Financing FDI into Developing Economies and the International Transmission of Business Cycle Fluctuations

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JEL-Classification: D82, F23, G15
Keywords: multinational corporations, foreign direct investment, financial constraints, investment fluctuations

> […] cyclical swings, which are reflected in the earnings situation of German subsidiaries located in other countries, can be transmitted rapidly to groups as a whole through these [internal] financial links and can affect not only local investment activity but potentially also investment in the parent company's country of domicile. (Deutsche Bundesbank, 2003, p. 65)

1. Introduction

The ongoing process of financial integration has been associated with a remarkable increase in the volumes of cross-border capital flows.[1] But developing and industrial countries have differed according to their respective structures of international capital flows: in the 1990s net capital inflows to industrial countries were dominated by bonds, then bank loans, and finally foreign direct investment (Hull and Tesar, 2001), whereas the bulk of inflows to developing economies was foreign direct investment with a share in overall private inflows of nearly 60 percent and bank loans played only a minor role with a share of

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1 Several indicators of financial integration are (controversially) discussed in the literature, such as interest parity tests (Frankel, 1992), tests of correlations between domestic savings and investments (Feldstein and Horioka, 1980; Tesar, 1991), and tests of international portfolio diversification across countries (Tesar and Werner, 1992) to name just a few (an overview is given by Obstfeld, 1995). For an emprical analysis of the determinants of gross and net capital flows see Buch and Pierdzioch (2001).

about 8 percent between 1991 and 2000 (Source: WORLD BANK, 2002, own calculations).

There is a large and ever growing literature dealing with foreign direct investment (FDI) into developing or transition economies. One strand of this literature takes a macroeconomic perspective considering FDI as an element of those countries' external finance, while another takes a microeconomic perspective focussing on industrial organisation issues. But none of these approaches takes into account that multinational corporations (MNC) may need to raise funds externally for their investments but suffer from a financial constraint.

Resting on the notion of a financially constrained MNC, this paper looks at one key mechanism through which country-specific macroeconomic disturbances are transmitted from industrial to developing countries and vice versa, a topic that has been to date of minor interest to economists (cf. IMF, 2001).[2] Basically, two effects of those shocks on the combined investment decision of MNCs are conceivable: (1) A negative shock on one project induces the MNC to shift its scarce funds in favour of the other project; this type of winner picking by the MNC headquarters is denoted here as the *substitution effect*. (2) A negative shock on either project causes harm to the financial standing of the MNC compelling it to reduce investment in both projects, an effect which is called the *lending effect*.

This paper aims at identifying what determines the dominance of either effect in order to draw conclusions for the direction of the international transmission of business cycle fluctuations. This is an issue of broad relevance, since traditional transmission channels – such as trade balance movements – appear to have declining explanatory power (IMF, 2001). We think that considering the investment behaviour of MNCs as an alternative transmission channel is fairly appropriate, the more so as the significance of multinational corporations as major investors in developing countries has been increasing considerably (UNCTAD, 2002):[3] Nowadays the ratio of FDI flows into these countries to total private

2 Recent studies by PEEK and ROSENGREN (2000) and by KLEIN, PEEK and ROSENGREN (2002) provide evidence that multinational corporations and banks constitute an independent channel for the international transmission of shocks between industrial countries. Both papers argue that the recent banking crisis in Japan has reduced loan supply both in Japan and the U.S. affecting also the real economic activity in the latter. The first paper focuses on a lending channel through Japanese banks operating internationally, and the second on the investment behaviour of financially constrained Japanese MNCs.

3 At least 60 percent of FDI into developing countries are greenfield investments, where MNCs start a new plant from scratch and thereby make real investments instead of merging or acquiring existing local firms, which is merely a change of ownership (UNCTAD, 2000).

