The Mixed Blessing of FDI: Two-Way Capital Flows and Growth

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Abstract

The elusive growth effects of FDI in developing countries are still controversely debated. This paper theoretically links inflows of FDI to investment opportunities of domestic investors via an (imperfect) credit market channel. It thereby shows that the initial increase in economic activity that FDI brings about may come at the cost of crowded out future domestic entrepreneurship. Also, the model predicts oppositely directed flows of financial capital (South-North) to those of FDI (North-South), which is indeed what we observe in the data, and connects them to growth patterns. The loss of domestic entrepreneurial income in the long run unambiguously reduces domestic income from capital stock-driven growth. Hence, developing countries could develop only more slowly, but more sustainably without inflows of FDI. The theory is in line with many stylized facts about the effects of FDI in developing countries.

Keywords: FDI, financial market globalization, welfare effects, open-economy growth, middle income trap, two-way capital flows
JEL: F21, F43, F54, F62, O16

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1 Introduction

Developing countries have undertaken great efforts to attract foreign direct investment (FDI) in the expectation positive effects on domestic economic growth (Aitken and Harrison, 1999; UNCTAD, 2014). However, the empirical results on a link between FDI inflows and economic growth on the macroeconomic level are mixed at best, and many studies that control for omitted variables rather find even negative effects of FDI on growth in developing countries (see Kose et al., 2009, for an overview). This is particularly surprising, because beside potential second-order effects, FDI should constitute an immediate increase in the domestic capital stock [1], and at least thereby create some positive economic effects for standard neoclassical reasons. Even though the empirical literature on this is as rich as it is inconclusive, theoretical arguments on why we fail to observe robust positive effects are rare and it exists to my knowledge no general equilibrium model of FDI that can help elucidate this phenomenon and thereby potentially help to understand the problem with FDI in developing countries better.

This paper proposes a novel mechanism involved with FDI and develops a coherent stylized model that can explain the elusiveness of, and even negative, growth effects from capital-stock increasing FDI. It therefore adopts a neoclassical growth model under credit market imperfections from Matsuyama (2004), which allows to analyze explicitly the two-tier structure of the captal market, one being the market for (financial) credit, needed in order to physically invest, the other being physical investment itself. In my adaption of the model, I do not only account for international competition for (financial) credit, but also particularly for the effect that FDI exerts in such a setting. Through its effects on the credit market, FDI in my model crowds out domestic physical investment and hence inhibits the further emergence of an entrepreneurial class. The mechanism put forward here is that through diminishing returns to capital which the increase in the capital stock through FDI induces, it becomes harder for domestic agents to obtain credit in order to pursue strictly profitable physical investment projects. Thus, even though domestic income increases immediately due to increased wage incomes, historically poorer countries must lose out in the long run by the opening up of capital markets and the concurrent inflow of FDI, compared to a situation of self-sustained growth. I can show that this result is not driven by the functional form of the model, but by the inner logic of the imperfect capital market. Then, as a byproduct,

[1] A conservative estimate is roughly 70% of FDI in developing countries being greenfield investment, see UNCTAD (2014).

the increase in domestic savings (and hence credit supply) and the decrease in domestic investment (and hence credit demand) will lead to an *outflow* of financial capital from a developing country as a direct result of the opposing inflows of FDI.

This pattern of two-way capital flows is indeed what we observe in the data for the group of developing countries. Whereas earlier literature, following Lucas (1990), has been concerned with the predictions of the neoclassical model because in aggregate one would not observe capital flows from the global North to the global South in close to the amounts expected, a more disaggregated view gives stronger support for that FDI is indeed flowing into the group of capital scarce developing and emerging economies, only that the contrary flow of financial capital tends to countervail these flows in aggregate numbers.[2] The pattern is illustrated in Figure 1. It depicts disaggregated net capital flows by type for the group of High Income OECD countries ("North") and the group of non-High-Income OECD countries ("South") for the period from 1980-2013.[3]. For both groups, it shows the net aggregate outflow of FDI, and net aggregate outflows of all other types of capital ('financial' capital).[4] By construction, flows between countries within a group net out, and the graph shows the outward (or inward) flows of the whole group of each type of capital, both as a share of worldwide GDP.[5] Positive values imply net capital outflows of FDI / financial capital, negative values imply inflows. The two-way pattern of capital flows is quite stable over time and accentuating with the general surge of capital market globalization.[6]

I argue in this paper, that this pattern of capital flows is directly linked to the growth prospects of developing and emerging economies. The net numbers of either type of capital flow are substantial, net FDI inflows to developing and emerging economies accounting for

[2]This observation does not derive solely from the special role of China in these flows, but the pattern is qualitatively equal for all other developing and emerging countries taken together.

[3]Based on country-level Balance of Payments data and definitions supplied by the International Monetary Fund (IMF)

[4]Financial capital includes portfolio investment, financial derivatives, other investment and reserve assets. FDI captures only that investment, where direct control over production is retained.

[5]The flows between the two groups do not net out to zero, because the data covers only 169 countries, excluding particularly offshore financial centers, as Zucman (2013) points out. He estimates that in fact the countries of the North would be a net creditor if their holdings in tax havens were included. In the official data shown here, both groups would be net debtors.

[6]Although the pattern has slightly attenuated in recent years, particularly for the more volatile financial capital, the signs of the flows persist, implying, by the definition of net flows, still increasing aggregate stocks of capital of either type at already high levels. The overall picture, again, does neither depend on the inclusion of China in the sample, nor on flows of reserve assets as part of financial capital flows.

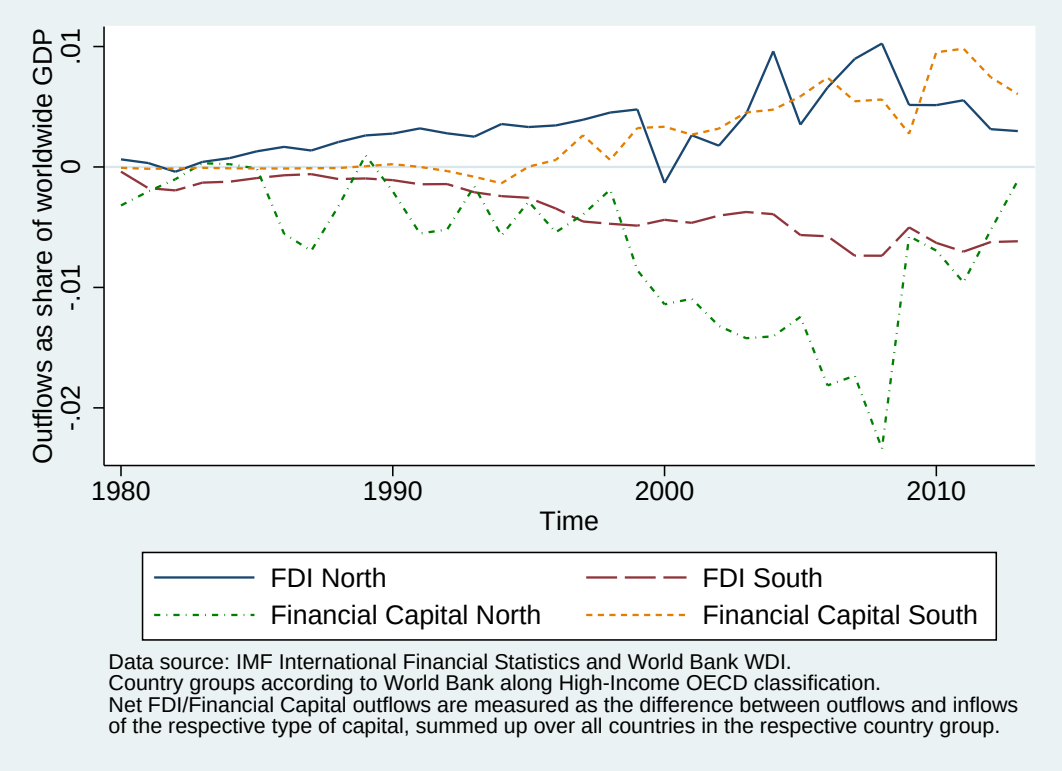

Figure 1: Net Capital Flows by type and country group as share of worldwide GDP

almost 2,5% of their aggregate GDP, or 10% of gross capital formation[7] in these countries.[8] Whenever the return on real investment is larger than that on financial capital, the two-way pattern wil always imply lost out returns for the global South (compared to a situation of no capital out- or inflows). However, it is not directly obvious how the two types of flows relate to each other or whether the increased financial savings might actually be benficial for developing countries, in contrast to no capital inflows. Therefore, we need a theoretical model that can generate some insight into what mechanism may lie behind the two-way structure of capital flows in order to see how this will affect economic growth. I deliver one such explanation in this paper. The model can account for many stylized facts within this nexus. The three facts that I particularly adress are the following: (i) FDI on net does indeed flow into capital scarce developing and emerging economies in aggregate, as seen. Its occurrence is mainly driven by low wage costs (Yeaple, 2003; Hanson et al., 2005) in the destination

[7]Equally defined to also include acquisitions.

