09
Passport power	3,164	52.73	30.89	1,568	60.84	34.02	1,596	44.77	25.04
Gini index	3,014	42.06	9.62	1,557	40.85	9.12	1,457	43.35	9.98
Unemployment rate	2,963	0.10	0.08	1,462	0.11	0.08	1,501	0.09	0.08
ln Disasters	2,257	9.36	3.87	1,115	9.16	3.88	1,142	9.55	3.86
Temperature	2,940	0.83	0.63	1,439	0.92	0.67	1,501	0.73	0.58
Rain	2,916	0.19	14.99	1,424	1.42	16.04	1,492	-0.98	13.83
Population (million)	2,963	43,761	156,177	1,462	34,784	119,691	1,501	52,505	184,543

Note: The sample is an unbalanced panel comprising developing 130 countries and 25 years. Subsamples: proportion of emigrants to developed economies $\leq$ 51.7 percent and proportion of emigrants to developed economies > 51.7 percent.

Table A3. Descriptive statistics of main development indicators. World regions

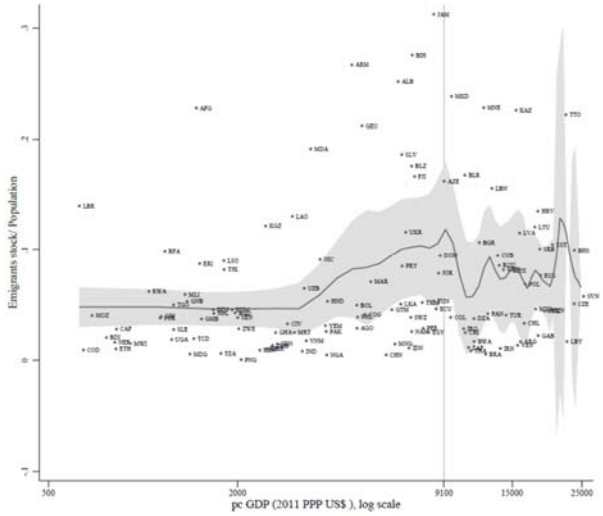
	Obs.	Mean	S.D.	Obs.	Mean	S.D.	Obs.	Mean	S.D.	Obs.	Mean	S.D.
	Eastern Europe			Central Asia			East Asia			Middle East		
GDP per capita	400	9.32	0.57	339	8.22	0.73	322	8.87	1.08	277	9.91	1.26
Population gr.	439	-0.32	0.78	350	1.30	1.56	325	1.54	0.73	296	3.59	2.75
School life expectancy	416	11.04	1.00	294	9.46	1.86	283	9.84	1.81	269	10.54	1.52
	North Central Africa			Sub Saharan Africa			North Central America			South America		
GDP per capita	117	9.12	0.48	1016	7.57	0.84	323	9.13	0.59	250	9.23	0.43
Population gr.	125	1.53	0.49	1046	2.58	1.01	325	1.48	0.78	250	1.40	0.51
School life expectancy	115	10.56	1.80	909	7.57	2.63	299	10.38	1.26	240	11.34	1.18

Note: The sample is an unbalanced panel comprising 130 countries and 25 years

Appendix II. Non-parametric and semiparametric estimations. Per capita GDP

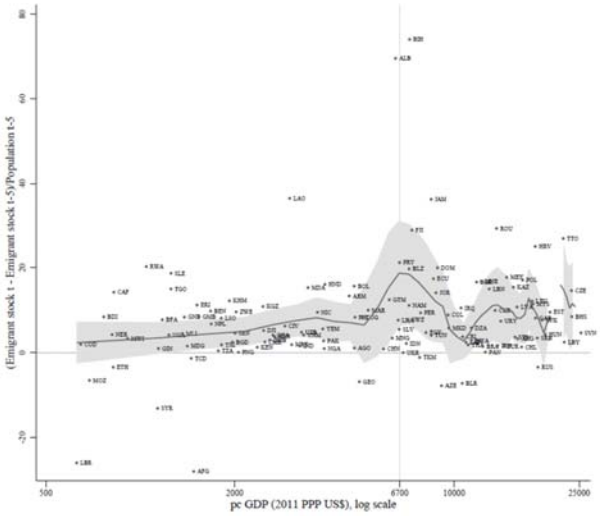
To check whether results change if GDP per capita is measured in levels rather than in logarithms, the non-parametric and semiparametric regressions of Figures 1, 2 and 4.b are run with per capita GDP as independent variable. The resulting paths, in Figures A1, A2 and A3 are similar to those of Figures 1, 2 and 4.b above. In particular, Figure A3 derives from the semiparametric estimation where per capita GDP is the non-parametric independent estimator and time and fixed effects are controlled for. Also in this case, the path reaches a minimum at an income level of about 2,000 US$. This confirms that results are robust to the logarithmic transformation of the variable of per capita GDP.