Table 1: FDI Inflows as a Percentage of Gross Fixed Capital Formation 1996–2001, Selected Developing Countries

Country	1996	1997	1998	1999	2000	2001
Bulgaria	8.1	46.1	33.2	41.4	51.7	32.8
Chile	23.2	23.5	22.3	56.9	22.9	31.4
Colombia	14.8	25.8	15.2	12.7	21.1	21.8
Czech Republic	7.7	7.9	22.3	41.3	34.3	35.6
Estonia	12.9	20.6	37.6	23.5	32.9	37.8
Hungary	23.5	21.3	18.3	17.2	14.6	20.1
India	2.9	4.0	2.9	2.2	2.3	3.2
Korea, Rep. of	1.2	1.7	5.7	8.3	7.1	3.1
Malaysia	17.0	14.7	14.0	22.2	16.5	2.5
Mexico	16.7	18.1	13.8	12.6	12.6	20.7
Morocco	5.0	17.2	5.3	16.5	5.3	37.2
Nigeria	20.2	16.4	11.9	52.1	49.4	31.3
Philippines	7.8	6.3	12.5	11.9	9.7	8.0
Russian Federation	2.9	5.9	5.7	11.9	6.7	4.3
Tunesia	7.7	7.8	13.6	7.0	15.2	9.3
Turkey	1.6	1.6	1.9	1.9	2.2	12.4
Uruguay	4.8	4.0	4.8	7.9	10.3	14.0
Memorandum: All developing countries, excl. China	7.9	10.6	11.7	15.3	16.0	13.6

Note: China is excluded owing to its dominating role as the largest user of FDI among developing countries (see IMF, 2001).
Source: UNCTAD (2003), FDI/TNC database.

investment approaches nearly 15 percent on average, while some transition economies in Eastern Europe and developing countries in Latin America exhibit even higher measures (see Table 1).

To cope with this issue theoretically we need a better understanding of the internal capital allocation *within* MNCs. We start out with the observation that FDI is both an instrument to *fund investment projects* in developing countries (according to the macroeconomic perspective) and to *diffuse technology and entrepreneurial skills* (according to the industrial organisation perspective).[4] We consider a non-

4 Borensztein, De Gregorio and Lee (1998) provide evidence that foreign direct investment is a driving force for economic growth mainly due to transferring technological progress to developing countries.

financial MNC, whose parent is based in an industrial country and its business will hereinafter be referred to as the domestic project. The MNC affiliate, on the other hand, resides in a developing country and will be referred to as the foreign project. External funds are needed to finance both the domestic and foreign project if the MNC does not possess sufficient own resources. In a world of frictionless capital markets with comprehensive financial contracts the MNC simply borrows the amount needed, either at home or on the international capital market, or even in the host country, irrespective whether funds are provided through banks or directly by households. As a result, marginal returns on investment in both countries are always balanced with the marginal costs of capital.

But it is reasonable to suppose that there are typical difficulties the MNC faces to obtain external funds: First, loanable funds in developing economies are scarce due to underdeveloped financial markets. It is therefore difficult to raise funds in a developing country to finance a project there. Second, legal systems and institutions in developing countries are frequently inadequately developed, so it is hard to enforce any cross-border financial contract. This lack of enforceability forms an obstacle for any type of cross-border external funding of the foreign project.

For both these reasons, the MNC parent raises external funds at home, which are thereafter allocated internally to its affiliate. Since running a foreign affiliate is, however, typically associated with a transfer of specific knowledge (BLOMSTRÖM and KOKKO, 1998) creditors of the MNC have to be aware of the following holdup problem (HART and MOORE, 1994): Though financiers provide funds at an early stage of the project, the MNC may later on refuse to contribute its specific entrepreneurial and technological skills unless loan obligations are renegotiated. If financiers are not willing to renegotiate or if renegotiations fail, the physical assets of the projects may be seized. But because the projects are of low value to the financiers without the specific skills of the MNC, liquidation will yield a comparatively low return where in the presence of country-specific transaction costs the proceeds from the foreign affiliate are even smaller than those from the MNC parent. It turns out that, when the collateral values of the projects diverge, the MNC's decision of how to split funds between the domestic and foreign project is interrelated with the willingness of financiers to grant a loan. As a consequence, the MNC may be willing to forgo investment returns abroad to ease its financial constraint.

