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Remittance and Migration Prospects for the Twenty-First Century

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Remittance and migration prospects for the 21st century*

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Abstract

Remittances have been increasingly perceived as offering a vital lifeline for millions of poor households in developing countries. Their future will be affected by the evolution of emigration rates and cross-country disparities in income. In this paper, we provide integrated projections of income, population, migration stocks and remittances for the 21st century under alternative technological and policy scenarios. Our quantitative analysis reveals that remittances will be a sustainable source of funding for low-income countries. Due to rising income disparities and the take-off of emerging countries, their share in GDP is likely to increase in the future, notwithstanding the fact that population growth will be greater in low-income countries. The average remittances-to-GDP ratio will be constant in our worst-case scenario, multiplied by 3 in our baseline, and by 10 in our best-case scenario. The latter assumes that the BRIC's catch up with high-income countries and open their borders to immigration, and a constant propensity to remit.

Key words: remittances, migration, development, projection.

JEL Codes : F22, F24, O14, J11, J61, O15.

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1. Introduction

Foreign aid and remittances (i.e. transfers of money by international migrants to their home country)¹ are key sources of external resources for developing countries. Although most industrialized countries remain committed to increasing their support to developing countries, the issue of the effectiveness of foreign aid has given rise to many controversial contributions (see among others, Burnside and Dollar, 2000; Hansen and Tarp, 2000; Easterly, Levine and Roodman, 2003; Rajan and Subramanian, 2008; Chauvet and Guillaumont, 2009; Clemens et al., 2012). On the contrary, migrants' remittances have been shown to reduce poverty and inequality in poor countries, and might stimulate investments in land, physical or human capital in countries with suitable institutions and economic conditions (for a review of the literature, see Rapoport and Docquier, 2006). Obviously, remittances and foreign aid should not be treated as substitutes. They are governed by different motives and have different effects on poverty, inequality and development. However, remittances have been increasingly perceived as offering a vital lifeline for millions of poor households in developing countries and their amount has kept increasing over the last decades.

Figure 1 depicts the evolution of the worldwide amounts of recorded remittances and foreign aid from 1970 to 2011. In the early seventies, official aid (62.2 billion USD) exceeded by far the amount of remittances (12.4 billion USD). Forty years later, the worldwide amount of remittances was equal to 514 billion of USD and was about 2.5 times greater than foreign aid. Overall, the amount of official development aid to developing countries has increased by about 2.9 percent on average per year since 1970 while the average annual growth rate of international remittances has been of 9.5 percent. Recorded remittances have more than doubled over the last ten years and the financial crisis of the last decade hardly affected this trend. These numbers have to be considered as estimates given that records still underestimate the full scale of remittances. Unrecorded flows through informal channels may conservatively add 50 percent to official flows in the poorest countries (World Bank, 2006).

About 70 percent of the worldwide amount of remittances is sent to developing countries. According to the World Development Indicators, each resident in developing countries receives an average transfer of USD 55.04 per year from national expatriates, to be compared

¹ In the World Development Indicators, "Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households. Personal transfers thus include all current transfers between resident and nonresident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by nonresident entities."

with USD 15.63 of official development aid per capita. Many developing countries receive more financial support from their own migrants than from the international community. There are, however, huge disparities between income groups: the amount of recorded remittances is 5 to 7 times greater than foreign aid in middle income countries but it only represents 60 percent of foreign aid in low-income countries. Figure 2 identifies the main recipient countries in 2010 (after excluding high-income countries). On Figure 2.a, countries are ranked on the basis of the aggregate monetary amount received. The two most populated countries in the world, India and China, are the main recipients. In 2010, Indians and Chinese sent 53.5 billion USD and 33.4 billion USD to their respective home country. Next in the ranking are Mexico, the Philippines, Nigeria, Egypt, Bangladesh, Pakistan, Vietnam and Indonesia. On Figure 2.b, the ranking is based on the share of remittances in GDP. In relative terms, the main recipients are low-income former soviet states (Tajikistan, Kyrgyzstan and Moldova), middle-East countries (Lebanon, West Bank and Gaza) and other small poor countries such as Lesotho, Haiti, Nepal, Samoa, Tonga, and Guyana. The share of remittances in GDP exceeds 15 percent in 15 countries, and reaches 40 percent in Tajikistan.

Remittance patterns are obviously affected by the evolution of emigration stocks and cross-country disparities in income. Indeed, the number of international migrants has increased from 92 to 211 million between 1960 and 2010 (United Nations, 2014). In addition, the data collected by Artuç et al. (2014) indicate that emigration rates are greater in middle income countries than in the poorest countries of the world. This might be due to financial constraints and partly explains why low-income countries receive less remittances than the middle-income ones. Nevertheless, the evolution of international migration alone cannot explain the extraordinary shift in the level of remittances. Since 1970, the number of international migrants has increased by 1.65 percent per year (United Nations, 2014); this is much smaller than the growth rate of remittances. Hence, the average amount sent by each migrant increased from 118 USD per year in 1970 to 2,583 USD in 2011. These amounts might be over-estimated since naturalized migrants (who likely send money to their relatives in their country of origin) are not accounted for in the total number of migrants. However, this should not bias the estimates by more than 10 to 20 percent (on naturalization rates, see Reichel, 2012). Several factors can explain this drastic change, such as rising income disparities between high-income and developing countries, changing composition of migration, lower transaction costs, greater share of remittances recorded in the balance of payment, etc.

While the amount of foreign aid has grown at a relatively stable rate in the past, the dynamics of remittances are more difficult to predict. First, the evolution of remittances will be affected by the future of international migration. Since World War II, the number of international migrants has grown at a similar pace as the world population: the worldwide average migration rate has been fairly stable at around 3 percent of the world population. However, the proportion of foreign-born in the population of high-income OECD countries has increased from 4.6 to 10.9 percent, and the share of immigrants originating from developing countries has soared from 1.5 to 8.0 percent. Immigration has become a key policy issue in traditional high-income countries and restrictions could get tougher in the future. Second, some emerging countries have taken off and partly caught up with high-income countries since the late eighties. The long-run development prospects in China, India and other emerging countries, coupled with the evolution of their immigration policies, will shape the size and structure of migration flows. Third, the future of remittances will also be affected by the demographic and economic disparities between regions. These disparities will govern the evolution of income inequality and the ratio of emigrants to stayers in recipient countries. For example, the macroeconomic and demographic prospects for sub-Saharan African countries are key determinants of future migration flows. The share of this continent in the world population is expected to increase threefold in the course of the 21st century (United Nations, 2014).

In this paper, we provide projections of migration and remittances for the 21st century under alternative technological and policy scenarios. To do so, we develop and parametrize a dynamic, stylized model of the world economy with endogenous income disparities, migration, fertility and education decisions. The model accounts for the links between skill-biased emigration prospects, investment in human capital and population growth (as in Mountford and Rapoport, 2014). Inevitably, such a stylized model omits several important features of the real world. Our model does not account for some demographic (urbanization, mortality, network externalities, aging) and economic variables (trade, unemployment, redistribution, capital movements). However, it accounts for the long-run interactions between human capital accumulation, migration, population growth and income inequality. We believe such a quantitative theory framework is an appropriate tool to identify the key factors that govern the future of the world economy. Using scenarios about the evolution of total factor productivity (TFP), education policies and immigration barriers, we jointly predict the evolution of income inequality, population growth, migration flows, and remittances. Then,

using scenarios about the evolution of the propensity to remit, we predict the ratio of remittances to GDP in developing regions and countries. We show that remittances will be a sustainable source of funding for developing countries. In our worst-case variant, their share in GDP will remain constant over the 21st century. However, due to rising income disparities and the emergence of new flourishing destination countries, their share in GDP is likely to increase in the future, notwithstanding the fact that population growth will be greater in low-income countries. In particular, if the BRIC's are catching up with high-income countries and open their border to immigration (our best-case variant), the average remittances-to-GDP ratio could be multiplied by 3 to 10 in low-income countries.

The remainder of the paper is organized as following. Section 2 provides a non-technical description of our model, describes its baseline parametrization, the alternative scenarios and the world economy prospects for the 21st century. Projections of remittances are presented in Section 3. Section 4 concludes.

2. Income and population projections for the 21st century

Our model covers the world economy over the period 2000-2100. It endogenizes the evolution of income and population in 195 countries ($k=1, \dots, 195$) as well as bilateral migration stocks by education level. We use it to predict the evolution of emigration rates, aggregated income of emigrants and stayers under alternative scenarios. Section 2.1 provides a non-technical description of the model.² Section 2.2 presents our baseline parametrization hypotheses. Alternative technological and policy scenarios are defined in Section 2.3. Finally, Section 2.4 presents our world economy prospects for the 21st century.

2.1. Model

We assume one-period lived adult decision-makers and countries characterized by heterogeneous levels of TFP, access to education and economic participation of children. Adults maximize their well-being and decide where to live, whether to invest in their own (higher or college) education, how much to consume, and how much to invest in the basic education of their children. We distinguish between college-educated adults and the less educated ($s=h,l$). We assume that preferences are represented by a two-level nested utility

² See Delogu et al. (2013) for a detailed description of the model.

function. The outer utility function has deterministic and random components. For an individual of type s in cohort t , the utility moving from a country of origin k to a country destination i is denoted by $U_{ki,s,t}$ and depends on four ingredients: an endogenous destination-specific component, $v_{i,s,t}$, the effort to move from the origin to the destination country (reflecting the effort to obtain a visa and private migration costs), $m_{ki,s,t}$, the effort to acquire higher education (if the individual decides to educate) in the origin country, $e_{k,s,t}$, and a migration taste shock, $\varepsilon_{ki,s,t}$. We use the following semi-logarithmic specification:

$$(1) \quad U_{ki,s,t} = \log(v_{i,s,t}) + \log(1 - m_{ki,s,t}) + \log(1 - e_{k,s,t}) + \varepsilon_{ki,s,t}.$$

The maximization of this outer utility function determines the education structure of the adult population, the number of bilateral migrants and the number of non-migrants. Indeed, the latter two components of the outer utility function vary across individuals. The effort to acquire higher education ($e_{k,s,t}$) follows a Pareto distribution – the density of ability decreases with the level of ability – with country-specific parameters. The migration taste shock ($\varepsilon_{ki,s,t}$) follows an extreme-value distribution of type 1: hence, as shown in the literature (McFadden, 1984), the ratio of migrants to non-migrants is given by a simple logit expression. Not everyone wants to acquire college education, wants to emigrate or to choose the same location (Grogger and Hanson, 2010).