[8]The gross numbers of capital in- and outflows exceed these numbers by far, particularly for flows in between developed countries.

countries, which supports the basic neoclassical paradigm. (ii) The long-term growth effects of FDI especially in developing countries seem to be rather limited, if not negative, particularly in the long-run (Carkovic and Levine, 2005; Bussiere and Fratzscher, 2008; de Vita and Kyaw, 2009; Herzer, 2012; also concluded in Kose et al., 2009, for financial globalization as a whole), despite the increase in the capital stock that FDI inflows induce (Bosworth et al., 1999). (iii) Studies that account for long-run effects show that FDI tends to have a crowding out effect on domestic investment activity (Agosin and Machado, 2005; Wang, 2010; Morrissey and Udomkerdmongkol, 2012, and Ashraf and Herzer (2014) for greenfield investment in particular), compared to countries that have not received large amounts of FDI. The adverse effects from FDI that is attracted by high returns can not be explained by existing theories of comprehensive capital market integration. With perfect capital markets, even if inflowing FDI would crowd out domestic investment because of diminishing returns to capital, the outflowing savings would still generate the same income as if invested domestically, and there would be further no reason for non-investment by domestic actors in the long run, such that the transition to some steady state welfare level would only be accelerated by increasing incomes. By taking a dynamic growth perspective and accounting for an imperfect capital market and hence endogenous wedge between investing and lending, this paper can relate the structure of North-South capital flows to the adverse growth effects of financial integration for countries in their development process. It particularly shows that FDI may drive both, reduced domestic entrepreneurial activity, and financial capital outflows, and thereby reduce overall income in developing countries in the long run.

In the model, investment is freely pursued around the globe. Capital ownership is initially concentrated rich countries but the physical capital itself need not be. Whereas international direct investment is not subject to frictions, the market for financial credit is imperfect. As a consequence, wealth plays a role for the possibility to obtain credit needed to conduct new investment. Therefore, the individual accumulation of assets is crucial for the further development of the worldwide distribution of (profitable) investment ownership and hence incomes. This is close to the analysis of international interaction on only an imperfect credit market by Matsuyama (2004). Credit eligibility here does not only depend on wealth, but also on the profitability of the prospective investment. We then here account for FDI in such a setting: First, FDI will indeed flow into the countries where capital stock is low, and returns to capital accordingly high. This inflow of FDI has a direct impact on domestic entrepreneurial activity: by raising the wage rate and reducing the scarcity of capital, it

decreases the marginal product of capital and hence of individual investments. Although the immediate raise in wage income also increases domestic income and hence pledgeability, the former effect dominates the latter necessarily: eventual entrepreneurs in poorer countries generally speaking then face the same investment opportunities as foreign investors, but due to their lower accumulated income, they are still not the ones who can actually invest, due to the structure of the credit market. There, potential investors from high income countries are preferred to pursue the basically same investment. On a fully integrated capital market, domestic entrepreneurial activity in developing countries is thus hindered by foreign direct investment.

This contrasts to an autarkic growth process, where at initially high marginal products to capital, and wage incomes that rise accordingly, an entrepreneurial class can emerge. Capital only builds up slowly by reinvested domestic savings, but thereby, with incomes increasing and marginal returns decreasing in pace, growth trickles down the economy by increased investment opportunities. Integrating into international capital market interrupts this growth process. Income initially increases as capital rushes in but investment income is foregone in the long run. This argument relates the real world observation of countries being stuck in a so-called 'middle income trap' (e.g. Eichengreen et al., 2013), i.e. growth slowdowns of emerging markets that experienced massive periods of growth prior to that, usually going hand in hand with their integration into world capital markets.

The mechanism that I point out here can also well explain the accompanying structure of two-way capital flows that is observed: Because the immediate rise in income and thus savings that is incurred by FDI is contrasted by a falling demand for credit by domestic agents, financial capital flows out of poorer countries into richer ones. This credit is hence used partly to, in turn, finance direct investment by Northern entrepreneurs in the South. The endogeneous wedge between the two types of capital income then shows responsible for lost out incomes in the long run in developing countries, despite the initial gains that the inflow of FDI incurs. By dampening domestic investment and hence credit demand, but raising income and savings, FDI hence is the driving force behind the concurrent financial capital outflows, according to this theory.

In the baseline model, countries only differ in their income levels due to different progress in the growth process. Even though we will take the perspective of a developing country throughout most of the analysis, the effects on incomes in richer countries are just the mirror image: An outflow of capital initially harms domestic workers, but investment around the

world, and the access to credit to pursue it, increase national income in the long run.
The model is very stylized and attempts to explain by one single mechanism unexplained facts about the pattern of capital flows and growth the effects of FDI as a coherent phenomenon. It therefore in its simplest form abstracts from other potential mechanisms often said to be involved with FDI. It can easily be extended to include these and the discussion will briefly touch on a few directions for elaboration of the basic mechanism. Two caveats should be noted: first, the mechanism described in this paper explains only why *income* is reduced in a developing country, not production, which will in contrast be efficient in this stylized setting. In order to explain growth outcomes with the model, we will have to believe in some mechanism by which a lower domestic income also translates into lower GDP growth. Second, FDI in the model is understood as greenfield investment. Bosworth et al. (1999) show that one dollar of FDI altogether is associated with a one dollar increase of the capital stock in the host country, only this being in foreign hands then. Hence, we can understand the above numbers as fairly well representing the decisive concept in the model.
The remainder of the paper is organized as follows: The next section discusses in more detail some related literature. Section 3 sets up the model and section 4 lays out how the growth and trickle down process in this economy emerges in autarky. Section 5 shows how this process is interrupted by the opening up of a small economy to world capital markets and section 6 discusses the resulting structure of capital flows. Some extensions are briefly presented in section 7: Section 7.1 lays out the two-country setting and 7.2 shows how the result is magnified when differences in total factor productivity between countries are accounted for. Section 8 concludes.

2 Related Literature

In the standard static neoclassical setting of capital flows, the increase in wage incomes exceeds the loss of capital incomes by domestic capital owners if capital flows into a capital scarce country. In a dynamic setting with perfect capital markets, this also leads to increased savings and surge in domestic capital ownership. Integration of capital markets should then lead to an accelerated convergence between countries. Borrowing in order to invest on the one hand, or lending on the hand, both yield the same return in perfect capital markets, such that the type of capital flows is usually not even considered in this type of analysis. When Lucas (1990) put up the puzzle that capital is not flowing from North to South by close to

the amounts predicted from theory, the literature following up on this argued that marginal returns to capital will probably be lower in developing countries even at lower physical capital stocks, mainly because of fewer accumulated (immobile) human capital (Mankiw et al., 1992). If only the buildup of physical, but not that of human capital can be financed via international capital markets, this may explain low inflows of capital into developing and emerging economies (Barro et al., 1995). Gourinchas and Jeanne, 2006, also find that an opening up to international capital markets with this type of distortions only marginally increases growth performances. This literature can well explain why capital doesn't flow in the amounts predicted, and why the marginal product for foreign investment remains low even at low levels of capital stocks. This would however not explain why we actually do observe net FDI flows into developing countries, as presented in figure 1. Neither can it explain why at the same time, other types of capital are flowing in the reverse direction on net.

There is another extensive strand of literature that discusses how upstream flows of financial capital can be explained by an imperfect credit market, starting with the partial-equilibrium framework of Gertler and Rogoff (1990). Matsuyama (2004) shows in general equilibrium that this may lead to endogenous inequality between countries when capital flows to where capital already is, because this ensures security for lenders. The analysis undertaken here has a lot in common with (and borrows from) this work. It extends the analysis to more precisely model intertemporal individual links of agents throughout the growth process, and to allow for FDI, defined as productive investment in another than the home country, while borrowing for home market credit conditions. This is excluded in Matsuyama (2004), which concentrates only on the effect of competition on credit markets for respective domestic investment, thereby potentially generating aggregate financial capital flows from South to North to finance domestic investment there.

In the same line, and closely related to our paper, are the works by Song et al. (2011) and Buera and Shin (2009). They look at how an economic transition will lead to outflows of financial capital when credit markets are imperfect. Whereas Buera and Shin (2009) concentrate on the supply side of credit as a driving force because entrepreneurs need to save in order to make investments, Song et al. (2011) show, with regard to the case of China, that the reallocation from financing-intensive state owned enterprises to more restricted private firms affects the demand side for credit, leading to a current account surplus during the transition period. All of these papers also do not consider the effects of FDI.