Applying this renegotiations approach to the investment decision of MNCs, this paper asks how country-specific macroeconomic shocks are transmitted internationally through internal capital markets of MNCs. We consider variations in factor productivity and argue that a joint financial constraint gives rise to cross-

border spillover effects on investment, which appear to be asymmetric. More precisely, since the (marginal) liquidation value of the MNC affiliate is less than that of the MNC parent, investment of the foreign affiliate is likely to respond adversely to a negative country-specific shock to the MNC parent (i. e. there is a relatively strong lending effect), whereas domestic investment is less affected by a negative shock of the same magnitude to the MNC affiliate and may even increase (i. e. there is a relatively strong substitution effect).

The line of arguments given in this paper is related to the contemporary theory of internal capital markets analysing the allocation of funds among divisions of conglomerate corporations (e. g. Stein, 1997), but contrary to most studies concerned with internal capital markets our approach deals with the interrelation of external financing constraints and the internal allocation of funds explicitly. Hence our model is most closely related to Inderst and Müller (2003), who investigate the effects of optimum financial contracting on the efficiency of internal capital markets using Jensen's agency theory of free cash flows. However, unlike Inderst and Müller (2003), our approach asks in a debt renegotiation model how capital is allocated internationally given that there are country-specific costs in utilising loan collaterals. As we assume that there are no informational or enforcement problems *within* MNC's we do not analyse explicitly the functioning of internal capital markets as for example Inderst and Laux (2001) do.

The assumptions made in this paper are similar to those in Albuquerque (2003). But unlike Albuquerque (2003) we do not deal with the relative variability in the different components of capital flows to developing countries. Instead, the paper asks how a financially constrained MNC decides how funds are shared between investments in the domestic parent and foreign affiliate. In so doing, the paper also differs from most studies concerned with international capital flows, which assume that international investors are not financially constrained but only borrowers in developing economies are (see for example Razin, Sadka and Yuen, 1999; Caballero and Krishnamurthy, 2001).

Since we are finally interested in the effects of macroeconomic disturbances on the international investment allocation of MNCs, this paper is also related to the literature on international business cycles. The standard real business cycle models for open economies, typically relying on perfect capital markets, fail to explain the positive international co-movements in investment: for example, the correlation of investment in the US and in Europe is 0.5 on average; the model, however, predicts negative cross-country correlations basically because capital always tends to move to that location with higher productivity (Backus, Kehoe and Kydland, 1993), a result that is quite robust against various model modifications (see discussion in Baxter, 1995). One of the most promising ways to

cope with this puzzle is to incorporate some frictions in financial markets. For example, KEHOE and PERRI (2002) approach this problem by incorporating an aggregate financial constraint on international trade, assuming that cross-border debt claims can be enforced only by threatening the whole economy with being excluded from future intertemporal and international trade.

Our model provides an alternative rationale for such co-movements resting also on the notion of imperfect capital markets but stressing the role of financially constrained MNCs. Basically, the paper shows that if the banker's ability to extract payments from the foreign affiliate without employing the MNC's specific skills is poor, the investment cycle in developing countries tends to depend positively on investment fluctuations in industrial countries – even beyond traditional transmission channels such as trade balance movements.

The paper is organised as follows. Section 2 introduces a fairly standard model of debt renegotiations with a single investment project. Section 3 applies the model to the combined investment decision of an MNC and presents the results. Section 4 discusses the main results and confronts them with some stylised facts about fluctuations in developing economies. The final section consists of concluding remarks.

2. A Model with a Single Investment Project

Consider an entrepreneur who at date T has access to a project. Let I denote capital investment at this date and W the entrepreneur's initial financial wealth. Suppose that the project yields a safe return $R(I)$ at date $T+1$ if and only if he contributes his specific technological or managerial skills at some intermediate date $T+\delta$. R is strictly concave, twice continuously differentiable, and satisfies $R'(0) = \infty$ and $R'(\infty) = 0$. If the entrepreneur does not provide his human capital, the physical assets of the project must be liquidated. The proceeds of liquidation are given by $L(I)$ where L is a continuously differentiable, concave function satisfying $L(0) = 0$ and $L'(I) \leq 1$. These assumptions imply: (1) liquidation does not yield returns to recover more than the funds invested in the project, and (2) additional investment does not increase liquidation proceeds more than directly proportionally.[5] Finally, let $\gamma > 1$ denote the marginal return on an alternative investment determined by the world capital market interest rate.

