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Abstract. The credit crisis of OECD countries has a negative impact on the growth of the world economy according to a simple error correction model. This causes negative growth effects in poor developing countries. The reduced growth has a direct or indirect impact on the convergence issue, aid, remittances, labour force growth, investment and savings, net foreign debt, migration, tax revenues, public expenditure on education and literacy. We estimate dynamic equations of all these variables using dynamic panel data methods for a panel of countries with per capita income below $1200 (2000). The estimated equations are then integrated to a dynamic system of fourteen equations for fourteen variables that allows for highly non-linear baseline simulations for these open economies. Then we analyze the effects of shocks as predicted by the international organizations for the OECD and world growth for 2008 and 2009. Whereas growth rates return to the baseline scenario very quickly, the GDP per capita returns to its baseline level in OECD countries and the world economy after some years but in poor developing countries it remains below the baseline scenario for more than 200 years. This long run blow to convergence leads to more remittances and emigration, a lower labour force growth, higher shares of GDP for saving, tax revenues, public expenditure on education and investment, and higher literacy. However, all these stabilizing forces through remittances and emigration cannot compensate the losses in levels of growth. Short and medium run effects are driven by a return to baseline for OECD and world GDP growth rates by the end of 2010, but for levels only 10 to 30 years later. Therefore we first get 15 to 20 years of fewer remittances, tax revenues, savings, public expenditure on education, literacy, and investment, more emigration and lower labour force growth.
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1. Introduction

In the business press and the publications of the OECD (see Schmidt-Hebbel (2009)), the World Bank (see Ratha et al. 2008; World Bank 2009) and the IMF (2009) some of the effects of the credit crisis on poor developing countries are discussed. However, they are analyzed and discussed in a non-integrated manner. In this paper we provide a model of difference equations that integrates many of the relevant aspects and allows having a look at the long and medium run as well. We will discuss these aspects in the following and collect the arguments in Table 1 in order to allow the reader to follow the logic of the argument through the system.

The first aspect that has been discussed is the transmission of the recession in OECD countries to the world economy through reduction of demand for natural resources and other goods (13, 12)[1]. When the world economy grows more slowly or even at negative rates the world buys less goods from the OECD countries, machinery and other goods. On the other hand, a reduced growth of the world economy leads to lower prices for natural resources and therefore is good for growth in the OECD. Which force dominates is an open issue a priori and may depend on the resource dependence and the size of the machinery sector of the respective countries (13, 12). The reduction in the growth of the world economy will lead to less demand for poor LDCs' exports (IMF 2009), and therefore reduce their means to buy machines and therefore reduce growth (12, 2).

A second issue that has been mentioned in IMF (2009) is the impact on development aid, which depends on growth of donors and recipients (13, 11), (2, 11). As the credit crisis hits first in the donor countries and only later in the receiving countries the fear is that aid first decreases before it perhaps increases later.

Third, worker remittances are expected to fall when the host countries of earlier migrants run into a recession (13, 4) and migrants may have to return (13,1). Only if the OECD recovers more quickly than the developing countries this may turn around later.

The consequence of return migration is a larger labour force growth, (1, 3), slowing growth even further (3, 2) although it may encourage investment (3, 6). Enhanced net immigration may increase savings (1, 5), but reduced remittances will decrease them (4, 5). Reductions in savings will also allow for less tax revenues, public expenditure on education and literacy, indicating the

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[1] The numbers indicate the row from where the effect comes and the column where the effect arrives in Table 1.

serious social consequences of the crisis. A recovery will have the opposite effects. This leaves us with the question what happens in the short, medium and long run with all these variables.

In order to estimate and integrate all these effects we set up a model consisting of fourteen equations in section 2. We cannot use the dynamic stochastic general equilibrium method for two reasons. First, the complexity of the issue is preventing it as there are many heterogeneous individuals: migrants and those left behind, migrants returning or not, lenders and borrowers, entrepreneurs and households, donor governments and receivers of aid. Second, migration and remittances beginning in the 1960s are a highly non-linear phenomenon of transitional growth that does not lend itself to log-linearized modeling for business cycles driven by stochastic trends models. We add the relevant non-linear relations in accordance with the theory of migration and remittances (see Todaro 1969), Stark and Bloom 1985, Massey et al. (1993), Faini and Venturini (1994), Taylor (1999), Cinar and Docquier (2004), Rapoport and Doquier (2006), Bertoli (2006)) and other areas of economics, in particular development economics, to lagged dependent variables well-known from the vector-autoregressive models (see Greene 2008).

In section 3 the data and the econometric method are explained. Section 4 explains the results of the estimates. Section 5 presents the baseline simulations of the dynamic model. Section 6 compares the simulation to its counterpart after introducing the shock in line with current predictions for 2009 and its dynamic consequences. Section 7 summarizes and concludes.

<div align="center">TABLE 1 ABOUT HERE</div>

2. The Model

In this section we explain the regressions in detail. We estimate them separately for econometric reasons explained in section 3 and put them together for simulation in section 5. We present the regressions including regressors that may turn out to be insignificant. Added quadratic terms or other variants of the same regressor and the use of lags including polynomial distributed lags will mostly be presented only in section 4 when presenting the result.

The starting point of the model is the growth regression for the OECD and the world economy. We assume that they depend on each other in the following form of an error correction model, which contains a long term relation in the second term of both equations.

$d(\log(oec)) =$ (1)
$c_{11} + c_{12}(\log(oec(-1)) - c_{13}\log(wld(-1)) - c_{14}time - c_{15}) + c_{16}(d(\log(oec(-1)))) + c_{17}d(\log(wld(-1))) + u_{1t}$

$$d(\log(\text{wld})) = \tag{2}$$
$$c_{21} + c_{22}(\log(\text{oec}(-1)) - c_{13}\log(\text{wld}(-1)) - c_{14}\text{time} - c_{15}) + c_{26}(d(\log(\text{oec}(-1)))) + c_{27}d(\log(\text{wld}(-1))) + u_{2t}$$

Equation (3) endogenizes the growth rate of the GDP per capita of the poor developing countries, which depends on that of world income.

$$\log(\text{gdppc})-\log(\text{gdppc}(-5)) = c_{31} + c_{32}\log(\text{gdppc}(-5)) + c_{33}\log(\text{gfcfgdp}(-x)) + c_{34}\text{lit} + c_{35}d(\log(\text{l})) +$$
$$c_{36}\text{wr/gdp} + c_{37}\text{oda/gdp} + c_{38}\text{time} + c_{39}(\log(\text{wld})-\log(\text{l})) + \text{lag.dep.var.} + u_{3(it)} \tag{3}$$

The first index of each coefficient indicates the number of the equation and the second that of the regressor; country-time indices are given only in the residuals. We use five-year intervals for the lagged dependent variable here for three reasons. First, we do want to get rid of business cycle effects, which would be captured by one-year lags. Second, we do not want to apply the method of using five-year averages for reasons discussed extensively in Loayza et al. (2000) and Attanasio et al. (2000). Third, lagged dependent variables with a five-year lag are less strongly correlated with other regressors reducing the danger from multicollinearity. In regard to the variable 'investment as a share of GDP' Attanasio et al. (2000) have pointed out that growth regressions tend to use the investment data over the same period as the dependent variable whereas vector-autoregressive approaches use lagged investment and both get opposite signs. As the authors point out, this is hard to explain. We try both, current and lagged investments because there is no guarantee that investment is productive only after a whole year. Then, in a hypothetical steady state both could have equal values and might have the same role as the savings ratio in a Solow or Cass-Koopmans growth model if the difference of their coefficients is positive. They can differ, however, outside the steady state. In fact though, the non-linear impact of the income difference between poor and OECD countries in the equations for migration and remittances make it impossible to have a steady state.[2] The literacy variable proxies for human capital but it will have no direct impact in this poor country sample. Moreover, the growth rate of employment, approximated here by that of the labour force, has a negative impact on the transitional growth rate and the steady-state level of GDP per capita. Remittances are also included because they may have direct effects via effort as in Chami et al. (2005) or via credit market effects as in the literature discussed above or via sectoral allocation effects as in Feder

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[2] On the relevance of non-linearities in growth regressions for other variables see Minier (2007).

(1983).[3] Similarly, development aid may have a positive growth effect if used to improve allocation and effort or it may have a negative effect if it makes them worse. In particular, if aid is directed towards emergency action, fighting diseases and poverty reduction one might expect that this strengthens sectors with productivity growth below the multi-sector average. Depending on whether or not the time trend is significant we would have permanent or only transitional growth. In models with imported inputs (see Bardhan and Lewis 1970) one finds also the growth rate of exports at constant terms of trade, which should be an income growth term in an export demand function, and therefore is approximated here by the world GDP. Constant long-run growth in the world economy allows for positive permanent growth in this model. Exports and this latter growth rate have to be taken relative to the size of the labour force of the country under consideration though. Therefore we include the natural logarithm of the labour force here as well.[4] Finally, we will add some lagged dependent variables as an autocorrelation correction hoping that this absorbs the business cycle effects and allows interpreting the other regressors as growth effects.[5] We expect the credit crisis to affect growth through the reduced growth of the GDP of the world and through the reduction of remittances if it is larger than that of the GDP per capita.

   Remittances and aid do not only have a direct impact on growth but also an indirect one via fixed capital formation, the enhancement of savings, reduction of net debt flows and reduction of interest rates if investment is interest elastic, and on literacy via savings and public expenditure on education, as well as on labour force growth via migration (directly and via savings) and literacy, and from the direct effect on GDP per capita growth to labour force growth.[6] These indirect channels and the impact of the credit crisis through them are considered next.

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[3] See also Timmer and Szirmai (2000) and Rodriguez 2006. For references to single-country studies of the effects of remittances see Taylor (1999, p.70) and Ramirez and Sharma (2008).

[4] We will discuss the plausibility for the steady state results quantitatively below. As we need the world GDP here and not its per capita value, but we need OECD GDP per capita in the migration and remittance equations we have put world GDP and OECD per capita into the error correction model although this implies a certain asymmetry in regard to using per capita terms. See also the footnote relating growth results to the model used by Mutz and Ziesemer (2008).

[5] The ideal response to serial correlation in growth regressions is probably to merge models of growth and cycles. The fact that some exists does not automatically mean that serial correlation vanishes, because the integration is mostly based on one aspect only, such as stochastic technical progress. However, the serial correlation may have other causes such as changing situations of too optimistic and too pessimistic expectations. Therefore we work with the traditional serial correlation correction of adding (growth rates of) lagged dependent variables.

[6] An early contribution to the relation between literacy and growth is Azariadis and Drazen (1990).

The equation explaining worker remittances as a percentage of GDP is the logical next point. This is formulated in equation (2).

$$wr/gdp = c_{41}+c_{42}wr(-1)/gdp(-1)+c_{43} \log(oec) + c_{44} (\log(gdppc(-x)) + c_{45}\log(1+ri(-2)) + c_{46}\log(1+rius(-1)) + c_{47}time + c_{48}peegdp(-x) + c_{49}nm(-x)/l(-x) + u_{4(it)} \qquad (4)$$

Remittances as a share of GDP, *wr/gdp*, are explained by an equation similar to that of Chami et al. (2005) and others earlier[7] containing the differences of income and interest rates of the recipient and the sender country. Therefore we include the income of the recipient country. The sender knows his own current income. As many migrants go to the OECD countries or want to go there after having migrated to other countries first we represent their income by per capita income of the OECD, *oec*.[8] The sender will have information on the recipient country only from data about earlier years because it takes about one year or more in many countries to make the data. An indicator of the recipients' income is therefore Gross Domestic Product per capita with some lags, *gdppc(-x)*. The two income variables need not have the same absolute value of the coefficient because the OECD income is only a crude proxy that comes in because we use only one indicator for the host country of the senders. We do not use the Gross National Income as senders are more likely to receive information on GDP then those of GNI through the media. Moreover, the effect of capital income may be captured by the interest rate arguments included and explained below. The sender might consider saving the amount of money rather than transferring it. Therefore we use the real interest rate of the USA, *rius*, as an indicator of these opportunity costs, also because we don't have an average interest rate for the OECD countries. On the other hand the sender might consider putting the money into a bank account in the recipient country. Therefore we also include the real interest rate of the recipient country, *ri,* also with some information lag. Next, remittances are assumed to depend on (a polynomial of) their own past value, a constant and a time trend, which will be dropped if insignificant. As real interest rates can be highly negative we add a value of 1 to it, before taking natural logarithms, because we use interest rates in their scientific notation, that is, 5% is indicated by '0.05'. Essentially equation (4) above as explained so far is the one that appears also in Chami et al.

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[7] See also El-Sakka and McNabb (1999) and the references there.
[8] Niimi and Özden (2006) provide some evidence that migration to Gulf countries does not yield different results than to the OECD in explaining remittances flows.

(2005).[9] Using natural logs for the remittance variable gives slightly worse results. An important variable related to the focus on market imperfections of modern migration theory is public expenditure on education as a share of GDP, *peegdp*, which indicates that migrants may send more money if the government spends less on education. If this is the case for current and lagged values then we would think of a structural relation indicating an investment motive. If, however, this occurs only when *peegdp* is currently low but not for lagged values we would interpret remittances as private emergency aid making sure that schooling plans can be realized in times of budget cuts. Finally, past migration may have an impact on remittances. However, we do not have stock data in panel format[10] and it is far from clear whether or not net migration flows, which are available, will have a significant impact. Further below we will provide equations explaining the dynamics of the interest rates and public expenditure of education as a share of GDP.[11] It is via the income terms that the crisis has an effect on remittances. From here it is affecting other variables.

   The next step is to explain the impact of worker remittances on savings in equation (5).

$$\text{savgdp} = c_{51} + c_{52}\text{savgdp}(-1) + c_{53}(\text{wr/gdp}) + c_{54}d(\log(\text{gdppc})) + c_{55}\log(1+\text{ri}(-1)) + c_{56}(\text{oda/gdp}) + c_{57}\text{peegdp} + c_{58}\text{nm/l} + u_{5(it)} \tag{5}$$

Remittances and migration are added to an equation explaining the savings ratio similar to that in Loayza et al. (2000). Basically, we assume that the savings ratio, *savgdp*, is driven by its own past value and, as in most of the literature (see Loayza et al. 2000, Table 1), by the growth of GDP per capita and by real interest rates. As disposable income is conceptually probably a better variable (see Bertoli 2006, eq. (6)) but also less available in terms of data we may add worker remittances to the regression, which are part of disposable income but not part of GDP. The idea here is that higher disposable income and therefore remittances lead to a higher savings ratio as

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[9] Chami et al. (2005) use the real income of the USA instead of that of the OECD. The correlation of these two series is gdppcusa = 3071+ 1.12oec with an adjusted R-square of .99 and t-values 116 and 885 respectively. It should not matter which of these is used.

[10] In the meanwhile Docquier has made data which can be found on the World Bank website http://siteresources.worldbank.org/INTRES/Resources/469232-1107449512766/Docquier_1975-2000_data_Panel.xls. Using these in migration regressions, Ziesemer (2009) finds that they mainly reduce the number of lagged flows. The stock data cover the migration stocks to six rich countries: US, UK, Canada, Australia, France and Germany.

[11] Using other regressors leads to different endogeneity problems than those discussed below. They are discussed by Niimi and Özden (2006) in connection with a cross-country regression. For example, the income per capita of sender and destination countries used in this paper would also explain the number of migrants, which are a major determinant in their regression as they are in our migration regression below.

in theoretical models using the difference of consumption and an existence minimum for consumption in the utility function when the country in question is close to that minimum. Moreover, we add official development aid to the regression because aid is also an international transfer and might be significant according to the single-equation-estimation literature (see Doucouliagos and Paldam 2006). Again related to market imperfections, people may want to save less if the government takes over the cost of schooling through higher public expenditure on education as a share of GDP. Finally, immigrants bring savings with them and emigrants take savings out of the country. These savings of migrants may be higher (for relatively rich migrants) or lower (for relatively poor migrants) than the domestic rate and therefore may have an impact on the savings rate, in particular if migrants get work only with some delay but bring their savings into the country without delay. Via the growth rate of the GDP per capita, and remittances return migration the crisis shocks affect the savings rate. If growth rates and remittances ratios go down this has a negative effect but return migration may have a positive effect.

