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# IMMISERIZING CAPITAL FLOWS TO DEVELOPING COUNTRIES

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## Abstract

Based on a neoclassical growth model for open low income economies this paper shows that development strategies, which rely on net borrowing abroad lead to a position of sustainable foreign indebtedness (provided that all capital imports are used for investment financing), but turn out to be immiserizing. The paper proves that development financing by foreign loans is either ineffective in terms of increasing per capita income but associated by sustainable foreign debts, or the effectiveness is bought at the price of growing into unsustainable debt positions. The first option is stable but counterproductive. The second option is effective but unstable.

**Keywords:** immiserizing growth, foreign debt, low income countries

**JEL classification:** F34, F43, O41

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# 1 INTRODUCTION

Between 1970 and 1989, many Sub-Sahara-African countries (SSA) registered a decline in GDP per capita. The average annual rates of decline (in percent) ranged from 3.3 (Sierra Leone) to 2.3 (Niger), 2.1 (Cote d'Ivoire), 2.0 (Zambia), 1.8 (Madagascar) and to 0.8 (Togo), 0.7 (Mali) and 0.6 in Cameroon (Sachs and Warner, 1995). All of these countries belong to the group of 41 (mainly SSA) highly indebted poor countries (HIPC) who were granted conditional debt relief under the HIPC-Initiatives from 1996 and 1999 (HIPC1 and HIPC2) and, at present, can qualify for debt forgiveness under the Multilateral Debt Relief Initiative (MDRI) from 2005.

Between 1990 and 1996, net capital inflows to HIPC could be maintained at approximately 10 percent of GDP. A large part of these capital imports consisted of financial aid (grants and concessionary loans). It seems that those massive capital inflows could not prevent these "growth disasters" but lead to the debt servicing problems of the late 1990s which were addressed by HIPC1 and 2. Particularly, the increasing external debt did not translate into economic growth but too often was accompanied by shrinking per capita incomes (PCI). Since we do not have counterfactual evidence of what had happened without these capital inflows, the question cannot be answered if international capital inflows to low income countries (LIC) contributed to their negative growth performance or had a positive impact on growth and hence prevented even worse outcomes.

Experiences of poorer countries borrowing from the rich mainly in the 1990s (Obstfeld, 2009) raise some doubts about financing development from borrowing abroad being a viable option. Recent contributions (Aizenman et al., 2007; Prasad and Rajan, 2007; Obstfeld, 2009) come to the conclusion that growth is significantly positive correlated with net capital outflows and, hence, negatively correlated with net capital inflows and that only for the richer group does greater use of foreign capital appear to be associated with higher growth. Moreover, it is argued that there is a growth premium associated with those countries not relying on foreign finance (Prasad and Rajan, 2007).Gourinchas and Jeanne (2009) analyze net capital inflows for a large sample of non-OECD countries over the period 1980-2000 and find that the cross-country correlation between productivity growth and net capital inflows is negative. The authors interpret this observation as an allocation puzzle.

These findings challenge conventional wisdom and require a theoretically proven and empirically supported understanding of the linkages between capital inflows, foreign indebtedness, GDP growth and long-run PCI which are neglected by older as well as by recent literature as cited above. Our paper tries to fill this gap by searching for an answer to the question whether or not financing development from capital imports in the form of interest bearing debt, debt-generating foreign loans, is a recommendable option for LICs. For this purpose, the standard Solow-model is modified by incorporating capital imports in the form of loans, external debt accumulation and debt sustainability. As in the standard neoclassical model, production is carried out using physical capital and labour inputs through constant-returns-to-scale technology that satisfies the usual Inada-conditions. As our focus is on technologically backward and stagnating LICs, the proposed extension of a Solow-model without technological progress is considered appropriate for serving our purpose.

In a similar framework of a small open economy version of the neoclassical growth model. Barro et. al. (1995) demonstrated that capital imports have no impact on steady-state PCI under perfect capital mobility. Our paper deviates from Barro et al. by assuming imperfect capital mobility which seems more appropriate for analysing the case of a capital-importing LIC that accumulates external debt and, hence, builds up a rising burden of debt service payments outflows. By including a debt service-GDP ratio and an interest burden ratio, the LIC-model can specify the conditions for capital imports having a negative impact on steady-state PCI and thus turning out as "immiserizing capital inflows": capital-importing poor countries not only will stay caught in the poverty trap, but their poverty also will be aggravated. The LIC in a long-term perspective is worse off with borrowing than without such borrowing provided the average interest rate on foreign loans cannot be kept below the threshold level which will be specified.

In the framework of an endogenous growth model, Eicher and Turnovsky (1999) explored the effects of capital flow reversals on growth dynamics and PCI in middle income countries (MIC) and emerging economies, whereas this study, in the framework of an extended variant of the traditional Solow-model, addresses the rather neglected question of how non-reverting capital flows and rising external debts are linked and how this linkage feeds back on growth dynamics and per capita income in low income countries, where low savings restrain the potential for investment-driven growth (savings gap). The savings gap could be overcome by financing domestic (excess) investment out of savings from high income countries (HIC). These capital imports are analysed with a "two gap version" of the neoclassical Solow-model of a small open LIC (SMOLIC) whose second gap comes from the shortage of foreign exchange needed to finance imports of goods and debt service payments (foreign exchange gap). It will be shown that both gaps are identical if the LIC neither is in a net debtor nor a net creditor position. Therefore, making use of the traditional two or even three gap models of economic development (Chenery and Bruno, 1962; McKinnon, 1964; Bacha, 1990; Taylor, 1990) might be misleading. Moreover, gap models have lost much of their attractiveness after having become discredited by their Harrod-Domar type modelling of growth under the untenable assumptions of an always constant capital output ratio and non-substitutable factors of production. Although still having been the favourite model used in International Financial Institutions for projections of capital import requirements and the realization of growth targets, this "Financial Gap Model" advocates two propositions which are not supported by evidence: (1) Capital imports will flow into investment one by one and (2) at least in the short run there will be a fixed linear relationship between investment and growth (Easterly, 1999, 2003).

In our study, the best case scenario of proposition (1) shall be maintained whereas proposition (2) is rejected because it shall be demonstrated that even if foreign loans flow into investment one by one this can lead to a lower level of PCI and does not necessarily provide a way out of poverty traps as is commonly believed. Furthermore, it is assumed that LIC are not attracting foreign direct investments and have no options other than financing investment out of domestic savings or external debts. Such cases of "immiserizing capital inflows" especially could arise if the debtor country fails in channelling the debt-generating capital imports into export-diversifying investment projects that raise the export-to-GDP-ratio.

This result could also contribute to the controversial debate over aid effectiveness (Burnside and Dollar, 2000; Weder, 2000; Easterly, 2001; Dalgaard et al., 2004) and opening the capital account. Cross-country regression estimates by Hansen and Tarp (2001) support the view that there exists a positive linkage between financial aid inflows and the rates of growth of PCI. Their results contradict those of Burnside and Dollar (2000) whose regression estimates show that financial aid has been ineffective in countries where governance is bad but has been effective in a good policy environment. The model underlying the results by Hansen and Tarp (2001) does not regard the linkages between external debt and potential growth which might be the reason for a positive link bias. We demonstrate how these neglected linkages modify the impacts of capital inflows and lead to a negative link if the loan interest rate lies above a critical threshold level. The lower this interest rate the more likely is a positive link. This casts shadows of doubt on the results of the Hansen and Tarp-study (2001) and is in accordance with Burnside and Dollar (2000) if the quality of governance is influencing the classification of countries by risk groups and, hence, lending interest rates. In a later study on the impact of aid in the tropics (Dalgaard et al., 2004), the estimated impact of aid on growth was negative but not significantly different from zero. The SMOLIC-model presented here gives a possible explanation for this result.