5 These assumptions are justified by everyone's lack of specific knowledge of how to extract payments from the project's assets at best without employing the entrepreneur's specific skills.

When the resulting first best investment I_{fb} (satisfying the first order condition $R'(I_{fb}) = \gamma$) is larger than the initial financial wealth of the entrepreneur, he may raise a loan from a banker amounting to $I_{fb} - W$. According to Hart and Moore (1994) financial contracts may be unenforceable, however, when the entrepreneur cannot commit himself at T to contribute his specific human capital to the project at $T + \delta$. Hence, even though at T funds are invested and repayments payable to the banker at $T + 1$ are agreed upon, the entrepreneur might initiate renegotiations at $T + \delta$ to beat down repayments by the threat of withdrawing his specific skills. The outcome of renegotiations z is taken to be given by the Nash-bargaining solution taking into account that, when renegotiations fail, the banker assumes control over the physical assets of the project (e. g. machinery and real estate) and liquidates in accordance with the underlying standard debt contract.[6]

To simplify matters and without loss of generality, we assume throughout the paper $L(I) = \beta I$, where $\beta \in [0,1]$. The outcome of renegotiations z is therefore given by

$$z = \alpha R(I) + (1 - \alpha)\beta I \tag{1}$$

where $\alpha \in (0,1)$ is a measure of the banker's exogenous bargaining power.[7] Hence, z is strictly increasing in I because higher investment at T increases the entrepreneur's opportunity costs of failing renegotiations but also the banker's liquidation value. Both effects strengthen the impact of the banker's threat point on the outcome of renegotiations but are less strong for higher investment levels, i. e. z is also strictly concave in I.

As banks are competitively organised, the repayment obligation initially agreed upon at T equals the opportunity costs of external funds and the entrepreneur will not initiate renegotiations as long as these repayments are smaller than the outcome of renegotiations at $T + \delta$:

6 There is a similar holdup problem between the banker and its ultimate financiers. If a banker has specific skills to collect loans, for example because only the banker knows how to bring out the best liquidation value of physical assets, she might refuse to use these specific skills on behalf of financiers. However, as Diamond and Rajan (2001) show, the banker is disciplined by a deposit contract which is subject to a bank run.

7 In a non-cooperative game setting suppose that in the course of renegotiations the banker can make a take-it-or-leave-it offer with probability α whereas $1 - \alpha$ is the corresponding probability that the entrepreneur is to make a take-it-or-leave-it offer. In this setting, α might be interpreted as a measure of the development of the legal system: the higher α, the better a banker's claims on borrowers are protected by law.

$$\max\left[\gamma(I-W),0\right] \leq \alpha R(I)+(1-\alpha)\beta I \tag{2}$$

Condition (2) implies that the banker's willingness to grant a loan is restricted by some linear combination of the project's cash flow $R(I)$ and its collateral value βI. Moreover, condition (2) defines an I_{crit} as a continuously differentiable and increasing implicit function of W satisfying (2) with equality, which gives an upper bound for investment: for any investment above I_{crit} the entrepreneur certainly refuses to fulfill the contract and renegotiations take place. Because the outcome of those renegotiations is smaller than the opportunity costs of provided funds, bankers are *ex ante* not willing to supply funds for any investment above I_{crit}.

According to HART (1995) we obtain

Proposition 1. Let I^* denote the actual investment chosen by the entrepreneur. If W is sufficiently large, the MNC does not suffer from a financial constraint, so that $I^* = \{I_{fb} : R'(I_{fb}) = \gamma\}$. As W decreases, a financial constraint becomes binding if the bargaining power of the banker fulfills

$$\alpha < \alpha_{crit} := \frac{(\gamma-\beta)I_{fb}}{R(I_{fb})-\beta I_{fb}} < 1$$