   If remittances enhance savings they should diminish the difference of investment and savings, which is the additional demand or flow variable of foreign debt, the current value of which increases and the future value reduces domestic interest rates as found by Obstfeld and Rogoff (2001) from a two period model with transport costs without the other variables included here. Other possible rationales for this aspect of modeling interest increases are as follows. In Bardhan (1967) and later publications on growth under capital movements by others one finds the assumption that large countries may have an impact on the world market interest rate and therefore on there own interest rate through a lower or higher stock of net debt per unit of GDP. If so, this should also hold for the flow of net debt. It is questionable though whether single countries involved have monopsony power. But they may have this as a group if their behaviour goes into the same direction. Moreover, it is plausible to relate domestic interest rates to the LIBOR/EURIBOR or Prime Rate plus a country specific spread or risk premium. Edwards (1984) has shown that spreads depend on the ratio of debt to GDP or GNI. This ratio is lower one period after investment net of savings has grown by less than the GDP. Banks and rating agencies then can verify that less new debt relative to GDP is incurred and may reduce spreads. Therefore we use the sum of lagged current account deficits or investment minus savings. Belloc

and Gandolfo (2005) argue that this relation may be non-linear based on data analysis. Therefore we include a polynomial distributed lag of the investment-savings difference.

$$\log(1+ri) = c_{61} + c_{62}\log(1+ri(-1)) + c_{63}\log(1+riusa) + \text{sum}_x c_{6x}(\text{invgdp}(-x)-\text{savgdp}(-x)) + c_{65}(\text{oda/gdp}) + c_{66}d(\log(\text{gdppc})) + u_{6(it)} \tag{6}$$

Moreover, the US interest rate, and the growth rate of the GDP per capita are included because they both enhance the domestic rate with the latter being a business cycle effect. Finally, more development aid implies more political dependence and signals risk of a lower power for debt service. If investment and the growth rate fall because of the crisis real interest rates will go down.[12]

If remittances, via enhanced savings and lower net debt demand, reduce interest rates, the link to physical capital is gross fixed capital formation as a share of GDP, *gfcfgdp*, if investment is elastic with respect to interest. This is captured as in the following equation.

$$\log(\text{gfcfgdp}) = c_{71} + c_{72}\log(\text{gfcfgdp}(-1)) + c_{73}\log(1+ri(-1)) + c_{74}d(\log(\text{gdppc}(-1))) + c_{75}\text{wr/gdp} + c_{76}((\text{oda/gdp})) + c_{77}d(\log(l)) + c_{78}d(\text{lit}) + u_{7(it)} \tag{7}$$

Gross fixed capital formation as a share of GDP is assumed to depend on its own lagged value, interest rates and lagged growth rates as an indicator of the business cycle and of expectations of future demand and the future need for investment. The domestic interest rate indicates (opportunity) costs. The lag in the interest rate variable indicates that it takes time to get the information on interest rates, order and deliver machines, and implement them. Moreover, as in the savings equation we add official development aid. Donors can try to enforce - by tying to imports from donor countries or through the World Banks Oil-and-dams program - that aid is invested[13]. Investors can try to use the fungibility of money to leave investment unchanged by shifting their own money elsewhere. If the coefficient of aid is significant this would also imply that the fungibility of money does not lead to a withdrawal of domestic money at an equal amount. Remittances may have a higher marginal propensity to invest than average income (growth) if the migrants are from relatively rich families and migrate in order to earn the money they can't get from imperfect capital markets. Poorer households are more subject to credit

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[12] For single firms though there may be an increase in the probability of default leading to higher interest rates and a credit crunch for them. We do not consider here the accompanying monetary policy which will also have a temporary impact.

[13] This does not necessarily mean that the type of investment or even the enhancement of it is efficient.

rationing (see IMF 2005, p.77 and Adams 2006). Then their investment may not exceed their savings. With investment limited by savings for sufficiently many households, investment may have the same sign for the interest rate variable as savings or be independent of interest rates. Remittances and aid may relax the credit constraint and therefore be significant variables, although the economy has some capital inflows from abroad. Finally, we add employment growth proxied by labour force growth and changes of literacy. In accordance with production theory a higher input of more or less skilled labour increases the marginal product of capital and makes more investment profitable. If savings and investment are interest inelastic the effect of increased savings will still be one of reducing debt service, new debt and the future interest paid on it. Vargas-Silva (2007) finds a positive impact of remittances on investment for Mexico. This should not be the case if credit were freely available. However, firms and in particular household producers may be credit rationed. Taylor (1999) emphasizes the impact of multiplier effects occurring even if remittances go into consumption in the first instance. The effects of the crisis discussed so far come mainly via income growth and remittances to investment. But of course other interactions in the whole system may also affect investment via the regressors.

Besides the impact of remittances on physical investment and savings and interest rates, remittances may complement public expenditure on education in financing schooling, directly or via savings. However, it may also be the case that governments provide less money for education if people have more private money from remittances. When more tax money or aid is available expenditures on education are likely to rise. The equation for this political behaviour is as follows:

$$Peegdp = c_{81} + c_{82}peegdp(-1) + c_{83}taxy + c_{84}oda/gdp + c_{85}wr/gdp + c_{86}savgdp + c_{87}time + u_{8(it)} \qquad (8)$$

Public expenditure on education is then used together with savings and aid to finance schooling. This results in higher literacy, which is captured in equation (9) below.

$$lit - lit(-5) = c_{91} + c_{92}lit(-5) + c_{93}savgdp(-x) + c_{94}oda/gdp + c_{95}peegdp(-x) + u_{9(it)} \qquad (9)$$

Savings available at the moment of enrolment can be used to avoid credit constraints. A higher savings ratio together with higher public expenditure on education and development aid leads to higher literacy with some lags. By implication, the concept is that remittances have an impact on human capital via savings with remittances and savings entering the equation for public

expenditure on education and savings and public expenditure on education entering the literacy equation.[14] Literacy data are used as a proxy for human capital. They have a good variation in our sample over time and across countries. Cinar and Docquier (2004), Rapoport and Docquier (2006) and Adams (2006) report evidence of positive impacts of remittances on education.[15]

As public expenditures on education are dependent on tax money we explain it next.

$$taxy = c_{10,1} + c_{10,2}\ taxy\ (-1) + c_{10,3}\ wr/gdp + c_{10,4}savgdp + u_{10(it)} \hspace{2cm} (10)$$

Tax revenues as a share of GDP are assumed to depend on their own past value. If people save more they signal that they have a surplus product and therefore might be willing and/or able to contribute to public investment as well. More worker remittances then may be an argument to tax people more or less heavily. On the one hand there is more money available that can be taxed. On the other hand the government may want to tax less as people can care better for themselves if they have more money and the government may want to withdraw. The credit crisis will have a direct effect on the denominator on public expenditure on education as a share of GDP and the tax ratio and indirect effects via savings and remittances on these variables and on literacy, but also via the aid/GDP ratio.

Official development aid helps financing literacy directly and indirectly by providing an incentive for more public expenditure on education in equations (8) and (9). We explain it by the lagged growth rate of the receiving country and that of the donor countries, captured by that of the OECD. If economies grow more quickly, they are likely to receive less aid over time and if donors grow more quickly they may be more generous.[16]

$$oda/gdp = c_{11,1} + c_{11,2}oda(-1)/gdp(-1) + c_{11,3}d(\log(gdppc(-x))) + c_{11,4}d(\log(oec(-x))) + u_{11(it)} \hspace{1cm} (11)$$

The effect of the credit crisis on development aid as a share of GDP then will depend mainly on whether the developing countries are more or less strongly affected than the OECD countries. Of course, the effect on the denominator may dominate.

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[14] Mazumdar (2005) has suggested public expenditure on education as a share of GDP. It is insignificant in his cross-country regressions but significant in our fixed effects estimate with lagged dependent variables presented below, which suggests that there is a dynamic impact.

[15] See also the theory of Cinar and Docquier (2004) and Bertoli (2006).

[16] It is not the purpose of this paper to go deeply into other motivations for and impacts on aid.

Next, we need an equation for the growth of the labour force. According to growth theory and empirics, a major contribution to growth may come from the reduction of population growth. However, in empirical work the crucial variable is equilibrium employment growth - proxied here by labour force growth rates -, because one of the growth problems is to have sufficient investment to employ people without falling wages and incomes. Labour growth is preceded by population growth. The literature there says that education of women leads to a slow down. Therefore we include literacy with a large lag. Labour market literature says that higher growth encourages people to (re-)enter the labour market in some countries but not in others.[17] This suggests including the growth rate of GDP per capita. Development aid may encourage people not to go to work but rather to education or other (in-)activities and to return to the labour market later or they may save lives and thereby increase labour supply sooner or later. Moreover, immigration adds partly to the labour force. We endogenize labour force growth as follows.

$$d(\log(l)) =$$
$$c_{12,1} + c_{12,2}d(\log(l(-1))) + c_{12,3}lit(-x) + c_{12,4}oda(-x)/gdp(-x) + c_{12,5}nm/l + c_{12,6}d(\log(gdppc(-1))) + u_{12(it)} \quad (12)$$

The credit crisis then affects labour supply through net migration, supposedly mainly return migration in the short run, and growth reduction. Other effects are a priori very unclear.

As immigration has an impact on labour force growth according to the previous equation and on savings according to other equations we need an equation for them to have all variables endogenous in the system. The traditional argument for migration is that of an expected income difference between origin and destination countries. In poor countries people are unlikely to bear the costs of migration out of current income and will need to increase their savings, if they are credit rationed, before migrating later. If they receive remittances they can use them either to pay for emigration or to invest them and stay, in particular if capital markets provide credit for small business only imperfectly. Therefore remittances have also a partial, direct effect of slowing down growth by enhancing immigration and labour force growth. Lagged dependent variables may reflect network effects.[18] The specification then is as follows.

$$nm/l = c_{13,1} + c_{13,2}nm(-5)/l(-5) + c_{13,3}(\log(gdppc)-\log(oec)) + c_{13,4} wr/gdp + c_{13,5} savgdp(-x) + u_{13(it)} \quad (13)$$

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[17] See López-Bóo (2008) for a recent discussion.
[18] For an extensive discussion of international migration theories see Massey et al. (1993).

The first and direct impact of the credit crisis then is the fall of OECD income inducing return migration and less emigration. This effect will be mitigated by slower growth in the poor countries themselves. For the remittances and savings variables it is a priori unclear whether their denominators or numerators are more likely to decrease.

The logic of the indirect effects of remittances now is as follows. After remittances enhanced[19] savings and thereby literacy, literacy enhances investment shares and reduces labour force growth, which in turn reduces investment shares. Both labour force growth and investment have an impact on transitional growth rates of the GDP per capita and the level of per capita income captured in equation (1). Another important economic mechanism is the effect of remittances directly and indirectly via savings on migration in equation (13) and from there to labour growth in equation (12). The link from migration to labour force growth and from there to growth is a strong feedback effect in our model. As remittances have an impact on savings and both affect literacy and migration and from there the labour force growth, it is this type of loops which makes a dynamic system very interesting - as noted earlier by Lucas (2005) - in particular in connection with non-linear effects obtained in the estimates below. Once the credit crisis has affected remittances they will carry the effects through the whole system, but of course the effect on the (growth rate of the) GDP per capita in equations (4)-(7) and (11)-(13) also has a strong impact on the whole system.

In order to run simulations with the estimated dynamic model, we also need an equation for the interest rate of the USA. As in dynamic stochastic general equilibrium models (DSGE) auxiliary equations are run just as autoregressive processes in order to limit the number of equations of the model (see for example Acosta et al 2007). We will present it in the section for results only.

3. Data and econometric method

All data are taken from the WDI (World Development Indicators). We include 52 countries (listed in Appendix 1) selected by the criterion of having at least one dollar of remittances received in one of the recent years, receive development aid and have data for literacy and GDP. We include countries under (constant 2000) $1200 GDP per capita. The reason is that we found in earlier work that the countries below $1200 have slow growth in a panel average when looking at the period since 1960. The richer countries mostly have a good growth performance

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[19] The long run impact will be positive, the short run impact will be shown to be negative below.

anyway. Poor countries may behave differently from the richer ones and therefore we concentrate on the poor ones who are likely to suffer more from a crisis and for whom shocks to remittances and aid are more important.

The data on remittances are official receipts in constant 2000 US$.[20] Flows going via financial investments and withdrawals from related accounts are not included (see IMF 2005, p.99). Unofficial receipts may be high - Freund and Spatafora (2005) estimate that informal remittances are between 35 and 75% of the official ones - and important but we have no way to deal with the issue directly (see Adams and Page 2005).[21] Data of the GDP per capita, *gdppc* and *OEC* are in constant 2000 US$ and stem from national accounts. We would like to point out that not only remittance data but also GDP data underestimate economic activity because of the neglect of the informal sector. Schneider and Enste (2000, Table 2) report values of 25-76% of GDP for developing countries. This is the same order of magnitude as cited above for remittances. For developed countries these values are lower. The imperfection of remittances data is broadly discussed in all recent related papers. That of GDP data is not discussed anymore although it may be as severe.

Interest rates, *ri* and *rius*, are real rates as obtained by use of the GDP deflator and taken from the IMF IFS Yearbook into the WDI data. Savings, *savgdp,* are gross national savings from national accounts, calculated as GDP minus consumption, plus net current transfers and factor income from abroad and expressed as a share of GDP.[22] As investment, *invgdp*, relates to the demand of net debt flows we use gross capital formation (formerly called gross domestic investment) as a percent of GDP. The major difference with gross fixed capital formation as a share of GDP, *gfcfgdp*, is the inventories, which are not investments that add to the capital stock. All savings and investment data come from the national accounts. Literacy data, *lit*, from the UNESCO are available in the WDI. Data on public expenditure on education, *peegdp*, are from the UNESCO and we take those of several versions of the World Development Indicators. Data on official development aid include loans containing at least a grant element of 25%. Data on

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[20] In the WDI there are surprisingly many zero values, which are quite implausible because they are preceded and followed by positive values of non-negligible size. We have turned them into 'non available'.

[21] Panel data on remittance fees, which cause unofficial receipts, would be an interesting addition here. But we are not aware of their availability. An interesting source is http://remittanceprices.worldbank.org/. However, so far it odes not have the format of our panel.

[22] Using savings as share of GNI does not change regression results here. As we need investment as a share of GDP in the growth regression, we use also savings as a share of GDP.

migration are five-year estimates of the United Nations Population Division. Labour force data are from the ILO.

The average values and growth rates of these data are presented in Table 2. These data show positive growth rates of GDP per capita. Investment/GDP and savings/GDP ratios have positive growth rates for these poor countries. Investment/GDP ratios are higher than savings/GDP ratios inducing indebtedness. Average remittances per unit of GDP are 2.9% and growing at a rate of more than 6%. It is often stated that remittances are larger than aid for all developing countries together. In our sample of poor countries though, aid is about 9% of GDP, more than three times as much as remittances.

<div align="center">TABLE 2 OVER HERE</div>

We estimate the equations specified above separately using dynamic panel data methods. We assume that the interaction of the residuals of the equations as taken into account in the seemingly unrelated regression method (SUR) have a much smaller impact on the coefficients than the fixed effects methods and their major impact is one on the standard error. Fixed effects turn out to be never redundant and random effects are never outperforming fixed effects. The bias of fixed effects estimates in case of lagged dependent variables is known to be of the order of magnitude *1/T*, where *T* is the number of periods. Fixed effects underestimate in principle, whereas OLS overestimates the coefficient of the lagged dependent variable. According to Judson and Owen (1999) the bias is very small when *T* is above *30*. When *T* is below thirty we try the GMM-systems estimator as explained in Chapter 8 of Baltagi (2005). We use its orthogonal deviation variant of the Arellano-Bover (1995) method.[23] This method specifies our equations in terms of levels and in terms of first differences and restricts the coefficients of these equations to be the same for identical variables. Orthogonal deviations replace the first differences by subtracting from the residuals their average future values (Helmert transformation). The use of this method has to result in two properties of an estimator. First, the estimated coefficient should be between those of fixed effects and OLS. Second, the Hansen-Sargan statistic, which is increased through the use of instruments, should not be too high through the over-identifying constraints but rather at its value according to the chi-square distribution; but it should also not be too low, because this would indicate that either the instruments have no effect or too many are used (Roodman 2007). We have tried this for all

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[23] Unfortunately it is not possible so far to combine the Arellano-Bover method with that of SUR.

equations. For the equations for growth, labour force, and migration, both conditions are fulfilled although the difference between fixed effect and Arellano-Bover results are small. But the two criteria are never fulfilled simultaneously for the other equations. In these cases we probably have to live with a bias. The reason probably is that we mostly have close to thirty periods in the observations and then this bias might be very small. Moreover, we have used another advantage of the Arellano-Bover method. We run some regressions also using dynamic instruments for other supposedly endogenous regressors than just the lagged dependent variable (see Appendix 2). Results change only slightly. A disadvantage is that from these estimates we do not obtain the constants of the equations because the orthogonal deviation method of Arellano-Bover for the calculations does not calculate them. Simulations in section 5 therefore have to be based on the first-difference version of the estimated equations.