The first and only work to explicitly jointly account for the observations of Figure 1 is Ju and Wei (2010). To explain the structure of two-way capital flows, they provide a static model where capital flows are driven by differences in institutional quality between countries. The quality of financial institutions determines where financial capital goes and the level of property rights protection and the capital scarcity determine where FDI flows to. However, both types of capital flows are not directly linked in their model. To generate the pattern shown in Figure 1, they therefore concentrate on a narrow group of countries that exhibit good property rights protection but at the same time weakly developed domestic financial markets. This is different to the analysis undertaken here insofar as we do not look at differences in institutional quality, but analyze this pattern as a result of interaction in one imperfect capital market of agents of different inital positions.[9] In contrast to Ju and Wei (2010), our analysis then considers the dynamic effects of FDI on domestic investment opportunities and income and thereby directly relates the inflows of FDI to financing opportunities for domestic entrepreneurs and concurrent financial capital outflows.[10]

By theoretically underpinning the empirical findings on the crowding out effect of FDI on domestic investment, this paper is related to the works of Grossman (1984) and Reis (2001), who also comment on how FDI might slow down domestic entrepreneurial activity. Both results complement the argument made here, but stress different mechanisms. The former argues that possible entrepreneurs in developing countries prefer to leave the risk of investment to foreign investors and instead work in foreign companies for lower, but safe wage income. Risk sharing is no objective in my model, which implies that agents would prefer, but are prevented from becoming entrepreneurs. The resulting welfare losses in the economy opening up are thus absent in Grossman (1984). Reis (2001) on the other hand shows in a model of endogenous growth that the exogenous technological advantage of foreign firms may crowd out domestic research activities in partial equilibrium, so that the profits that accrue to these activities and then escape the country by repatriation may mirror domestic welfare losses. However, in her model, the countries differ in their technological characteristics and the capital market is restricted to direct investment.

I show the effect of a reduction of domestic entrepreneurial activity in a general equilibrium

[9] Also, because the analysis undertaken here takes into account the role of individual agents, we do not have to assume aggregated convex costs of investment to obtain an interior solution.

[10] To be specific, The appendix of Ju and Wei (2010) extends their setting to a dynamic one. Still, feedback effects between investment and credit market interaction are cut. Consequently, short term effects are simply magnified in the long run.

model of complete – and same – market interaction that deliberately stays as close to neoclassical growth theory as possible. I thereby deliver a tractable way to identify why – in contrast to conventional arguments – there is a short-run long-run tradeoff involved with FDI and it could be disadvantegeaous for developing countries in the long run to have substantial shares of GDP leave the country as foreign factor payments such that GNI is lower than the domestic value of production. This pattern holds true for almost all developing countries.
I do not consider other effects of FDI than the increase in the domestic capital stock which are often attributed to it, such as technological or competition-induced spillover effects (see e.g. de Mello, 1997, for an overview). The reason is twofold: First, a metastudy by Harrison and Rodriguez-Clare (2010) concludes the empirical evidence on these two be negligable at best. Second, and more importantly, I want to highlight one specific effect of FDI, abstracting from everything else that may well be considered additionally. Even if positive effects may be present, the mechanism presented here should help answering the question why especially FDI doesn't have the expected overall positive effect on welfare in developing countries. Whereas most literature focuses on country-specific reasons, my model offers a systemic explanation for this.

3 The model

The model is based on that of growth under imperfect credit markets from Matsuyama (2004), but alters the basic framework to analyse the effects of FDI in particular instead of only looking at the effect of competition for financial capital.[11]
Consider an economy that is made up by a homogeneous population of unit mass. Individual agents are indexed by $i \in [0,1]$ and each supplies one unit of labor inelastically in each period. Agents are infinitely lived. There is only one good produced, used for consumption and production. Production follows standard neoclassical patterns: $Y_t = F(K_t, L_t)$, where K_t and L_t are aggregate supplies of capital and labor in period t. F is a constant returns to scale production function and we normalize $L = 1$ such that production equals per capita production and can be expressed as $y_t = f(k_t)$, lower case notation indicating per capita variables. Furthermore, $f'(k) > 0 > f''(k)$. Inada conditions hold. However, since we will

[11] The central results in the autarky case therefore resemble the one in Matsuyama (2004). The situation under open markets, however, looks fundamentally different here compared to the one in his setting.

have to make a statement about the characteristics of growth over history, suppose that $f(0) = \epsilon$, with ϵ small, but greater zero.

The labor market is competetive and labor is paid its marginal product, $w_t(k_t) = \frac{\partial F(K_t,1)}{\partial L}$. Invested capital receives the residual of production, which is, per invested unit of capital, $\rho_t = \frac{f(k_t)-w_t(k_t)}{k_t} = f'(k_t)$. $f'(k) > 0 > f''(k)$ implies that an increasing capital stock decreases per unit capital returns and increases wages.

For simplicity, capital depreciates fully after one period.[12] Agents save – in a Solow-type way – a constant fraction s of their income.[13] They can transfer their savings to the next period by either lending it on the competetive market for credit, earning the gross return of r_{t+1}, or by investing it into physical capital. Investment in physical capital only becomes effective the next period. If investing, each agent can run exactly one investment project by investing exactly 1 unit of capital into the joint production process. This restricts in both directions: First of all, investment is indivisible, i.e. there is a threshold of funds that have to be brought into each single investment. This will lead to competition on the market for credit in the first place. Secondly, this is the most extreme, but also most tractable form of individually diminishing returns to investment. If they weren't, the richest individual would always be able to attract all credit, as we will see. Both, indivisibility and diminishing returns, are in their extreme form a simplification and only introduced in this form for tractability, but both in general are essential for the mechanism to be at work.

If an individual i wants to invest, but her funds – which equal her savings – are not sufficient to ensure investment, she has to borrow the remaining share, $1 - sI_t^i$, on the credit market in order to invest one unit in physical capital in $t+1$, where I_t^i is her end-of-period income. She then earns the return on her investment in $t+1$, has to repay her credit taken (if any), and also receives the wage payment on her labor supplied.[14] An entrepreneur's income in period $t+1$ then reads:

$$^{E}I_{t+1}^i = f'(k_{t+1}) - r_{t+1}(1 - sI_t^i) + w(k_{t+1}) \tag{1}$$

[12] This emphasizes the fact that some investment is not just èarlier' when it comes to competition for investment, but that investment takes place constantly and investment opportunities are distributed structurally.

[13] This could easily be motivated by an OLG-Model with log-preferences and 'warm-glow' bequests or simply as a dynasty-model as in Matsuyama (2011). Both modifications to the interpretation would not change the results qualitatively.

[14] For simplicity, we assume that an entrepreneur still supplies labor. This doesn't affect the results, but avoids taxonomical exposition.

If she instead lends her savings, she receives the credit market return on this loan and earns her wage, and her income is given by:

$$^{L}I^{i}_{t+1} = r_{t+1}sI^{i}_{t} + w(k_{t+1}) \tag{2}$$

To compare the two, (1) can be rearranged to:

$$^{E}I^{i}_{t+1} = f'(k_{t+1}) - r_{t+1} + r_{t+1}sI^{i}_{t} + w(k_{t+1}) = (f'(k_{t+1}) - r_{t+1}) + {}^{L}I^{i}_{t+1} \tag{3}$$

Thus, an individual will always be willing to invest if

$$f'(k_{t+1}) \geq r_{t+1} \tag{4}$$

Because this does not depend on individual characteristics, this is also the condition for any investment to take place. We refer to this as the Profitability Constraint (PC). All individuals additionally underlie a borowing constraint (BC), however. This takes the form:

$$\lambda f'(k_{t+1}) \geq r_{t+1}(1 - sI^{i}_{t}) \tag{5}$$

This capital market imperfection lies at the heart of our analysis. It says that an individual with income I^{i}_{t} can only pledge a share $\lambda < 1$ of the prospective return to her investment (LHS) on her payback (RHS).[15] This has two implications: First, ceteris paribus, an individual with a lower income has less collateral to bring in the investment, thus has to raise more credit and consequently finds it harder to warrant for the high repayment by the return to investment, i.e. have the condition satisfied. Secondly, a higher aggregate capital stock decreases the prospective returns and thus the probability of everyone to be eligable for credit. λ is a measure of credit market imperfection.
If (4) holds with inequality, i.e. if physical investment is more profitable than lending, everyone would like to invest rather than lend on the credit market. As long as agents can do so, this investment decreases the left hand side of both, (4) and (5). Therefore, for any given r_{t+1}, either one will bind to 'stop' investment activity. The equilibrium interest rate r_{t+1} will be determined by supply and demand on the credit market, as spelled out below.

[15] This reduced form of the borrowing constraint is e.g. directly derived from a moral hazard story a la Holmstrom and Tirole (1997). Matsuyama (2004), p.860f, argues that it stands in line with most microfoundations of capital market imperfections that can be found in the literature.