The remainder of the paper is organized as follows. Chapter 1 models the growth dynamics in a small open LIC which finances a savings gap by borrowing abroad. Chapter 2 first models the debt dynamics following these capital imports and then brings both of these processes together in a "growth-cum-debt model" which reveals the conditions for the case of immiserizing capital inflows. Chapter 3 presents the empirical evidence.

# 2 GROWTH DYNAMICS AND DEBT SUSTAINABILITY

## 2.1 SMOLIC model

This model is an extension of a structural closed economy one-sector neoclassical growth model which will be applied to a small open LIC where the growth potential is restrained by too low domestic savings and by foreign exchange shortages. Capital mobility is imperfect. The LIC is unskilled labor abundant. Human capital endowment is too low to adopt modern technologies and to benefit from technological innovations (absence of technological change: gA = 0). GDP consists of consumption goods produced for the domestic market and for export. There is no domestic production of capital goods. Expenditures for equipment investment flow into imports of capital goods (Lee, 1995; Hendricks, 2000). Investment-driven growth of potential output will only be possible, if the imports of capital goods and thus investment outlays can be financed out of foreign exchange earnings. Foreign exchange inflows are earned from exports of consumption goods (EX). Foreign exchange outflows are equal to the sum of expenditures on imports of consumption goods ($IM_C$) and capital goods ($IM_K = I$).

This LIC produces a GDP of $Y = C + I + EX - IMC - IMK = C + EX - IMC$. The trade account balance ($TA = EX - IM_C - IM_K$) is split up into the primary trade account balance or balance of trade in consumption goods ($PTA = EX - IM_C$) and the balance of trade in capital goods which is negative ($- IM_K = - I$). The current account balance ($CA = PTA - I - iD$) is smaller than the trade account balance if interest payments on the stock of foreign debts (D) are flowing out.

Gross domestic product which can be written $Y = C + PTA$ is used for consumption (C) and gross savings (S): $Y = C + S$. From these definitions $Y - C = S = PTA$ follows.

Over the long term, the gross savings ratio ($s = S/Y$), consumption goods import ratio ($im = IM_C/Y$) and export ratio ($ex = EX/Y$) are assumed to be constant and are exogenously given; $S = sY$, $IM_C = imY$, $EX = exY$.

The LIC receives financial aid in form of grants (public transfers and private remittances) and public (ODA-, IMF-, World Bank- or donor country-) loans ($KIM_1$) given at subsidized interest rates ($i_1 \geq 0$). The remaining part of targeted investment has to be covered by private (commercial bank) loans ($KIM_2$) at a market interest rate ($i_2$) which, including a country specific risk premium, exceeds the interest on public loans ($i_2 > i_1$). Assuming that foreign direct investments and grants are zero and excluding volatile short-run capital flows, all capital imports ($KIM = KIM_1 + KIM_2$) are debt-generating long-run debt inflows. These capital inflows lead to external debt ($D = D_1 + D_2$) accumulation whenever net capital imports under amortization rates $q_2 > q_1 > 0$ are positive:

$$KIM^n = KIM - qD = KIM_1 - q_1D_1 + KIM_2 - q_2D_2 = \dot{D} = \dot{D}_1 + \dot{D}_2 > 0$$

The loan interest rate is the weighted average $i = i_1(D_1/D) + i_2(D_2/D)$ and the amortization rate as well is $q = q_1(D_1/D) + q_2(D_2/D)$. Debt service payments are $DS = (i + q)D = (i_1 + q_1)D_1 + (i_2 + q_2)D_2$. Finally, definitions of the debt ratio ($d = D/Y = D_1/Y + D_2/Y = d_1 + d_2$), debt service ratio ($ds = (i + q)d = (i_1 + q_1)d_1 + (i_2 + q_2)d_2$) and interest burden ratio ($id = i_1d_1 + i_2d_2$) are introduced. Financial aid may include no-interest loans ($i_1 = 0$) and grants ($i_1 = q_1 = 0$). Grants are not capital imports but transfer receipts booked in the current account balance.

These assumptions and definitions allow us to analyze the interdependent time paths of growth of GDP and foreign indebtedness which result if the indebted LIC does not succeed in channelling capital inflows into efficient investments that either lead to a higher export ratio or lower import ratio.

## 2.2 External debt sustainability

The external debt position is sustainable as long as debt service is covered by GDP growth. Hence, the debt sustainability condition requires that

$$Y - C = S = (i + q)D + S^n. \qquad (1)$$

Net savings are equivalent to gross savings minus debt service:

$$S^n = Y - C - (i + q)D = S - (i + q)D$$

The LIC´s growth potential is restricted by two gaps. On the one hand a savings gap restrains domestic investment:

$$S - (i + q)\,D = S^n < I \qquad (SG1)$$

Gross domestic savings after deducting debt service (net savings) are smaller than targeted investment. Targeted investment will be realized if the savings gap can be bridged by capital imports:

$$KIM = I - [S - (i + q)\,D] = I - S^n \qquad (SG2)$$

On the other hand, a foreign exchange gap limits imports of capital goods:

$$PTA - (i + q)\,D < I \qquad (FG1)$$

if net inflows of foreign exchange (PTA - (i+q)D) do not cover the outflows caused by targeted investment ($I = IM_K$).

Targeted investment will only be realized if the condition

$$KIM = I - (PTA - (i + q)\,D) \qquad (FG2)$$

is met. Since by definition the primary trade account balance is equal to gross savings (PTA = S), conditions (SG2) and (FG2) are identical. If foreign borrowing covers the savings gap, the foreign exchange gap is bridged, too.

Therefore, the investment ratio (I/Y) can be derived from either (SG2) or (FG2) which is divided through Y (all of the other variables defined as a percentage of GDP are written in small letters):

$$I/Y = s + kim - (i + q)d \quad \text{or} \quad I/Y = s^n + kim \qquad (2)$$

$$\text{with} \quad s^n = s - (i + q)d.$$

Hence, net savings (in percent of GDP) decline whenever the debt-to-GDP-ratio and the debt service-ratio are rising. The interaction of debt-generating capital imports, physical capital accumulation, GDP-growth and debt dynamics makes the debt ratio and the net savings ratio and thus the investment ratio become endogenous variables, if the debt sustainability condition is met.

Contrary to ours, Hansen and Tarp (2001) build their reduced form aid-growth model upon the basic equation I/Y = s + kim. Their implicit assumption that d = 0 must be misleading whenever kim > 0.