The use of the systems GMM method and of fixed effects requires absence of unit roots. Applying standard panel unit root tests would reject the hypothesis for the natural logarithm of the GDP per capita variable. However, in their standardized package version these tests do not take into account other regressors than a fixed effect and an individual specific time trend. Growth regressions though do this. There it is accepted wisdom that in the regression of the growth rate on other variables the lagged level of the GDP per capita has a significantly negative coefficient and by implication no unit root. Therefore systems GMM is often applied to growth regressions (see Bond et al. 2001 and Giuliano and Ruiz-Arranz (forthcoming). A similar argument can be made for worker remittances as a share of GDP. Standard tests for unit roots show mixed evidence in our sample as in that of Ramirez and Sharma (2008). We assume, as they do, that worker remittances as a share of GDP have no unit root. Note that a unit root in variables taken as natural logarithms would imply a constant growth rate which would imply that variables which are shares of GDP exceed unity or go to zero in the long run. Moreover, assuming a unit root below in the regression for remittances and therefore dropping lagged dependent levels results in a strong fall of the adjusted R-squared. For a more exact test we do not have the critical values (corresponding to those in the standard tests) for cases with other regressors than fixed effects and individual time trends. There are no strong indications for unit roots for worker remittances as well as for other variables expressed as share of GDP per capita. In the growth regression, the logs of world GDP and the labour force of the country are likely to have unit roots, but they are cointegrated according to the panel cointegration tests by Pedroni

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(1999), Kao (1999) and Maddala-Wu (1999) and therefore can be used in the regression. Finally, a standard ADF test suggests that US interest rates have unit roots. Where they appear in the equations they are also cointegrated with the income difference of the OECD and the poor countries in equation (4') below. The US interest rate will not be determined in the model but will be considered to be an autoregressive processes. With the entire panel related variables and equations we remain in the realm of having more countries than periods and for panel cointegration methods the number of periods is too small.

On a more intuitive level we also carry out the following robustness checks. (i) We present forecasting properties in Table A.1 for all fixed effects versions of the regressions. (ii) All non-linear results are plotted in order to check for counterintuitive effects from overfitting that are unlikely to be working well in extrapolations. (iii) In the system simulations we check for end-of-sample realism. (iv) We check for the long-run stability by way of simulation for more than hundred years (the purpose is not to consider them as forecasts). Simulation is a simple spread-sheet exercise. Circular references between cells are solved iteratively. Whenever we detect a problem we try to improve the regressions by either improving t-values, adjusted R-squared or Durbin-Watson statistics. The more general point here is that any flaw in the regressions is likely to generate problems in the simulations through the interactions of the equations which transport any flaw into unrealistic simulations results. In the estimation-of-systems literature this problem is called 'contamination' of equations through flaws in other equations (see Akhand and Gupta 2002). As a matter of experience we learned here that not all good-looking regression results yield good simulations and sometimes require searching for improvements. It is this multiple check through estimation, forecast of single equations and simulations of the whole system that indicates the robustness of our results.

4. Estimation results

The results for the interaction of the OECD per capita GDP growth and that of the world GDP are as follows (t-values in paranthesis of equations (1') and (2')).

d(log(oec)) =   (1')
0.285 - 0.13(log(oec(-1)) -0.07log(wld(-1)) -0.018time -7.24) + 0.89(d(log(oec(-1))) - 0.73d(log(wld(-1)))
(4.05) (-3.9)   (-0.265)   (-2.07)   (2.14)   (-1.61)

d(log(wld)) = (2')
0.033 -0.124(log(oec(-1))) -0.07log(wld(-1)) -0.018time -7.24) +0.64(d(log(oec(-1))) -0.39d(log(wld(-1)))
(5.23) (-4.16)   (-0.265)   (-2.07)   (1.74)   (-0.97)

The long-term relation in the error correction term can be read as the world economy having a

slight positive effect on OECD growth, with the log of the GDP per capita otherwise starting out

from a value of 7.24 and having a constant growth rate of 1.8%. Adding 0.07 times a growth rate

of 3% for the world GDP yields an OECD growth rate of 2.1%. In regard to the short term

effects outside the error correction term it is remarkable that OECD growth enhances both

growth rates whereas World GDP growth reduces both growth rates.

The growth regression: The direct effects of the world economy and international transfers. [24]

$\log(gdppc) = c_{1i} + 0.81\log(gdppc(-5)) + 0.051\log(gfcfgdp) - 0.327d(\log(l))$
                        (0.0000)   (0.005)   (0.015)

$+ 0.52\ wr(-1)/gdp(-1) -2.44(wr/gdp)^2 -1.1oda/gdp + 0.365\ oda(-1)/gdp(-1) + 1.61(oda/gdp)^2$
  (0.032)   (0.0223)   (0.0025)   (0.0001)   (0.0334)

$+ 0.196\ \log(wld) -0.148\ \log(l)$ (3')
(0.0022)   (0.017)

Per.: 30 (1976-2005); Countr.: 48; Obs.: 644. S.E.E.: 0.057; J-stat.: 74.7; Instr.rank: 68; p(J): 0.07.[25]

In the relevant range remittances have a positive impact on growth and aid has a negative one.

The world GDP has a positive impact as expected. If the crisis reduces remittances and world

GDP growth poor countries' growth goes down. For aid the result is plausible because for poor

countries much of the aid serves emergency and poverty alleviation and some parts are just lost

in the political and administrative process. These effects may bias the sectoral structure towards

consumption sectors, which possibly have lower growth than those of exports because they serve

relatively more poor people and include agriculture whose growth rate is limited in many poor

countries.[26] Aid may also weaken democratic institutions (Djankov et al 2008) which may have a

negative impact on total factor productivity (Rodriguez 2006). The opposite results for

remittances and aid within the group of poor countries is also quite plausible in view of the fact

that emergency aid may go predominantly to the poor strata whereas remittances are obtained by

those who are able to afford the cost of migration (see IMF, 2005, p.73). The indirect effects of

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[24] p-values in paranthesis in the following equations. (0) means that the p-values is zero at the first five digits. Two lagged dependent growth rates functioning as serial correlation correction are not reported.
[25] This p-value belongs to the Hansen (or Sargan) J-statistic.
[26] For the richer sample used in complementary work we find a significantly positive sign for aid. On the topic of parameter heterogeneity for different samples see Hineline (2008).

aid on growth treated in a companion paper are positive though and outweigh the direct ones. The amount of aid is also an indicator of bad times because of famines, earthquakes, and tsunamis et cetera, which may shift the sectoral allocation towards consumption and reduce the productivity of the economy. This is an endogeneity we deal with by use of lagged aid variables as instrument (see Appendix 2). The GDP of the world, included as *log(WLD)*, and the level of the labour force, *log(L)* have coefficients of the same order of magnitude and would be closer to each other if we had the lower employment data.[27] The significant lagged dependent variable is used with a five years lag implying a yearly rate of convergence to the steady state of about 4%. Gross fixed capital formation as a share of GDP[28], and labour force growth have the expected sign and are significant. Without the world income variable, a time trend would be significant. The ordinary time trend would be associated with total factor productivity growth, whereas world income is an argument in the export function of models with imported inputs (see Mutz and Ziesemer 2008). With an insignificant time trend when both are included, the latter seems to be more relevant than the former in developing countries. The literacy variable is insignificant. If we drop *log(wld)* and *log(l)* - several of the papers cited do drop the labour variables form the regression although it is crucial in growth theory and often significant in the literature -, literacy becomes significant. In related work on richer countries we find a significant effect for both, literacy and world income. The reason for the insignificance may be that the countries are specialized in sectors that use predominately unskilled labour, because of the countries' low human capital endowments. Only when low population growth and education for women are sufficiently close to that of richer countries, these countries can specialize in goods where human

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[27] The standard steady-state assumption from growth theory would be a constant share of all variables which are expressed as a share of GDP. Under these assumptions taking first differences of equation (1') leads to a formula that is familiar from the Bardhan/Lewis (1970) model: $d(\log(gdppc)) = 0.81d(\log(gdppc(-5))) + 0.196d(\log(wld)) - 0.148d(\log(l))$. In terms of steady state growth rates this implies $g_y = 1.03g_w - 0.78g_L$ with g_y as the growth rate of the GDP per capita, g_w that of the GDP of the World, and g_L that of the labour force. Inserting our long run result of 3% for World GDP growth we get $g_y = 0.031 - 0.78g_L$. Only at a labour force growth rate of 1.334% will our result for poor countries be equal to 2.05%, that of the OECD. At a labour force growth rate of 1% we get a growth rate of 2.3%. These are quite reasonable results for economies which import their capital goods and therefore are driven by the world income term in their export function (see Mutz and Ziesemer 2008 for a theoretical formulation and estimation of an explicit growth model without linearization).

[28] Current investment and labour force growth may suffer from an endogeneity bias. Using lagged instruments in the Arellano-Bover method and as a cross-check also in two-stage-least squares (TSLS) corrects for this.

capital is relevant as witnessed by the 'intrusion' of newly industrialized countries into the realm of North-North intra-industry trade (see Wörz 2005). [29]

Worker remittances: The credit crisis hits directly

For remittances we get the following results.

wr/gdp = -0.12 - 2.95wr(-1)/gdp(-1) -0.08 log(1+riusa(-1)) -12.3 (wr(-1)/gdp(-1))^2
       (0.005) (0.012)   (0.0001)   (0.0079)

-226.15 (wr(-1)/gdp(-1))^4 - 0.005(log(wr(-1)/gdp(-1))) –7.17 (log(wr(-1)/gdp(-1)))$^{-3}$ (4')
(0.0003)   (0.0079)   (0.0013)

0.034(log(oec(-2))-log(gdppc(-2))) -0.003(log(oec(-2))-log(gdppc(-2)))^2
(0.06)   (0.06)

Per.: 34 (1972-2005); Countr.: 51; Obs.: 777. Adj. R^2 = 0.926; DW stat.: 2.02.

Worker remittances as a share of GDP depend on their own past values in a highly non-linear way as one might expect of variables at the beginning of their history.[30] The sum of all lagged dependent variable expressions has a surprisingly constant negative value of about 0.06 if we plot it against the change of the remittance ratio. A negative value is plausible if sending money in one year implies a reduction in the next, be it because of the negative correlation of past unfavourable shocks in the income of the receiving countries or because of the limitations in money available. Next, interest rates in the USA reduce remittances, indicating that they are also competing with investment elsewhere, which is typical for investment oriented expenditures but could also hold for others. Domestic interest rates are insignificant. This confirms the result by Vargas-Silva and Huang (2006) for a smaller sample that home country variables have a weaker impact on remittances than host country variables. Public expenditure on education as a share of GDP is a variable that is highly insignificant once we use panel corrected standard errors of the cross-section-weight type. If we drop it net immigration flows also become insignificant.

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[29] We have abstained from trying other human capital indicators because their endogenization would make the model even more complex and in poor countries the variation of literacy is as wide as that of secondary schooling. We want to point out though that in the literature all growth regressions for poor countries with significant human capital indicators do not employ the export growth part of our regressors although capital goods are imported.
[30] When the GDP part of a variable appears with a fraction sign for variables we have made ourselves, we have algebraic values like 0.02. Then high positive exponents make them even smaller because they are below unity as in the case of wr/GDP. The variables without a fraction sign like peegdp are taken from the WDI and 6% then is 6 because the World Bank multiplies them by 100. If we would multiply all the remittance variables by 100 the coefficient of -2.95 goes to 0.64 because of the highly nonlinear nature of the regression.

Therefore we drop them both.[31] When the OECD income falls by more than that of the recipient countries, remittances fall two years later.

Savings: Crisis effects via worker remittances and return migration

The results are as follows.

savgdp = 5.92 + 0.67 savgdp(-1) + 79.1 wr(-1)/gdp(-1) -338(wr(-1)/gdp(-1))^2 -0.006(peegdp)^2
      (0.0001) (0.0000)   (0.013)   (0.004)   (0.000)

-24.1 oda/gdp + 40.1(oda(-1)/gdp(-1))^2 + 22nm/l   (5')
(0.027)   (0.072)   (0.004)

Periods: 7 (1975-2005). Countries: 41. Observations: 106. Adj. R^2 = 0.86; DW stat.: 0.85.

The lagged dependent variable has a positive impact. Worker remittances have a positive slightly decreasing effect for the relevant range until 11.7% of GDP. Public expenditure on education (squared) has a slightly negative impact: If the government spends more on education households save less. Official development aid has a negative impact even if aid were tripled. Finally, an increase in net immigration, or less emigration, would increase savings ratios. Again we have a high loss of observations from gaps in the data. We also have a low Durbin-Watson statistic, but we don't worry about it here because it is probably due to the low number of observations in the time dimension when five-yearly migration data are used.[32] If the crisis leads to lower remittances savings are reduced, but more return migration enhances savings. The net effect is unclear unless one runs numerical simulations as we do below. Also, income growth is not a significant variable. The reason probably is that people save more in crises times because of the uncertainty and in booms because they have unexpectedly much income. If these outweigh each other income growth is insignificant. For richer samples the risk is less important

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[31] When regressions are run merely to compare them to some theory one may of course leave insignificant variables in the regression. When the validity of theory is unclear or several theories contain valid elements and the total body of theory is fairly complex as in an area of our paper we prefer to drop insignificant variables from simulations in order to avoid effects of collinearity on coefficients, which might have strange effects in the simulations.

[32] Interest rates could be added to this equation at the cost of reducing the significance of other variables and changing their values. In simulations the result are too high savings, going beyond investments, which is never the case in the sample period. Using the Arellano-Bover method we get lower coefficients of the lagged dependent unless the number of instruments is two-thirds that of the observations; then we get about equal coefficients but no constant; therefore we stick to the fixed effect method.

Interest rates drop with growth during the crisis

The result for the interest equation is as follows.

log(1+ri) = -0.105 + 0.54log(1+ri(-1)) -0.28log(1+ri(-2)) + 0.80d(log(gdppc)) + 1.57 oda/gdp   (6')
        (0.023) (0.00)   (0.00)   (0.0004)   (0.004)

- 5.83(oda/gdp)^2 + 0.92(oda(-1)/gdp(-1))^2+0.0084[Sum-of-Lags (invgdp(-2)-savgdp(-2))]
 (0.00)   (0.047)   (t-value: 2.165)

Periods: 25 (1981-2005). Countries: 34. Observations: 406. Adj. R^2 = 0.68; DW = 1.95

Real interest rates depend on their own two lagged values. Growth rates of GDP per capita enhance them. Official development aid also has a positive impact in the relevant range with a maximum of 16% - beyond which higher interest rates might increase the probability of bankruptcy - and a zero at 32%. Probably the reason is that aid signals a weak future ability to pay and a political risk of withdrawal through donor countries and therefore increases spreads. Tying of aid to co-financing investment may raise credit demand and interest rates. The difference between investment and savings increases foreign debt, and therefore also spreads, with a lag of two years. The result is based on a polynomial distributed lag of the eighth degree with 14 lags. We have used polynomial distributed lags because past flows of debt are collinear with each other. There are no direct effects of remittances on interest rates in this sample. A negative effect of the crisis on growth will reduce interest rates whereas other effects are unclear a priori as we do not know whether or not investment, savings and aid fall by more compared to each other and compared to the GDP in the denominator of the ratios.

Investment rates decrease with growth in the crisis

The preferred regression for investment is as follows:[33]

log(gfcfgdp) = 0.52 + 0.776log(gfcfgdp(-1)) + 0.45d(log(gdppc(-1))) + 0.27(oda(-1)/gdp(-1))
             (0.00) (0.00)   (0.00)   (0.002)

+ 31.25 d(log(I(-1)))^2 - 24.89 log(1+d(log(I(-1))))^2 + 0.028lit(-5) -0.0265 lit(-6)   (7')
 (0.05)   (0.06)   (0.006)   (0.01)
Periods: 30 (1974-2005). Countries: 43. Observations: 1066. Adj. R^2 = 0.86; DW = 1.96

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[33] Investments are independent of interest rates or, alternatively, would have a positive sign, which could be justified by a strong impact of credit rationing for a large part of investors. Under credit rationing investments are limited to savings, for example of producer households, and savings react positively to interest rates and so do investments. If the share of the population suffering from credit rationing is large enough, a positive impact of interest rates on investments is also plausible. We use the regression without positive interest effect because it has a much higher adjusted R-squared and it covers eight countries more.