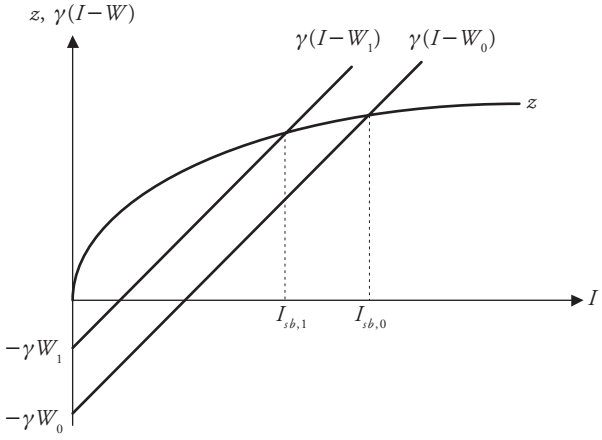
implying $I^* = \{I_{sb} : \gamma(I_{sb}-W) = \alpha R(I_{sb})+(1-\alpha)\beta I_{sb}\} < I_{fb}$ and $\partial I_{sb}/\partial W > 0$.

Proof. For very large W the financial constraint (2) is not binding and the first best investment strategy I_{fb} is feasible. Investment will not be affected by decreasing wealth as long as (2) is still fulfilled for $I = I_{fb}$. By the intermediate value theorem the financial constraint becomes, however, binding for some $W_{crit} \in (0, I_{fb})$ if the bargaining power of the banker α is strictly less than some α_{crit}, where α_{crit} is implicitly defined by

$$\gamma I_{fb} = \alpha_{crit} R(I_{fb}) + (1-\alpha_{crit})\beta I_{fb},$$

i. e. where (2) holds with equality for $I = I_{fb}$ and $W = 0$ (since $\beta \leq 1 < \gamma$ it follows $\alpha_{crit} < 1$). In that case, the entrepreneur is restricted by a financial constraint and he will choose the maximum investment meeting (2) with equality. By the implicit function theorem, this second best investment I_{sb} decreases if financial wealth further declines (see Figure 1).

Figure 1: Financial Wealth and Investment of Financially Constrained Firms ($W_0 > W_1$).



3. Investment Behaviour of MNCs

Next consider an internationally operating entrepreneur with investment opportunities at home and abroad. To focus on problems in financial contracting it is assumed that, beyond its liquidation value, the foreign project is worthless without the skills of the domestic entrepreneur but has the same value as the domestic project otherwise, i. e. the production function R also applies to the foreign affiliate. If financial markets were perfect, the associated first order conditions would require that the marginal returns on investment at home and abroad are always balanced and equal the marginal opportunity costs of investment. Hence, it would follow $I_{fb} = FDI_{fb}$ where FDI denotes investment of the foreign affiliate.

As noted in the introduction, developing economies suffer from scarcity of loanable funds, and the enforceability of debt claims in these economies is frequently very difficult because of underdeveloped legal systems (for the latter see also Markusen, 2001).[8] However, Hausmann and Fernandez-Arias (2001) find that FDI serves as a substitute for underdeveloped legal and financial

8 The shortcoming in developing countries' legal systems can be captured formally by an even weaker bargaining power of a banker vis à vis borrowers in developing economies, i. e. α approaches zero.

institutions (see also RAZIN, 2003). They argue that, though international investors bridging the financial gap are not protected by developing countries' law, profitable investment projects in these countries become feasible when international investors are directly provided with residual control rights over their foreign assets.[9]

From this point of view, the internal capital market allows the MNC to borrow at home and to use these funds (partly) for investment in the developing country. Nevertheless, the MNC might initiate renegotiations with the domestic banker in order to beat down total loan repayments. For these renegotiations, suppose that a domestic banker has even fewer skills to liquidate foreign assets, an issue justified in the presence of additional transaction costs. One may think of these costs as those the banker has to bear in order to find a potential buyer of the assets. This is a bold venture, particularly in developing countries, since the value of the physical assets to local firms as potential buyers is very low when they do not possess any of the specific skills needed to use the physical assets appropriately. Precisely, we assume that liquidation of the foreign project yields only a fraction $\mu \leq 1$ of the liquidation proceeds of a domestic project of same size.

Finally, suppose that the MNC's initial financial wealth is confined to its parent but that its internal capital market functions without friction, i. e. the MNC is able to allocate funds internally such that its overall profits are maximised.