## 2.3 GDP growth dynamics

The rates of growth of GDP and per capita income are derived in the conventional way from the neoclassical production function

$$Y = K^{\alpha}L^{1-\alpha} \qquad (0 < \alpha < 1), \quad K : \text{physical capital stock}, L : \text{labor input} \tag{3}$$

and the per capita version

$$y = \frac{Y}{L} = K^{\alpha}L^{-\alpha} = k^{\alpha} \qquad k = {}^{K}\!/_{L} : \quad \text{capital - labor - ratio} \tag{4}$$

GDP grows at a rate of (g indicates the rate of change of a variable)

$$gY = \alpha gK + (1-\alpha)gL .$$

Assuming that gL is determined by the rate of population growth (n), i.e. a constant percentage of the population is employed, the growth equation yields:

$$gY = n + \alpha(gK - n) \tag{5.1}$$

$$gy = gY - n = \alpha(gK - n) = \alpha gk \tag{6}$$

The rate of growth of the capital stock is determined by the investment ratio and the capital output ratio ($v \equiv K/Y$):

$$gK = \frac{I}{K} = \frac{I}{Y}\frac{Y}{K} = \frac{{}^{I}\!/_{Y}}{v} \tag{7}$$

The capital output ratio is an increasing function of the capital labor ratio:

$$v = \frac{K}{Y} = KK^{-\alpha}L^{-(1-\alpha)} = k^{(1-\alpha)} .$$

Inserting (2) in (7) yields

$$gK = \frac{s + kim - (i+q)d}{v} = \left(s + kim - (i+q)d\right)k^{-(1-\alpha)}$$

and therefore

$$gY = n + \alpha\left[\frac{s + kim - (i+q)d}{v} - n\right]$$

$$= n + \alpha\left[\left(s + kim - (i+q)d\right)k^{-(1-\alpha)} - n\right] \tag{5.2}$$

The reformulation of (5) demonstrates that the rates of growth of capital stock and GDP will decline, whenever the capital labour ratio or the debt ratio increases. Therefore, an increase in the capital import ratio ($\Delta$kim) has a much weaker effect on economic growth than an increased savings ratio ($\Delta s = \Delta$kim), because $\Delta$kim $> 0$ leads to $\Delta d > 0$. Without integrating these debt dynamics into the LIC growth model, nothing can be said neither about the transitional and long-term effects of capital imports on per capita income nor about foreign indebtedness and debt sustainability.

## 3 DEBT AND GROWTH DYNAMICS

The change of the debt ratio over time is

$$\dot{d} = \frac{\dot{D}\,Y - \dot{Y}\,D}{Y^2} = \frac{\dot{D}}{Y} - \frac{D}{Y}\frac{\dot{Y}}{Y} = \frac{\dot{D}}{Y} - dgY\,.$$

Since the stock of foreign debts changes according to $\dot{D} = KIM - qD$, it follows that

$$\frac{\dot{D}}{Y} = kim - qd\,.$$

Hence, debt dynamics are shown by

$$\dot{d} = kim - (q + gY)\,d\,. \qquad (8)$$

Debt ratios are increasing ($\dot{d} > 0$) as long as the existing debt ratio weighted by the sum of repayment rate and GDP growth rate is smaller than the capital import ratio ($d(q+gY) < kim$). If $d(q+gY) > kim$, debt ratios are declining ($\dot{d} < 0$). Since $\dot{d} = 0$ if $d(q+gY) = kim$, the condition for a stable debt ratio is

$$d(\dot{d} = 0) = \frac{kim}{q + gY}\,. \qquad (9)$$

As is well-known, neoclassical models distinguish the growth stages of transition and steady state. During transition, the rates of change of endogenous variables (gK, gY, gD, gk, gv, gy, gd) follow an upward or downward trend. All of these trends approach the steady state where all of these rates of change stay constant: $gK = gY = gD = n$; $gk = gv = gy = gd = 0$.

It follows from (5.2) that growth dynamics are in the stage of transition as long as $(s + kim - (i + q)d)\,k^{-(1-\alpha)} \neq n$. If $(s + kim - (i + q)d)\,k^{-(1-\alpha)} > n$, then $gK > n$, $gk > 0$, $gY > n$, $gy > 0$ and from $gk > 0$ it follows that gK, gY, gk, gy must decline until the steady state equilibrium condition $(s + kim - (i + q)d)\,k^{-(1-\alpha)} = n$ is met.

(9) indicates that the downward trend of the GDP growth rate during transition is accompanied by an upward trend of the debt ratio ($\dot{d} > 0$) and therefore by $gD > gY$.

These debt dynamics are transitory, too, as a decreasing gY which converges to the steady state growth gY = n = const. implies that the debt ratio also converges to a steady state equilibrium level of d*:

$$d^* = \frac{kim}{n+q} \qquad (10)$$

The transitional and steady state dynamics of GDP growth can be examined by inserting the inverse of (4): $k = y^{1/\alpha}$ into (5.2). This results in

$$gY = n + \alpha\left[\left(s + kim - (i+q)d\right) y^{-\frac{(1-\alpha)}{\alpha}} - n\right]. \qquad (11)$$

Equation (11) demonstrates that (for given values of s, kim, d and n) gY is higher when y is lower (conditional convergence). It also reveals transitional growth dynamics in the cases where s, kim and n are changing. In line with conventional neoclassical reasoning, a rise of the gross savings rate by Δs will immediately be followed by an increase of gY above its steady state level. Now, gY > n holds and the GDP per capita rises. Over time, the neoclassical magnetism of n brings gY down and the new steady state is characterized by the equality of gY and n but also by a higher per capita GDP.

Equation (11) seems to indicate that an increase in the capital import ratio by +Δkim = +Δs will produce the same effects. However, the long-term effects of these shocks differ. This observation holds true as in contrast to the mobilisation of domestic savings the acquisition of capital imports translates into foreign debt which sets off interest payments. As a result, the investment ratio which was boosted by capital imports can even fall below its initial level so that the new steady state equilibrium will be characterized by a lower steady state PCI than was initially realised. This can be shown easily: For this purpose, we insert the steady-state debt ratio from (10) in (11) which must fulfil the steady-state condition gY = gK = n. This condition is met if

$$gY = n = n + \alpha\left[\left(s + kim - \frac{i+q}{n+q} kim\right) y^{*-\frac{1-\alpha}{\alpha}} - n\right],$$

and thus $\left[s + \left(\frac{n-i}{n+q}\right) kim\right] y^{*-\frac{1-\alpha}{\alpha}} = n.$

From this follows the steady-state PCI

$$y^* = \left[\frac{s + \left(\frac{n-i}{n+q}\right) kim}{n}\right]^{\frac{\alpha}{1-\alpha}} > 0. \qquad (12)$$

(12) can be used to compare the new steady state PCI (with borrowing abroad (index D) and foreign indebtedness: d > 0) and the initial steady state PCI without foreign borrowing (index ND) and no foreign debt (d = 0).

For kim = 0 (no foreign borrowing and no foreign debt: d = 0) we get the well known result:

$$y^*_{ND} = \left[\frac{s}{n}\right]^{\frac{\alpha}{1-\alpha}},$$

for any kim > 0 (borrowing abroad and foreign indebtedness (d > 0)) it holds that

$$y^*_D > y^*_{ND} \quad \text{if} \quad i < n; \quad y^*_D = y^*_{ND} \quad \text{if} \quad i = n; \quad y^*_D < y^*_{ND} \quad \text{if} \quad i > n.$$ [1]

Considering that the normal case will be i > n, development strategies relying on borrowing abroad will lead to a position of sustainable foreign indebtedness (provided that all capital imports are used for investment financing) but turn out to be immiserizing.