Aid and lagged growth rates of GDP per capita have a positive impact on investment. Remittances having an impact on growth and therefore have an indirect impact here. The effect of aid may also stem from tying aid to the export of donors countries machinery sector. Boone (1996) is often cited as finding a negative impact of aid on investment. However, he reports positive effects for small countries with high aid/GDP ratios, which are generally small and poor countries as many in our sample. Labour force growth and changes in literacy have both a positive impact on investment. We will see next that remittances enhance literacy and therefore they have a second positive indirect impact here. A reduction in their own growth through the crisis will reduce investments of the poor countries.

Public expenditure on education: The crisis hits via reduced remittances and tax money

The second type of investment besides fixed capital formation is public expenditure on education. This is a highly political variable. Our most plausible result is as follows.

$$peegdp = 0.66 + 0.84\ peegdp(-1) - 0.0226\ peegdp(-1)^2 + 0.04\ taxy + 1.69\ oda(-5)/gdp(-5)$$
$$\quad\quad (0.015)\ (0.00)\quad\quad (0.018)\quad\quad\quad (0.023)\quad (0.008)$$

$$+ 0.114\ \log(wr(-1)/gdp(-1)) \quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad (8')$$
$$(0.0012)$$

Periods: 25 (1981-2005). Countries: 35. Observations: 219. Adj. R^2 = 0.95; DW = 2.07.

Public expenditures on education are positively related to the amount of taxes raised (by the central government as a share of GDP). Remittances and aid have positive effects in poor countries. Governments react positively to aid and remittances, which could express an attitude of co-financing: if donors and domestic people put in more money the government may get convinced of doing the same, in particular because they do not have to pay alone. If the crisis reduces tax revenues and worker remittances as a share of GDP public expenditure on education will fall as well.

The crisis hits education: Change of literacy is financed by aid, savings and peegdp

Public expenditures on education enhance literacy. We have to resort to polynomial distributed lags (Almon lag) again probably because it takes between zero and five years until money financing beginners or preventing drop outs has an effect.

lit = 8.2 + 0.831lit(-5) + 6.465oda/gdp + 0.09512 [sum of lags savgdp] + 0.75[sum of lags peegdp]   (9')
     (0.02) (0.00)   (0.063)   (t-value:1.94)   (t-value:2.13)

Periods: 18 (1985-2004). Countries: 30; Observations: 171. Adj. R^2 = 0.99; DW = 0.81.

Development aid, savings and public expenditure on education all enhance literacy. For savings there are three lags and the current value and for public expenditure on education there are four lags and the current value. Polynomial distributed lags are well known to cause serial correlation resulting in a low Durbin-Watson statistic here. As all these variables are measured as a percentage of the GDP it is interesting to see the differences in the coefficients. Development aid has the highest coefficient, perhaps because aid, for example from the Netherlands, is often tied to education. Probably this induces some reduction of private savings being used for this purpose because they have the lowest coefficient. But this reduction is still imperfect because under imperfect capital markets savings remain important. There is no complete crowding out of private money. The effects of emigration and remittances on savings presented above have an indirect effect on literacy. Similarly, the effect of remittances on public expenditure on education has an indirect effect on literacy. The latter two channels are the way how the crisis affects literacy.

Another variable that is highly political in spirit is the ratio of central government tax revenues to GDP. Our result is as follows.

taxy =

1.3+ 0.83 taxy(-1) + 0.0012 taxy(-1)^2 – 7.53 wr/gdp + 51.1(wr(-1)/gdp(-1))^2 + 0.05 savgdp   (10')
(0.05) (0.00)   (0.018)   (0.09)   (0.0008)   (0.0013)

Periods: 31. Countries: 35. Observations: 348. Adj. R^2 = 0.975; DW = 2.02.

Tax ratios depend on their own lagged values and a very small quadratic one, which is positive. Worker remittances have a negative impact in the relevant range. Via this channel remittances reduce education working against the positive effects discussed above. But if people save more, indicating a higher surplus product, the tax ratio is also increased. The crisis affects the tax ratio via remittances and savings.

Aid: Donors react to growth of the poor countries and their own and transmit the crisis

   Of all the variables, which are important for literacy all but official development aid have been discussed so far.

$$oda/gdp = 0.016 + 0.82\ oda(-1)/gdp(-1) - 0.0186\ d(\log(gdppc(-1))) + 0.056\ d(\log(oec(-2)))\qquad(11')$$
$$(0.00)\quad(0.00)\qquad\qquad(0.0004)\qquad\qquad\qquad(0.0007)$$

Periods: 43 (1963-2005). Countries: 52. Obs.: 1775. Adj. R^2 = 0.90; DW = 2.18.

   Aid as a share of GDP depends on its own lagged value and is negatively dependent on the growth rates of the recipient countries and positively on that of the OECD countries, the major donors. In other words, aid is reduced if a country is doing better relative to the donors. Low growth countries will therefore keep a high share of aid, but high growth countries will get less aid. This equation could probably be enhanced by including motives for paying aid in a more detailed way. However, the focus of this paper is the level - because we need it for the simulations - and not the detailed motives and therefore we keep the equation simple. Moreover, some motives may be grasped by the lagged dependent variable and time invariant motives are implicit in the fixed effects. As with some of the other regressions, many alternative specifications tend to deliver too high simulation values for aid in the years close to 2005. As the crisis first hit in the OECD and then in the poor countries the oda/gdp ratio will first go up and then down because of the lags and the long term effects do their work.

Endogenous labour force growth

Literacy has no direct impact on growth but an indirect one via the labour force growth equation. Migration, discussed extensively below, also has an impact on the labour force growth. These are two indirect channels for remittances to have an impact on growth via labour force growth.

$$d(\log(l)) = c_{10i} + 0.17d(\log(l(-1))) + 1.39\ d(\log(l(-1)))^2 - 0.00018lit(-13) + 0.015\ oda(-5)/gdp(-5)+$$
$$\phantom{d(\log(l)) = c_{10i} + }(0.005)\qquad\qquad(0.005)\qquad\qquad(0.025)\qquad\quad(0.09)$$

$$+0.04nm/l + 0.018\ d(\log(gdppc(-1))).\qquad\qquad\qquad\qquad\qquad\qquad(12')$$
$$\ (0.05)\qquad(0.12)$$

Per.: 4 (1990-2005). Countr.: 43. Obs.:153. SEE: 0.0072. J-stat.: 72.4. Instr.rank:71. p(J): 0.25

Labour force growth depends on its own linear quadratic lagged values. Literacy as of 13 years ago reduces it. This effect probably stems from lower population growth 13 years earlier. Development aid as of five years earlier also enhances labour force growth. This is probably due to financing primary schooling through aid and postponing labour market participation by five

years or to emergency aid and poverty alleviation reducing starvation from hunger and diseases and thereby allowing people to stay in the labour force later. Net immigration also increases the labour force immediately, indicating that some people are allowed to immigrate for the purpose of work. Finally, growth of GDP per capita in the previous year encourages people who did not believe in the chance of getting a job to enter the labour force. The crisis leads to a decrease of the growth and therefore one of the labour force growth, whereas return migration does the opposite in the short run, but in the long run emigration may resume if the effects in poor countries are more lasting than in the rich ones.

   Via net immigration more variables may have an impact on the labour force growth. Essentially, net emigration would reduce labour force growth and therefore can be expected to be growth rate enhancing in an indirect way. Therefore we turn to net immigration next.

$$nm/l = c_{11i} - 0.18nm(-5)/l(-5) + 2.97(\log(gdppc) - \log(oec)) + 0.73(\log(gdppc) - \log(oec))^2$$
          (0.06)   (0.002)   (0.0014)

$$+ 0.058(\log(gdppc) - \log(oec))^3 + 1.29\ wr(-10)/gdp(-10) - 1.36(wr/gdp)^2 +$$
  (0.0013)   (0.0000)   (0.006)

$$+12.8(wr(-5)/gdp(-5))^2 - 19(wr(-10)/gdp(-10))^2 - 0.00118savgdp(-3) \qquad (13')$$
(0.0000)   (0.000)   (0.0001)

Per.: 4 (1990 2005). Countr.: 20. Obs.: 46.[34] S.E.E..: 0.012655. J-stat.: 23.69. Instr. Rank 30. p (J): 0.31

The lagged dependent variable normally is interpreted to reflect network effects (see for example Hatton and Williamson 1998, Chap.4, and Mayda 2007) and expected to have a positive sign. We get a positive sign for an OLS estimate (known to be too high) , but a negative one when using fixed effects (known to be underestimating) or the Panel systems GMM reported. The negative sign may stem from migration that is caused by natural disasters or political conflict including war and civil war. These may be negatively correlated with similar events five years later. In addition, if a person in a network has financed the costs of migration for one person then, for relatively poor countries like those in our sample, the probability that another one can be financed five years later may be very low and affected negatively. This may be different for large stocks of migrants when such uncertainties and fluctuations are averaged out over a large

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[34] Remittance data are available for all 52 countries but only since 1971. GDP per capita data are available for all 52 countries and 46 periods, but with some gaps: instead of 52x46 = 2392 we have only 1957 observations. Savings data start in 1965 with gaps again, leaving us with 1423 observations instead of 41x52=2132. As a consequence we loose more than half the possible observations in both dimensions

number of people. Our result is more plausible for small stocks of migrants with much temporary migration as Hatton and Williamson (2002) report for Africans in the USA constituting a small network whose behaviour may resemble that of single persons in the presence of fluctuations.[35] The second argument is the backwardness in GDP per capita, *GDPpc*, relative to that of the OECD, *oec,* which matters in a highly non-linear way. Most international migrants in the meanwhile go to OECD countries. However, many do not but go to richer neighboring countries. Only 15% of the migrants to the OECD come from low-income countries (Skeldon 2008). Countries that are loosing people to the OECD directly are willing to allow for immigrants from other countries. These countries in turn are willing to allow for immigrants from the next poorer countries. This constitutes a chain from rich to poor countries, where the incentive essentially stems from the rich end of the chain (see Ratha and Shaw (2007)). In this perspective the GDP per capita in the OECD reflects the income that can be earned in the upper end of the chain. This income difference is only a rough indicator of what the migrant gets as an income change when changing the country of his location. Of course, he may not exactly have the average income before and after migration and the probabilities of getting a job in the new and old locations may differ but still the income difference between the places of origin and destination is a good proxy for the revenue gain of the national and international migrants since the work of Todaro (1969) (see Mayda 2007 for an extensive discussion of modern literature).[36] According to our combination of data and simulations presented below the gap increased from *-3.38* to *-3.67* in the period 1960-1990, and falls slightly afterwards; then catching up takes place in our simulations until a value of *(-3.01)* in 2230 when our simulation ends because remittances become zero.

The next argument appearing in the form of current and lagged, linear and quadratic terms are worker remittances as a share of GDP.[37] This is what those who are left behind by the migrants get in order to solve the market imperfections like insurance problems and related credit constraints emphasized by modern migration theory (see Stark and Bloom 1985, Taylor 1999 and Rapoport and Docquier 2006). For the European migration to the US before WWI Hatton and Williamson (2003) emphasize that remittances financed further emigration. In our sample

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[35] Hatton and Williamson (1998, chap.4) report strong volatility for migration streams before WWI.

[36] Hatton and Williamson use wages instead of income in their papers. Note that for a CES production function wages are proportional to per capita GDP.

[37] Note that worker remittances as a share of GDP is a value below unity. Therefore the exponents do not have a strong impact as they would for values above unity.

this effect increases net immigration and reduces emigration in a slightly non-linear way. As worker remittances as a share of GDP are between 2.5 and 3 per cent there direct effect is that they reduce net emigration by about 3 percentage points. This makes sense because reducing problems from market imperfections makes sense only if some members of the family want to stay in the country of origin. The effect emphasized by modern theory therefore seemingly dominates the one of financing additional migration.

The last regressor[38] is the savings ratio as of three years ago. In poor countries with less than $1200 per year or $100 per month it will hardly be possible to pay migration costs out of current income even if reconsidered in terms of purchasing power parity. It is necessary to save first. Whereas the income difference and remittances represent the incentives to migrate or stay, the lagged savings ratio represents an important part of the means available to carry the costs of migration. Remittances then finance emigration via their impact on savings. With a savings ratio of 1/6 = 16 2/3 % an average family saves $200 of the $1200 or $100 if it is half as rich. Over three years this cumulates to $300 plus interest earned. This might be enough to cover the migration costs without being payable out of current income. For low savings ratios as in the early 1960s the savings ratio explains about one percentage point of net emigration. For high savings ratios of later years this goes up to 2.5 percentage points.

The crisis first affects migration through the impact effect in the OECD income, leading to return migration. A bit later when the poor countries' GDP per capita also goes down, the pressure to emigrate comes back. And when remittances fall the means to stay at home also get less. But so do the savings, which finance emigration. Except for the first return migration net effects are unclear a priori.

The thirteen equations provided so far are the heart of the model. In addition, we have used US interest rates in equation (4') for remittances. For this variable we provide only an auxiliary equation as is the habit in dynamic stochastic general equilibrium models in order to round off the model in a way that limits the number of variables in it. For US interest rates we find that they depend only on their own lag.

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[38] Other regressors, which are not used in the regressions, are discussed broadly in Appendix 4 of the working paper version.

RIUSA = 0.59 + 0.85RIUSA(-1)   (14)

                                                                          (12)
        (0.0422) (0.00)

Periods: 43 (1963 -2005). Adj. R^2 = 0.718. DW: 1.785

All the fourteen estimated equations are used jointly to form a dynamic system. The signs of the significant effects for the whole system are summarized in Table 1 in order to allow for a quick check of dynamic interactions. The system is used for dynamic simulation and an analysis of the effects of the crisis in the next sections.

5. Simulations with the dynamic system

The model is driven by the interaction of OECD and World growth. From there the effects go to aid and remittances, which feed back to growth of poor countries, and to savings, migration, public expenditure on education, and taxes revenues. Indirect effects go via savings to public expenditure on education and on literacy, and from there as well as from migration to population and labour force growth. The simulation of the system allows us to take all of these effects jointly into account. Thereby we automatically include second and higher round effects, which are missing in many other types of studies (see Adams 2006).[39]

The simulation for equation (14) leads to a US interest rate of almost 4%. Equations (1') and (2') result in a long run value of about 2.05% for the growth of the GDP per capita of the OECD. World GDP moves to about 3.01%. The other equations form a fairly complex non-linear system for which we cannot make many simple statements. We present the Figures for the baseline scenario in Appendix 3. The growth GDP per capita is shown in Figure 1. Its long run value is above 2% and that of the OECD. Therefore we have slight convergence shown in Figure 2. In Figure 1 the lower curve is net immigration as a share of the labour force.[40] Values are negative and therefore we have emigration. The highest emigration of about 2.8% is obtained in 1989-1990. An implication from the negative sign of the lagged dependent variable in the migration

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[39] As all regressions employ lags of some variables we have to construct initial values for each series. We do this by regressing the variable in question on a constant and a (quadratic) time trend for the first five years or more if necessary and use simpler regressions in some cases for the early periods.

[40] The values of the first four periods stem from a simple regression on a linear-quadratic time trend. These are needed as initial values as difference equation (13') has five-year lags. As we have also ten-year lags of remittances, we add lagged dependent variables next for some periods. This variant of our regression is used until 1983. From 1984 onwards we use regression equation (13'). The points of changes from the simplified regressions to (1)-(14) have always been chosen in a way that minimizes frictions at the point of switching to the estimated equation.

equation is that the increase in emigration in the first phase does not come from self-perpetuating forces. Rather three forces are at work here explaining the phase of increasing emigration, the crucial and controversial part of the emigration curve sometimes called migration hump. First, after a very early peak of remittances as a share of GDP in 1979 (the lower curve in Figure 3) this percentage rate is falling providing less means for financing the desire to stay at home and to solve problems from market imperfections. After the 1979 peak lower remittances contribute to higher emigration. Second, the mild convergence of incomes leaves the income gap (see Figure 2) fairly large thereby stimulating further emigration.[41] Third, according to Figure 4, savings are increasing in the first phase beyond 20% and allow financing more emigration and fall later below 15%, whereas investment is fairly stable above 20% of GDP. The fall in savings and the decreasing income difference are the dominant force for migration. Whereas the income differential changes only slowly, the fall in remittances goes finally as far as zero because of its own non-linearities and negative effects of lagged variables.