The borrowing constraint will be binding as long as $\frac{1-sI_t^i}{\lambda} \geq 1$ for some individual i.[16]
We will restrict ourselves in what follows to the case that this holds, which is equivalent to saying that the borrowing constraint (5) is always binding for some agents and the profitability constraint (4) holds with inequality, i.e. investment is strictly profitable.[17] Those agents (we will introduce the reason for ex post income heterogeneity later) which have to borrow only as much that they can guarantee repayment will borrow on the credit market and invest their savings and credit in physical capital and become entrepreneurs. All others will lend their savings as credit. If an entrepreneur already has enough own funds such that these suffice for investment alone, she will make the investment and lend the remaining savings on the credit market, which also results in an entrepreneur's income given by (3).[18]
W.l.o.g., order the agents increasing in their income, such that I_t^i is increasing in i. Now, we define $\tilde{i}_t$ as the agent which can just pledge investment, i.e. for whom the borrowing constraint (5) is exactly binding, for a given r_{t+1}. Denote her critical income $\tilde{I}_t$, which is the income that just suffices such that (5) holds with equality:

$$\tilde{I}_t = \frac{r_{t+1} - \lambda f'(k_{t+1})}{s r_{t+1}} \tag{6}$$

All agents $i < \tilde{i}_t$ cannot invest, all agents $i \geq \tilde{i}_t$ can. It means that agents with a lower income and hence less collateral lend their savings, all those who in contrast can self-finance a larger share of investment will be able to invest. The richest agents will be preferred to obtain credit, because they can also ensure payback at high interest rates, but all borrowers pay the same interest rate. The exact equilibrium values of k_t, k_{t+1}, and r_{t+1} will depend on the whether an economy is closed or integrated into international markets.

[16] To be exact, it has to bind for the critical agent as defined below. This will in equilibrium be equal to the lowest income, making the two statements equivalent.

[17] Note, that this is different to Matsuyama (2004)'s analysis where an interior solution can only exist if the Profitability Constraint is binding in the richer countries. By cutting intertemporal links in individual incomes, he does not account for ex post heterogeneity between agents within countries, which changes the interpretation.

[18] We will still refer to such an agent as 'entrepreneur' rather than 'lender'.

4 Autarky

Credit market equilibrium

In autarky, equilibrium on the credit market is determined by equalizing respective credit supply and demand. For a fixed savings rate s, and given current period incomes, aggregate savings are fully determined and fixed in a given period. These savings can either be invested by the saver herself, or be lent on the credit market to be invested by someone else. Investment must hence equal savings, which is consequently given by $k_{t+1} = sf(k_t)$. The interest rate is then determined such as to equalize the two. From (6), we see that for a given k_{t+1}, more and more lower income agents will be able to borrow funds necessary for investment with a decreasing interest rate. Hence, investment is also decreasing in the interest rate r_{t+1}. Equilibrium on the credit market is depicted in Figure 2. For a higher interest rate, there

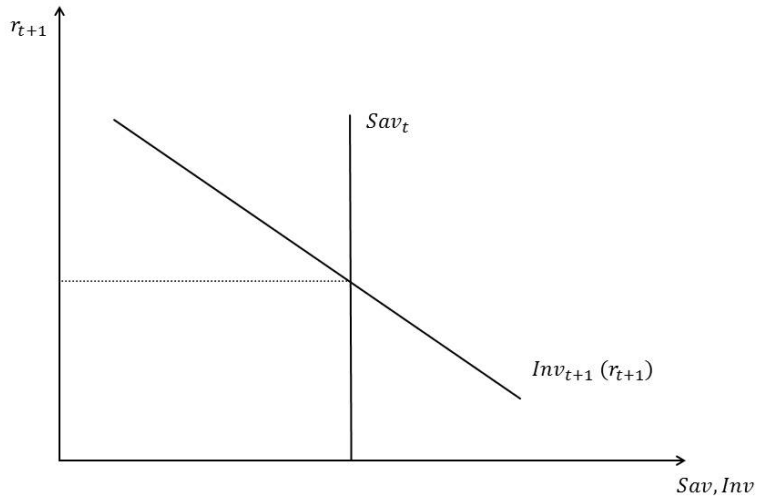

Figure 2: Credit market equilibrium

would be excess credit supply and vice versa. If able to demand credit (and not by the BC forced to supply), an agent will do so, such that the borrowing constraint regulates who can invest. Because all agents can run only 1 investment project, the amount of investment is also equal to the number of agents who invest. In equilibrium, the interest rate will hence

to adjust such that exactly the fixed amount of savings can be invested by the same number of agents (from their own savings and the amounts borrowed). Equilibrium on the credit market is thus indirectly determined by $\tilde{I}_t$, which is the income of agent $\tilde{i}_t$, defined by

$$Sav_t = Inv_{t+1}(r_{t+1}) = 1 - \tilde{i}_t(r_{t+1}) \tag{7}$$

The amount of savings determines how many agents will be investors, and the lowest income of these, $\tilde{I}_t$, hence determines the interest rate. This is then from (6) given by

$$r^*_{t+1} = f'(k_{t+1})\frac{\lambda}{1 - s\tilde{I}_t} \tag{8}$$

As we will see in what follows, the income distribution may have flat parts, i.e. more agents may have the exact same income. If this is the case at $\tilde{i}_t$, some agents of those of equal income are credit rationed. Appendix A offers a different representation of the mechanism from the view of supply and demand, which underlies the savings-investment perspective given here.

From (8), we also see that the credit market imperfection implies that there is a wedge between the equilibrium interest rate and the return to physical investment, the latter being greater by $\frac{1-s\tilde{I}_t}{\lambda}$, as long as the borrowing constraint is binding.

Dynamics

It follows from the above analysis that in autarky all domestic savings in period t are invested in physical capital, i.e. $sf(k_t) = k_{t+1}$ – either directly by the saver or via lending. This determines $f'(k_{t+1})$. The interest rate r_{t+1} will adjust such that all savings find an investor. Thus, for the aggregate economy, capital builds up and standard neoclassical growth emerges, irrespective of the capital market imperfection. Figure 3 illustrates the dynamics.

Because Inada conditions hold, the capital stock is increasing over time. The share of entrepreneurs in each period $t + 1$ is also given by k_{t+1}, and is hence increasing.

From (3), the income of an agent who becomes an entrepreneur will exceed that of an agent of same period-before income by exactly the excess profits of physical investment on her invested one unit of capital. She earns the wedge between returns to physical investment and the interest rate on what she borrows and and on her own savings. If she can fully self-finance her investment, one unit of her savings is paid off with the higher return and the

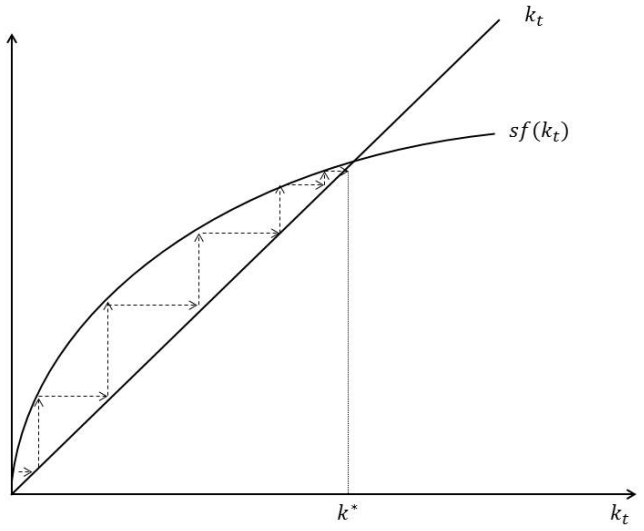

Figure 3: Autarky Dynamics

remainder is lent on the credit market.

Since it is the highest income (and thus highest savings) individuals who are able to borrow and invest, they must have had a higher income in the period before. Thus, all period-before entrepreneurs with the higher income will again be entrepreneurs in the next period, as long as the aggregate capital stock is increasing - and thus the share of entrepreneurs.[19] (2) and (3) imply that the ordering of agents according to their income does not change, due to the deterministic path-dependence of incomes. However, an increasing capital stock implies that in each period additional agents must become entrepreneurs. These must then have been lenders the period before and all periods before that. Figure 4 illustrates the transition and the resulting income distribution.

The critical income $\tilde{I}_t$ is hence the income of an agent who has been a lender throughout from the beginnning of the growth process. Having only received wage income and saved

[19] Obviously, there is heterogeneity within the group of entrepreneurs, depending on the time that they have been investors and have received the respective higher income.

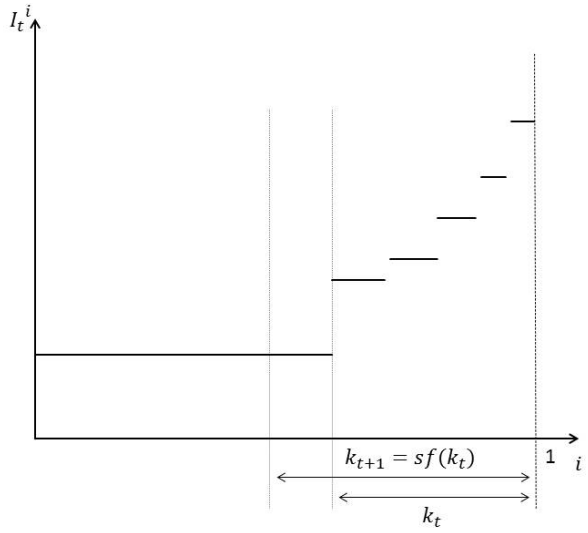

Figure 4: Autarky Transition

part of that for all periods since then, by iterating (2), this income is given by:

$$^{L}I_t^i = w(k_t) + \sum_{i=0}^{t-1} w(k_i)s^{t-i} \prod_{j=0}^{t-i-1} r_{t-j} = \tilde{I}_t \tag{9}$$

This critical income determines the equilibrium interest rate, given by (8). In each period, the income of the next 'new' entrepreneur fixes the interest rate which in turn determines next period's incomes and so on. With an increasing capital stock, also the wage rate increases with economic growth.