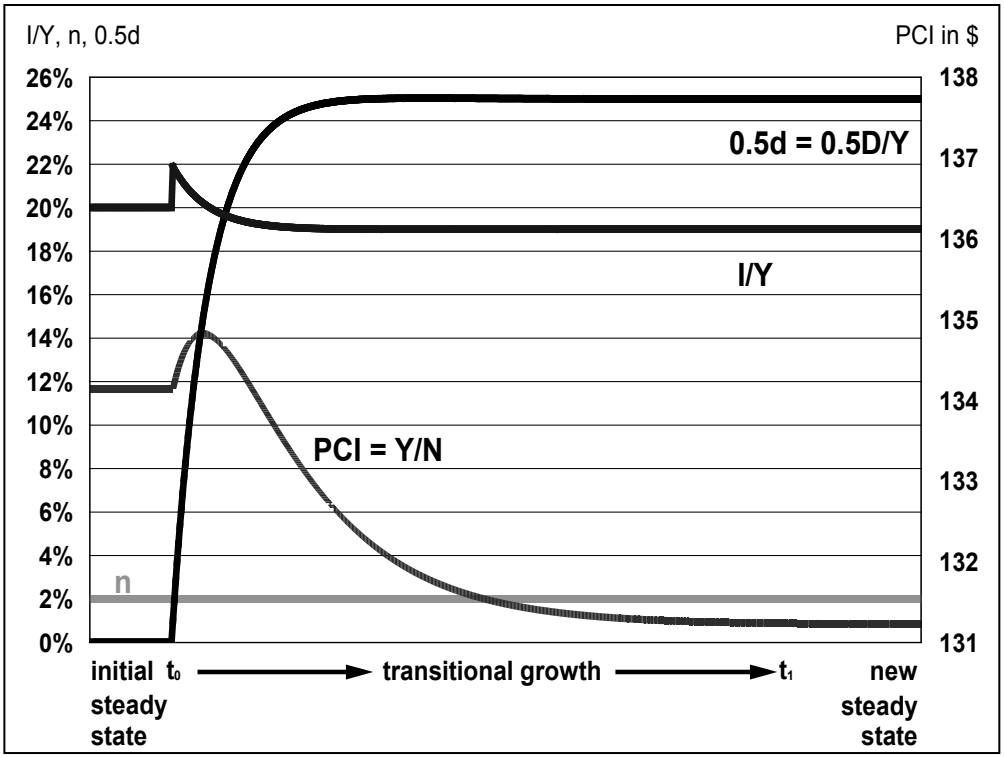


Fig. 1: Capital Imports, Investment Ratio and the Development of Interest Burden Ratio and Per Capita GDP

[1] When the simplifying assumption from page 4 is removed that there is no technological change (gA = 0) in the SMOLIC the comparison of steady state incomes with and without foreign debt must be modified to

$$y^*_D > y^*_{ND} \quad \text{if} \quad i < n + gA; \quad y^*_D = y^*_{ND} \quad \text{if} \quad i = n + gA; \quad y^*_D < y^*_{ND} \quad \text{if} \quad i > n. + gA$$

Fig. 1 illustrates these results based on a numerical simulation using a rather favourable set of data for low income economies (s. annex A1 for details of the simulation). Population in the country in view grows by an annual 2%, the savings ratio is 20%, and the country's GDP grows in the initial steady state with a rate of gY = n = 2%. Its investment ratio which is initially financed to a hundred percent out of domestic (in this case: gross = net) savings is 20%, i.e. the country does not borrow abroad and its debt stock is equal to zero (s. eq. (2)). The LIC's constant initial per capita income is 134.14 $.

At $t_0$ the country starts borrowing abroad with the aim to increase the per capita GDP. The capital import ratio jumps from 0 to 2% and is maintained over time. As a result, the country's debt stock is rising from an initial level of 0 to a new steady state debt ratio which can easily be calculated by inserting given values for the capital import ratio (kim), the population growth rate (n) and the redemption rate (q) into equation (10). We take n = kim = q to be 2%. As a result, the steady state debt ratio reaches 50% of GDP (= d*). In our simulation (s. fig. 1) we draw 0.5d instead of d for a better visibility of the curves. The interest rate that the country must pay on its foreign debt is taken to be 4% which is rather low but reflects that the country's debt stock consists to a big share of foreign loans from financial aid. With this information we can compute the interest burden ratio (id) which rises in the transition phase with the accumulation of debt to a steady state value of id* = 0.02.

The mechanisms which are responsible for the immiserizing effects of interest-bearing capital imports can be taken from equation (5.2): First, capital imports are fuelling the net savings ratio – the investment ratio – which now increases from 0.2 to nearly 0.22. At that stage the debt stock is still small so that the inflow from capital imports is much bigger than the outflow from interest payments and from servicing the debt. In consequence gY gets bigger than its steady state growth rate 'n' and the per capita income is rising to a maximum of 134,80 $. With the increase of the debt ratio more and more of the gross savings are to be spent for redemption and interest payments so that the net savings ratio – the investment ratio – is falling below the level of the initial steady state. The new steady state level of the investment ratio under the simulation can be computed by inserting the values of s (= 0.2), kim (= 0.02), i (= 0.04), q (= 0.02) and d* (= 0.5) into equation (2). This reveals the expected fall of the investment ratio to 0.19 which is 1%-point less than the investment ratio in the initial steady state. In turn, the LIC's GDP per capita falls below its initial steady state level, too, and converges in the new steady state to a value of 131,22 $.

Nevertheless, there are two ways out of this poverty trap. Either the country gradually reduces the capital import ratio while raising the rate of savings together with the primary-trade-account-balance-to-GDP-ratio. In such a case, development financing by foreign loans is only a temporary option that buys time for the necessary and efficient measures to be taken. Or the capital import ratio is increased in a way that the increasing interest payments on existing foreign debt are financed by new loans. In this scenario, foreign debt financing is effective with regard to the long-run target of a higher GDP per capita but leads to an increasing foreign indebtedness which becomes unsustainable. Expectations of an unsustainable debt position lead to a breakdown of net inflows of capital and eventually a debt crisis where the LIC-government has to declare the country's inability to service the debt anymore. The LIC becomes a HIPC candidate for debt relief.

Thus, either development financing by foreign loans is ineffective but foreign debts are sustainable, or the effectiveness is bought at the price of growing into an unsustainable debt position. The first option is stable but counterproductive. The second option is effective but unstable. The solution to this dilemma is well-known: channelling capital inflows into financing of export-diversifying and/or import substituting investments which result in $\Delta ex > 0$, $\Delta im < 0$, therefore $\Delta pta > 0$. Efficient use of $kim > 0$ means substituting $\Delta s = \Delta pta$ for kim and getting to a steady state with a current account equilibrium.

Hence, importing interest-bearing capital and investing it in export diversification helps in solving the problem of low per capita income. But our model shows that this type of capital imports does not automatically contribute to the solution but may aggravate the problem.