The inner utility function determines $v_{i,s,t}$, the destination-specific component of the outer utility function. It is assumed to be a Cobb-Douglas function of private consumption ($c_{i,s,t}$), fertility ($n_{i,s,t}$) and the proportion of children receiving basic education ($q_{i,s,t}$). In logs, we have:

$$(2) \quad \log(v_{i,s,t}) = (1-\theta) \log(c_{i,s,t}) + \theta \log(n_{i,s,t}) + \theta\lambda \log(q_{i,s,t}),$$

where (θ, λ) are preference parameters.

After migration, adults maximize this inner utility function subject to a standard budget constraint, which includes the time cost of raising children (τ per child), the cost of providing basic education and child labor. Their fertility and basic-education decisions govern population growth and the proportion of children receiving basic education. Only those who received basic education when they were young will be able to invest in college education in the next period.

The outer and inner utility functions are interrelated. When deciding whether to emigrate or to stay in their home country, individuals anticipate the optimal level of (inner) utility attainable in all the possible destinations, $\log(v_{i,s,t})$, and the effort required to emigrate, $m_{ki,s,t}$. Hence,

destination choices are governed by differences in income, (basic and higher) education policies, and migration costs. The sum of type- s adults deciding to live in country k is denoted by $N_{k,s,t}$: their labor supply is denoted by $L_{k,s,t} = (1 - n_{k,s,t}\tau)N_{k,s,t}$ as raising one child implies a time cost τ .

The model also endogenizes income disparities. Education and migration decisions affect the size and the structure of the labor force in all the countries which determines the production (or GDP levels) and wages. In each country, production is the product of TFP by a Constant-Elasticity-of-Substitution (CES) combination of the low-skilled and high-skilled employment levels. We write:

$$(3) \quad Y_{k,t} = A_{k,t} [\phi_k (L_{k,h,t})^\varphi + (1 - \phi_k) (L_{k,l,t})^\varphi]^{1/\varphi},$$

where $A_{k,t}$ measures the TFP, ϕ_k governs the relative productivity of college-educated workers, and φ is a transformation of the elasticity of substitution, $\sigma = 1/(1 - \varphi)$. Given the CES structure, changes in the composition of the labor force driven by migration or education decisions affect wage inequality within countries.

The mechanics and timing of the model are summarized on Figure 3. The set of exogenous variables include TFP levels, basic and higher education costs, and the relative wage that can be earned by uneducated children. The latter variable affects the opportunity cost of having children and is a key determinant of the fertility rate. At time t , the size of the native adult population and the proportion of adults who received basic education are pre-determined. The timing of decision is such that adults decide whether to acquire higher education or not before discovering their migration taste. At the beginning of the period, they educate if the expected benefits from college education exceed the training effort; adults who did not receive basic education have no access to higher education. The expected benefit from college education is affected by emigration prospects: if migration restrictions are skill-biased, individuals anticipate that acquiring higher education increases the probability to migrate to a wealthier country. This is in line with recent literature on brain drain and brain gain (see Docquier and Rapoport, 2012).³ This cost-benefit analysis determines the number of college-educated and less educated natives at time t . Then, natives discover their migration taste and decide to emigrate or to stay in their home country. This determines the number of college-educated and less educated residents at time t . Finally, after migration, each individual chooses the

³ We will not emphasize too much this incentive mechanism since it has limited effects on the aggregate (as in Delogu et al., 2013).

number of children and the proportion of them who receive basic education. The model is calibrated in such a way that college-educated adults provide each child with basic education. The structure of the resident labor force and fertility decisions determines the supply of labor in each country. In turn, this determines the equilibrium wage rates and the GDP level. In this general equilibrium framework, decisions about fertility, education, migration and the world distribution of income (i.e. wage disparities across and within countries) are therefore interdependent.

[Insert Figure 3 about here]

2.2. Baseline calibration

Our model is calibrated to match the characteristics of the world economy in the year 2000 and its evolution over the period 1975-2000. In the baseline scenario, our demographic projections are compatible with the ‘High Fertility’ demographic forecasts of the United Nations for the period 2000-2100 (United Nations, 2014), and we extrapolate the recent trends in TFP.

Structural parameters of the utility function are assumed to be identical across countries and are calibrated in line with the empirical literature (for more details, see Delogu et al., 2013). The time-cost of having children is set to 15 percent of the parental time endowment. This means that the maximal/biological fertility rate equals 6.7 children per adult, or about 13 per couple. The preference parameters for the quantity and quality of children, θ and λ , are set 0.3 and 0.6, respectively. The scale parameter of the distribution of the random component of the outer utility function ($\varrho_{k,i,s,t}$) is set to unity. This matches the empirically estimated level of the elasticity of migration to income (around 0.7, equal to $1-\theta$ in our model). The slope of the Pareto distribution of higher education costs is set to 0.4. This matches the empirically estimated level of the average elasticity of college-education investment to high-skilled emigration prospects in developing countries (an elasticity of 0.2 in Beine et al., 2008).

As far as the technology is concerned, we extrapolate TFP disparities using an estimated convergence equation. We use historical data and regress the 5-year growth rate of TFP of each country k , $\log(A_{k,t}/A_{k,t-5})$, on the 5-year lagged distance to the USA, $\log(A_{US,t-5}/A_{k,t-5})$, time fixed effects, a_t , income-group and geographic dummies, X_k , an indicator of lagged human capital, $\log(h_{k,t-5})$, and a constant, a_0 . Our “convergence equation” writes as following:

$$(4) \quad \log(A_{k,t}/A_{k,t-5}) = a_0 + a_t + b \log(A_{US,t-5}/A_{k,t-5}) + c X_k + d \log(h_{k,t-5}) + u_{k,t}$$

This equation determines the trajectory of TFP disparities across countries and is compatible with a long-run balanced-growth path. Indeed, (4) can be rewritten as:

$$(4') \quad \log(A_{US,t}/A_{k,t}) = (1-b) \log(A_{US,t-5}/A_{k,t-5}) + c (X_{US}-X_k) + d \log(h_{US,t-5}/h_{k,t-5})$$

We have collected data on GDP per capita, the size and education structure of the labor force for all the countries of the world in 5-year intervals over the period 1980-2010. To identify the TFP level, we use the CES production technology in (3) and assume an elasticity of substitution equal to 3 in all countries as in Docquier and Machado (2014). The country-specific preference parameters for high-skilled and low-skilled workers are calibrated to match skill premium data in 2000 (taken from Hendricks, 2004). These parameters are assumed to be time invariant over the whole period. We then identify the TFP levels of the 195 countries in 5-year intervals (denoted by $A_{k,t}$) as a residual of the production technology. As for the human capital proxy, we use the proportion of individuals aged 25 and over with completed college education (Barro and Lee, 2013). We estimate (4) using 1,365 observations (195 countries times 7 periods of 5 years, from 1980-85 to 2005-10). Empirical results are described in Table 1.

[Insert Table 1 about here]

In columns 1 and 2 (the most parsimonious specifications), we identified a slow convergence process. The speed of convergence is around 4 percent per 5 years; it is robust to the inclusion of time fixed effects. In column 3, we added income-group dummies (reference group = high-income countries) and show that (i) the constant is not significantly different from zero (i.e. there is absolute convergence in TFP among high-income countries); (ii) the dummy variables for the BRIC's (Brazil, Russia, India and China) is not significant, suggesting that these emerging countries are also catching up with high-income countries; and (iii) the dummy for middle-income and low-income countries are negative and significant. Contrary to the BRIC's, the other developing countries will not catch up with high-income countries in the long-run. The R^2 of this regression is rather small (between 0.14 and 0.15) because we use a minimal number of explanatory variables and fixed effects to extract some general trends by country group. Obviously, adding the full set of country fixed effects would strongly improve the fit; however, these fixed effects capture unobserved – and endogenous – determinants of productivity growth that could drastically change over one century. Adding human capital in column 5 does not improve the fit as human capital is, at best, weakly significant. In columns

5 and 6, the empirical models with geographical dummies have lower predictive power than models based on income groups. Multicollinearity issues arise when region and income group dummies are included in the same regression.

The regression in column 3 is used to define our baseline TFP scenario. It predicts that, in the very long-run, TFP levels in low-income and middle-income countries will be equal to 6.47 and 25.4 percent of the TFP level in the USA (and other high-income countries), respectively. Indeed, in (4), the term cX_i is equal to -0.304 and -0.152 in low-income and middle-income countries respectively, b is equal to 0.111, and cX_{US} is equal to zero. We assumed an annual TFP growth rate of 1.5 percent for the USA and used the estimated coefficients to forecast TFP levels of all the countries until the year 2100.

In the BRIC's, the average TFP in 2000 amounted to 30.4 percent of the US level and is predicted to reach 87.7 percent of the US level in 2100 (full, absolute convergence in the very long-run). In high-income countries, the TFP level will increase from 76.8 to 96.9 percent of the US level. On the contrary, the technological distance to the US frontier will increase for middle-income and low-income countries, where the relative TFP level will decrease from 35.5 to 25.9 and from 11.0 to 6.7 percent, respectively. As a corollary, the average TFP level of sub-Saharan African countries will decrease from 23.6 to 15.6 percent.

2.3. Set of macroeconomic scenarios

To highlight some key factors governing the world economy, our baseline scenario will be compared with six alternative macroeconomic scenarios (two technological, two socio-demographic and two migration policy scenarios). In sum, our seven variants are characterized as following:

- 1) The '*Baseline*' scenario assumes that (i) the average TFP level of the BRIC's will increase from 30.4 to 87.7 percent of the US level, and the average TFP level of sub-Saharan African countries will decrease from 23.6 to 15.6 percent of the US level; (ii) the world population aged 25 and over will increase from 3.2 billion to 10.4 billion (as in the 'High Fertility' variant of the United Nations population prospects) and the share of college graduates will increase from 11.2 to 14.3 percent between 2000 and 2100; (iii) migration costs will remain constant over the 21st century (i.e. constant moving costs and migration policies).