The labour force growth in Figure 1 goes from above 2% during the initial years to below 1%. It follows the emigration curve with a similar but less drastic curvature: The growth of the labour force goes down when emigration increases, and when net immigration goes up labour force growth follows. The growth rate of the GDP per capita in Figure 1 reacts with the opposite tendencies. There is a strong interaction in the system between migration, growth of the labour force and GDP per capita.

In regard to the savings ratios in Figure 4 we see that they follow the path of remittances, which first shoot up and then go down again. Figure 5 shows that tax revenues, going slightly beyond 14 percent of GDP, and public expenditure on education as a share of GDP, going a bit higher than 4 percent, as well as literacy, going to about 80 percent in Figure 6 do not reflect much of the ups and downs of migration and remittances. They all are not decreasing as much as savings do. Public expenditure on education as a share of GDP parallels the pattern of total investment from very low values to a high and almost constant level although a value of not more than 80 percent is somewhat disappointing. Getting a better performance in regard to literacy requires a structural break. Finally, development aid, the higher curve in Figure 3 goes to

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[41] A major difference with European migration of that time is that much emigration came from relatively rich countries, the UK and its followers. Massey (1988) gives a detailed summary of the reasons for the migration into the USA.

a maximum of 9.8% of GDP and then back to 9.4% thus contributing to the stable values of investment and education variables together with the stable value of taxes as a share of GDP.

In these simulations there are some aspects which are highly sensitive to changes in the regressions, whereas others are very robust. The robustness is present in the first part of the migration hump. Slight changes in the regression can switch the point where emigration is half its maximum value in the end of our simulations by some decennia. This is easy to understand, because now it takes 100 years to get from 2.8 percent net emigration to 1.9%. That is a long period for a small change. A slight shift of the line upward or downward then easily translates into some decennia in the horizontal direction. One aspect that can easily change is whether or not savings will exceed investment. For example allowing for a positive interest rate in the investment and savings functions will increase investment, therefore also net debt flows, which in turn will enhance the interest rate again. However, this mechanism leads to savings larger than investment at times for within sample simulations although this can never be found for a panel average value at any time. It also increases the effects of more aid discussed in a companion paper dramatically and therefore we stick to the choice of an investment function presented above. Another point that is highly sensitive is that an increase in labour force growth by a half percentage point reduces growth, postpones convergence and dramatically increases migration and remittances to levels which are know from countries with the highest levels of remittances.

6. The crisis as transitional shock: Simulations

In order to analyze the impact of the crisis we add shocks to the baseline simulation in equations (1'), (2') and (3'). The shocks for (1') and (2') are chosen such that the predictions of the international organization for OECD growth and GDP growth of the world economy as summarized in Table 3 are realized. The predicted values for 2009 by Schmidt-Hebbel (2009) and Ratha et al. (2008) are a growth rate for OECD GDP per capita of -3.6 and -4.9% after subtraction of 0.6% population growth. But for the US and Germany there were also more pessimistic recent predictions of -7.2% (after subtraction of 1% population growth), which we use as a pessimistic scenario.[42] For the World GDP the scenarios go from -1.7% to -4.2%. In panel (b) of Table 3 we show the shocks we add to equations (1') and (2') in order to get the predicted values. Moreover, as rich people in the poor countries have also lost money at the stock

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[42] See also Bhaskaran (2009, chart 1.2)).

exchange and their banks are also slightly exposed to bad credits, and capital outflows we impose a shock of -0.01 to equation (3') for these countries in all scenarios for the year 2009. With these shocks imposed for the years 2008 and 2009 we re-run the simulations. Then we divide the values of these re-runs by those of the baseline scenarios. The Figures in Appendix 4 collect all effects. Values below (above) unity then reflect that shocks decrease (increase) the respective variable compared to the baseline scenario of Appendix 3. The three different lines for each variable capture the three scenarios of Table 3.

   Figure 7 shows the crisis relative to the baseline scenario. The value of -3 is the result of dividing the after shock value of -7.2% by that of the baseline, 2.44%. Growth rates are above the baseline value again in 2011, but become positive already in 2010.

   Figure 8 shows that the World GDP has a similar pattern, but the baseline scenario generates a higher denominator. Again growth rates are back to baseline in 2011. These simulations should not be viewed as predictions because policy will react to predictions. Other shocks may come in like the bad-credit-bad-bank cum credit crunch problem and currently the swine flue. They may perhaps invalidate our coefficients in the spirit of the Lucas critique and reduce the strong stabilization force of the error-correction mechanism, into which the shock comes after one year and generates a strong adjustment effect. If this were the case, the recovery may be more pessimistic, because permanent shocks would have to be imposed, whereas ours are only temporary. For levels the quick return to baseline does not hold. The perspective here is one of looking at what happens to poor developing countries under optimistic assumptions for other countries' stabilization process.

   Figure 9 shows that it takes the OECD thirty years to come back to baseline in spite of the optimistic results in terms of growth rates, indicating how huge the costs of the credit crisis are. In terms of levels it does not matter much, whether we take a more or a less pessimistic scenario.

   The impact on the GDP per capita of poor developing countries is permanent as shown in Figure 10. Here the three scenarios are most clearly visible after the first years. Temporary shocks translate into much more serious level effects. The effect in the first years is about -3% as predicted by some policy notes (see Massa and te Velde 2008; Committee 2009).

   As the GDP per capita of the OECD goes down by more than that of poor countries the crisis has a positive impact on convergence in the short and medium run (see Figure 11). As the crisis is more persistent in the poor countries we get less convergence in the long run.

A similar effect holds for aid, which depends only on the growth rates of the OECD and the poor countries. It first goes down and then up again (see Figure 12) as a mirror image of the recovery of that of the OECD income in Figure 7. The initial fall is much weaker than that predicted by IMF (2009) for a slightly different sample though.

The larger strength of the shock in the OECD also causes remittances to go down by more than the GDP (Figure 13), but the persistence in the level effects of the GDP make them go up as a percent of GDP in the long run. According to the growth equation this fall in the remittance ratio reduces growth, which in turn enhances remittances and this enhancement mitigates the fall in growth.[43] Figure 13 shows the net effect of all interactions of our system of equations.

Labour force growth goes down in the short run, up in the medium term, and down in the long term (Figure 14). The short and medium effects come from those in growth and the aid/GDP ratio. The long term fall comes from the long term increase in literacy discussed below. The long term fall contributes to the long term recovery of the GDP per capita but has no dominating effect.

Figure 15 shows that investment as a share of GDP goes down for about fifteen years and then is larger in the longer run. As the long run effects of remittances, investment and labour force growth are favourable for the GDP per capita, and that of aid and the world economy (not shown) is phasing out after fifteen years the negative long term consequences for the GDP per capita must be due to the self-perpetuating forces of the lagged dependent variable in spite of a rate of convergence of almost 4%.

Figure 16 shows that the savings ratio will be lower for about twenty years and then higher in the long run because of its reduced denominator. As investment and savings both first go down and then up it is important to see what happens to their difference, the new net foreign debt, which is equal to the current account. Figure 17 shows that in 2010 the current account deficit is 2 percentage points larger as suggested by IMF (2009) but then it is less for ten years, then higher for about ten years and lower in the long run.

The plots for tax revenues (peak at 1.018), public expenditure on education (1.016) and literacy (1.008) are so similar to those of savings that we do not present them as Figures. For literacy the worst effect is 0.1 percentage points because literacy is a cumulative variable; for taxes and

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[43] The stabilitzing effect of remittances on output volatility of five-year periods has been shown by Chami et al. (2009).

public expenditure on education it is a bit more than a half percentage point in the worst case an a bit less than a half percentage point in the other two cases.

Finally, emigration goes up - in spite of return migration under the convergence shock - and dominates in the first phase of about fifteen years because remittances are lower for these years. Later, when both, savings and remittances are larger, first remittances allowing for immigration are stronger and then savings inducing emigration dominate.

The overall picture for the long term is dominated by the persistent long term fall in the level of the GDP per capita. In the pessimistic scenario it is four to six percent below baseline and in the other scenarios two to four percent. Except for remittances, migration and debt other variables have weaker effects. The curvatures suggests that remittances help resuming growth in the long run but emigration gets larger in the longer run because the GDP per capita stays lower than in the benchmark scenario.

7. Summary and conclusion

The model we have used has the following properties. First, we estimate more equations than just one for growth of the GDP per capita getting the following main results. Remittances has not only direct positive effects on the level and growth rates of the GDP per capita but also on the rate of savings and public expenditure on education. They also decrease tax revenues and emigration. Emigration has the direct effect of reducing the rate of savings and the rate of growth of the labour force.

A second major difference between our study and earlier ones is that we analyse the interactions between the effects of several equations in a dynamic system running simulations of the whole system. Stability of the model for a fairly long period is shown through forward iteration of the model.

Third, we construct three shock scenarios by generating transitional shocks to the GDP per capita growth of the OECD, the GDP of the world economy and those of the poor countries, which make sure that the predictions which have been published in March 2009 by some international organisations appear in our simulations. The results in comparison with the baseline scenario show that growth rates are back to baseline in 2011. Levels will be below benchmark for thirty years in the OECD, about fifteen years in the world (in spite of the quick stabilization of growth rates through the error-correction mechanism), and two hundred years in the poor

countries. The aid/GDP ratio is below benchmark four five years, the remittance/GDP ratio for fifteen years. Labour force growth and new debt go down, up, and down again. Savings first drop and then are higher and tax revenues, public expenditure on education and literacy follow that pattern. Net migration is first dominated by the decrease in remittances leading to less immigration, then emigration is lower because of higher remittances and savings with a dominance of remittances, and in the very long run it is higher because savings dominate.

   This paper has not suggested anything normative for policy. We largely agree with Lin (2008, p.13-23) although we feel that the chance for international fiscal policy coordination is gone.

References

Acosta, P., C. Calderón, P.Fajzylber, and H. Lopez (2007). What is the impact of International Remittances on poverty and Inequality in Latin America? *World Development*; vol. 36 (2008), afl. 1, 89-114.

Adams, R.H. Jr. (2006). International Remittances and the Household: Analysis and Review of Global Evidence. *Journal of African Economies*, December 2006; 15: 396 - 425.

_____ and J. Page (2005). Do international Migration and Remittances Reduce Poverty in Developing countries? *World Development*, vol.33, No.10, 1645-1669.

Akhand, H.A. and K.L. Gupta (2002). *Foreign Aid in the Twenty-First Century. Kluwer*. Boston/ Dordrecht/ London.

Attanasio, Orazio P.; Picci, Lucio; Scorcu, Antonello E. (2000). Saving, Growth, and Investment: A Macroeconomic Analysis Using a Panel of Countries. *Review of Economics and Statistics*, May, v. 82, iss. 2, 182-211.

Arellano,M. and O. Bover (1995), Another look at the instrumental variable estimation of error-components models, *Journal of Econometrics* 68 29-51.

Azariadis, Costas; and Allan Drazen *(1990)*, Threshold Externalities in Economic Development. *Quarterly Journal of Economics*, May, v.105, iss. 2, pp. 501-26.

Baltagi, B.H. (2005). *Econometric Analysis of Panel Data*. 3nd edition, John Wiley, Chichester.

Bardhan, P.K. (1967). Optimum Foreign Borrowing, in: *Essays in the Theory of Optimal Growth*, edited by K. Shell: 117-128, MIT Press, Cambridge.

Bardhan, P.K. and S. Lewis. 1970. Models of Growth with Imported Inputs, *Economica*, November, p. 373.

Belloc, M. and G.Gandolfo (2005). The Current Account-Interest Rate Relation as a Nonlinear Phenomenon. *Journal of International Trade and Economic Development*, June 2005, v. 14, iss. 2, 145-66.

Bertoli, S. (2006). Remittances and the Dynamics of Human Capital in the Recipient Country. Department of Economics, University of Torino WP No. 07/2006.

Bhaskaran,M. (2009), The Impact of the global economic slowdown on South Asia, Asian Development Bank.

Bond, S.R., Hoeffler, A. and Temple, J.R.W. (2001). GMM Estimation of Empirical Growth Models, November, CEPR Discussion Paper No. 3048.

Boone, P. (1996). Politics and the effectiveness of foreign aid, *European Economic Review* 40, 289-329.

Chami, R., C.Fullenkamp and S. Jahjah (2005). Are Immigrant Remittance Flows a Source of Capital for Development? *IMF Staff Papers*, 2005, v. 52, iss. 1, pp. 55-81.

Chami , R., D. Hakura, and P. Montiel (2009). Remittances: An Automatic Output Stabilizer? *IMF WP*/09/91.

Catrinescu, N., M. Leon-Ledesma, M Piracha and B. Quillin (2009). Remittances, Institutions and Economic Growth. *World Development*; vol. 37 afl. 1, pag. 81-92.

Cinar, D. and F. Docquier (2004). Brain Drain and Remittances: Implications for the Source Country, *Brussels Economic Review* 47(1), 103-118.

Committee of African Finance Ministers and Central Bank Governors (2009), Impact of the Crisis on African Economies- Sustaining Growth and Poverty Reduction, March 21.

Djankov, S., J.G.Montalvo, M. Reynal-Querol (2008), The Curse of Aid, *Journal of Economic Growth* 13: 169-194.

Doucouliagos, H. and M.Paldam (2006). Aid Effectiveness on Accumulation: A Meta Study, *Kyklos*, Vol. 59 (2), 227-254.

Edwards, S. (1984). LDC Foreign Borrowing and Default Risk: An Empirical Investigation, 1976-80, *The American Economic Review*, September, 726-34.

El-Sakka, M.I.T. and R. McNabb (1999). The Macroeconomic Determinants of Emigrant Remittances. *World Development*, Vol27, No.8, 1493-1502.

Faini, R. and A. Venturini (1994). Migration and Growth: The Experience of Southern Europe. CEPR Discussion Paper No.964. May.

Feder, G. (1983). On exports and economic growth, *Journal of Development Economics*, Volume 12, Issues 1-2, February-April 1983, 59-73.

Freund, C. and N. Spatafora (2005). Remittances: Transaction Costs, Determinants, and Informal Flows. *World Bank Policy Research Working Paper* 3704, September.

Giuliano, P. and M. Ruiz-Arranz (2008). Remittances, Financial Development, and Growth. *Journal of Development Economics* 90(1), 144-152.

Greene, W.H. (2008), Econometric Analysis, Pearson Prentice-Hall, New Jersey.

Hatton, T.J. and J.G. Williamson (1998). The Age of Mass Migration. Oxford University Press, Oxford, New York.IMF (2005). World Economic Outlook. Washington , Chap.2, 69-107.

Hatton, T.J. and J.G. Williamson (2002). Out of Africa? Using the Past to Project African Emigration Pressure in the Future. *Review of International Economics*, 10(3), 556-573.

Hatton, T.J. and J.G. Williamson (2003). Demographic and Economic Pressure on Emigration out of Africa. *Scandinavian Journal of Economics* 105 (3), 465-486.

Hineline, D.R. (2008). Parameter heterogeneity in growth regressions. *Economics Letters* 101, 126-129.

IMF (2005). World Economic Outlook. Washington , Chap.2, 69-107.

IMF (2009), The Implications of the Global financial Crisis for Low-Income Countries, Washington, March.

Judson, R.A. and A.L. Owen (1999). Estimating dynamic panel data models: a guide for macroeconomists. *Economics Letters* 65, 9–15.

Kao, C. (1999). "Spurious Regression and Residual-Based Tests for Cointegration in Panel Data," *Journal of Econometrics*, 90, 1–44.

Lin, J.X. (2008), The Impact of the Financial Crisis on Developing Countries, mimeo, 31 pages.

Loayza, N., K. Schmidt-Hebbel, and L. Servén (2000). What Drives Private Saving Across the World? *The Review of Economics and Statistics*, Vol.LXXXII, May, No.2.

Lopéz-Bóo, Florencia (2008). How Do Crises Affect Schooling Decisions? Evidence from Changing Labor Market Opportunities and a Policy Experiment, Inter-American Development Bank WP 653, December.

Lucas, R.E.B. (2005). International Migration to the High-income Countries: Some consequences for Economic Development in the Sending Countries. In Blanpain, R. (ed.): Confronting Globalization. Kluwer, The Hague, 157-190.