In general, capital imports can strengthen LICs' efforts to speed-up economic development if it is granted in the form of official development assistance (ODA) with heavily subsidised interest rates. If accompanied with the conditionality of using this inflow of resources wisely, interest free credit is a very effective tool for increasing per capita income in low income countries. In this case increasing the capital import ratio does not affect the interest burden ratio (id) and brings about the same positive transitional and long-term growth effects as a respective increase of the savings rate. In this scenario, the interest burden, i.e. the opportunity costs of capital, is paid by the (richer) donor countries and financed out of their savings.

Our argument against a general promotion of useless or damaging capital imports and in favour of a performance-oriented financial aid policy is strengthened if potential foreign creditors already perceive a country's debt ratio (d) as critical before it reaches its steady state level d*. The country's rating goes down and the creditors will add a higher risk premium which increases the interest rate on foreign debt. If a debt threshold such as $d_T < d^*$ exists at which the interest rate rises with an increasing debt ratio ($i = i(d)$, $\delta i/\delta d > 0$) then the potentially positive growth effects of capital imports will be further weakened and the immiserizing effects will be strengthened.

# 4 EMPIRICAL EVIDENCE

For confronting our model with reality, data is used from a set of 64 developing countries located in the tropical belt for which following Dalgaard et al., 2004, we expect similarities in growth factors such as climate and institutional quality. The data set excludes small tropical (island) states and those countries in the region where time series data was not available. The remaining sample is dominated by poor developing countries including 34 low income economies and 19 lower-middle income countries. It covers 30 of a total of 41 heavily indebted poor countries, includes 24 of 47 least developed countries. These countries can be seen as a convergence club as indicated by earlier empirical estimates based on an extended Solow-model (Löwenstein, 2004).

The sample is used to test for the effects of the variables on the steady state per capita income y* as suggested by equation (12) using OLS-type cross-country regressions. As y* is unobservable the countries' average per capita income realised between 1999 and 2004 is introduced as dependent (instrumental) variable. This instrumental variable is explained by the average savings rate, the (net-)capital import ratio and the average population growth rate that the countries realised in the three decades prior to the year 2000 (for the definition of variables, see annex 2). In contrast to the propositions made in equation (12) we dropped the interest rate on foreign debt as explanatory variable as the data is not available for the whole country sample. Furthermore we added a constant to explicitly capture the systematic influence of those variables on the steady state per capita income which are not included in our regression approaches. According to equation (12) we expect that the average PCI realised between 1999 and 2004 will be the larger, the higher the savings rate, the lower the capital import ratio and the population growth rate that has been realised between 1971 and 1999.

We test for the immiserizing effects of foreign indebtedness using two OLS-type regression approaches which differ in terms of the assumed functional relation (linear and log-linear) between the dependent variable 'steady state per capita income (y*)' and the independent variables 's', 'kim' and 'n'. Table 1 summarises the results (for the full data set s. annex 3).

Tab. 1: Regression results[a], whole sample

| **Row** | **OLS-approach, functional form** | **$R^2$** | **Constant** | **Coefficients** | **s** | **kim** | **n** |
|---|---|---|---|---|---|---|---|
| 1 | PCI = f(s, kim, n), linear | 45,6% (0.000) | 1470.35 (0.03) | Coefficient | 97.31 (0.000) | -20.95 (0.57) | -644.56 (0.004) |
| | | | | Standardized coefficient | 0.502 | -0.060 | -0.307 |
| | | | | | **ln s** | **ln kim** | **ln n** |
| 2 | lnPCI = f(ln s, ln kim, ln n), log-linear | 45.7% (0.000) | 5.305 (0.000) | Coefficient | 0.857 (0.000) | -0.370 (0.092) | -0.452 (0.015) |
| | | | | Standardized coefficient | 0.487 | -0.178 | -0.247 |

a: P-values in parentheses

With determination coefficients above 45% both regressions seems to be efficient in explaining the 64 tropical countries' average per capita income realised between 1999 and 2004 but the testing of the linear regression model (s. row 1, tab. 1) suggests heteroscedasticity, therefore misspecification of the model and biased reported P-values. In contrast, the log-linear estimate indicates homoscedasticity as the partial scatter plot of ln PCI against ln kim shows (s. fig. 2).

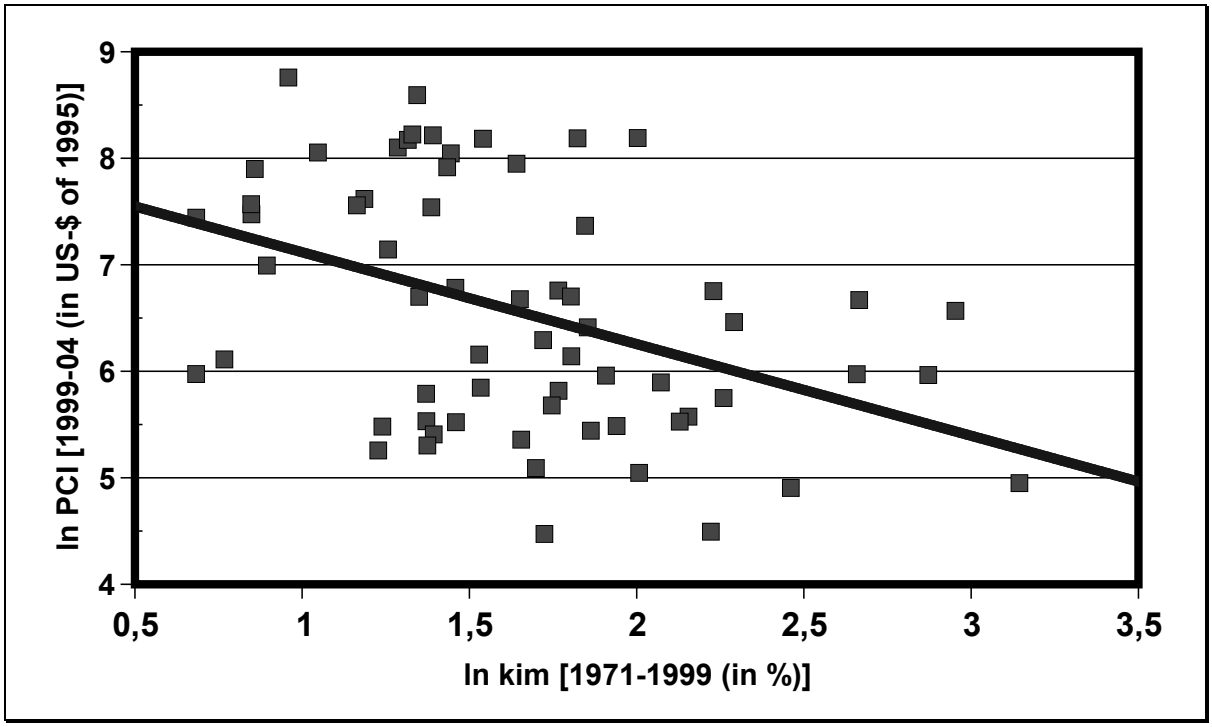


Fig. 2: Steady state Per Capita GDP and Capital Import to GDP Ratio, log-linear version

The regression output for the loglinear approach (see row 2, tab. 1) demonstrates that all independent variables show the expected signs as predicted by (12): the average PCI between 1999 and 2004 is the higher the higher the savings rate and the lower population growth in the preceding three decades which excludes reversed causality. The coefficient of the capital import ratio also shows the expected negative sign which supports our model-based hypothesis of the potential immiserizing effects of capital imports. But in contrast to the constant and to the coefficients of s and n the capital import ratio kim is only significant at the 10%-level so that one can conclude that the data at least is not contradictory to our theoretical findings.