The movement of the interest rate is ambiguous. Because the interest rate changes over time and part of a lender's income is also given by the return on her savings, the increasing wage income does technically not necessarily imply a rising overall income. We will, however, assume that this is always the case and the income of pure workers increases with their wage income, which is in line with the empirical evidence.[20]

Assumption 1 *The income of pure lenders is increasing over time, i.e.* $\frac{\partial^L I_t^i}{\partial t} > 0$.
This derives from the increase of the wage income, which is rising with the increase in the

[20]See e.g. Chen and Ravallion (2010).

capital stock. The increase in wage therefore must always offset possible losses in interest income on savings. For the necessary restrictions on the production function, see Appendix B.

Assumption 1 always holds for reasonable parameter values.
The capital income of individual investors on the other hand decreases over time, but they benefit from the increase in the wage rate as well. The result on their overall income is ambiguous. However, more and more agents become entrepreneurs, yielding the higher income compared to that of the lenders.
Aggregate GNI in autarky, $GNI_{a,t}$, must be equal to $GDP_{a,t} = f(k_t)$. We can rewrite this in terms of aggregated individual incomes. This is given by

$$\begin{aligned} GNI_{a,t} = k_t(f'(k_t) - r_t) + \sum_{i=1}^{t-1} k_{t-i}(f'(k_{t-i}) - r_{t-i})s^i \prod_{j=0}^{i-1} r_{t-j} \\ + w(k_t) + \sum_{i=0}^{t-1} w(k_i)s^{t-i} \prod_{j=1}^{t-i} r_{t-j+1} \end{aligned}$$

This representation emphasizes the fact that in each period the share of entrepreneurs receives an additional income on their 1 unit of invested capital (the terms in the first line), and all agents get a wage income (second line). All either get paid interest on their savings or, when investing, do not need to borrow this amount on the credit market. Thus, all income is discounted through with the respective interest rate of all relevant periods.
The overall dynamics of the aggregate capital stock, described by $sf(k_t) = k_{t+1}$, as laid out above, are not affected by the capital market imperfection.

Steady State

The dynamics implicitly define the steady state to which the autarky economy converges to, as depicted in figure 3:

$$sf(k^*) = k^* \tag{10}$$

In the steady state, the share of entrepreneurs is then also k^*. The respective incomes of each type of agent converge to:

$$^{E}I^* = \frac{f'(k^*) - r^* + w^*}{1 - r^* s} \tag{11}$$

$$^{L}I^* = \frac{w^*}{1 - r^* s} \tag{12}$$

Where again the steady state interest rate is determined by the most recent entrepreneur's last income, which is just given by (12).[21] It will adjust such that all savings can be invested by someone who is able to do so. The steady state level of investment is also unaffected by the credit market imperfection.

Note, that in the steady state, the savings of entrepreneurs cannot alone suffice to afford investment, i.e. $s\frac{f'(k^*)-r^*+w^*}{1-r^*s} < 1$. If they didn't demand credit, savings would be invested by new entrepreneurs, and a steady state would not yet be reached.

GNI in the steady state is again equal to GDP, $f(k^*)$, and can be expressed as

$$GNI_a{}^* = k^* \frac{f'(k^*) - r^*}{1 - r^* s} + \frac{w^*}{1 - r^* s} = \frac{k^*(f'(k^*) - r^*) + w^*}{1 - r^* s} \tag{13}$$

5 Open Capital Markets

Now, consider a small economy in the South, which is fully described by the above characteristics, that opens up to the world market. To focus on the structural mechanism, assume that all other countries in the world (the North) are of the exactly same type. Especially, the level of capital market imperfection λ is equal in all countries, implying that differences in the competitiveness on the credit market arise from differences in incomes solely.[22] The countries differ only by that the North is more progressed (higher t), whereas the opening economy is behind (lower t) in the process of development. This implies that the world is

[21] An alternative way to look at it would be that 'in' the steady state, no new entrepreneur will emerge and $\tilde{I}_t$ is the income of the 'last' entrepreneur. Considering instead that we always only approach the steady state, marginal shares of the population will become new entrepreneurs and the critical income is given by the income of the lenders. We will look at it the latter way, even though it makes no difference for the analysis undertaken here.

[22] Loosening this assumption would magnify our results while making the weaker point that institutional differences account for differences in developmental outcomes. The abstraction made here instead points out a feature of same market interaction.

relatively less capital scarce than the domestic country. Denote the period of opening up by T. Then the domestic capital ratio $k_T < k_T^W$ (the world capital ratio). For convenience, we will henceforth assume that the world is already in its steady state, such that $k_T^W = k^*$. This is not crucial, the analysis holds for all cases where a less developed country opens up to a more progressed world in terms of the development process described in section 4.

Opening up now implies two things: First, investors can freely invest in physical capital around the world. As above, each investor can only make one indivisible investment, but now needs to decide where to do so. Also, agents can freely lend and borrow at the world market for financial capital, only restricted by the borrowing constraint (5). Lenders receive the world market return $r^W = r^*$ on their savings. Potential borrowers face this credit cost and the borrowing constraint, which is dependent on their individiual incomes and on the prospective return of their investment. Hence, borrowing source and investment location are disentangled from each other in the open economy.

In period T, all saved incomes are determined by the history of incomes in the closed economy, and wage incomes by the capital installed, because foreign investment becomes only effective in the next period. With unrestricted investment, Northern investors will for the next period invest in the South and capital will flow into the domestic country until returns to physical investment are equalized, such that $k_{T+1} = k_{T+1}^W = k^*$. As the returns for all investors equalize around the world, also next period's returns for domestic investors drop due to the inflow of foreign capital, as $f'(k^*) < f'(k_T)$.

First, consider what this implies on the market for credit. The world market cost of credit is given by r^*. Agent i is in period T hence able to pledge investment for period $T+1$ iff

$$\lambda f'(k^*) \geq r^*(1 - sI_T^i) \quad \Leftrightarrow \quad I_T^i \geq \frac{r^* - \lambda f'(k^*)}{sr^*} \tag{14}$$

This is exactly equivalent to the critical income for borrowing in the steady state. However, by Assumption 1, the incomes of current domestic lenders in T are lower than this, and they will not be able to borrow and invest. For current domestic entrepreneurs, it is not clear whether their income exceeds the critical income. Denote the share of domestic agents who can in period T pledge payback and hence invest for the next period by $\tilde{k}_{T+1}$. Then, Proposition 1 holds.

Proposition 1 *The share of domestic entrepreneurs after opening up will at most be all agents that have been entrepreneurs before opening up, i.e.* $\tilde{k}_{T+1} \leq k_T$.

Proof. The world interest rate r^* is determined exactly such that for a lender with steady state income, given by (12), condition (14) is satisfied with equality, i.e. $\tilde{I}_T = {}^L I^* = \frac{w^*}{1-r^*s}$. Agents in South thus can borrow on international markets if their income exceeds that of a steady state lender. For those that are already entrepreneurs in the moment of opening up, equation (14) may or may not hold, i.e. it is not clear whether ${}^E I_T^i > \tilde{I}_T$. It may hold for all, for only some, or for none of those that were already entrepreneurs. Lenders' income, in turn, by Assumption 1, in T is strictly lower than in the steady state, ${}^L I_T < {}^L I^* = \tilde{I}_T$. Thus, these agents cannot pledge investment for $T+1$ at world market conditions. ■

The statement in Proposition 1 holds with equality if all past entrepreneurs can become entrpreneurs in the open economy.[23] Note, that the timing of investment in the model is not crucial for the result of Proposition 1.
What happens in the following periods? In period $T+1$, foreign investment becomes effective and the physical capital stock in the economy is given by k^* (which may – and does – differ from $\tilde{k}_{T+1}$). The increase in the capital stock raises the wage rate in $T+1$ to w^*. This is an immediate gain for the entire population and increases the balance sheet for pledging borrowing and investment for the subsequent periods.
The income of a lender from period T to period $T+1$ in South is then given by:

$$ {}^{LS} I_{T+1} = w^* + sr^* \cdot {}^{LS} I_T \tag{15}$$

However, the income that would be just sufficient to obtain credit is still given by $\tilde{I}_{T+1} = \frac{r^* - \lambda f'(k^*)}{sr^*}$ and hence determined by steady state world market conditions, because foreign investment also rules domestic investment returns for all subsequent periods. The income just sufficient for pledging investment can be expressed as the wage income in steady state plus the savings on previous income, and the critical income in period $T+1$ can hence be rewritten as:

$$ \tilde{I}_{T+1} = w^* + sr^* \frac{w^*}{1 - r^*s} \tag{16}$$

Comparing (15) and (16) shows that a lender's income is still not sufficient to pledge investment. This is summarized in Proposition 2.