- 2) The '*Slower BRIC*' variant assumes a slower convergence for the BRIC's. In (4), we set the fixed effect for the BRIC's to $X_{BRIC}=-0.075$, rather than zero in Table 1. This level is roughly equivalent (in absolute value) to half of the fixed effect of other middle-income countries (equal to -0.152). Under this variant, the BRIC's will not catch up with high-income countries: on average, the average TFP of the BRIC's will increase from 30.4 to 47.5 percent of the US level between 2000 and 2100 (rather than 87.7 percent in the baseline).
- 3) The '*Faster SSA*' variant assumes a faster convergence for sub-Saharan African countries. In (4), we set the fixed effect for the SSA countries to $X_{SSA}=-0.225$, rather than -0.303 in the baseline. This represents a 0.075 shock in X_{SSA} , equivalent in size to the BRIC's drop in TFP considered in the first variant. Hence, while diverging in the baseline, the relative TFP level of sub-Saharan countries will partly converge towards the US level: on average, the average TFP of African countries will increase from 23.6 to 28.9 percent of the US level between 2000 and 2100 (rather than 15.6 percent in the baseline).
- 4) The '*Low FERT*' variant assumes lower birth rates in all the countries of the world. Compared to the baseline, we divide children's potential income by 1.2 (i.e. we decrease it by 16.7 percent) in all the countries from 2025 on. This reduces the opportunity cost of basic education and the fertility rate. The effect is stronger in poor countries where child labor is severe.
- 5) The '*High EDUC*' variant assumes greater educational attainment in all the countries of the world. Compared to the baseline, we divide the cost of basic education by 1.5 (i.e. it decreases by 33.3 percent) in all the countries from 2025 on. Hence, the investment in basic education by low-skilled parents and the pool of adults eligible for higher education will gradually increase over the 21st century.
- 6) The '*Restr USA*' variant assumes greater immigration restrictions in the United States. Numerically, we divide the identified values for $(1 - m_{kUS,s,t})$ by four for all the origin countries from 2025 on.
- 7) The '*Open CHIND*' variant assumes that the costs of migrating to China and India will fall from 2025 on. The new values for $(1 - m_{ki,s,t})$, for $i = \text{China and India}$, equal 0.8 and 0.96 for college graduates and low-skilled workers from Asia (these levels correspond to the average migration cost from Latin America to the United States), and to $(1 - m_{kUS,s,t})$ of the previous variant for migrants from other countries.

2.4. World economy prospects

Figure 4 describes the evolution of the world economy under these seven macroeconomic variants. The left panel represents the trajectory of each variable over the 21st century, in perspective with historical data for the 19th and 20th centuries. We used population and GDP data from Maddison (2007), migration data from McKeown (2004) and the United Nations (2014), and inequality data from Bourguignon and Morrisson (2002) and Sala-i-Martin (2006). For each alternative scenario, the right panel gives the percentage of deviation from the baseline over the 21st century. Table 2 presents the long-run population, income and migration projections for selected regions.

Figures 4.a and 4.b describe the evolution of the world population. In the baseline, the world population aged 25 and over will increase from 3.2 billion to 10.4 billion between 2000 and 2100. This involves an average annual growth rate of 1.2 percent. As shown in Table 2, the share of Africa in the world adult population will increase from 7.1 percent in 2000 to 20.4 in 2100. The share of the EU15, China and India will fall. Three factors drastically affect the evolution of the world population. Under the '*Slower BRIC*' scenario, the wage rate (i.e. the opportunity cost of education) increases less rapidly in emerging countries. Under this scenario, the share of China and India in the world population keeps on increasing in the 21st century (see Table 2). Compared to the baseline, the fertility rate is greater and by 2100 the world population will be 29.9 percent larger, reaching 13.5 billion (instead of 10.4 billion under the baseline).⁴ On the contrary, under the '*Faster SSA*' scenario, fertility decreases in Africa and the world population will be 16.2 percent smaller in 2100 (8.7 billion instead of 10.4 under the baseline); the share of Africa in the world population will reach 15.7 percent in 2100 (rather than 20.4 in the baseline). The latter population trajectory becomes similar to the medium-fertility variant of the United Nations projections. Similarly, the world population aged 25 and over will be 25 percent lower than in the baseline (10.4 billion) in the '*Low FERT*' scenario. It will reach 7.8 billion in 2100, which corresponds to the central variant of the United Nations projections.

Figures 4.c and 4.d describe the evolution of the GDP per worker. In the baseline, the worldwide average income increases from USD 18,500 to 147,300 between 2000 and 2100, which amounts to an average annual growth rate of 2.1 percent. These income prospects are

⁴ This population size roughly corresponds to the United Nations prediction with constant fertility.

drastically affected by the TFP perspectives in Africa and in China and India. The share of these two countries in the world aggregate income increases from 17.1 to 45.7 percent over the 21st century. The long-run level of income per worker is 26.5 percent smaller under the ‘*Slower BRIC*’ variant, and 14.5 percent greater under the ‘*Faster SSA*’ one. In addition, income per worker will drastically increase if emerging countries open their borders to immigration (+14.5 percent under the ‘*Open CHIND*’ variant).

Figures 4.e and 4.f describe the evolution of the Theil index of wage inequality. Since the beginning of the 19th century, the world distribution of income has become more unequal: the level of the Theil index has increased from 0.45 to 0.80 and its across-country component has risen from 0.08 to 0.50 (Bourguignon and Morrisson, 2002; Sala-i-Martin, 2006). Our model disregards within-group inequality and only captures inequality between countries and between skill levels. Our Theil index amounts to 0.398 in 2000, which corresponds to 50 percent of the actual Theil index. In the baseline, the Theil index will decrease between 2000 and 2050 (from 0.398 to 0.289) and slightly increase between 2050 and 2100 (from 0.289 to 0.347). Four factors drastically affect the evolution of income inequality. Under the ‘*Faster SSA*’ scenario, the long-run level of the Theil index will be 10 percent smaller; under the ‘*Low FERT*’, ‘*Slower BRIC*’ and ‘*Open CHIND*’ variants, it will be 4 to 6 percent smaller.

Finally, Figures 4.g and 4.h describe the evolution of the world migration rate. Assuming unchanged immigration policies, the worldwide average proportion of adult migrants will increase from 3.5 to 4.5 percent over the 21st century. This rate is stable across scenarios. It could be 0.5 percentage-point smaller if the US immigration policy became more restrictive and about 1.0 percentage-point smaller under the ‘*Low FERT*’ variant. The only scenario inducing a large change in the immigration rate is the ‘*Open CHIND*’ one. If income in China and India converges towards the US level and if these countries open their borders to immigration, the world migration rate will be twice as large in the long-run, an extraordinary shift compared to historical data.

The evolution of the worldwide average migration rate hides large differences between destination regions. Migrants tend to agglomerate in high-income countries, as shown in Table 2. In the baseline, a moderate decrease in immigration rates will be observed in the United States, Japan, Switzerland, South Africa, Canada and Australia. On the contrary, European and emerging countries will see their immigration rates increase. In the EU15, the immigration rate will be 2.3 times larger in 2100 than in 2000. This is due to the combination of two factors. On the demand side, Europe will gradually become more attractive, due to the

convergence in TFP and income with the United States. More importantly, on the supply side, rising income disparities with sub-Saharan Africa and the MENA (Middle-East and Northern Africa) will increase the migration pressure to Europe. Under the ‘*Faster SSA*’ scenario, the immigration rate could be reduced by 3 percentage points in Europe (from 17.7 to 14.2 percent), and by 10.5 percentage points in the United Kingdom. A similar decrease in immigration rate is obtained in the ‘*Low FERT*’ scenario (from 17.7 to 14.4 percent). TFP and population growth rates in Africa are thus key determinants of the migration pressure to Europe. In all the scenarios, the brain drain from Africa and the MENA is expected to increase during the 21st century; on the contrary, it will be smaller in China and India, due to income convergence.

[Insert Figure 4 about here]

3. Remittance prospects for the 21st century

We now use the world economy prospects to simulate the evolution of the ratio of remittances to domestic GDP ($R_{k,t}/Y_{k,t}$) in developing countries. This ratio can be expressed as following:

$$(5) \quad R_{k,t}/Y_{k,t} = r_{k,t} \cdot (M_{k,t} \cdot y_{k,t}^*) / (L_{k,t} \cdot y_{k,t})$$

where $r_{k,t}$ is the average propensity to remit of emigrants from country k at period t , $M_{k,t} \cdot y_{k,t}^*$ denotes the aggregate income of emigrants (product of the number of emigrants by their average income), and $L_{k,t} \cdot y_{k,t}$ is the aggregate domestic income (product of the domestic labor force by the average domestic income).

Our model allows to estimate the aggregate income of emigrants and domestic GDP in the year 2000. We can thus calibrate the propensity to remit of each country ($r_{k,t}$) to perfectly match data on the remittance-to-GDP ratio in 2000. Our model also generates predictions for the aggregate income of emigrants and the aggregate domestic income. Hence, using assumptions on the evolution of the propensity to remit, we can simulate the trajectory of the remittance-to-GDP ratio of each country over the 21st century.

We consider three scenarios for the propensity to remit:

- The first (optimistic) one assumes a constant propensity to remit ($r_{k,t}=r_{1,k}$ for all t). From (5), this implies that $R_{k,t}/Y_{k,t} = r_{1,k} \cdot (M_{k,t} \cdot y_{k,t}^*) / (L_{k,t} \cdot y_{k,t})$: the share of remittances in GDP is proportional to the ratio of aggregate income between emigrants and residents, i.e. an elasticity of remittances to the stock of emigrants equal to unity.

- The second (pessimistic) one assumes a -1.0 elasticity of the propensity to remit to the emigrant-to-stayer ratio ($r_{k,t}=r_{2,k} \cdot (M_{k,t}/L_{k,t})^{-1}$). From (5), this implies that $R_{k,t}/Y_{k,t} = r_{2,k} \cdot (y_{k,t}^*/y_{k,t})$: the share of remittances in GDP is proportional to the ratio of average income between emigrants and residents, i.e. an elasticity of remittances to the stock of emigrants equal to zero.
- The third (intermediate) one assumes a -0.5 elasticity ($r_{k,t}=r_{3,k} \cdot (M_{k,t}/L_{k,t})^{-1/2}$). From (5), this implies that $R_{k,t}/Y_{k,t} = r_{3,k} \cdot (M_{k,t}/L_{k,t})^{1/2} \cdot (y_{k,t}^*/y_{k,t})$, i.e. an elasticity of remittances to the stock of emigrants equal to 0.5.

Many empirical analysis on the determinants of remittances use the amount of remittances per migrants as a dependent variable. They disregard the role of the number of emigrants (Giuliano and Ruiz-Arranz, 2009) or implicitly assume that remittances are proportional to emigration, as in our first scenario (see Schioupou and Siegfried, 2006). Other studies include the number of emigrants in the set of regressors. Faini (2007) and Niimi et al. (2010) found an elasticity of remittances to the stock of emigrants of 0.5, as in our third scenario. Freund and Spatafora (2008) found an elasticity between 0.65 and 0.75, which is between our first and third scenarios. Similarly, Docquier et al. (2012) used bilateral data on remittances and migration and found an elasticity of remittances to the stock of emigrants of 0.8. On average, the estimated level of this elasticity lies between 0.5 and 1.0. The second scenario therefore seems too pessimistic and should be considered as an extreme scenario.