The preconditions for the negative impact of the capital import ratio on the steady state PCI as shown in fig. 2 can be taken from the first derivative of equation (12) above: Immiserizing growth takes place if the interest rate on foreign debt exceeds the population growth rate. We checked that precondition for 46 tropical countries for which the necessary data was available. The result of this exercise is shown in fig. 3 where we confront the national mean value of the population growth rate and the variable '$i_{prox}$', the interest rate that the country's central government was paying on domestic and on foreign debts between 1970 and 1990.

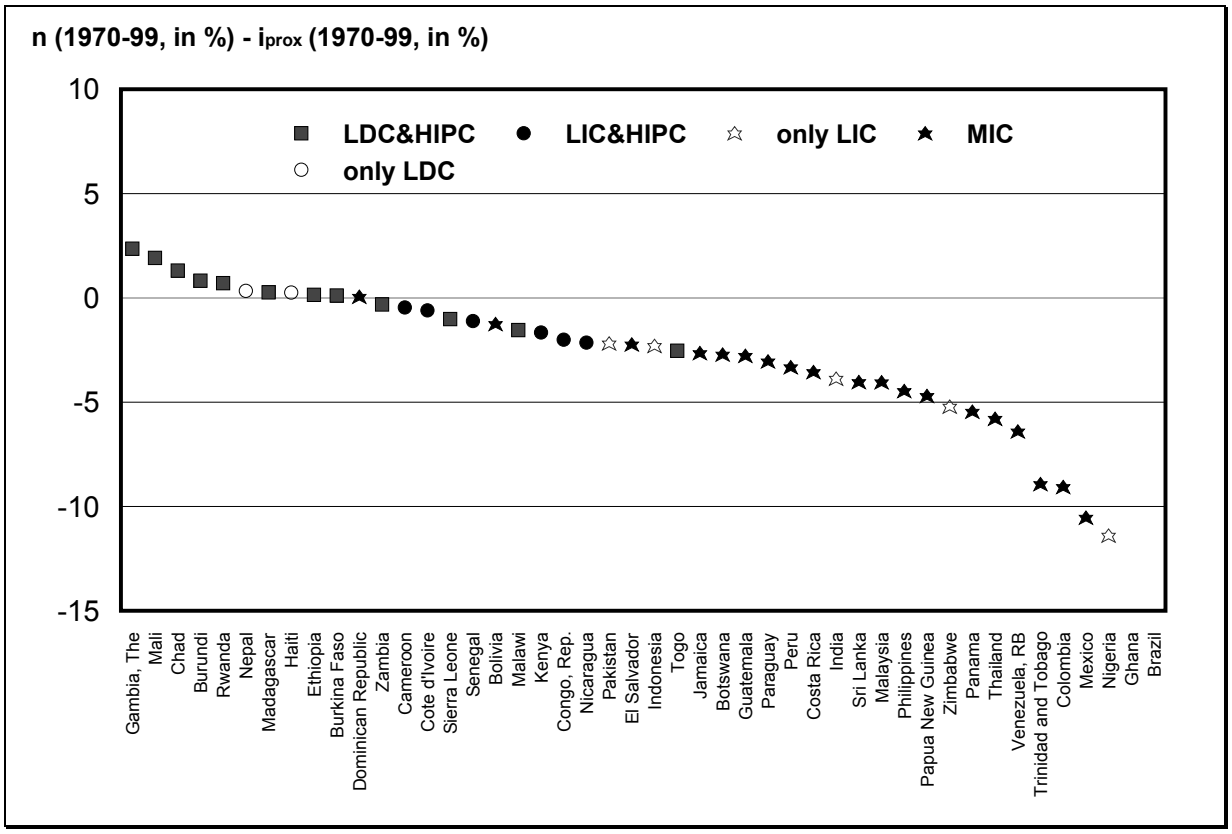


Fig. 3: Comparing population growth and interest rate

Figure 3 indicates that the precondition for immiserizing growth, i.e. an interest rate on foreign debt which is larger than the population growth rate (= all entries below the 0% line), holds for the majority of the analysed 46 countries.[2] Among them are with one exemption all middle income economies, 16 out of 26 low income economies but only a minority of least developed countries (4 from 14).

In contrast, it is obvious that the LDC-status has qualified quite a number of developing countries for more favourable credit conditions – resulting in $i_{prox} < n$ – as granted by international donors like the International Development Agency and others in the past decades so that for two thirds of the LDC in our sample the precondition for the immiserizing effects of international indebtedness was not met between 1970 and 1999. The same result can be expected for the future from the ongoing HIPC-initiative which considerably contributed to a reduction of LDC debt stocks after 1996, motivated the

[2] As practiced throughout most of this paper Fig.3 ignores technological change. The inclusion of gA would require the comparison of gA+n and $i_{prox}$ (s. footnote 1) to determine whether the preconditions for immiserizing growth hold. The Conference Board Total Economy Database™ as of January 2014 provides data on the growth of total factor productivity, that represents the effects of the change in technology and efficiency improvements as well as the inability to measure the contribution of all other inputs, for 28 out of the 46 countries covered by fig. 3 for the period 1990 to 1999. Including gA does not change the overall results as shown in the figure apart from three cases for which $n\text{-}i_{prox}$ is near to Zero. This holds for Ethiopia and the Dominican Republic where due to gA<0 the preconditions for immiserizing growth are met when including gA, i.e. $n\text{-}i_{prox}>0$ but $n+(\text{-}gA)\ \text{-}i_{prox}<0$, and for Zambia where due to gA>0 the preconditions are not met anymore i.e. $n\text{-}i_{prox}<0$ but $n+gA\text{-}i_{prox}>0$.

multilateral and bilateral donors to significantly increase the grant element of international credits and will result in a fall of the interest rate on international foreign debts.

As this paper is focusing on the effects of development financing by foreign loans rather than by foreign grants we re-estimate equation (12) in its log-linear version, this time excluding those 11 countries for which the data indicates that the interest rate on foreign loans is below population growth (s. table 2).

Tab. 2: Regression results[a], excluding countries with privileged access to development financing

| **OLS-approach, functional form** | **$R^2$** | **Constant** | **Coefficients** | **ln s** | **ln kim** | **ln n** |
|---|---|---|---|---|---|---|
| lnPCI = f(ln s, ln kim, ln n), log-linear | 50,6% (0.000) | 5.872 (0.03) | Coefficient | 0.752 (0.000) | -0.471 (0.031) | -0.388 (0.023) |
| | | | Standardized coefficient | 0.474 | -0.247 | -0.244 |

a: P-values in parentheses

The concentration on the 53 developing countries from the tropics without privileged access to development financing results in improved statistical parameters: The determination coefficient rises by 5%-points and the negative effect of capital inflows from international loans on the long term per capita income is now confirmed on the 5%-level.