[23] Because returns and thus investors' incomes are higher the lower the capital stock is, it is more likely that it holds for some or even all past entrepreneurs, the less developed the country is when opening up.

Proposition 2 *In an economy opening up to international investment, the share of entrepreneurs will not expand over time from the period after opening up, $T+1$ and it is fixed at $\tilde{k}_{T+1} \equiv \tilde{k}$ for all subsequent periods.*

Proof. The income of a lender in period $T+1$, given by (15) is lower than the critical income sufficient to pledge investment, given by (16), because ${}^{LS}I_T < \frac{w^*}{1-r^*s} = {}^{L}I^* = \tilde{I}_T$, which was the condition to be a lender in period T. The same wage rate combines with lower historical savings at same credit and investment market conditions. This argument holds for all subsequent periods. ■

Who is once not wealthy enough to be eligible for borrowing after opening up will not be in $T+1$, $T+2$, and so on. When competing with world market investors for investment and credit, Southern entrepreneurs fall behind, because they have a lower historical income. The trickle-down mechanism is disrupted when the economy opens up to world capital markets. This is illustrated in figure 5 (for the case of all past entrepreneurs being able to borrow internationally).

Especially for low levels of development, the capital inflow and concurring increase in the

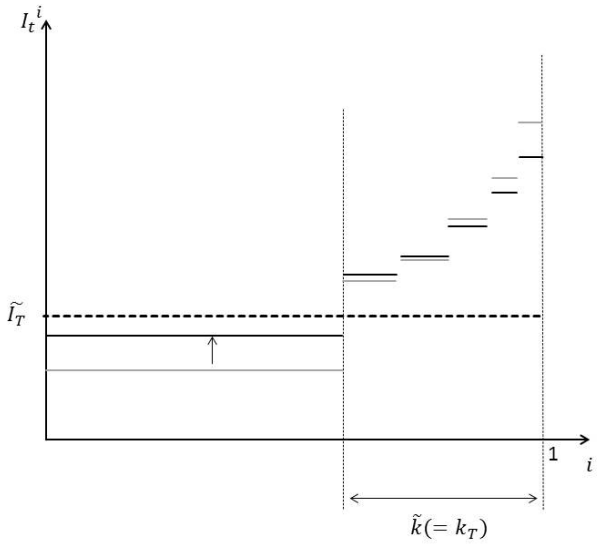

Figure 5: An Economy opening up

wage rate implies an immediate gain in individual incomes. But at the same time, due

to FDI, the prospective returns for capital decrease so much that the agents in South still cannot pledge investment despite their risen income.
GNI thus also initially increases due to the inflow of FDI. It now doesn't have to equal GDP, which immediately jumps to $GDP_{o,t} = f(k^*)$ for $t > T$.
GNI, in contrast, is given by

$$\begin{aligned} GNI_{o,t} &= \tilde{k}(f'(k^*) - r^*) \sum_{i=0}^{t-T-1} (sr^*)^i \\ &+ w(k^*) \sum_{i=0}^{t-T-1} (sr^*)^i + f(k_T)(sr^*)^{t-T}, \end{aligned} \tag{17}$$

which is the constant capital income of the constant share of investors plus the constant

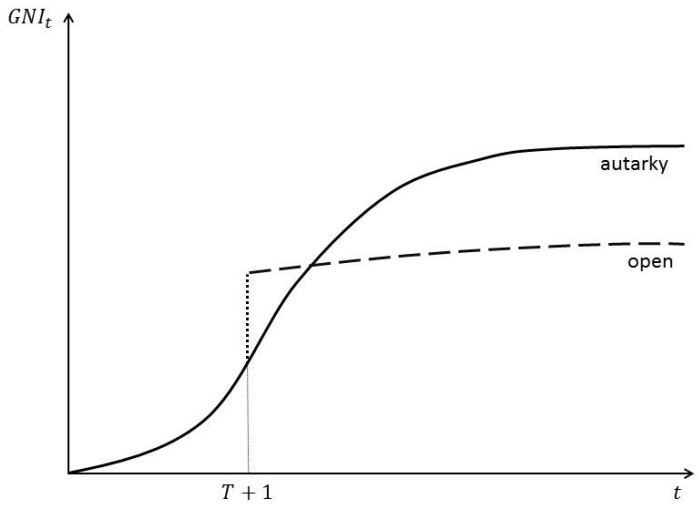

Figure 6: Timepath of GNI

wage payments, each transferred at the same rate throughout time from period T on, plus the remaining savings on income in period T. Figure 6 illustrates the time dynamics of this and contrasts it to the situation in autarky. In autarky, capital would build up slowly, but the share of entrepreneurs would expand, who would then reap the surplus profits on physical investment. When opening up, capital rushes into the country, but domestic agents

who cannot become entrepreneurs in the moment of opening up will never be able to benefit from the gains of capital ownership.
GNI under open capital markets then converges to the following steady state value:

$$GNI_o{}^* = \tilde{k}\frac{f'(k^*) - r^*}{1 - r^*s} + \frac{w^*}{1 - r^*s} \tag{18}$$

This compares to the autarky steady state GNI, which was given by:

$$GNI_a{}^* = k^*\frac{f'(k^*) - r^*}{1 - r^*s} + \frac{w^*}{1 - r^*s} \tag{13}$$

Proposition 3 summarizes the comparison of the two outcomes.

Proposition 3 *The steady state national income is strictly lower for a developing country after having opened up during the growth process than it would have been in autarky, i.e.* $GNI_o{}^* < GNI_a{}^*$.

Proof. By propositions 1 and 2, $\tilde{k} \leq k_T < k^*$, i.e. the number of domestic entrepreneurs after opening up is lower than the steady state number of entrepreneurs in autarky. Comparing the expressions for GNI in the respective steady states, as given by equations (18) and (13) yields the result. ■

Steady state national income will always be lower when the country has opened up to international markets in the process of development. In the long run, labor income would have been the same. But, in autarky, capital ownership and the concurring profits would be in domestic hands, which they are not if a country integrates into international capital markets. The standard neoclassical result of initial gains due to capital inflows is bought at the expense of a disruption in the trickle-down process.

6 The Structure of Capital Flows

The resulting structure of capital flows in and out of the country is straightforwardly analyzed, concentrating on the steady state for exposition.[24] Since the share of domestic

[24]I here talk about 'net' flows in the sense of net for each type of capital flow - financial and direct investment. In the absence of costs to international investment, all domestic investors could invest abroad and all domestic capital could be FDI. We simply assume that an investor first invests at home as long as this yields the same return.

investors who each invest 1 unit of capital is lower than the overall capital stock, FDI into the country is positive and given by the difference of the two:

$$FDI^*_{in} = k^* - \tilde{k} > 0 \tag{19}$$

The outflow of financial capital is given by the difference between *domestic* savings and investment. The latter is given by $\tilde{k} = k^* - (k^* - \tilde{k})$. Savings are the same as they would have been in autarky, where they would have constituted the steady state capital stock, lowered by the not occuring savings on the missed out returns to physical capital, and are hence given by $Sav^*_o = k^* - s(k^* - \tilde{k})\frac{f'(k^*)-r^*}{1-r^*s}$.
Financial capital outflow as the difference of these two then reads

$$\begin{aligned} FC^*_{out} &= k^* - (k^* - \tilde{k})s\frac{f'(k^*) - r^*}{1 - r^*s} - [k^* - (k^* - \tilde{k})] \\ &= (k^* - \tilde{k})\left(1 - s\frac{f'(k^*) - r^*}{1 - r^*s}\right) > 0, \end{aligned} \tag{20}$$

where the last inequality derives from the fact that savings on capital income in the steady state must be smaller than 1, as shown before. Compared to the autarky steady state, the reduction in savings is proportionally not as high as the difference in investment by domestic agents that is crowded out by foreign investment. These excess savings flow out of the country via the credit market, to flow back as direct investment.
The structure of two-way capital flows is exactly what we had seen in Figure 1. The outflow of financial capital is here a direct result of the inflow of FDI. The difference in returns between the two types of investment that an imperfect capital market creates and the outflow of factor incomes show responsible for lost out welfare in the long run. The aggregate financial account is given by the difference between the outflow of financial capital (20) and FDI-inflow (19)

$$FA^* = (k^* - \tilde{k})\left(-s\frac{f'(k^*) - r^*}{1 - r^*s}\right) < 0 \tag{21}$$

This implies a net flow of capital from North to South, such that the flows of FDI are not entirely met by the opposing flow of financial capital. In official statistics, both groups of countries appear to be net debtors, which obviously cannot be true. Following the literature, the predicted aggregate, although reduced, flow of capital from North to South from the model, is indeed rather what is likely to be actually happening, when capital holdings of

Northern countries in offshore financial centers are added to official numbers (see Zucman, 2013).