By applying the same structure of renegotiations as above, investments of MNCs are hence restricted by[10]

$$\max\left[\gamma(I + FDI - W), 0\right] \leq \alpha\left[R(I) + R(FDI)\right] + (1-\alpha)\left[\beta\left(I + \mu FDI\right)\right] \quad (3)$$

9 This is generally consistent with observations that foreign direct investment plays a predominant role in international capital flows to developing economies. However, our motivation for the dominance of foreign direct investment does not rely on the assumption that domestic lenders have less information on foreign entrepreneurs' probability of success than foreign lenders (as for example in RAZIN, SADKA and YUEN 1998), which might even be true between developed countries. Instead, the reason here is given by the underdeveloped legal system in developing economies, which makes it more difficult to enforce debt or loan repayments in those countries. That means that direct external funding of the affiliate is too costly.

10 The derived financial constraint fits well with evidence for FDI projects of German MNCs in Eastern Europe (MARIN, LORENTOWICZ and RAUBOLD, 2003): about 83 percent of the foreign projects are financed by internal funds (W in our setting) or by a mixture of external and internal funds whereby loans raised by the German parent from a bank located in Germany are the predominant source of external funds with a share of 43 percent in total external finance.

In the following we draw conclusions concerning the combined investment decision of the MNC.

3.1. Financially Unconstrained Multinationals

In the first place, analysis of an unconstrained MNC serves as a benchmark for the interrelated domestic and foreign investment decision as a response to macroeconomic shocks. For the sake of simplicity, we assume throughout the paper that these shocks occur before contracts are written and investments are placed. A shock induces a percentual shift in the factor productivity measured by some $\varepsilon \in \mathbb{R}$, and a project's return is then given by $(1+\varepsilon)R(\cdot)$. In what follows, we refer to shock as a *deterioration* of the factor productivity. The results for the benchmark case are given by

Proposition 2. For unconstrained MNCs it follows:

1. The first best investment strategy is executed in both countries.
2. Investment does not vary in either country following an intra-marginal change of wealth.
3. A country-specific shock to the factor productivity at home does not affect FDI and vice versa.

Proof. See Appendix.

The proposition states that, if the financial constraint is not binding owing to either sufficiently large financial wealth or strong bargaining power of the banker, the investment strategy is determined by the counterbalance of the marginal returns on the investments in both countries and the marginal opportunity costs of investment. As long as lower wealth does not lead to a financial constraint, this strategy is independent of the precise amount of financial wealth and of the occurrence of shocks. The latter implies that investment only responds in the country where the shock arises.

The results of the model change substantially, however, when we consider a financially constrained MNC.

3.2. Financially Constrained Multinationals

3.2.1. Symmetric Liquidation Skills

At first, we ignore country-specific transaction costs, i. e. collateral values of projects do not diverge ($\mu = 1$). In that case we have

Proposition 3. For constrained MNCs, for which $\mu = 1$ holds, it follows:

1. Underinvestment in both countries occurs symmetrically.
2. Investment at home and abroad will be reduced symmetrically following a decrease of financial wealth.
3. An adverse country-specific shock to the factor productivity lowers investment in the country where the shock occurs while also affecting investment in the other country, but whether the latter effect is positive or negative is ambiguous. However, irrespective of that sign, the investment in that country where the shock arises bears the brunt of it.

Proof. See Appendix.

The first and second results are straightforward because there are no fundamental differences between the projects if liquidation skills are symmetric. Hence, the firm invests in such a way that marginal returns of both projects are balanced. When the financial constraint is further tightened due to decreasing financial wealth, investment in both countries will be reduced by the same amount.

An adverse technological shock to the domestic project influences the optimum investment decision twofold. On the one hand, since marginal returns on investments have to be balanced, the MNC substitutes domestic investment in favour of FDI. That is to say the MNC shifts its scarce funds towards its foreign affiliate in response to a shock affecting the parent. This type of winner picking is beneficial because the financial constraint results in an overall underinvestment. On the other hand, the financial constraint is tightened by the shock because maximum pledgeable repayments fall due to a decreasing domestic cash flow. We refer to this effect as the lending effect by which the firm is forced to reduce domestic as well as foreign investment. Even though both the substitution and the lending effect operate in the same direction concerning domestic investment, the net effect on FDI is ambiguous.