Regarding the present financial crisis, the results of our paper also show bleak prospects for highly indebted LICs. For two reasons, which are embedded in our model, these economies will be especially hurt. Private capital inflows will only become available at higher loan interest rates because of much higher country risk premia. Additionally, the share of private capital imports in total capital inflows increases, if financial aid flows to LIC grow less than private capital flows or even decline, because the burdens the crisis puts on donor countries budgets might force them to economize on the cost of subsidized lending. The average rate of interest is pulled upward by a higher loan interest rate and by her higher weight in debt portfolios. Thus, the number of immiserizing capital inflow cases as well as the magnitude of each immiserizing effect is likely to increase under the financial crisis.

# 5 CONCLUSION

It has been demonstrated that financing investment by borrowing abroad will lead to a transitory increase in the investment-GDP ratio. But this growth-stimulating effect does not generate a sustained increase in the investment rate and per capita income as long as this is not supported by a higher domestic savings rate which in a long-term view still restricts the investment rate. In the longer run, the rising debt service burden will force the investment rate on the return path toward the former level which had been restricted by low domestic savings.

In this respect, the SMOLIC-model offers an alternative solution to the Feldstein-Horioka-puzzle (Feldstein and Horioka, 1980) raised by their observation that the divergences between domestic saving and investment rates have not been large since World War II – in spite of the liberalization of international capital flows and increasing development financing on concessional or market-determined terms. The empirical evidence for a high domestic saving-investment correlation receives some theoretical foundation from our LIC model.

## SUMMARY

This paper demonstrates that capital imports can have a negative impact on the steady state per capita income. The preconditions for such immiserizing effects of capital inflows are derived from a neoclassical Solow-type model of a low-income country bridging a savings gap through foreign loans with or without a grant element. The debt and growth dynamics brought about by those capital imports are derived in the framework of an extended neoclassical "growth-cum-debt model" without technological progress.

The transitional dynamics of GDP-growth and rising foreign indebtedness converge to a steady state equilibrium with constant levels of per capita income, debt-GDP ratio, and interest burden-GDP ratio. This steady state solution implies that foreign loans lead to a sustainable level of foreign indebtedness which is bought at the price of investment and income per capita beneath those levels which have been realized without these capital imports, if the capital import-GDP ratio is held stable and the rate of interest on outstanding debt exceeds the rate of population growth.

In such cases, the initially higher per capita income could only be maintained by continuously increasing the capital import-GDP ratio. Thus, development financed by foreign loans is either ineffective in terms of increasing per capita income but associated by sustainable foreign debts, or the effectiveness is bought at the price of growing into unsustainable foreign debt positions.

The empirical evidence presented for developing countries of the tropical belt indicates that the number of states where the condition for immiserizing capital imports holds is three times higher than the number of countries which – due to their LDC-status – receives more favourable conditions from international donors. Concentrating on the tropical development economies without privileged access to international development financing in cross-country regression analyses supports the hypothesis that previous borrowing abroad negatively affects the countries' present per capita income as predicted by our model.

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## INTERNET SOURCES

The Conference Board Total Economy Database™, January 2014, http://www.conference-board.org/data/economydatabase/, accessed: 07 April 2014.

# ANNEX

## A1. Simulation

Equations used

Production function: $Y_t = K_t^{\alpha} L_t^{(1-\alpha)}$

(constant: $\alpha = 0.3$, variables $K_t$, $L_t$)

Capital stock : $K_t = K_{t-1}(1+gK_t)$ (variable: $gK_t$)

Growth rate of the capital stock: $gK_t = \dfrac{s + kim - (i+q)d_t}{v_t}$

(constants: $s = 0.2$, $kim = 0.02$, $i = 0.04$, $q = 0.02$, variables: $d_t = D_t/Y_t$, $1/v_t = Y_t/K_t$)

Debt stock: $D_t = (1-q)\sum_{t=1}^{T} KIM_t$

(constants: $q = 0.02$, $kim = 0.02$, variable: $KIM_t = kimY_t = 0.02\ Y_t$)

Labor Force : $L_t = L_{t-1}(1+n)$ (constant: $n = 0.02$)

Population: $N_t = N_{t-1}(1+n)$ (constant: $n = 0.02$)

Growth rate of the labor force and of population: n

Per capita GDP: $Y_t/N_t$

Growth rate of GDP: $gY_t = \alpha gK_t + (1-\alpha)n$

Growth rate of per capita GDP: $gy_t = gY_t - n$

Values of variables in the initial steady state, in the shock period and in the new steady state

| Variable | Value in the initial steady state | Value in the shock period | Value in the new steady state |
|---|---|---|---|
| **gK** | 0.0200 | 0.0219 | 0.02 |
| **d = D/Y** | 0.00 | 0.0196 | 0.50 |
| **1/v = Y/K** | 0.1 | < 0.1 | 0.1052 |
| **gY** | 0.02 | 0.02057 | 0.02 |
| **gy** | 0.00 | 0.00057 | 0.00 |
| **Y/N (in 00 $)** | 1.341 | 1.342 | 1.312 |

## A2. Definition of variables (World Bank series name in parentheses)

PCI 1999-04: Average per capita income of the years 1999 to 2004 calculated using the GDP (current US$) (NY.GDP.MKTP.KD) of the years from 1999 to 2004 deflated to 1995 constant US$ using the GDP-deflator of the US (NY.GDP.DEFL.ZS) divided by total population (SP.POP.TOTL) of the same year,

s 1970-99: Savings rate calculated as average of Gross National Savings in % of GDP (NY.GNS.ICTR.ZS) of the period from 1970 to 1999,

kim 1971-99: Capital import ratio calculated as average of the period from 1971 to 1999 from the following Data: $[(D_t - D_{t-1})/Y_t]$ with $(D_t - D_{t-1})$ being the difference of a country's total External Debt in current US-$ (DT.DOD.DECT.CD) of two subsequent years t-1 and t, $Y_t$ is a country's GDP in current US-$ (NY.GDP.MKTP.CD) of year t, t = 1971, ... 1999,

n 1970-99: Population growth rate calculated as average of the period from 1970 to 1999 in the following way: $((N_t - N_{t-1})/N_t)*100$, with $(N_t - N_{t-1})$ being the difference of a country's total Population (SP.POP.TOTL) of two subsequent years t-1 and t, t = 1970, ... 1999,

$i_{prox}$ 1970-99: interest rate that the countries' central governments are paying on domestic and on foreign debt. Calculation as average of the period 1970 to 1999 based on annual data from the following data series: Central governments interest payments in % of total expenditure (GB.XPC.INTP.ZS) times total expenditure in % of GDP (GB.XPD.TOTL.GD.ZS) divided by central government's total debt in % of GDP (GB.DOD.TOTL.GD.ZS).