Figure A1. Emigration ratios and income



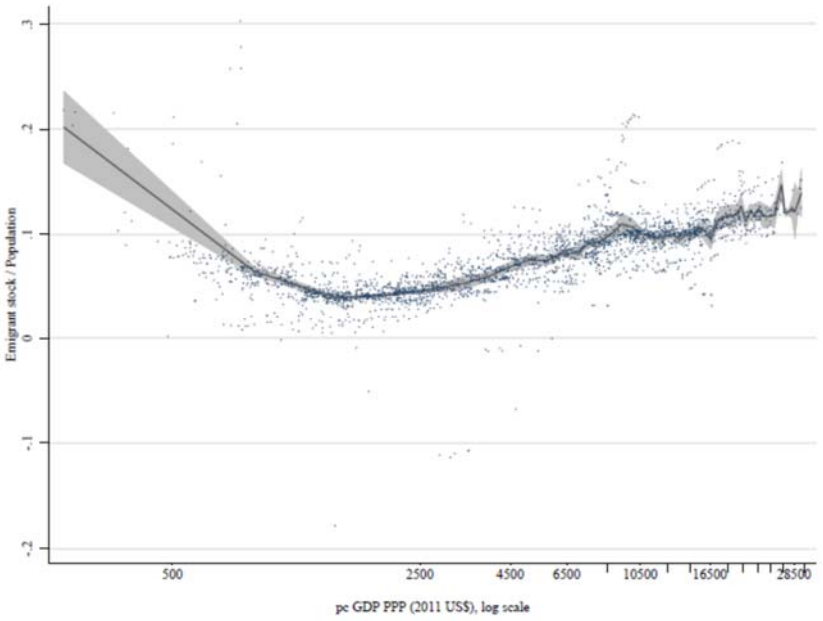
Note: Between-country variations, country sample averages. The sample is an unbalanced panel comprising 130 countries and 25 years. Non-parametric regression using Epanechnikov kernel, local mean smoothing.

Figure A2. Emigration variations and income



Note: Emigration is measured as (Emigrant $stock_t$ – Emigrant $stock_{t-5}$/$Population_{t-5}$). Average variations over 5-year lags. The sample is an unbalanced panel comprising 130 countries and 25 years. Non-parametric regression using Epanechnikov kernel, local mean smoothing.

Figure A3. Semiparametric estimation. Income levels



Note: The sample is an unbalanced panel comprising 130 countries and 25 years. Predicted emigration from semiparametric estimations with pc GDP non parametric. Regressors are country and time fixed effects.

Appendix III. Simulations.

Some interesting patterns emerge with the main development indicators computed at their average values in two different groups of countries: Sub-Saharan countries and middle-income economies. Values in Table A4 are the predictive margins deriving from to regression of column (4) (Table 1, computed at specific values of the covariates with significant coefficients in all specifications. In particular, in columns (1) and (2), education, population growth and passport power values are computed at their mean levels in Sub-Saharan Africa: *School life expectancy* and *Population growth rates* are, respectively, 7.6 years and 2,6 percent, *Passport power* is 30. With these values, the

predicted *Emigrant stock/Population* ratio is 0.033, which corresponds to less than half of the mean value of the ratio in the entire sample, which is 0.070. [14]