3.1. Constant propensity to remit

Results obtained with a constant propensity to remit are depicted in Table 3. Table 3.1 gives the results for developing regions. Tables 3.2 and 3.3 give the results for the main recipient countries, based on the rankings for the year 2000 in terms of USD or percentage of GDP, respectively.

The ratio of remittances to GDP ($R_{k,t}/Y_{k,t}$) will drastically increase under all macroeconomic scenarios. Under the baseline world economy prospects, it will increase from 2.2 to 12.6 percent in low-income countries, and from 2.5 to 8.0 percent in the least developed countries. These ratios are of the same order of magnitude as the current ratios observed in the 20 main recipient countries. On average, this ratio will be multiplied by 2 to 2.5 in all developing regions except in Latin America and the Caribbean, where it stagnates (see Table 3.1). Table 3.2 shows that remittances will gradually become a negligible resource for emerging

economies such as China and India. On the contrary, if the propensity to remit remains constant, the share of remittances in GDP will soar in large recipient countries such as the Philippines, Jordan, Morocco, El Salvador, Guatemala or even Mexico. In Table 3.1, we see that the ratio of remittances to domestic income could exceed 100 percent in Tajikistan, Nepal or Bangladesh.

The comparison of macroeconomic scenarios reveals that the ratio of remittances to GDP will increase less if emerging countries grow slower (due to a decrease in emigration to emerging countries and in emigrants' income) or if Africa takes off (due to a decrease in the willingness to emigrate from Africa). A decrease in fertility and population growth would also reduce the demographic share of developing countries, the number of emigrants and the amount of remittances. On the contrary, if the convergence of emerging countries is accompanied by a relaxation of immigration restrictions, the long-run share of remittances would reach 16.5 percent in low-income countries and 11.5 percent in the least developed countries (see Table 3.1). Drastic changes would be observed in the MENA and Asian countries (as revealed in Tables 3.1 and 3.2). Remittances would become extremely large in Nepal or Bangladesh, two outliers in our simulations.

3.2. Declining propensity to remit

As discussed above, many empirical studies on the determinants of remittances find an elasticity of remittances to emigration below one. Tables 4 and 5 give the evolution of the remittance-to-GDP ratio under a declining propensity to remit. They have the same structure as Table 3. In Table 4, we assume a -0.5 elasticity of the propensity to remit to the emigrant-to-stayer ratio (third remittance scenario). In Table 5, this elasticity is equal to -1.0, a value that can be considered as too pessimistic (second remittance scenario).

In both cases, the ratio of remittances to GDP is expected to increase or stagnate in developing countries. With a -0.5 elasticity, it increases from 2.2 to 5.4 in low-income and from 2.5 to 3.8 in least developed countries. Under the baseline world economy prospects, the long-run level of the remittances-to-GDP ratio would reach 125.4 percent in Tajikistan, 51 percent in Nepal, 48.6 percent in Bangladesh, 36.4 percent in Haiti and 35.4 percent in Kyrgyzstan. Greater levels are reached in the optimistic '*Open CHIND*' macroeconomic scenario. Even under the pessimistic scenario (elasticity of -1.0), the ratio of remittances to GDP increases from 2.2 to 2.7 low-income and stagnates in the least developed countries.

Figure 5 summarizes the projections obtained under our 21 scenarios (7 macroeconomic variants for the world economy prospects, times 3 scenarios for the propensity to remit) for low-income countries. Bold lines represent the three scenarios involving baseline macroeconomic prospects. This figure confirms that remittances will be a sustainable source of funding for developing countries. In the worst-case scenario, their share in GDP will remain constant over the 21st century. Due to rising income disparities and the emergence of new flourishing destination countries, their share in GDP is likely to increase in the future, notwithstanding the fact that population growth will be greater in low-income countries. More than ever before, remittances are likely offer a vital lifeline for millions of poor households in the 21st century.

4. Conclusion

Remittances have substantially increased over the last decades, offering a vital lifeline for millions of poor households in developing countries. Their future development will be affected by the evolution of emigration rates and cross-country disparities in income. In this paper, we provide integrated projections of income, population, migration stocks and remittances for the 21st century under alternative technological and policy scenarios. Our quantitative analysis reveals that remittances will be remain a major source of funding for low-income countries. Due to rising income disparities and the take-off of emerging countries, their share in GDP is likely to increase in the future, notwithstanding the fact that population growth will be greater in low-income countries. Our lower-bound scenarios find a constant remittances-to-GDP ratio. In our baseline, this ratio will be multiplied by 4. Our most optimistic scenario assumes that the BRIC's will catch up with high-income countries and open their borders to immigration: the average remittances-to-GDP ratio could then be multiplied by 10.

5. References

- Artuç, Erhan & Frédéric Docquier & Çağlar Özden & Christopher R. Parsons (2014). A Global Assessment of Human Capital Mobility: the Role of non-OECD Destinations. *World Development*, forthcoming.
- Barro, Robert J. & Jong-Wha Lee (2013). A new data set of educational attainment in the world, 1950-2010. *Journal of Development Economics*, 104(C):184–198.

- Bauer, David & Ilda Boyandin & Rene Stalder (2014). The incredible rise of migrants' remittances. URL: <http://www.visualizing.org/full-screen/54850>.
- Beine, Michel & Frédéric Docquier & Hillel Rapoport (2008). Brain drain and human capital formation in developing countries: winners and losers. *Economic Journal* 118: 631-652.
- Bourguignon, François & Christian Morrisson (2002). Inequality Among World Citizens: 1820-1992. *American Economic Review* 92 (4): 727-744.
- Burnside, Craig & David Dollar (2000). Aid, Policies, and Growth, *American Economic Review*, 90(4): 847-868.
- Chauvet, Lisa & and Patrick Guillaumont (2009). Aid, Volatility and Growth Again. When Aid Volatility Matters and When it Does Not, *Review of Development Economics*, (13), 3: 452-463.
- Clemens, Michael A. & Steven Radelet & Rikhil R. Bhavnani & Samuel Bazzi (2012). Counting Chickens when they Hatch: Timing and the Effects of Aid on Growth. *Economic Journal* 122: 590–617.
- Delogu, Marco & Frédéric Docquier & Joël Machado (2013). The dynamic implications of liberalizing global migration, IRES Discussion Paper n. 2013-029, Université Catholique de Louvain.
- Docquier, Frédéric & Joël Machado (2014). Global competition for attracting talents and the world economy. *World Economy*, forthcoming.
- Docquier, Frédéric & Hillel Rapoport (2012). Globalization, brain drain and development, *Journal of Economic Literature* , 50 (3): 681-730.
- Docquier, Frédéric & Hillel Rapoport & Sara Salomone (2012). Remittances, migrants' education and immigration policy: Theory and evidence from bilateral data. *Regional Science and Urban Economics* 42 (5): 817-828.
- Easterly, William & Ross Levine & David Roodman (2004). Aid, Policies, and Growth: Comment, *American Economic Review*, 94(3):774-780.
- Faini, Ricardo (2007). Remittances and the Brain Drain: Do More Skilled Migrants Remit More? *World Bank Economic Review* 21 (2):177-191.
- Freund, Caroline & Nikola Spatafora (2008). Remittances: transaction costs, determinants, and informal flows. *Journal of Development Economics* 86: 356–366.

- Giuliano, Paola & Marta Ruiz-Arranz (2009). Remittances, financial development and growth. *Journal of Development Economics* 90 (1): 144–152.
- Grogger, Jeffrey & Gordon Hanson (2011). Income Maximization and the Selection and Sorting of International Migrants. *Journal of Development Economics* 95 (1): 42-57.
- Hansen, Henrik & Finn Tarp (2000). Aid effectiveness disputed, *Journal of International Development*, 12(3): 375-398.
- Hendricks, L. (2004). A Database of Mincerian Earnings Regressions. Available online at: www.lhendricks.org/Mincer.htm.
- Maddison, Angus (2007). *Contours of the world Economy, 1-2030 AD. Essays in Macroeconomic History*, Oxford University Press.
- McKeown, Adam (2004). Global Migration, 1846–1940. *Journal of World History* 15 (2): 155-189.
- McFadden, Daniel L. (1984). Econometric analysis of qualitative response models. In Griliches, Z. and Intriligator, M. (eds), *Handbook of Econometrics*, Volume 2. Elsevier/North-Holland, Amsterdam.
- Mountford, Andrew & Hillel Rapoport (2014). Migration Policy, African Population Growth and Global Inequality. *World Economy*, forthcoming.
- Niimi, Yoko & Caglar Ozden, Maurice Schiff (2010). Remittances and the brain drain: skilled migrants do remit less! *Annales d'Economie et de Statistique* 97–98 : 123–142.
- Rajan, Raghuram G. & Arvind Subramanian (2008). Aid and Growth: What Does the Cross-Country Evidence Really Show?, *The Review of Economics and Statistics*, 90, No. 4: 643-665.
- Rapoport, Hillel & Frédéric Docquier (2006). The Economics of migrants' remittances. In: J. Mercier-Ythier et S.C. Kolm (eds), *Handbook on the economics of giving, altruism and reciprocity*, Handbook series edited by Kenneth Arrow and Michael Intriligator, Elsevier-North Holland, chapter 17.
- Reichel, David (2012). Regulating political incorporation of immigrants – Naturalization rates in Europe. ICMDP Working paper n.4, International Centre for Migration Policy Development.

Sala-i-Martin, Xavier (2006). The World Distribution of Income: Falling Poverty and Convergence, Period. *Quarterly Journal of Economics* 121 (2): 351-397.

Schioupu, Iona & Nikolaus Siegfried (2006). Determinants of workers' remittances. Evidence from the European neighbouring region. *European Central Bank Working Paper Series*, No 688 (October).

United Nations (2014). Probabilistic Population Projections based on the World Population Prospects: The 2012 Revision. Population Division: New York.

World Bank (2006). Global economic prospects 2006 – Economic implications of remittances and migration. The World Bank: Washington DC.

TABLES AND FIGURES

Table 1. Estimation of TFP trends, 1980-2010

Dep: $\log(A_{i,t}/A_{i,t-5})$	(1)	(2)	(3)	(4)	(5)	(6)
$\log(A_{US,t-5}/A_{i,t-5})$	0.043*** (0.007)	0.040*** (0.007)	0.111*** (0.012)	0.116*** (0.012)	0.061*** (0.008)	0.075*** (0.010)
BRIC	-	-	0.029 (0.042)	0.023 (0.043)	-	-
Middle income	-	-	-0.152*** (0.020)	-0.144*** (0.022)	-	-
Low- income	-	-	-0.304*** (0.020)	-0.283*** (0.039)	-	-
$\log(h_{i,t-5})$	-	-	-	0.015* (0.008)	-	0.036*** (0.009)
Constant	-0.050*** (0.010)	-0.051*** (0.014)	-0.016 (0.015)	-0.060** (0.030)	-0.050*** (0.017)	0.067* (0.035)
Time FE	No	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	No	No	Yes	Yes
Obs.	1,365	1,365	1,365	1,365	1,365	1,365
F(.)	35.15	10.32	13.32	13.17	10.70	10.59
R ²	0.033	0.056	0.143	0.146	0.110	0.120

Notes. T-stat between parentheses. Columns 3 and 4: reference group = high-income countries. Columns 5 and 6: reference group = USA.