7 Extensions

The basic setting considered so far was a simple and tractable way to isolate the effect of how FDI crowds out domestic investment in developing countries and leads to two-way capital flows. As that, the equilibrium described has some features that we would not expect to see in the real world. One is, for example, that with otherwise identical countries, the productive capital stock in the developing country (although not owned) is the same as in more developed countries after opening up, and that happens immediately. As a result, in the steady state, income of lenders approaches the critical income, thus technically bringing them close to become entrepreneurs themselves when in a 'large' rest of the world, an infinite amount of investment projects is potentially realizable. Also, we should be interested in how this structure of capital flows and ownership affects agents in the northern countries. Therefore, in the following, we will look at how the presented mechanism interacts with additional considerations that semm important in the study of FDI and the interaction between North and South. The result is, that the income diverging effect of FDI is even magnified when the interaction between different countries is modeled more explicitly.
We will first extend the analysis to a two-country-setting and then look at the interaction when the developing country does not only lag behind in capital endowment but also exhibits a lower total factor productivity. Both extensions should hold as a robustness check for the validity of the theory, as well as an elaboration of its predictions.

7.1 Two-Country Setting

The two country setting follows straightfoward from the analysis in section 5. Consider, country 'South', as before in period T, integrates its capital markets with 'North', which is now of the same size as the developing country. Both countries have grown as in section 4, only that $k_T^N > k_T^S$. Free movement of investment equalizes capital stocks from period $T+1$ on. The capital stock in each country is given by half of aggregate world savings, i.e. $k_{T+1}^S = k_{T+1}^N = \frac{1}{2}s(f(k_T^N) + f(k_T^S)) \equiv \bar{k}_{T+1}$. The capital stock in North is smaller as compared to autarky after opening up, by exactly the amount that it is increased in South.

The dynamics of national capital stocks then follow Solow-type growth for both countries parallelly: $\bar{k}_{t+1} = \frac{1}{2}s2f(\bar{k}_t) = sf(\bar{k}_t),\ \forall t > T$.
However, income dynamics are disparate between the countries after opening up. As before, the credit market imperfection defines the critical income as given in (6), being the same for agents in both countries. The comparison of incomes analogously to the one between (15) and (16) now reads

$$ {}^{L}I^{S}_{t+1} = w(\bar{k}_{t+1}) + sr_{t+1}{}^{L}I^{S}_{t} < w(\bar{k}_{t+1}) + sr_{t+1}{}^{L}I^{N}_{t} = {}^{L}I^{N}_{t+1}, \tag{22} $$

$\forall t \geq T$. Because ${}^{L}I^{S}_{T} < {}^{L}I^{N}_{T}$, all new capital will be invested by northern agents. Define the share of entrepreneurs in South who could pledge for borrowing in T as $\tilde{k}^S \in [0, k^S_T]$. This share will again not expand. In contrast, the share of entrepreneurs in North is given by $\tilde{k}^N_t = 2\bar{k}_t - \tilde{k}^S$, which is increasing as long as the world economy is growing. GNI in country j is analogously given by

$$ \begin{aligned} GNI^j_t = \tilde{k}^j_t(f'(\bar{k}_t) - r_t) + \sum_{i=1}^{t-T-1} \tilde{k}^j_{t-i}(f'(\bar{k}_{t-i}) - r_{t-i})s^i \prod_{h=0}^{i-1} r_{t-h} \\ + w(\bar{k}_t) + \sum_{i=1}^{t-T-1} w(\bar{k}_i)s^i \prod_{h=0}^{i-1} r_{t-h} + f(k^j_t)s^{t-T} \prod_{h=0}^{t-T-1} r_{t-h}. \end{aligned} \tag{23} $$

National income will increase for both countries with an increasing capital stock. However, South does not expand its share of entrepreneurs, whereas North does, by investing in both countries. South does – after an initial gain due to capital inflows – not only grow slower than North in terms of income, it does so also more slowly than it would have under autarky at that level.
Steady State national incomes are given by:

$$ GNI^{j^*} = \tilde{k}^j \frac{f'(k^*) - r^*}{1 - r^*s} + \frac{w^*}{1 - r^*s} \tag{24} $$

where $\tilde{k^N} = 2k^*_t - \tilde{k}^S$. National income in South is strictly lower than in North and, in the long run, again also lower than it would have been under autarky. South hence unambiguously loses in the long run by integrating its capital market with a more advanced country. North, in turn, gains in the long run, even though workers initially lose due to the outflow

of physical capital.[25]
The two-country equilibrium is even more stable than the small open economy case. Even though the income of a lender in South approaches that of a Northern lender and thus the critical income for investment in the steady state, this does not create investment chances on a large scale. The reason is, that all entrepreneurs' income is still higher than that of lenders all over the world and the historical entrepreneurs will also in steady state re-take investment chances, not leaving much room for 'new' investment. The time dimension does enter here – not in that investment is taken, but in that incomes are distributed which determine borrowing, and thus investment possibilities.

7.2 TFP-Differences

Capital flows to South are said to be reduced because human capital, infrastructure, etc. in developing countries are not comparable to those in developed economies. By affecting the incentives for FDI, this will obviously interact with the mechanism described here.
Consider South exhibits lower total factor productivity than North, such that

$$f^S(k) = \delta f(k),$$

with $\delta < 1$. Consequently, $f'^S(k) = \delta f'(k)$ and $w^S(k) = \delta w(k)$.
In autarky, South would converge to a steady state given by $s\delta f(k^{*S,a}) = k^{*S,a} \Leftrightarrow \frac{f(k^*)^{S,a}}{k^{*S,a}} = \frac{1}{s\delta}$. Because the LHS is decreasing in k, $k^{*S,a}$ is lower than in the autarky steady state with higher TFP and thus lower than that in North.
If the two countries integrate their capital markets in T, capital returns from T+1 are equalized. Suppose $f'^S(k_T^S) > f'(k_T^N)$, such that some FDI will still take place in South, as empirically relevant. From T+1, relative capital stocks are implicitly determined by $f'^S(k_t^S) = \delta f'(k_t^S) = f'(k_t^N) \equiv \bar{f}'_t$. Consequently, $k_t^N > k_t^S$ holds $\forall t > T$. The capital stock, and with it GDP, is increased in South, but still lower than in North after opening up.
Again, the critical income to just pledge investment is given by $\tilde{I}_t = \frac{r_{t+1} - \lambda \bar{f}'_t}{r_{t+1} s}$, which is equal for agents in both countries. Lenders' income in South again compares to the critical income

[25] The structure of capital flows is analogolous to the analysis in section 6. Capital inflows in South are now capital outflows in North and vice versa.

as follows:

$$^{L}I^{S}_{t+1} = \delta w(k^{S}_{t+1}) + sr_{t+1}{}^{L}I^{S}_{t} < w(k^{N}_{t+1}) + sr_{t+1}{}^{L}I^{N}_{t} = {}^{L}I^{N}_{t+1} \tag{25}$$

It is thus again not sufficient to pledge borrowing in open markets for southern agents. Note, that the difference is even greater than with equal TFP, because a lower capital stock and lower overall productivity reduce wage income in comparison to lenders in North, in addition to the lower historical income. Consequently, as for identical countries, all investment after opening up will be pursued by northern agents, such that $\tilde{k}^{S}_{t} = \tilde{k}_{T+1} \leq k^{S}_{T}$.
Steady state amounts of capital stocks are equal to autarky steady state amounts, $k^{*S,o} = k^{*S,a}$ and $k^{*N,o} = k^{*}$.[26] GNI in either country j in the steady state read

$$GNI^{j^*} = \tilde{k}^{j}\frac{f'(k^{*j}) - r^*}{1 - r^*s} + \frac{w^{*j}}{1 - r^*s} \tag{26}$$

where $\tilde{k}^{N} = k^{*} + k^{*S} - \tilde{k}^{S} > k^{*}$.
Because as before, $\tilde{k}^{S}_{t} < k^{*S}$ holds, income in South is reduced by missed out investment returns $(k^{*S} - \tilde{k}^{S})\frac{f'(k^{*S}) - r^*}{1 - r^*s}$, and analogously increased in North as an outcome of globalization in the long run. The result of diverging incomes (and disparate growth) induced by FDI still holds in this setting when countries are not identical and capital stocks installed do not equalize. It holds even stronger, because incomes are then diverging, and chances on investment hence further reduced for Southern agents. The underlying mechanism is not driven by the simplifying assumptions made earlier.