Income growth starting from levels below 1,400$US is associated with lower rates of emigration. At 1,400$US the correlation reaches a minimum. From that level, if income increases, for example from 1,400$US to 1,800$US (everything else constant), the predicted emigration rate before and after the change remains unchanged at 0.034 (columns 1 and 4 in Table A4). However, if at that constant income level of 1,400$US, expected education increases by one year, from 7.6 to 8.6, the emigration rate falls, in this case from 0.034 to 0.031. Moreover, if schooling increases by one year *and* the rate of population growth falls by one percentage point (with income constant at 1,400$) the emigration ratio further decreases to 0.026. The two bottom rows of Table A4 report the total number of emigrants from the average country at each predicted rate of emigration. With an increase of one year in education, the emigrant stock from the country decreases from 590,176 to 538,102. The average population in the Sub-Saharan country is 17,358,120. Since the area comprises 42 countries, one extra year of education is therefore correlated with almost 2,200,000 fewer emigrants moving across and from Sub-Saharan Africa. With an increase of one year in education *and* a reduction of one percentage point in the rate of population growth, the emigrant stock decreases by almost six million (5,832,328 = 24,787,395 -18,955,067).

Simulations concerning countries at middle levels of development (where the emigration-income relationship becomes bell-shaped in Figures 4.e and 4.f) are in columns (6) to (10) of Table A4. There, education is computed at 11 and 12 years and population growth at 1.6 percent and 0.6 percent. A first clear difference with less developed countries is the average emigration-population ratio, which is now 0.1 – much higher than in columns (1) to (5), regarding low-income countries – and well above the sample average of 0.070. In this scenario, with education computed at 11 years and

[14] The mean emigration rate from the region in the dataset is 0.26. This lower rate may depend on factor values that have not been explicitly considered in the simulation and are therefore automatically computed ad their sample means.

population growth at 1.6 percent, an increase in income from 17,000$ to 22,000$ is associated with a decrease in the emigration ratio from 0.1 to 0.096 (columns 6 and 9 of Table A4). A reduction in population growth at 0.6 percent does not significantly change emigration. However, an increase in income to 22,000$ and a parallel increase in education, for example by one school year, the emigration rate *increases* to 0.98 (or, from 0.1, falls by a smaller amount). This correlation of higher emigration rates with higher education levels in countries at a more advanced stage of development takes the opposite sign of that regarding earlier stages, where more schooling is associated with less emigration. Hence, education facilitates emigration from middle-income economies. The average population size in middle-income economies, of 17,569,680 people, is not very dissimilar to that of Sub-Saharan Africa, but the rates of emigration and emigrant stocks from middle-income economies are higher. Afterwards, as Figure 5 shows, beyond middle-income levels, emigration rates decline again. An interpretation of these results is that development, which implies higher income, more education and slower demographics, in low-income countries makes moving abroad less of a necessity, while along certain range of middle-income levels it facilitates migration to rich economies and, at the same time, significantly increases job opportunities at home. When the second effect prevails, countries become net immigration magnets themselves.

Table A4.- Simulations. Dependent variable: *Emigrant stock/Population*

	Sub-Saharan Africa					*Medium development countries*				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Per capita GDP	1,400	1,400	1,400	1,800	1,800	17,000	17,000	17,000	22,000	22,000
Expected years of schooling	7.6	8.6	8.6	7.6	8.6	11	12	12	11	12
Population growth rate	2.6	2.6	1.6	2.6	1.6	1.6	1.6	0.6	1.6	0.6
Emigrant stock/ Population	0.034	0.031	0.026	0.034	0.026	0.1	0.1	0.1	0.096	0.098
Emigrant stock average	590,176	538,102	451,311	590,176	451,311	1,756,968	1,756,968	1,756,968	1,686,689	1,721,829
Emigrant stock total	24,787,395	22,600,272	18,955,067	24,787,395	18,955,067					

Note*:* Predictive margins from equation (2), column (4) in Table (1). Model VCE robust. All coefficient significant at 5%. Passport power is computed at 33 for Sub-Saharan Africa and at 70 for medium-developed countries.