Table 2. Projections by region and scenario (year 2100)

	Obs. 2000	Base 2100	Slower BRIC 2100	Faster SSA 2100	Low FERT 2100	High EDUC 2100	Restr USA 2100	Open CHIND 2100
Share in the world population aged 25 and over								
USA	5.8	6.0	4.7	7.1	7.7	6.9	3.9	5.9
EU15	8.4	5.6	4.3	6.2	6.4	6.1	5.7	5.4
MENA	4.2	6.1	4.7	7.1	5.7	5.8	6.3	4.5
SSA	7.1	20.4	15.7	5.9	15.3	19.4	20.6	20.8
CHIND	39.0	32.1	42.8	38.2	33.4	30.7	32.1	41.9
Share in the world aggregate income								
USA	21.2	12.5	13.7	12.6	14.3	13.6	8.4	10.6
EU15	19.5	10.7	11.7	10.3	11.1	11.3	11.3	9.0
MENA	3.2	2.5	2.7	2.5	2.2	2.4	2.7	1.6
SSA	2.3	3.4	3.7	1.9	2.4	3.2	3.5	3.0
CHIND	17.1	45.7	41.7	47.0	44.3	42.3	47.1	57.2
Proportion of immigrants								
USA	13.2	12.5	13.0	11.6	10.5	12.0	5.2	10.9
EU15	7.5	17.2	17.7	14.2	14.4	16.0	17.2	15.4
CHIND	0.4	2.1	0.9	2.0	1.9	2.1	2.1	11.2
Emigration rate of college graduates								
MENA	17.5	25.2	25.1	25.3	25.5	25.3	21.7	41.0
SSA	15.8	26.8	26.7	18.1	26.9	27.8	23.0	28.5
CHIND	5.7	1.4	2.5	1.4	1.5	1.5	0.9	12.8

Source: own calculations.

Table 3. Projections of remittances as percentage of GDP (2000-2100)*3.1. Developing regions (2000-2100)**Assuming a constant propensity to remit*

	Baseline	Slower BRIC	Faster SSA	Low FERT	High EDUC	Restr USA	Open CHIND
<i>LOW = Low-income countries (World Bank classification)</i>							
2000	2.2	2.2	2.2	2.2	2.2	2.2	2.2
2025	7.5	5.5	7.4	7.7	7.3	7.2	14.6
2050	14.1	8.7	13.3	12.6	14.4	13.7	28.1
2075	14.2	8.9	12.2	11.3	14.7	13.8	23.8
2100	12.6	8.7	9.3	8.7	13.6	12.2	16.5
<i>LDC = Least developed countries (United Nations classification)</i>							
2000	2.5	2.5	2.5	2.5	2.5	2.5	2.5
2025	6.3	4.7	6.3	6.5	6.2	6.1	12.8
2050	10.4	6.4	10.1	9.3	10.6	10.2	22.1
2075	9.9	6.0	9.2	7.9	10.2	9.8	18.1
2100	8.0	5.2	6.9	5.7	8.4	7.9	11.5
<i>SIDS = Small Island Developing States (United Nations classification)</i>							
2000	2.0	2.0	2.0	2.0	2.0	2.0	2.0
2025	2.9	2.8	2.8	2.9	2.8	2.1	2.9
2050	3.5	3.4	3.2	3.2	3.7	2.8	3.5
2075	3.7	3.7	3.1	3.0	4.1	3.2	3.8
2100	3.4	3.4	2.7	2.4	3.7	3.1	3.5
<i>Asia (except China, India, GCC and MENA countries)</i>							
2000	0.8	0.8	0.8	0.8	0.8	0.8	0.8
2025	1.3	1.1	1.3	1.3	1.2	1.1	3.1
2050	2.0	1.5	2.0	1.9	2.1	1.9	6.2
2075	2.4	1.7	2.4	2.0	2.6	2.3	7.5
2100	2.4	1.7	2.4	1.8	2.6	2.2	6.9
<i>MENA = Middle East and Northern Africa</i>							
2000	2.1	2.1	2.1	2.1	2.1	2.1	2.1
2025	2.9	2.9	2.9	2.9	2.8	2.7	3.3
2050	3.5	3.5	3.5	3.2	3.7	3.3	4.7
2075	4.0	4.0	4.0	3.3	4.3	3.8	5.7
2100	4.1	4.1	4.1	3.1	4.5	3.9	5.9
<i>SSA = Sub-Saharan Africa</i>							
2000	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2025	1.4	1.4	1.3	1.5	1.4	1.3	1.4
2050	1.8	1.7	1.1	1.6	1.9	1.6	1.8
2075	1.9	1.9	0.7	1.4	2.1	1.8	2.0
2100	2.2	2.1	0.5	1.3	2.5	2.0	2.3
<i>LAC = Latin America and the Caribbean</i>							
2000	0.9	0.9	0.9	0.9	0.9	0.9	0.9
2025	1.1	1.1	1.1	1.1	1.1	0.7	1.1
2050	1.1	1.2	1.1	1.0	1.2	0.8	1.1
2075	1.1	1.3	1.1	0.9	1.2	0.8	1.1
2100	1.0	1.3	1.0	0.8	1.1	0.8	1.0

Source: own calculations.

Table 3. Projections of remittances as percentage of GDP (2000-2100)*3.2. Largest recipient countries in 2000 (in USD)**Assuming a constant propensity to remit*

	Basel. 2000	Basel. 2100	Slower BRIC 2100	Faster SSA 2100	Low FERT 2100	High EDUC 2100	Restr USA 2100	Open CHIND 2100
India	1.4	0.1	0.3	0.1	0.1	0.1	0.1	2.4
China	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Mexico	1.2	5.1	5.1	5.1	5.0	4.9	2.0	5.1
Philippines	6.2	8.1	8.1	8.1	8.3	8.4	5.4	49.7
Nigeria	2.1	0.8	0.8	0.3	0.8	0.9	0.6	0.9
Egypt	2.8	4.6	4.6	4.6	4.7	4.9	4.2	5.0
Bangladesh	3.3	148.2	50.6	148.2	148.0	149.1	147.2	460.3
Pakistan	2.0	3.5	1.8	3.5	3.6	3.7	3.4	13.9
Vietnam	4.5	3.5	3.5	3.5	3.7	4.1	2.4	30.3
Indonesia	0.5	0.7	0.7	0.7	0.7	0.7	0.6	20.4
Lebanon	9.4	25.4	24.6	26.1	26.5	27.1	21.9	38.3
Ukraine	0.2	0.7	0.3	0.7	0.7	0.7	0.7	0.7
Morocco	4.5	13.0	13.0	13.1	13.0	13.4	12.7	13.3
Guatemala	3.7	14.6	14.6	14.6	14.8	15.5	6.5	14.6
Sri Lanka	4.9	9.8	6.8	9.8	9.9	10.2	9.5	39.7
Colombia	1.2	4.9	4.8	4.9	5.0	5.1	3.2	4.9
Dominican R.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Romania	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.7
Thailand	0.8	1.8	1.7	1.8	1.9	2.1	1.4	45.9
Jordan	15.1	12.3	12.1	12.3	12.5	13.0	11.3	30.6
El Salvador	9.0	16.6	16.5	16.6	17.1	18.0	6.8	16.6
Nepal	3.8	143.2	42.5	143.2	144.4	145.6	143.2	800.9
Serbia Mont.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brazil	0.2	0.2	0.5	0.2	0.2	0.2	0.1	0.2
Honduras	5.6	7.6	7.5	7.6	7.7	8.0	3.6	7.6

Source: own calculations.

Table 3. Projections of remittances as percentage of GDP (2000-2100)*3.3. Largest recipient countries in 2000 (as % of GDP)**Assuming a constant propensity to remit*

	Basel. 2000	Basel. 2100	Slower BRIC 2100	Faster SSA 2100	Low FERT 2100	High EDUC 2100	Restr USA 2100	Open CHIND 2100
Tajikistan	10.3	290.0	94.0	290.1	290.0	290.6	288.5	291.5
Lesotho	23.4	3.1	3.1	2.8	3.2	3.3	3.1	3.1
Kyrgyzstan	2.1	85.5	29.0	85.5	86.0	85.9	85.3	86.1
Moldova	10.1	8.9	3.7	8.9	8.8	8.8	8.8	9.0
Haiti	10.6	59.4	59.4	59.4	63.3	79.9	40.1	59.4
Nepal	3.8	143.2	42.5	143.2	144.4	145.6	143.2	800.9
Samoa	13.5	12.2	12.1	12.4	11.7	12.0	11.0	13.1
Tonga	24.6	30.5	29.9	8.3	29.7	30.8	22.5	35.5
Lebanon	9.4	25.4	24.6	26.1	26.5	27.1	21.9	38.3
W.Bank-Gaza	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Armenia	4.5	13.5	5.5	13.5	13.6	13.8	12.8	16.6
Honduras	5.6	7.6	7.5	7.6	7.7	8.0	3.6	7.6
Guyana	5.1	6.7	6.1	6.8	6.8	7.0	4.5	6.8
El Salvador	9.0	16.6	16.5	16.6	17.1	18.0	6.8	16.6
Jamaica	8.2	19.9	19.6	20.0	19.9	20.1	11.6	19.9
East Timor	0.2	0.5	0.5	0.5	0.5	0.5	0.5	8.3
Jordan	15.1	12.3	12.1	12.3	12.5	13.0	11.3	30.6
Gambia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Senegal	3.6	2.3	2.3	0.9	2.3	2.5	2.2	2.3
Bosnia Herz	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bangladesh	3.3	148.2	50.6	148.2	148.0	149.1	147.2	460.3
Philippines	6.2	8.1	8.1	8.1	8.3	8.4	5.4	49.7
Togo	3.1	9.0	9.0	6.0	9.2	9.5	8.7	9.2
Guatemala	3.7	14.6	14.6	14.6	14.8	15.5	6.5	14.6
Georgia	5.3	14.4	5.5	15.1	14.5	14.5	14.3	14.5

Source: own calculations.