Maddala, G. S. and S. Wu (1999). "A Comparative Study of Unit Root Tests with Panel Data and A New Simple Test," *Oxford Bulletin of Economics and Statistics*, 61, 631–52.

Massa, I. and D.W. te Velde (2008). The Global Financial Crisis: will successful African countries be affected? Overseas Development Institute, December.

Massey, D.S. (1988). Economic Development and International Migration in Comparative Perspective. *Population and Development Review* 14 (3), September, 383-413.

Massey, D.S., J. Arango, G.Hugo, A.Kouaouci, A. Pellegrino, J.E. Taylor (1993). Theories of International Migration: A Review and Appraisal. *Population and Development Review* 19, No.3 (September).

Mayda, A.M. (2007). International Migration: A panel Data Analysis of the Determinants of Bilateral Flows. CEPR Discussion Paper No. 6289. May.

Mazumdar, K. (2005). Socio-economic factors determining adult literacy in developing   countries. *International Journal of Social Economics*, Vol. 32, 1/2, p.98-120.

Minier, J. (2007). Nonlinearities and Robustness in Growth Regressions Preview; *American Economic Review*, May, v. 97, iss. 2, 388-92.

Mutz, C. and T. Ziesemer (2008). Simultaneous Estimation of Income and Price Elasticities of Export

     Demand, Scale Economies and Total Factor Productivity Growth for Brazil, *Applied Economics*, Volume 40, Issue 22 November 2008, 2921 - 2937.

Niimi, Y. and C. Özden (2006). Migration and Remittances: Causes and Linkages, World Bank WPS4087, December.

Obstfeld, M. and K. Rogoff (2001). The Six Major Puzzles in International Macroeconomics. *NBER Macroeconomic Annuals*, 339-90.

Pedroni, P. (1999). "Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors," *Oxford Bulletin of Economics and Statistics*, 61, 653–70.

Ramirez, M.D. and H Sharma (2008). Remittances and Growth in Latin America: A Panel Unit Root and Panel Cointegration Analysis. Department of Economics Yale University WP No. 51.

Rapoport, H. and F. Docquier (2006). The Economics of Migrants Remittances, *Handbook on the Economics of Giving, Reciprocity and Altruism,* Volume 2, 1135-1198.

Ratha, D., S. Mohapatra, Z. Xu (2008), Outlook for Remittance Flows 2008-2009, *Migration and Development Brief* 8, November.

Ratha D. and W. Shaw (2007), South-South Migration and Remittances, *World Bank Working Paper* No. 102.

Rodriguez, F. (2006). Cleaning Up the Kitchen Sink: On the Consequences of the Linearity Assumption for Cross-Country Growth Empirics. Wesleyan Economic WP 2006-004.

Roodman, D. (2007). A Short Note on the Theme of Too Many Instruments. CGDEV WP 125, August.

Schmidt-Hebbel,K. (2009), Economic Outlook Interim Report, 31st March.

Schneider, F. and D. Enste (2000). Shadow Economies: Size, Causes, and Consequences. *Journal of Economic Literature*, March, Vol. 38 Issue 1, 77-114.

Stark, O. and D.E. Bloom (1985). The New Economics of Labour Migration, *American Economic Review*, Vol.75, No.2, May, 173-178.

Taylor, J.E. (1999). The New Economics of Labour Migration and the Role of Remittances in the Migration Process. *International Migration* Vol.37 (1), 63-88.

Timmer, M.P. and A.Szirmai (2000). Producitivity growth in Asian manufacturing: The structural bonus hypothesis examined. *Structural Change and Economic Dynamics* 11, 371-392.

Todaro, M.P. (1969). A Model of Labour Migration and Urban Unemployment in Less Developed Countries. *The American Economic Review* (59 (1), 138-148.

Vargas-Silva,C. (2007). Measuring the macroeconomic impact of workers' remittances in a data-rich environment. *Applied Financial Economics Letters*, 2007, 359-363.

Vargas-Silva, C. and P. Huang (2006). Macroeconomic Determinants of Worker Remittances: Host versus Home Country's Economic Conditions. *Journal of International Trade and Economic Development*, Vol.15, No.1, 81-99, March.

World Bank (2009), Global Economic Prospects, Forecast Update, March 30.

Wörz, J. (2005). Dynamics of Trade Specialization in Developed and Less Developed Countries. *Emerging Markets Finance and Trade*, May-June, v. 41, iss. 3, pp. 92-111.

Ziesemer, T. (2009). Remittances, lagged dependent variables and migration stocks as determinants of migration from developing countries. UNU-MERIT WP 2009-007, February.

Appendix 1: List of Countries

Countries with GDP per capita below $1200 (2000):

Armenia, Azerbaijan, Bangladesh, Benin, Bolivia, Burkina Faso, Cambodia, Cameroon, Comoros, Congo Rep., Cote d'Ivoire, Djibouti, Ethiopia, Ghana, Guinea, Guyana, Haiti, Honduras, India, Indonesia, Kenya, Kyrgyz Republic, Lesotho, Madagascar, Malawi, Mali, Mauritania, Moldova, Mongolia, Mozambique, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Philippines, Rwanda, Senegal, Sierra Leone, Sri Lanka, Sudan, Syria, Tajikistan, Tanzania, Uganda, Ukraine, Vanuatu, Yemen, Zimbabwe.

Appendix 2: Instrumental variables

This appendix provides the list of instruments used in the regressions, starting with the number of the respective regressions. The first number after a variable gives the first lag used and the second the last lag. These are used as dynamic instruments (see Baltagi (2005, Chap.8). If only one lag is mentioned we have a simple standard instrument.

(1): $NM(-10)/L(-10)$, $NM(-15)/L(-15)$, $((LOG(GDPPC)-LOG(OEC)),-1,-1)$, $((LOG(GDPPC) -LOG(OEC))^2,-1,-1)$, $((LOG(GDPPC)-LOG(OEC))^3,-1,-1)$, $((WR/GDP)^2,-1,-3)$, $WR(-10)/GDP(-10)$, $(WR(-5)/GDP(-5))^2$, $(WR(-10)/GDP(-10))^2$, $SAVGDP(-3)$.

(2): $(D(LOG(L)),-2,-7)$, $(D(LOG(L))^2,-2,-7)$, $ODA(-5)/GDP(-5)$, $LIT(-13)$, $NM(-5)/L(-5)$, $D(LOG(GDPPC(-1), -1,-5))$
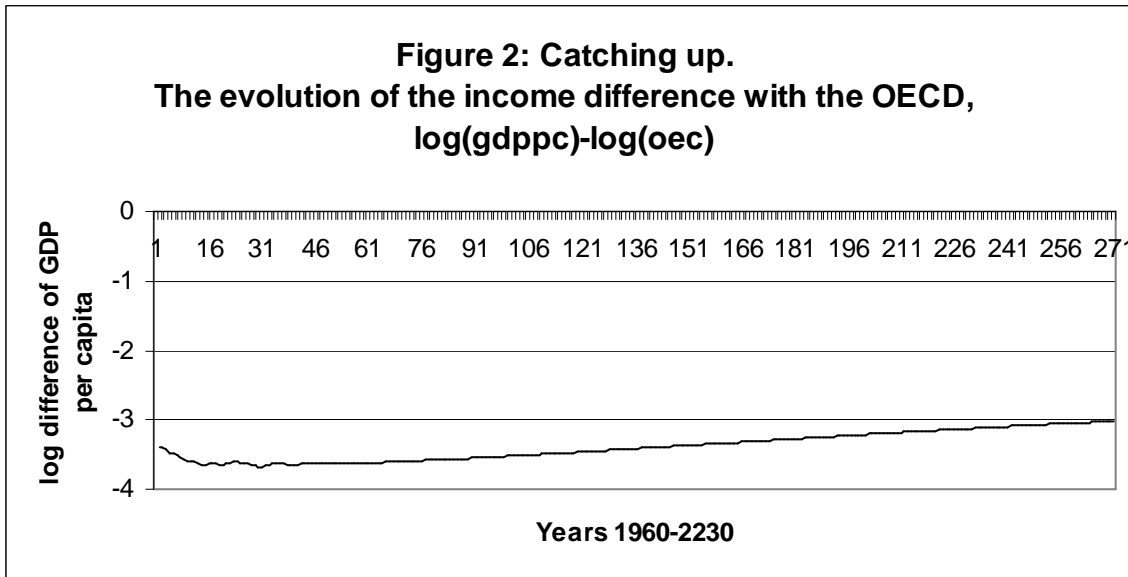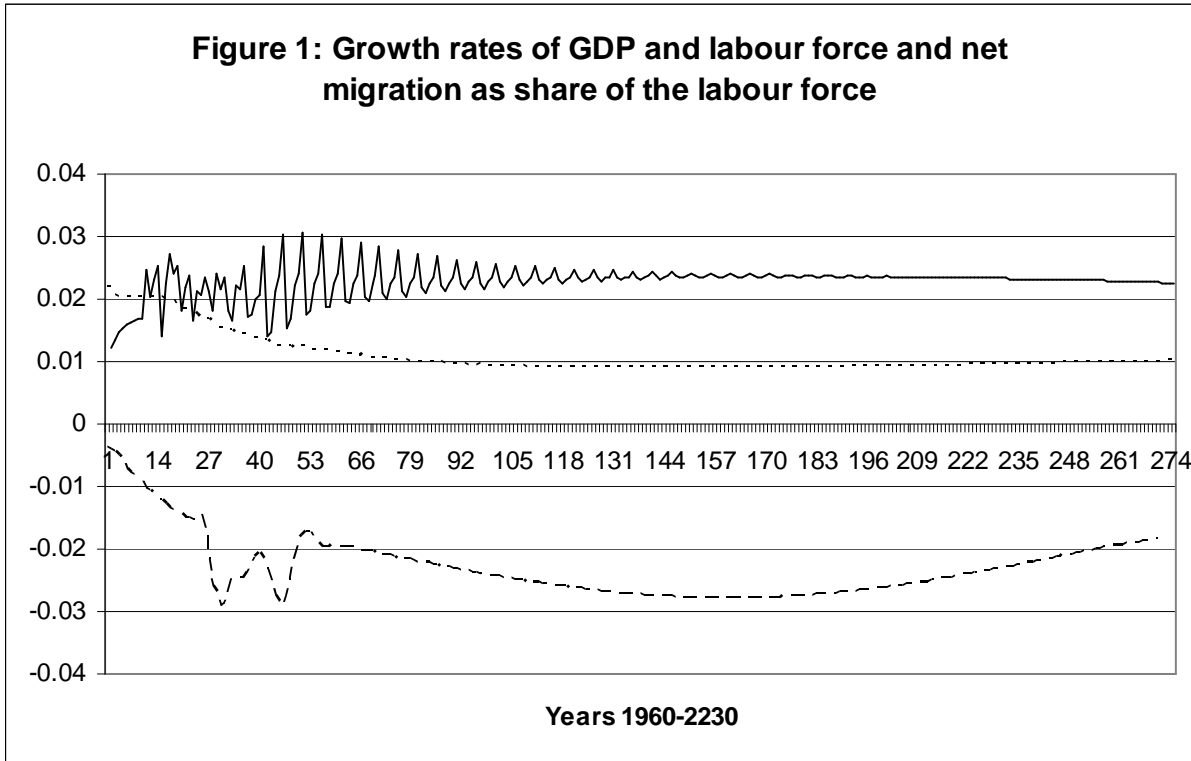
(3): $(LOG(GDPPC),-5,-5)$, $(LOG(GFCFGDP),-1,-1)$, $D(LOG(L))$, $WR(-1)/GDP(-1)$, $(WR(-1)/GDP(-1))^2$, $ODA(-1)/GDP(-1)$, $(ODA(-1)/GDP(-1))^2 LOG(WLD(-1))$, $LOG(L(-1))$, $LOG(GDPPC(-1))-LOG(GDPPC(-6))$, $LOG(GDPPC(-2))-LOG(GDPPC(-7))$.

The last two instruments in equation (3) are identical to the regressors added for serial correlation correction. They are not reported in the text and not included in the simulations. Gross fixed capital formation is essential for growth, whereas for net foreign debt in the interest equation investment as a share of GDP matters. The difference of the two is inventories. There relation then is needed to come from one to the other.
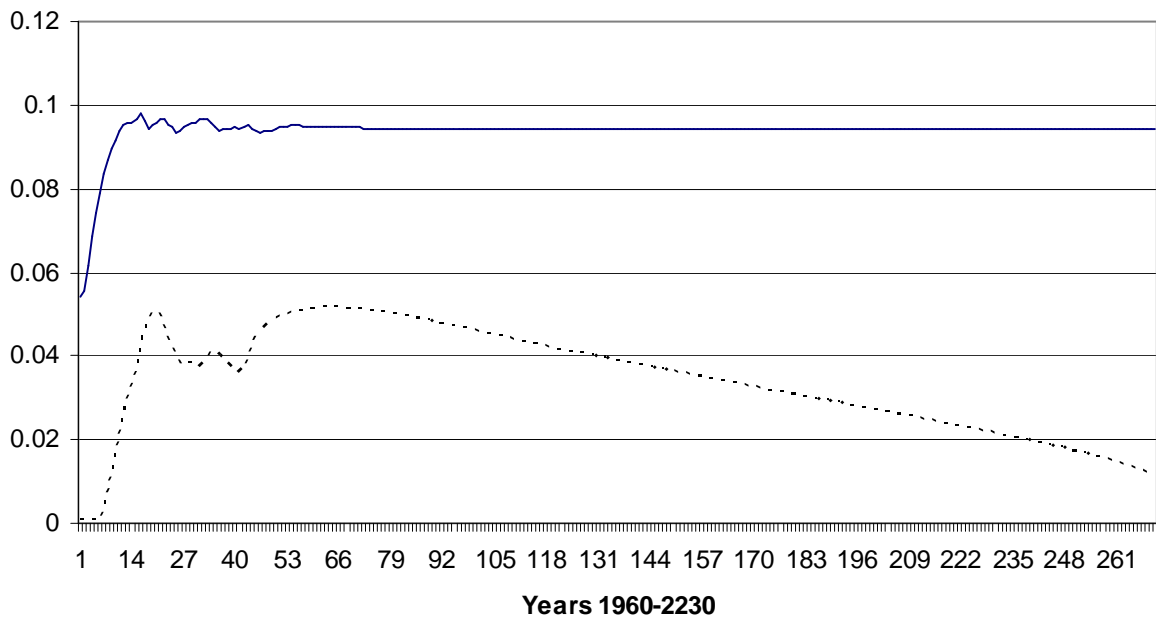
$Invgdp = 1.562113 + 1.003GFCFGDP$; $Adj.R^2 = 0.875$; $DW = 0.9$
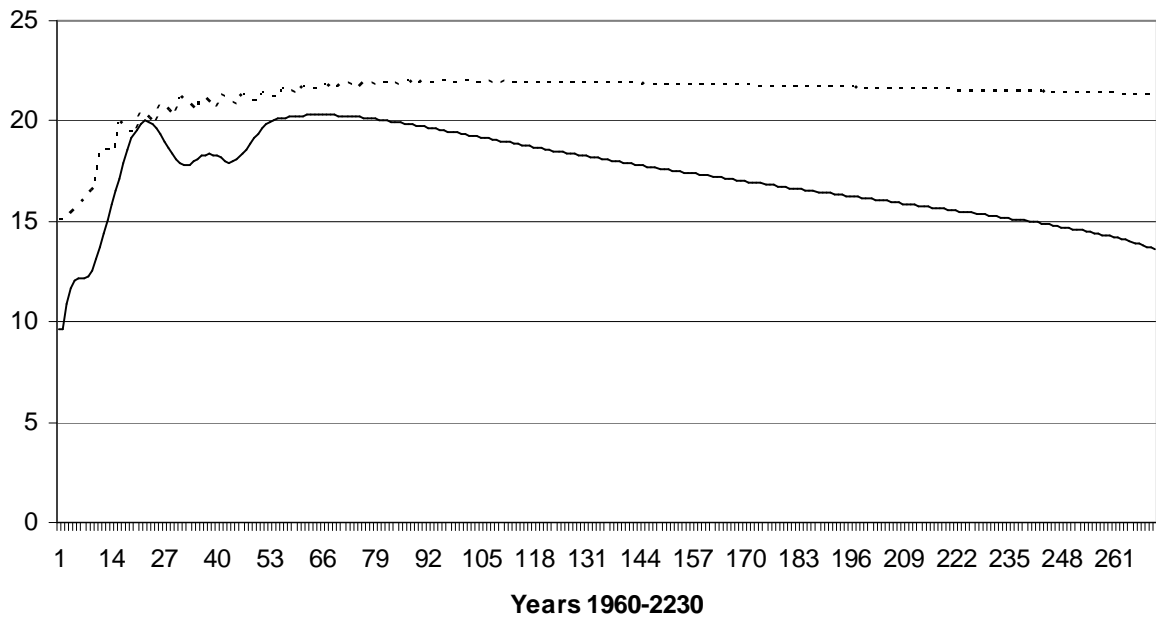   (0.01)   (0.0000)