## A3. Data Set [Sources: World Bank (2001) for s, kim, $i_{prox}$, World Bank (2006) for PCI 1999-04, The Conference Board Total Economy Database™ (January 2014) for gA]

| Country | PCI 1999-04 | s 1970-99 | kim 1971-99 | n 1970-99 | $i_{prox}$ 1970-99 | gA 1990-99 |
|---|---|---|---|---|---|---|
| Benin | 336,45 | 7,42 | 5,85 | 2,91 | n.a. | n.a. |
| Botswana | 3.150,15 | 36,47 | 2,85 | 3,21 | 5,92 | n.a. |
| Burkina Faso | 252,68 | 18,09 | 3,94 | 2,32 | 2,2 | 0,57 |
| Burundi | 87,7 | 9,51 | 5,61 | 2,21 | 1,38 | n.a. |
| Cameroon | 610,59 | 13,47 | 6,38 | 2,78 | 3,24 | -1,71 |
| Cape Verde | 1.267,62 | 28,21 | 3,51 | 1,66 | n.a. | n.a. |
| Central African Rep. | 250,63 | 6,92 | 4,31 | 2,26 | n.a. | n.a. |
| Chad | 223,4 | 7,14 | 4,03 | 2,49 | 1,18 | n.a. |
| Congo, Rep. | 788,13 | 18,34 | 14,37 | 2,85 | 4,85 | n.a. |
| Cote d'Ivoire | 640,79 | 8,36 | 9,89 | 3,65 | 4,25 | n.a. |
| Ethiopia | 89,65 | 8,98 | 9,22 | 2,71 | 2,56 | -1,06 |
| Gabon | 3.598,53 | 31,21 | 6,19 | 3,01 | n.a. | n.a. |
| Gambia, The | 263,75 | 15,21 | 8,63 | 3,46 | 1,11 | n.a. |
| Ghana | 293,12 | 9,93 | 5,73 | 2,71 | 21,49 | 3,59 |
| Guinea | 346,4 | 13,88 | 4,64 | 2,16 | n.a. | n.a. |
| Guinea-Bissau | 141,34 | 5,01 | 23,2 | 2,8 | n.a. | n.a. |
| Kenya | 388,07 | 15,06 | 6,74 | 3,3 | 4,96 | -1,06 |
| Madagascar | 231,18 | 3,97 | 6,44 | 2,73 | 2,46 | -0,02 |
| Malawi | 135,16 | 11,85 | 11,72 | 3,04 | 4,58 | 1,28 |
| Mali | 241,75 | 10,26 | 6,96 | 2,39 | 0,47 | 1,59 |
| Mauritania | 389,88 | 12,42 | 17,67 | 2,63 | n.a. | n.a. |
| Niger | 162,87 | 7,16 | 5,47 | 3,21 | n.a. | -0,59 |
| Nigeria | 363,83 | 16,23 | 7,95 | 2,95 | 14,34 | 0,87 |
| Rwanda | 192,1 | 12,91 | 3,41 | 2,93 | 2,22 | n.a. |
| Senegal | 465,05 | 6,3 | 6,08 | 2,81 | 3,92 | -0,92 |
| Sierra Leone | 155,69 | 0,81 | 7,44 | 2,16 | 3,17 | n.a. |
| Tanzania | 240,45 | 7,99 | 3,45 | 3,07 | n.a. | 0,64 |
| Togo | 251,93 | 19,68 | 8,4 | 2,91 | 5,43 | n.a. |
| Uganda | 212,58 | 4,26 | 5,23 | 2,76 | n.a. | 2,38 |
| Zambia | 314,07 | 5,66 | 9,59 | 3 | 3,31 | 1,00 |
| Zimbabwe | 813,18 | 14,48 | 3,86 | 2,87 | 8,08 | n.a. |
| Bangladesh | 327,23 | 14,49 | 3,94 | 2,28 | n.a. | 0,25 |
| India | 451,61 | 20,66 | 2,15 | 2,1 | 5,97 | 1,59 |
| Indonesia | 814,92 | 27,1 | 6,07 | 1,99 | 4,28 | -0,29 |
| Malaysia | 3.585,95 | 30,46 | 4,67 | 2,58 | 6,62 | 0,02 |
| Nepal | 201,21 | 13,14 | 3,95 | 2,52 | 2,18 | n.a. |
| Pakistan | 472,4 | 20,23 | 4,61 | 2,8 | 4,98 | 0,67 |
| Papua New Guinea | 541,61 | 20,9 | 5,59 | 2,32 | 7,02 | n.a. |

| Country | PCI 1999-04 | s 1970-99 | kim 1971-99 | n 1970-99 | $i_{prox}$ 1970-99 | gA 1990-99 |
|---|---|---|---|---|---|---|
| Philippines | 883,9 | 21,57 | 4,3 | 2,4 | 6,86 | -0,56 |
| Sri Lanka | 795 | 19,36 | 5,21 | 1,47 | 5,51 | n.a. |
| Thailand | 1.884,31 | 27,93 | 4 | 1,86 | 7,65 | -0,34 |
| Vietnam | 392,83 | 17,9 | 14,27 | 2,08 | n.a. | 0,24 |
| Belize | 3.124,72 | 22,88 | 4,24 | 2,49 | n.a. | n.a. |
| Bolivia | 862,45 | 13,1 | 5,85 | 2,3 | 3,55 | 1,01 |
| Brazil | 2.699,10 | 18,87 | 2,36 | 1,97 | 48,13 | 0,05 |
| Colombia | 1.763,46 | 17,43 | 2,34 | 2,14 | 11,2 | -1,17 |
| Costa Rica | 3.703,65 | 16,9 | 4,02 | 2,56 | 6,11 | 0,58 |
| Dominica | 3.302,87 | 18,78 | 3,62 | 0,26 | n.a. | n.a. |
| Dominican Republic | 2.037,05 | 16,91 | 3,27 | 2,26 | 2,2 | -0,27 |
| Ecuador | 1.582,72 | 17,51 | 6,33 | 2,57 | n.a. | -0,08 |
| El Salvador | 1.939,64 | 14,47 | 2,33 | 1,92 | 4,15 | n.a. |
| Grenada | 3.547,80 | 18,9 | 3,73 | 0,05 | n.a. | n.a. |
| Guatemala | 1.708,55 | 11,28 | 1,98 | 2,62 | 5,39 | 0,87 |
| Haiti | 393,8 | 10,33 | 1,98 | 1,9 | 1,64 | n.a. |
| Honduras | 857,65 | 17,08 | 9,3 | 3,11 | n.a. | n.a. |
| Jamaica | 2.834,18 | 19,09 | 5,16 | 1,15 | 3,79 | -0,32 |
| Mexico | 5.400,39 | 20,56 | 3,83 | 2,29 | 12,82 | -0,04 |
| Nicaragua | 712,2 | 2,21 | 19,16 | 2,95 | 5,09 | n.a. |
| Panama | 3.609,58 | 20,38 | 7,41 | 2,2 | 7,65 | n.a. |
| Paraguay | 1.089,37 | 16,42 | 2,45 | 2,87 | 5,91 | n.a. |
| Peru | 1.919,66 | 17,5 | 3,2 | 2,28 | 5,6 | 0,08 |
| St. Vincent and the Grenadines | 2.743,14 | 17,02 | 4,19 | 0,9 | n.a. | n.a. |
| Trinidad and Tobago | 6.372,79 | 22,67 | 2,61 | 1 | 9,93 | 1,97 |
| Venezuela, RB | 3.733,18 | 27,1 | 3,78 | 2,8 | 9,19 | 0,84 |