Table 4. Projections of remittances as percentage of GDP (2000-2100)*4.1. Developing regions (2000-2100)**Assuming a -0.5 elasticity of the propensity to remit to the emigrant-to-stayer ratio*

	Baseline	Slower BRIC	Faster SSA	Low FERT	High EDUC	Restr USA	Open CHIND
<i>LOW = Low-income countries (World Bank classification)</i>							
2000	2.2	2.2	2.2	2.2	2.2	2.2	2.2
2025	4.8	3.6	4.8	5.0	4.7	4.6	9.5
2050	6.9	4.5	6.4	6.2	7.1	6.7	13.9
2075	6.3	4.3	4.9	4.9	6.6	6.1	10.3
2100	5.4	4.1	3.4	3.7	6.0	5.2	7.0
<i>LDC = Least developed countries (United Nations classification)</i>							
2000	2.5	2.5	2.5	2.5	2.5	2.5	2.5
2025	4.3	3.4	4.3	4.5	4.2	4.1	8.8
2050	5.4	3.7	5.2	4.8	5.6	5.3	11.7
2075	4.7	3.2	4.1	3.7	4.8	4.6	8.7
2100	3.8	2.8	2.9	2.6	4.1	3.7	5.7
<i>SiDS = Small Island Developing States (United Nations classification)</i>							
2000	2.0	2.0	2.0	2.0	2.0	2.0	2.0
2025	2.4	2.4	2.4	2.5	2.4	1.8	2.4
2050	2.6	2.6	2.4	2.4	2.8	2.0	2.6
2075	2.5	2.5	2.2	2.0	2.7	2.1	2.5
2100	2.2	2.1	1.8	1.6	2.3	2.0	2.2
<i>Asia (except China, India, GCC and MENA countries)</i>							
2000	0.8	0.8	0.8	0.8	0.8	0.8	0.8
2025	1.0	0.9	1.0	1.1	1.0	0.9	2.6
2050	1.3	1.0	1.3	1.2	1.4	1.2	4.5
2075	1.4	1.1	1.4	1.2	1.5	1.3	5.2
2100	1.4	1.1	1.4	1.1	1.5	1.2	4.9
<i>MENA = Middle East and Northern Africa</i>							
2000	2.1	2.1	2.1	2.1	2.1	2.1	2.1
2025	2.6	2.6	2.6	2.6	2.5	2.4	3.0
2050	2.9	2.9	2.9	2.6	3.0	2.7	3.9
2075	3.1	3.1	3.1	2.5	3.3	2.9	4.5
2100	3.1	3.1	3.1	2.3	3.4	3.0	4.6
<i>SSA = Sub-Saharan Africa</i>							
2000	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2025	1.3	1.3	1.2	1.4	1.3	1.2	1.3
2050	1.5	1.5	1.0	1.3	1.6	1.3	1.5
2075	1.5	1.5	0.6	1.1	1.7	1.4	1.6
2100	1.6	1.6	0.3	1.0	1.9	1.4	1.7
<i>LAC = Latin America and the Caribbean</i>							
2000	0.9	0.9	0.9	0.9	0.9	0.9	0.9
2025	1.0	1.0	1.0	1.0	0.9	0.6	1.0
2050	0.9	1.0	0.9	0.9	1.0	0.6	0.9
2075	0.8	1.0	0.8	0.7	0.9	0.6	0.8
2100	0.8	1.0	0.8	0.6	0.8	0.6	0.8

Source: own calculations.

Table 4. Projections of remittances as percentage of GDP (2000-2100)*4.2. Largest recipient countries in 2000 (in USD)**Assuming a -0.5 elasticity of the propensity to remit to the emigrant-to-stayer ratio*

	Basel. 2000	Basel. 2100	Slower BRIC 2100	Faster SSA 2100	Low FERT 2100	High EDUC 2100	Restr USA 2100	Open CHIND 2100
India	1.4	0.2	0.6	0.2	0.2	0.2	0.2	4.7
China	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.4
Mexico	1.2	3.5	3.5	3.5	3.4	3.3	1.4	3.5
Philippines	6.2	6.9	6.9	6.9	7.1	7.1	4.6	42.3
Nigeria	2.1	1.0	0.9	0.4	1.0	1.1	0.8	1.2
Egypt	2.8	3.9	3.9	4.0	4.1	4.2	3.6	4.3
Bangladesh	3.3	48.6	16.6	48.5	48.5	48.9	48.2	150.8
Pakistan	2.0	2.4	1.3	2.4	2.5	2.6	2.4	9.6
Vietnam	4.5	3.4	3.3	3.4	3.5	3.9	2.3	28.7
Indonesia	0.5	0.6	0.6	0.6	0.7	0.7	0.6	19.4
Lebanon	9.4	18.8	18.2	19.3	19.6	20.0	16.2	28.3
Ukraine	0.2	0.5	0.2	0.5	0.5	0.5	0.5	0.5
Morocco	4.5	9.2	9.2	9.2	9.1	9.4	9.0	9.3
Guatemala	3.7	9.6	9.6	9.6	9.7	10.2	4.2	9.6
Sri Lanka	4.9	7.0	4.8	7.0	7.0	7.2	6.8	28.3
Colombia	1.2	3.2	3.1	3.2	3.3	3.3	2.0	3.2
Dominican R.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Romania	0.4	0.6	0.5	0.6	0.6	0.6	0.5	0.6
Thailand	0.8	1.3	1.3	1.3	1.4	1.5	1.0	33.5
Jordan	15.1	13.2	13.1	13.2	13.4	14.0	12.2	32.9
El Salvador	9.0	13.1	13.0	13.1	13.5	14.1	5.4	13.1
Nepal	3.8	51.8	15.4	51.7	52.2	52.6	51.7	289.4
Serbia Mont.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brazil	0.2	0.2	0.5	0.2	0.2	0.2	0.1	0.2
Honduras	5.6	6.2	6.1	6.2	6.3	6.5	2.9	6.2

Source: own calculations.

Table 4. Projections of remittances as percentage of GDP (2000-2100)*4.3. Largest recipient countries in 2000 (as % of GDP)**Assuming a -0.5 elasticity of the propensity to remit to the emigrant-to-stayer ratio*

	Basel. 2000	Basel. 2100	Slower BRIC 2100	Faster SSA 2100	Low FERT 2100	High EDUC 2100	Restr USA 2100	Open CHIND 2100
Tajikistan	10.3	125.4	40.6	125.4	125.4	125.6	124.7	126.0
Lesotho	23.4	5.0	4.9	4.5	5.1	5.2	4.9	5.0
Kyrgyzstan	2.1	35.4	12.0	35.4	35.6	35.6	35.3	35.6
Moldova	10.1	9.2	3.8	9.2	9.1	9.1	9.1	9.3
Haiti	10.6	36.4	36.5	36.4	38.8	49.0	24.6	36.4
Nepal	3.8	51.8	15.4	51.7	52.2	52.6	51.7	289.4
Samoa	13.5	13.0	12.9	13.1	12.4	12.8	11.6	14.0
Tonga	24.6	28.5	27.9	7.7	27.7	28.8	21.0	33.2
Lebanon	9.4	18.8	18.2	19.3	19.6	20.0	16.2	28.3
W.Bank-Gaza	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Armenia	4.5	10.1	4.1	10.1	10.3	10.4	9.7	12.5
Honduras	5.6	6.2	6.1	6.2	6.3	6.5	2.9	6.2
Guyana	5.1	5.8	5.2	5.8	5.8	6.0	3.9	5.8
El Salvador	9.0	13.1	13.0	13.1	13.5	14.1	5.4	13.1
Jamaica	8.2	14.2	14.0	14.2	14.2	14.3	8.3	14.2
East Timor	0.2	0.4	0.4	0.4	0.4	0.4	0.4	6.4
Jordan	15.1	13.2	13.1	13.2	13.4	14.0	12.2	32.9
Gambia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Senegal	3.6	2.7	2.7	1.0	2.7	2.9	2.6	2.8
Bosnia Herz	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bangladesh	3.3	48.6	16.6	48.5	48.5	48.9	48.2	150.8
Philippines	6.2	6.9	6.9	6.9	7.1	7.1	4.6	42.3
Togo	3.1	6.8	6.8	4.5	7.0	7.2	6.6	7.0
Guatemala	3.7	9.6	9.6	9.6	9.7	10.2	4.2	9.6
Georgia	5.3	11.2	4.3	11.7	11.3	11.3	11.1	11.3

Source: own calculations.

Table 5. Projections of remittances as percentage of GDP (2000-2100)*5.1. Developing regions (2000-2100)**Assuming a -1.0 elasticity of the propensity to remit to the emigrant-to-stayer ratio*

	Baseline	Slower BRIC	Faster SSA	Low FERT	High EDUC	Restr USA	Open CHIND
<i>Low-income countries (World Bank classification)</i>							
2000	2.2	2.2	2.2	2.2	2.2	2.2	2.2
2025	3.2	2.5	3.1	3.3	3.1	3.0	6.5
2050	3.6	2.6	3.2	3.3	3.8	3.5	7.4
2075	3.1	2.3	2.2	2.4	3.3	2.9	5.0
2100	2.7	2.2	1.4	1.8	3.0	2.5	3.4
<i>Least developed countries (United Nations classification)</i>							
2000	2.5	2.5	2.5	2.5	2.5	2.5	2.5
2025	3.2	2.6	3.2	3.3	3.1	3.0	6.5
2050	3.3	2.6	3.1	3.0	3.4	3.2	7.2
2075	2.8	2.2	2.2	2.2	2.9	2.7	5.3
2100	2.5	2.0	1.6	1.6	2.6	2.3	3.9
<i>Small Island Developing States (United Nations classification)</i>							
2000	2.0	2.0	2.0	2.0	2.0	2.0	2.0
2025	2.1	2.1	2.0	2.1	2.0	1.5	2.1
2050	2.0	1.9	1.8	1.8	2.1	1.5	2.0
2075	1.7	1.7	1.5	1.4	1.9	1.5	1.7
2100	1.4	1.4	1.2	1.0	1.5	1.3	1.4
<i>Asia (except China, India, GCC and MENA countries)</i>							
2000	0.8	0.8	0.8	0.8	0.8	0.8	0.8
2025	0.9	0.8	0.9	0.9	0.8	0.7	2.2
2050	1.0	0.8	1.0	0.9	1.0	0.8	3.6
2075	1.0	0.8	1.0	0.8	1.0	0.8	4.1
2100	0.9	0.8	0.9	0.7	1.0	0.8	3.8
<i>MENA = Middle East and Northern Africa</i>							
2000	2.1	2.1	2.1	2.1	2.1	2.1	2.1
2025	2.4	2.4	2.4	2.4	2.3	2.2	2.8
2050	2.5	2.5	2.5	2.2	2.6	2.3	3.4
2075	2.5	2.5	2.5	2.1	2.6	2.4	3.8
2100	2.5	2.5	2.5	1.9	2.7	2.4	3.9
<i>SSA = Sub-Saharan Africa</i>							
2000	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2025	1.2	1.2	1.1	1.3	1.2	1.1	1.3
2050	1.4	1.3	0.9	1.2	1.4	1.2	1.4
2075	1.3	1.3	0.5	1.0	1.5	1.2	1.4
2100	1.3	1.3	0.3	0.8	1.6	1.2	1.5
<i>LAC = Latin America and the Caribbean</i>							
2000	0.9	0.9	0.9	0.9	0.9	0.9	0.9
2025	0.9	0.9	0.9	0.9	0.8	0.6	0.9
2050	0.8	0.8	0.8	0.7	0.8	0.5	0.8
2075	0.7	0.8	0.7	0.6	0.7	0.5	0.7
2100	0.6	0.8	0.6	0.5	0.7	0.5	0.6

Source: own calculations.