Appendix 3: Figures of the benchmark scenario

Figure 1: Growth rates of GDP and labour force and net migration as share of the labour force

Years 1960-2230

**Figure 2: Catching up.
The evolution of the income difference with the OECD,
log(gdppc)-log(oec)**

Years 1960-2230

Figure 3: Remittances and aid as a share of GDP

Years 1960-2230

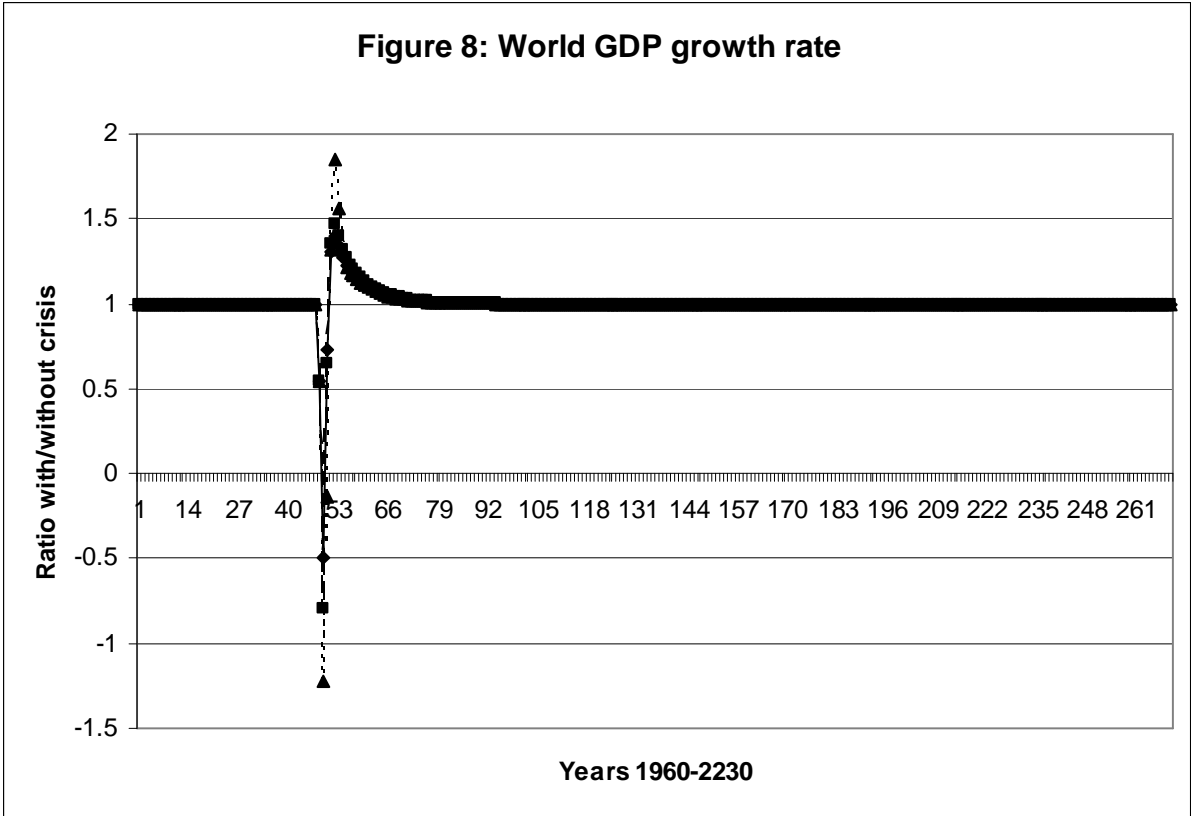**Figure 4: Investment and savings as a share of GDP**

Years 1960-2230

Figure 5: Tax revenues and public expenditure on education

%x100

Years 1960-2230
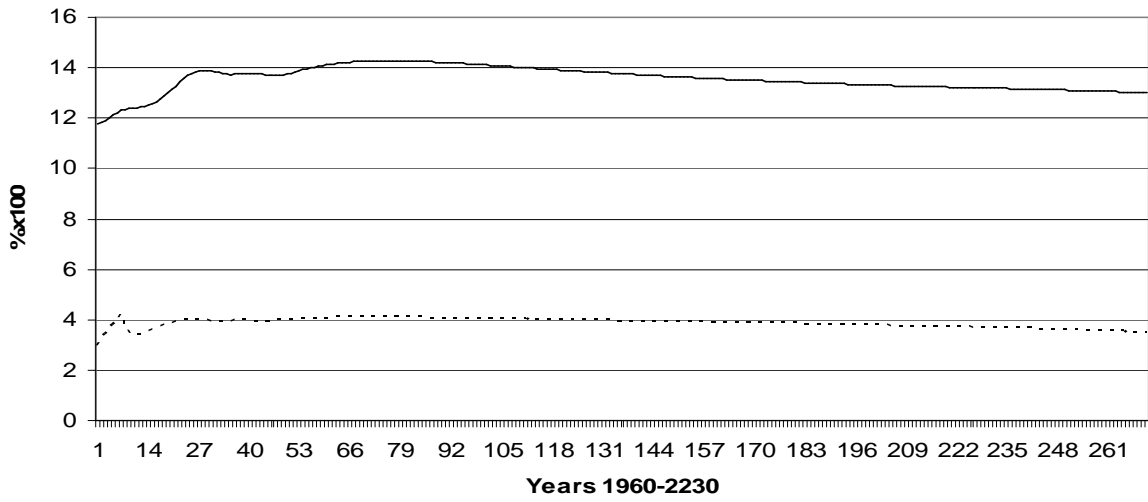
Figure 6: Literacy in poor developing countries

Years 1960-2230
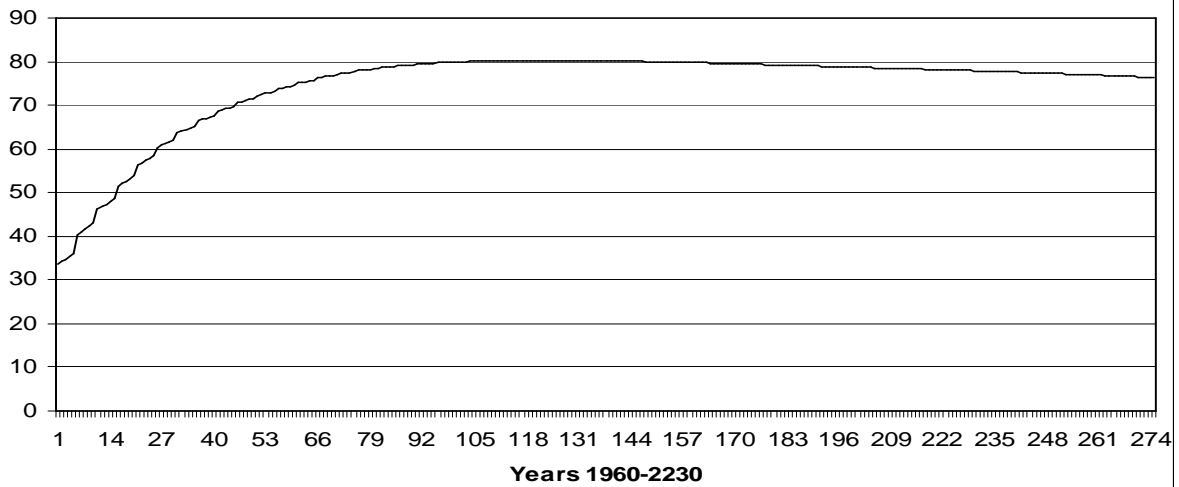
Appendix 4: Ratio of after-shock and baseline results

Figure 7: OECD GDP per capita growth rates

Years 1960-2230

(Y-axis: Ratio with/without crisis; X-axis: 1, 14, 27, 40, 53, 66, 79, 92, 105, 118, 131, 144, 157, 170, 183, 196, 209, 222, 235, 248, 261)

Figure 8: World GDP growth rate

Years 1960-2230

(Y-axis: Ratio with/without crisis; X-axis: 1, 14, 27, 40, 53, 66, 79, 92, 105, 118, 131, 144, 157, 170, 183, 196, 209, 222, 235, 248, 261)

Figure 9: OECD GDP per capita 1960-2230: Three scenarios of return to baseline

Ratio with/without crisis

Years

Figure 10: GDP per capita of developing countries below $1200: Persistent effects
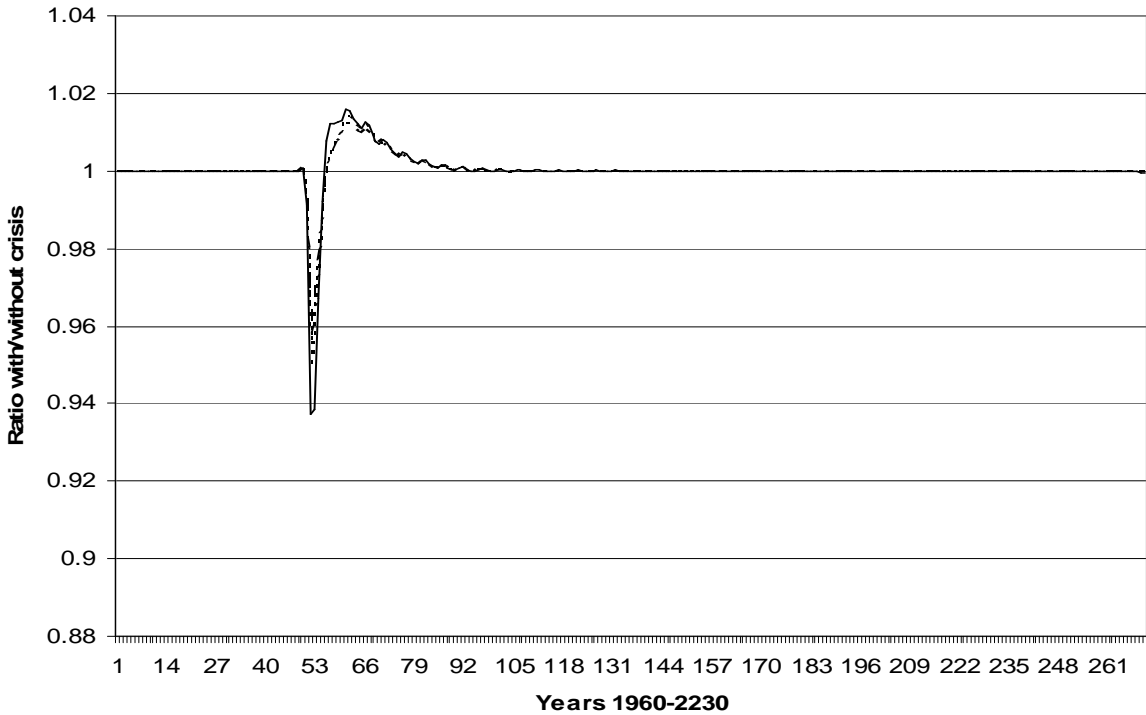
Ratio with/without crisis

Yeas 1960-2230

Figure 11: GDP per capita difference between OECD and poor countries: Convergence in the short run, divergence in the long run
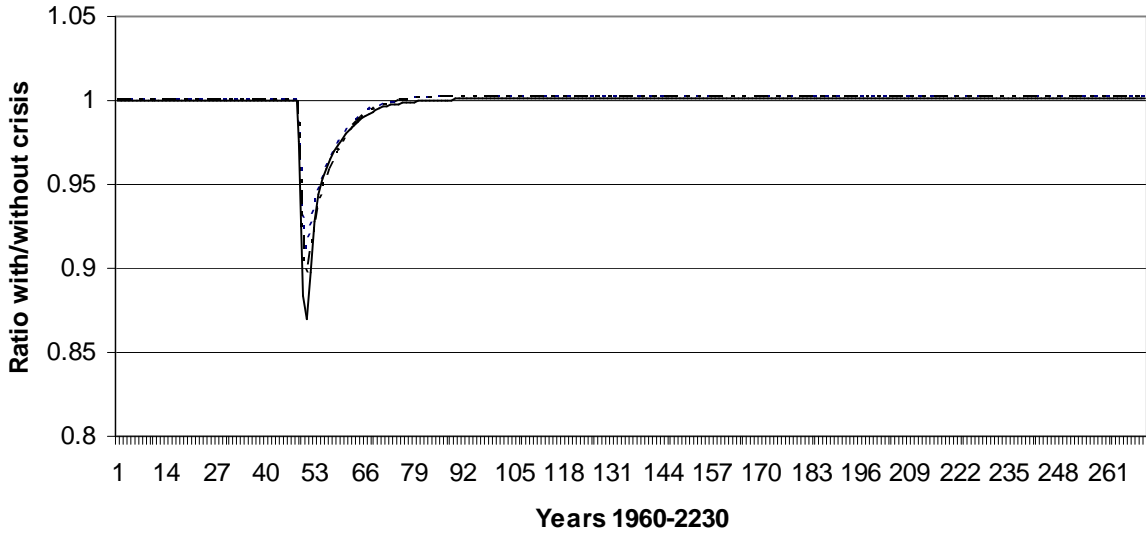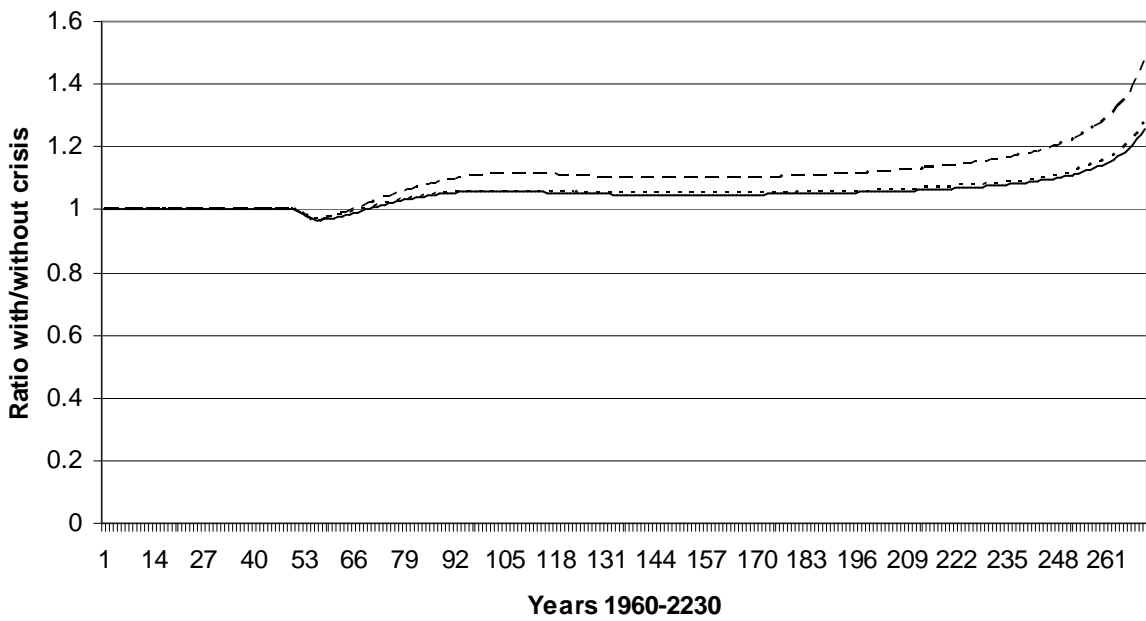

Figure 12: Aid as share of GDP

Figure 13: Worker remittances as a share of GDP

Ratio with/without crisis

Years 1960-2230

Figure 14: Labour force growth rate goes down, up, down
Persistently lower in the long run