8 Conclusion and Outlook

We have included a standard capital market imperfection into a simple neoclassical model of growth to give a more nuanced view on the effects of FDI. This at the same time can systematically explain the observed structure of two-way capital flows between developed and developing countries.
Imperfect credit markets imply that there is an endogenous wedge between lending and entrepreneurial income, and that individual incomes determine the distribution of credit eligibility

[26] This is a direct result from that world savings has to equal world investment - as in autarky - and Jensen's Inequality. Throughout the growth process, by the same argument, capital stocks installed evolve as in autarky from their values at period T+1 on.

and hence investment possibilities. The natural trickle-down process that autarky growth entails is disrupted in a developing country when it opens up to international markets with more progressed economies. Then, FDI flows in, which raises the physical capital stock, but at the same time reduces its marginal product and thus possibilities to invest. Because the poorer country's agents cannot compete on the market for credit given this new conditions, the share of entrepreneurs will not expand anymore, despite an initially risen income due to the capital inflow. In the long run, the missed out returns on investment lower national income in comparison to the autarky growth path. Hence, there is a trade off between short and long run effects involved with opening up for international capital markets for developing countries. Our model also gives a theoretical underpinning for the empirical findings that countries that self-finance themselves experience better growth experiences in the aftermath (Aizenman et al., 2007).

Extending the model to a two-country analysis yields a pattern of parallel, but disparate growth. The losses of the poor countries in the long run are mirrored by gains for foreign investors (whereas the initial inflow is the typical win-win situation from static models).

It shows that the structure of capital flows and incomes of countries are mutually interdependent. This is different from saying that each type of capital flows has different idiosyncratic reasons to flow in either direction. Instead, inflows of FDI, outflows of financial capital, and underdevelopment are different sides of the same story here.

To illustrate the basic mechanism, we have first abstracted from any other differences between countries other than the capital stock. This assumption is strong and hints at the possibility that countries that lag behind could have developed in the same way as developed countries if they wouldn't have integrated their capital markets and let FDI flow into the country. This perspective emphasizes the structural character of the mechanism analyzed. However, the assumption can be relaxed without altering the model's qualitative predictions. The structure of capital flows and growth effects from integration also occur as prediction from the model when productivity in the developing country is lower and hence the inflow of FDI. In this case, the split is even clearer, because agents in South would never be able to invest neither at home nor abroad in an international capital market. With a closed financial account, they would still have built up capital only slowly, but would have received entrepreneurial income from it.

Still, even when accounting for productivity differences, in the model, GDP is the same in the long run as it would be in autarky. It even jumps initially to that level. This is obviously

simplifying. Following the previous literature, the reason for lower productivity could well be differences in human capital of poorer countries' working force. In the spirit of Galor and Zeira (1993), this is even more probable if credit markets are imperfect, such that poorer agents cannot borrow to invest in schooling. FDI is unlikely to reduce returns to investment in human capital, but should rather increase them. An initial inflow of capital could consequently loosen constraints for investment in human capital and also increase incentives to publicly invest in schooling.

Thus, the story could have two sides to it, depending on how the initial income gain is used. By creating taxable income, it could give governments opportunities to publicly invest in other factors that hold down economic development, such as schooling, but also infrastructure and institutional development. From a policy perspective, it does hence not imply that FDI is necessarily negative for developing countries. But it shows that initial gains from integration to international capital markets may come at a price, and should hence not be treated carelessly. This might well be an explanation for the quite distinct experiences with capital market integration for developing economies.

The theory presented here is very stylized. It thereby abstracts from other mechanisms possibly involved with FDI and capital market integration. It thereby points at one paricular, potentially additional effect that should be taken into account, both, from a theoretical point of view, and from policy perspective. In the first place, it draws the attention to the fact that the observed structure of two-way capital flows may be both result of and reason for income disparities between countries. As discussed, it may in many ways interact with well-known results regarding capital market integration. It thus does add a novel argument by introducing another dimension to the discussion about the pattern and the welfare effects of globalization.

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A An additional perspective on credit market equilibrium

This section gives a slightly different perspective on how equilibrium on the credit market is determined, than the one in section 4. Because when investing, also own savings are invested additional to borrowed funds, savings and credit supply, on the one hand, and investment and credit demand are each not perfectly identical concepts. We will here look at supply and demand, even though this closely resembles the logic from section 4 and delivers the exact same result. Credit supply is given by the current incomes of only lenders and credit demand by the additionally needed funds of those agents that are eligible to borrow and invest. Credit supply is hence given by $s\int_0^{\tilde{i}_t} I_t^i di$ and credit demand is given by $(1-\tilde{i}_t) - s\int_{\tilde{i}_t}^1 I_t^i di$. Whereas the former is strictly increasing, the latter is strictly decreasing in in $\tilde{i}$. Equality of the two again determines $\tilde{i}_t$. This is illustrated in Figure 7. The income of agent $\tilde{i}_t$, i.e. $\tilde{I}_t$,

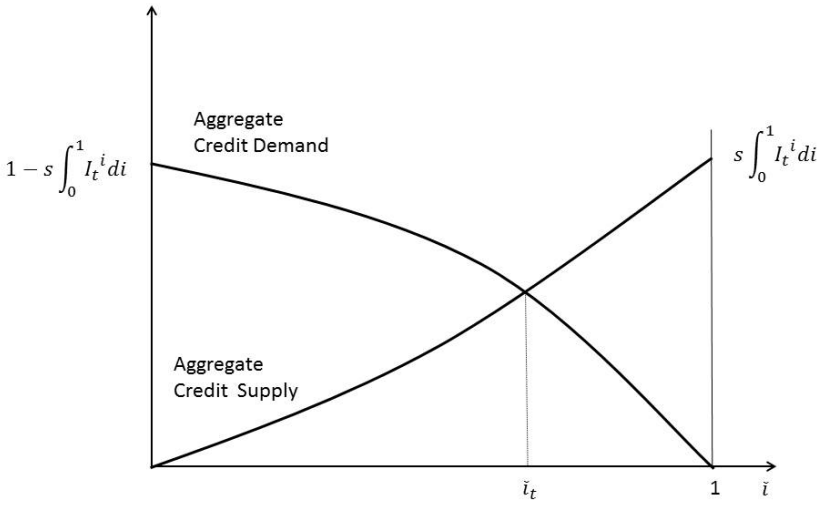

Figure 7: Autarky credit market equilibrium, supply and demand

determines the interest rate r_{t+1} by (8) in any period, such that aggregate savings can be invested in every period.

B Conditions on Assumption 1

We want to show under which conditions the income of lenders, ${}^{L}I^{i}_{t+1} = r_{t+1}sI^{i}_{t} + w(k_{t+1})$, is increasing over time.
Dropping the individual index for readability, this condition is given by $w_t + r_t s I_{t-1} > I_{t-1} \forall t$. Inserting (8) and rearranging yields:

$$I^2_{t-1} - \frac{1 + sw_t - s\lambda f'(k_t)}{s} I_{t-1} + \frac{w_t}{s} > 0 \tag{27}$$

The LHS is an upward opened parabola. Solving for its zeros yields

$$I_{t-1;1,2} = \frac{1 + sw_t - s\lambda f'(k_t)}{2s} \pm \sqrt{\left(\frac{1 + sw_t - s\lambda f'(k_t)}{2s}\right)^2 - \frac{w_t}{s}} \tag{28}$$

Now, we have to make some case distinctions:
a) For $\left(\frac{1+sw_t-s\lambda f'(k_t)}{2s}\right)^2 < \frac{w_t}{s}$, this has no solutions. Therefore for all I_{t-1}, The LHS of (27) is positive and income is unambiguously increasing.
b) If $\left(\frac{1+sw_t-s\lambda f'(k_t)}{2s}\right)^2 > \frac{w_t}{s}$ holds, such that (28) has two solutions, two cases may occur:
i)$1 + sw_t - s\lambda f'(k_t) < 0$. This is the case if the marginal product of capital is high and the wage rate rather low, i.e. especially likely in the beginning of the growth process. Because $\frac{w_t}{s} > 0$, both are in the negative range of I_{t-1}. Therefore, for all positive values of I_{t-1}, condition (27) still holds, and income is further increasing (Note, that first period income is always positive). ii)If $1 + sw_t - s\lambda f'(k_t) > 0$, the zeros are in the positive range of I_{t-1}, such that for some incomes in between, we may have a decreasing income. Note, that this is the case only if the wage rate is sufficiently high compared to the return to physical capital, i.e. this would in any case only occur towards the end of the growth process.
We can see that, with the evolution of the return to capital throughout the growth process, the likelihood runs from case b)i) to case a) to case b)ii). Note also, that even in the last case, if income is already sufficiently high (i.e. greater than the solutions to (28), it will further increase anyway. However, to avoid taxonomical exposition, we can easily assume that even in the steady state, where (27) is most likely not to hold, it will still hold, i.e. we assume:
If

$$1 + sw^* - s\lambda f'(k^*) > 0$$

then

$$\left(\frac{1+sw^*-s\lambda f'(k^*)}{2s}\right)^2 < \frac{w^*}{s}$$

In words, this is equivalent to assuming that the return to investment in physical capital is still sufficiently high throughout the growth process up to the steady state.