Table 5. Projections of remittances as percentage of GDP (2000-2100)*5.2. Largest recipient countries in 2000 (in USD)**Assuming a -1.0 elasticity of the propensity to remit to the emigrant-to-stayer ratio*

	Basel. 2000	Basel. 2100	Slower BRIC 2100	Faster SSA 2100	Low FERT 2100	High EDUC 2100	Restr USA 2100	Open CHIND 2100
India	1.4	0.4	1.1	0.4	0.4	0.4	0.3	9.2
China	0.3	0.1	0.2	0.1	0.1	0.1	0.0	0.9
Mexico	1.2	2.4	2.4	2.4	2.3	2.3	0.9	2.4
Philippines	6.2	5.9	5.8	5.9	6.0	6.1	3.9	36.0
Nigeria	2.1	1.2	1.2	0.5	1.3	1.3	0.9	1.4
Egypt	2.8	3.4	3.4	3.4	3.5	3.6	3.1	3.7
Bangladesh	3.3	15.9	5.4	15.9	15.9	16.0	15.8	49.4
Pakistan	2.0	1.7	0.9	1.7	1.7	1.8	1.6	6.7
Vietnam	4.5	3.2	3.1	3.2	3.4	3.7	2.2	27.3
Indonesia	0.5	0.6	0.6	0.6	0.6	0.6	0.6	18.4
Lebanon	9.4	13.9	13.4	14.3	14.5	14.8	11.9	20.9
Ukraine	0.2	0.4	0.2	0.4	0.4	0.4	0.4	0.4
Morocco	4.5	6.4	6.4	6.5	6.4	6.6	6.3	6.6
Guatemala	3.7	6.3	6.3	6.3	6.4	6.7	2.8	6.3
Sri Lanka	4.9	5.0	3.5	5.0	5.0	5.2	4.8	20.1
Colombia	1.2	2.0	2.0	2.0	2.1	2.1	1.3	2.0
Dominican R.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Romania	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.5
Thailand	0.8	1.0	0.9	1.0	1.0	1.1	0.7	24.4
Jordan	15.1	14.2	14.0	14.2	14.4	15.0	13.1	35.3
El Salvador	9.0	10.3	10.2	10.3	10.6	11.1	4.2	10.3
Nepal	3.8	18.7	5.6	18.7	18.9	19.0	18.7	104.6
Serbia Mont.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brazil	0.2	0.2	0.5	0.2	0.2	0.2	0.1	0.2
Honduras	5.6	5.1	5.0	5.1	5.2	5.4	2.4	5.1

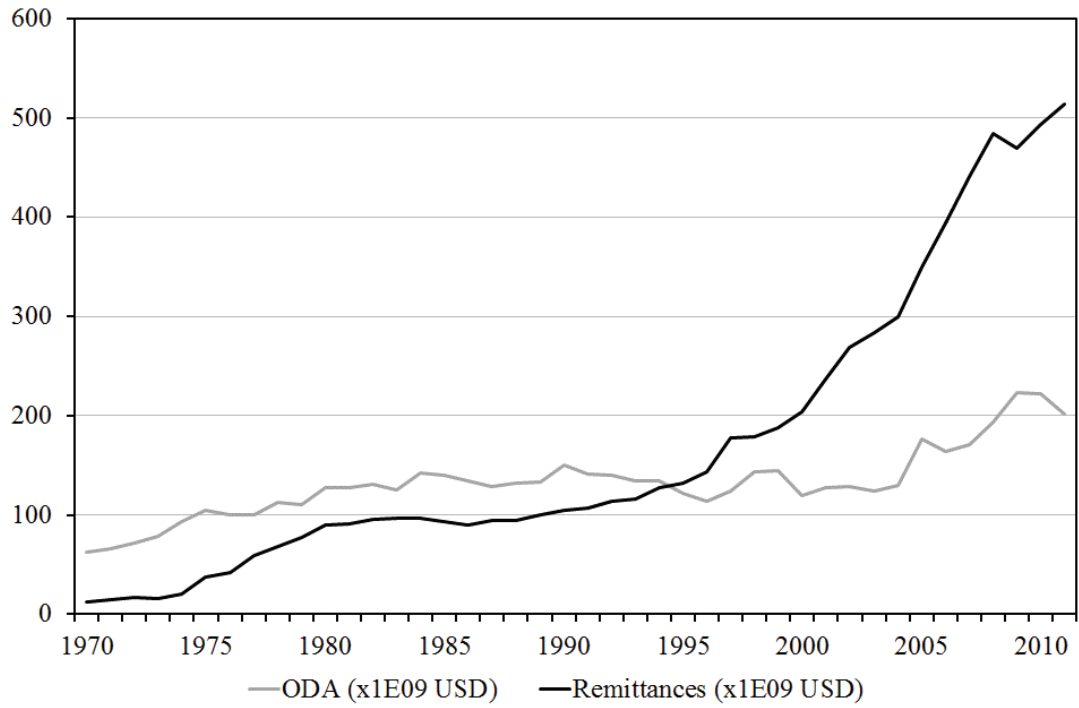
Source: own calculations.

Table 5. Projections of remittances as percentage of GDP (2000-2100)*5.3. Largest recipient countries in 2000 (as % of GDP)**Assuming a -1.0 elasticity of the propensity to remit to the emigrant-to-stayer ratio*

	Basel. 2000	Basel. 2100	Slower BRIC 2100	Faster SSA 2100	Low FERT 2100	High EDUC 2100	Restr USA 2100	Open CHIND 2100
Tajikistan	10.3	54.2	17.6	54.2	54.2	54.3	53.9	54.5
Lesotho	23.4	8.0	7.9	7.2	8.2	8.4	7.9	8.1
Kyrgyzstan	2.1	14.6	5.0	14.6	14.7	14.7	14.6	14.7
Moldova	10.1	9.5	4.0	9.5	9.4	9.4	9.4	9.7
Haiti	10.6	22.4	22.4	22.3	23.8	30.1	15.1	22.3
Nepal	3.8	18.7	5.6	18.7	18.9	19.0	18.7	104.6
Samoa	13.5	13.8	13.7	13.9	13.2	13.6	12.4	14.8
Tonga	24.6	26.6	26.0	7.2	25.9	26.8	19.6	31.0
Lebanon	9.4	13.9	13.4	14.3	14.5	14.8	11.9	20.9
W.Bank-Gaza	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Armenia	4.5	7.6	3.1	7.6	7.7	7.8	7.3	9.4
Honduras	5.6	5.1	5.0	5.1	5.2	5.4	2.4	5.1
Guyana	5.1	5.0	4.5	5.0	5.0	5.1	3.3	5.0
El Salvador	9.0	10.3	10.2	10.3	10.6	11.1	4.2	10.3
Jamaica	8.2	10.1	10.0	10.2	10.1	10.2	5.9	10.1
East Timor	0.2	0.3	0.3	0.3	0.3	0.3	0.3	4.9
Jordan	15.1	14.2	14.0	14.2	14.4	15.0	13.1	35.3
Gambia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Senegal	3.6	3.1	3.1	1.2	3.2	3.4	3.0	3.2
Bosnia Herz	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bangladesh	3.3	15.9	5.4	15.9	15.9	16.0	15.8	49.4
Philippines	6.2	5.9	5.8	5.9	6.0	6.1	3.9	36.0
Togo	3.1	5.2	5.1	3.4	5.3	5.5	5.0	5.3
Guatemala	3.7	6.3	6.3	6.3	6.4	6.7	2.8	6.3
Georgia	5.3	8.7	3.3	9.1	8.8	8.8	8.7	8.8

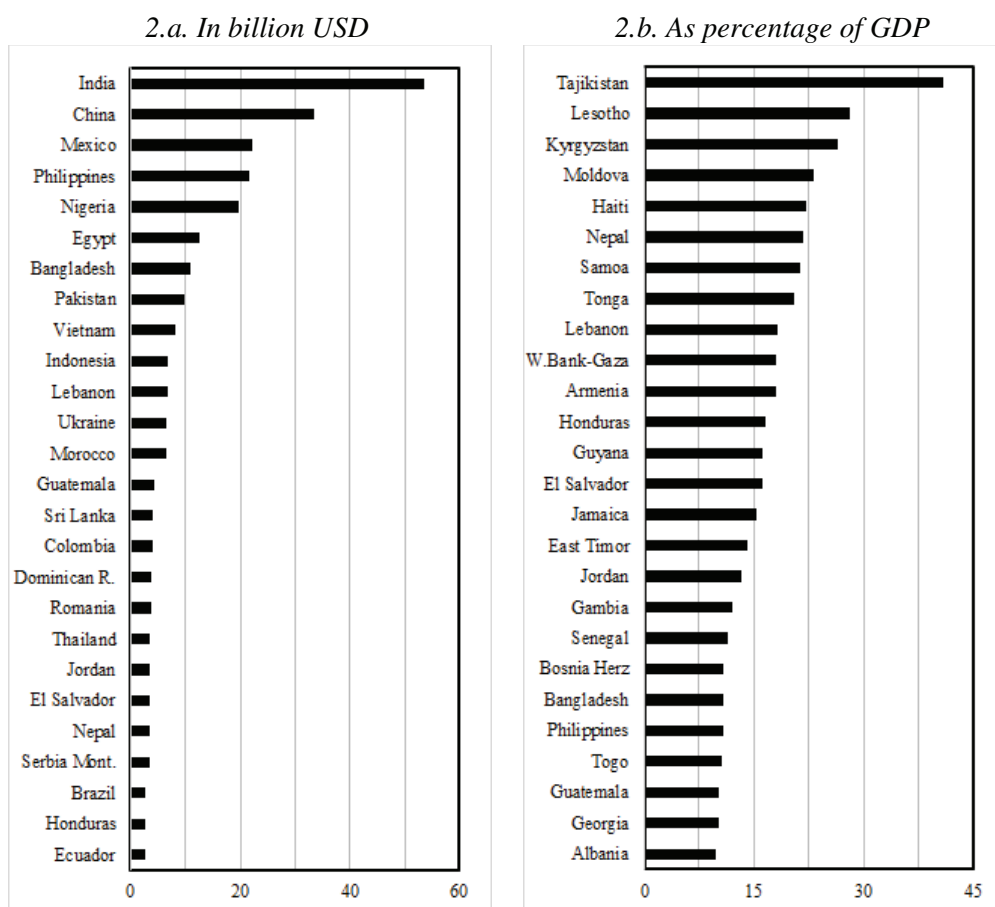
Source: own calculations.