Ratio with/without crisis

Years 1960-2230
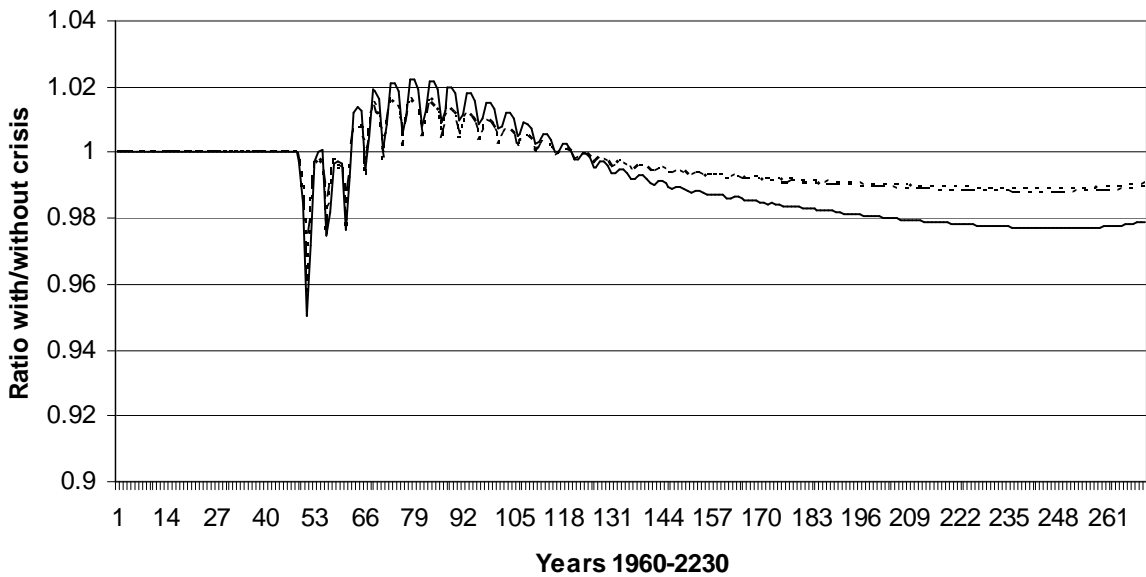
Figure 15: Gross fixed capital formation as a share of GDP
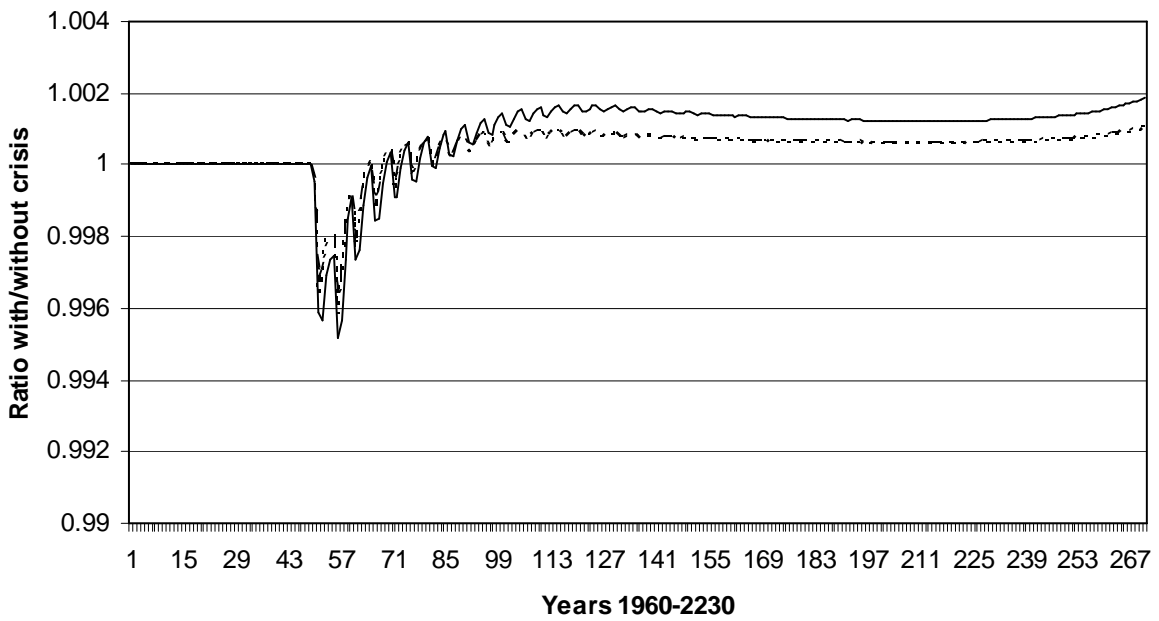
Figure 16: Savings a share of GDP: Lower in the short run, Permanently higher in the long run
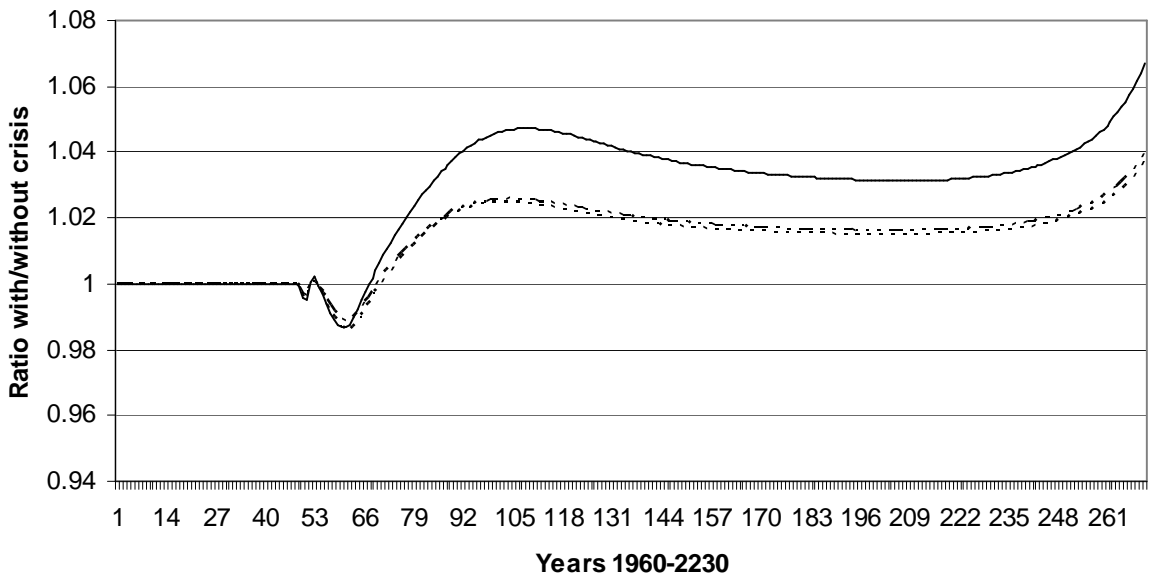
**Figure 17: : Investment minus savings as a share of GDP.
Current account deficit goes up, down, up, down**

Years 1960-2230

**Figure 18: Emigration.
Return, more emigration, less emigration**

Yeras 1960-2230

Table 1: The dynamic system

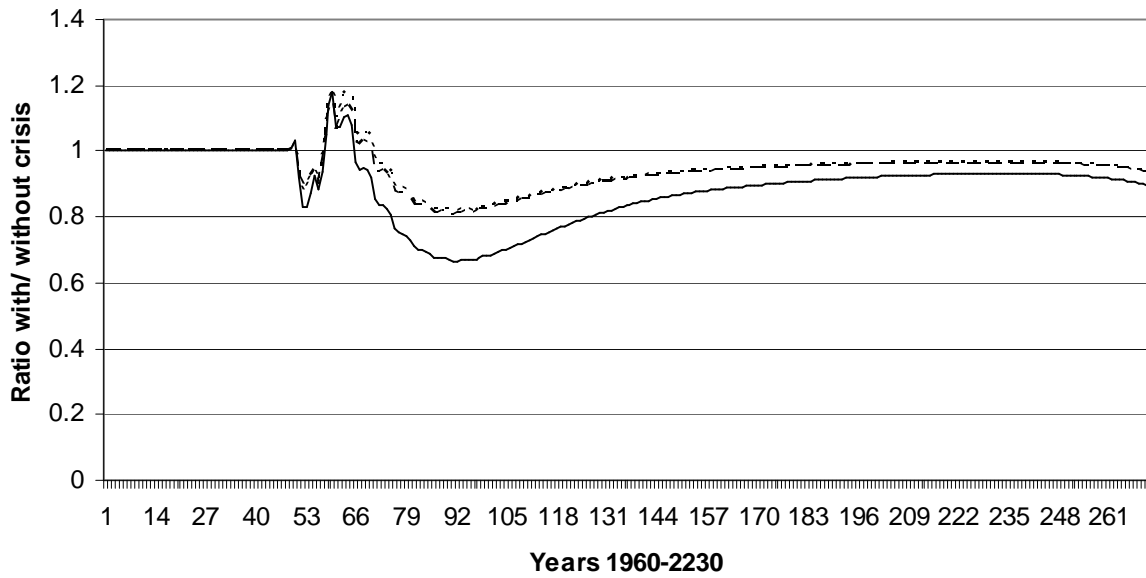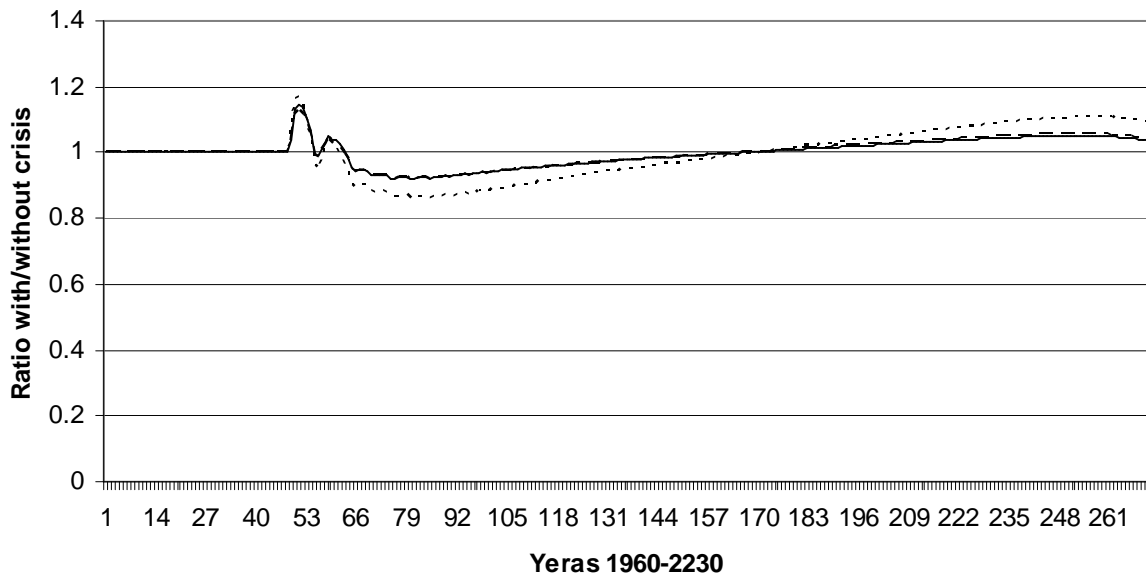| dep. variab	1	2	3	4	5	6	7	8	9	10	11	12	13	14
regressors	nm/l	gdppc	d(log(l))	wr/gdp	savgdp	gfcfgdp	ri	taxy	peegdp	lit	odagdp	wld	oec	riusa
1. nm/l	-	0	+	0	+	0		0	0	0	0	0	0	0
2. gdppc	+	+	+	-	0	+	+	0	0	0	-	0	0	0
3. d(log(l))	0	-	+	0	0	+		0	0	0	0	0	0	0
4. wr/gdp	+	+	0	+	+	0		-	+	0	0	0	0	0
5. savgdp	-	0	0	0	+	0	-	+	0	+	0	0	0	0
6. gfcfgdp	0	+	0	0	0	+	+	0	0	0	0	0	0	0
7. ri	0	0	0	0	0	0	+	0	0	0	0	0	0	0
8. taxy	0	0	0	0	0	0	0	+	+	0	0	0	0	0
9. peegdp	0	0	0	0	0	0	0	0	+	+	0	0	0	0
10. lit	0	0	-	0	0	+		0	0	+	0	0	0	0
11. odagdp	0	-	+	0	-	+	+	0	+	+	+	0	0	0
12. wld	0	+	0	0	0	0	0	0	0	0	0	?	?	0
13. oec	-	0	0	+	0	0	0	0	0	0	+	+	+	0
14. riusa	0	0	0	-	0	0	0	0	0	0	0	0	0	+

Table 2 Data description of the poor country sample

Variable	Panel average[a]	Growth rate[b]
Remittances/GDP	0.029	0.065
GDP per capita $	470	0.006
Investment/GDP	0.21	0.0143
Savings/GDP	0.13	0.069
net immigration/labour force	-0.0094	-0.00084[c]
Literacy	45.6	0.0244
Publ. exp. Educ./GDP	4.13	0.024
Tax rev./GDP	17.3	0.031
Labour force growth rate	0.021	0.0088[d]
Oda/GDP	0.089	0.0017[c]
Real interest rate USA	0.04	-
Real interest rate	0.012	0.0018
GDP per capita OECD	18975.43	0.0245
GDP World	1.98×10^{13}	0.034

a Least-squares dummy variable regressions of the variable on a constant.

b Least-squares dummy variable regressions of the natural log of the variable on a constant and a time trend.

c In case of negative values we use log(1+x) rather than log(x) in (b).

d Insignificantly different from zero.

Table 3: Predictions and the shocks that realize them

Predictions of GDP (GDP per capita) growth (%)

Year (Org.)	OECD	World
2008 (WB)	0.7 (0.1)	1.9
2009 (WB)	-3 (-3.6)	-1.7
2009 (OECD)	-4.3 (-4.9)	-2.75
2009 (pessimistic)	-6.6 (-7.2)	-4.2

Shocks on baseline imposed to get predicted values (%)

	OECD	World
2008	-2.4	-1.6
2009 (WB,optimist.)	-5.4	-4.5
2009 (OECD, med.)	-6.7	-5.55
2009 (pessimistic)	-9.0	-7.0

Table A.1
Forecast quality indicators for fixed effect versions of the regressions

Equation No.	dependent variable	Theil index	Covariance proportion
1	nm	0.126	0.98
2	d(log(L))	0.1	0.89
3	log(gdppc)	0.0068	0.999
4	wr/GDP	0.084	0.93
5	savgdp	0.074	0.977
6	log(1+ri)	0.28	0.917
7	log(gfcfgdp)	0.044	0.82
8	lit	0.007	0.97
9	peegdp	0.076	0.897
10	taxy	0.068	0.99
11	oda/gdp	0.17	0.96
12	riusa	0.138	0.92
13	log(wld)	0.00002	0.974
14	log(oec)	0.00087	0.937

Appendix: List of abbreviations

c_i	constant of equation i
CD	Cobb-Douglas
CES	Constant elasticity of substitution
D, d	first difference operator
DSGE	Dynamic Stochastic General Equilibrium Model
DW	Durbin-Watson statistic
ECM	Error Correction Model
EGLS	Estimated Generalized Least Squares
er	emigration rate
GDP	Gross Domestic Prod
gdppc	Gross Domestic Product per capita
gfcfgdp	gross fixed capital formation as a share of GDP times 100
GLS	Generalized least squares
GMM	Generalized Method of Moments
GNI	Gross National Income
HAC	heteroscedasticity and autocorrelation consistent
invgdp	Gross investment as a share of GDP times 100
J-statistic	Hansen-Sargan function minimized by GMM
l	labour force measured as number of workers
LDC	less developed country
lit	percentage of the population above 15 which can read and write
log	natural logarithm
MSFE	mean squared forecast error
nm/l	net immigration per worker
oda/GDP	official development aid as a share of GDP
oec	GDP per capita of the OECD countries
OLS	ordinary least squares
PCSE	Panel Corrected Standard Errors
pdl	polynomial distributed lag
peegdp	public expenditure on education as a share of GDP times 100
ri	real interest rate
riusa	real interest rate in the USA times 100.
savgdp	savings as a share of GDP times 100.
S.E.E.	standard error of estimation
SUR	Seemingly unrelated regression
T	time trend, @trend
t	t according to student distribution
taxy	tax revenue as a share of GDP times 100.
VAR	Vector Autoregressive Regression
WDI	World Development Indicators
wld	GDP of the world
wr	worker remittances
wr/GDP	worker remittances as a share of GDP

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