Figure 1. Remittances and official development assistance, 1970-2012



Source: Bauer et al. (2014), based on World Bank and OECD data.

Figure 2. Main recipient countries in 2010



Source: World Development Indicators (2014).

Figure 3. Mechanics of the model

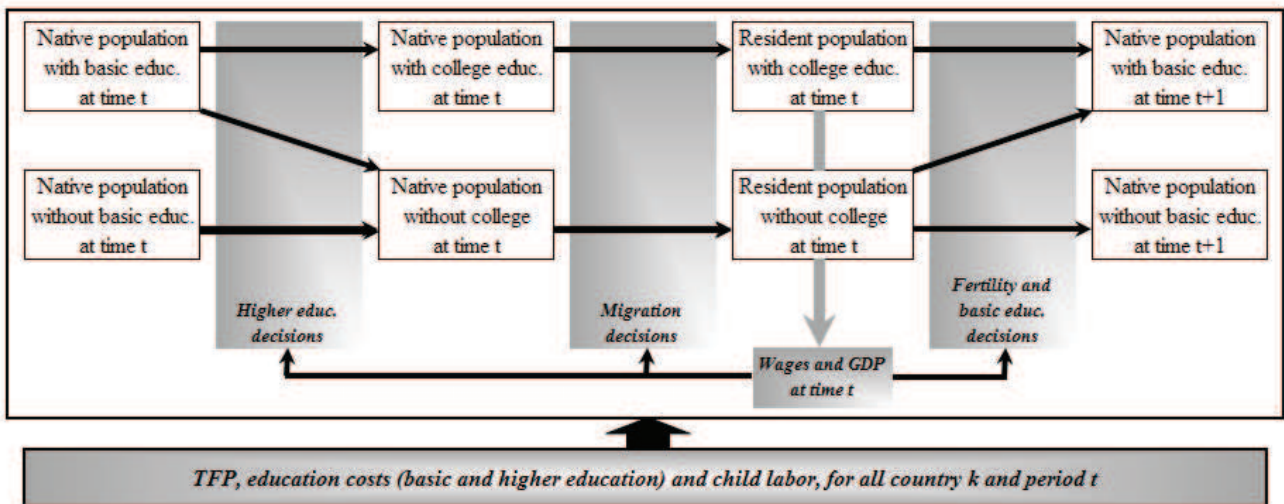


Figure 4. Demographic and economic projections for the world economy, 2000-2100

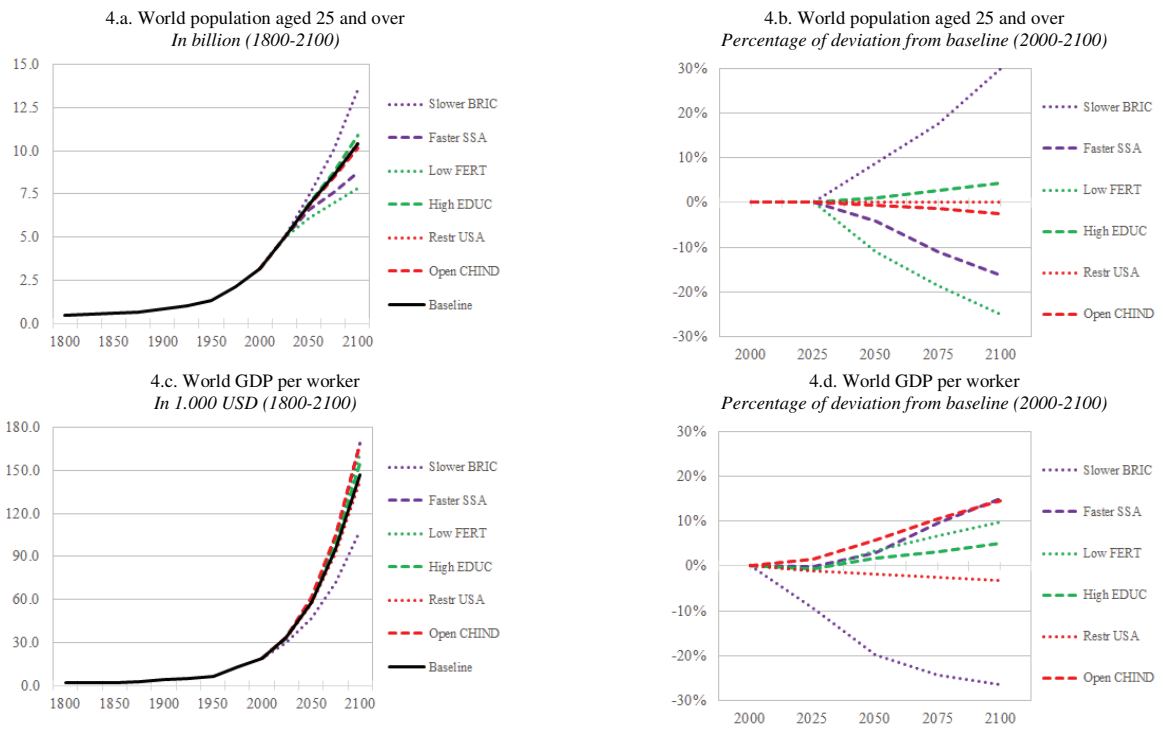


Figure 4 (continued). Demographic and economic projections for the world economy, 2000-2100

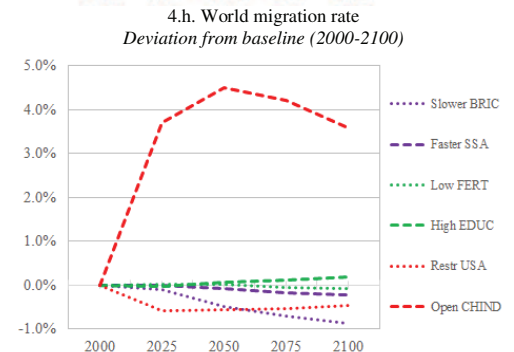
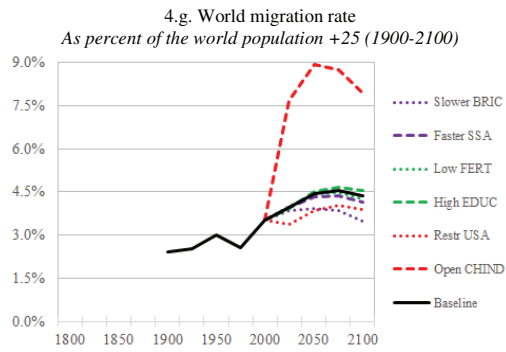
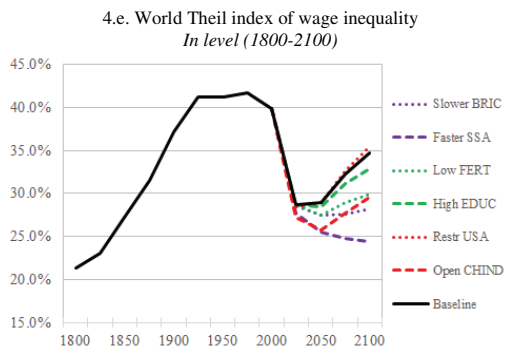
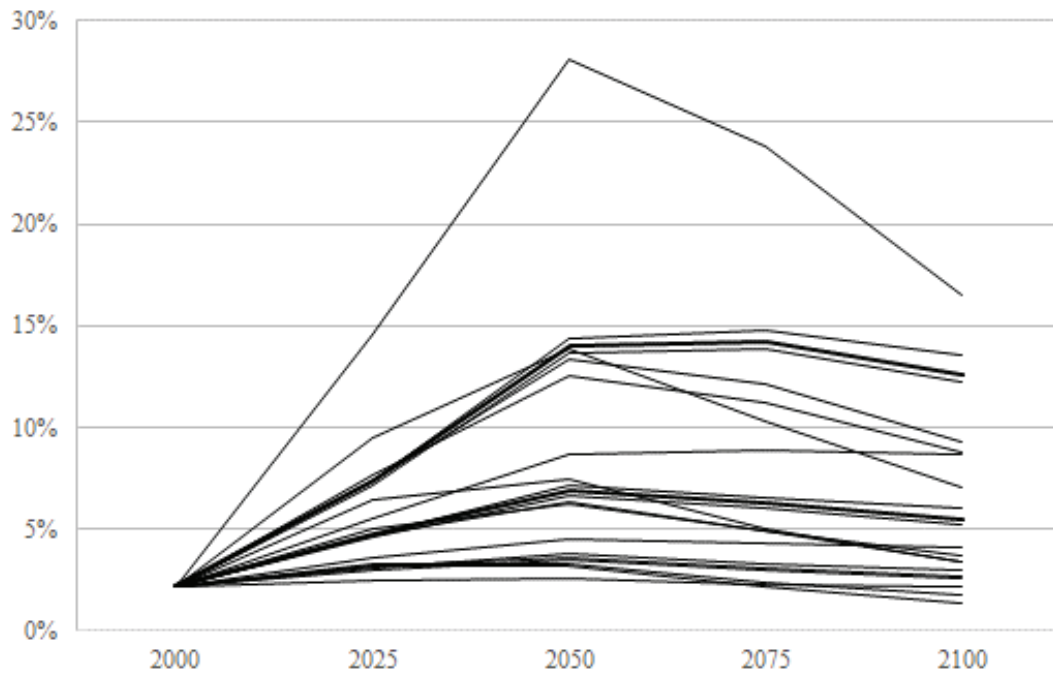


Figure 5. Remittances as percentage of GDP in low-income countries (2000-2100)

Summary of 21 scenarios



“Sur quoi la fondera-t-il l'économie du monde qu'il veut gouverner? Sera-ce sur le caprice de chaque particulier? Quelle confusion! Sera-ce sur la justice? Il l'ignore.”

Pascal



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