As regards the dominance of either effect on FDI, we deliver more detailed arguments for alternative parameter settings. First, if the bargaining power of the banker α is too strong, the financial constraint is not binding at all and first

best investments in both countries are feasible irrespectively of the occurence of shocks (see proposition 2). Second, if the bargaining power of the banker α is too weak, the projects' cash flows scarcely influence the maximum pledgeable repayments. The banker is only concerned with the collateral value of the projects. These values do not diverge and are not affected by macroeconomic shocks.[11] Hence, the banker is completely indifferent whether funds are invested at home or abroad and her willingness to grant a loan is not affected when the MNC simply shifts funds from one project to the other, holding total investments almost unchanged.[12] The lending effect can therefore be neglected.

Third, if α takes some intermediate value, the lending effect dominates the substitution effect if (see Appendix)

$$\frac{\alpha R(I)}{(\gamma-\beta)-\alpha(R''(I)-\beta)} > -\frac{R'(I)}{R''(I)}. \tag{4}$$

In general, this condition is likely to hold when the shock does affect pledgeable repayments noticeably through its influence on the project's cash flow (α is not too small), and when the opportunity costs of failing renegotiations $\gamma-\beta$ are small (i. e. any fall in domestic investment does not ease the financial constraint too much). Both imply that substituting funds is not sufficient to restore the creditworthiness of the MNC. The MNC therefore has to curtail investment abroad to meet its tightened financial constraint. (Since these requirements also imply a low W_{crit}, only a few MNCs may need to reduce investment abroad.) Altogether, since substituting funds alone is insufficient to meet its tightened financial constraint, the MNC has to decrease total investment irrespective of the response of FDI owing to the operative lending effect. But since the lending effect becomes an equal burden for both domestic and foreign investment, the bulk of the shock is absorbed by the investment in that country where the shock occurs because of the substitution effect.

Finally, note that country-specific shocks abroad have laterally reversed effects because of the strict symmetry of the projects.

11 This assumption can be justified as follows: if the banker has to liquidate a project she has to find an entrepreneur who will redeploy the physical assets of the project. Because of his lack of specific skills the purchaser can use these assets to produce low value added manufactures only. But this production is less vulnerable to domestic shocks, so that in turn the liquidation value of the project is barely affected by those shocks.

12 This holds true as long as the liquidation function L is linear. The willingness to grant a loan is still affected even with very small α when L is strictly concave.

3.2.2. Asymmetric Liquidation Skills

As mentioned above, it is reasonable to suppose that in developing countries it is even more difficult to liquidate physical assets than in industrial countries. For this case, the associated results are summarised as follows:

Proposition 4. For constrained MNCs, for which $\mu < 1$ holds, it follows:

1. Underinvestment in both countries occurs but is more severe abroad than at home.
2. Investment at home as well as abroad will be reduced following a decrease in wealth. The share of FDI in total investment decreases iff

$$\frac{\gamma - \mu\beta}{\gamma - \beta} > \frac{R''(FDI_{sb})}{R''(I_{sb})}.$$

3. If the share of FDI in total investment decreases in response to changes in financial wealth, then domestic investment is likely to increase following a shock to the MNC affiliate but FDI is likely to decrease following a shock to the MNC parent.

Proof. See Appendix.

It is always optimal for a constrained MNC to invest fewer funds in the foreign project when the banker has fewer skills in liquidating foreign assets. This result is driven by the need to trade off not only the marginal returns on the investments in various countries but also to take into account the different effects of these investments on the strength of the financial constraint. Since foreign assets are less valuable to a banker than domestic assets, her willingness to grant loans is even more restricted when the firm uses funds for FDI. Hence, a firm is willing to forgo investment returns abroad in favour of financial easing.

Both domestic and foreign investment projects suffer from a tightening of the financial constraint owing to decreasing wealth but FDI bears the brunt of it, i. e. the share of FDI in total investment decreases, iff

$$\frac{\gamma - \mu\beta}{\gamma - \beta} > \frac{R''(FDI_{sb})}{R''(I_{sb})}.$$

This condition requires that shifting one extra dollar away from the domestic to the foreign project increases the banker's costs of failing renegotiations by more than the additional total return on investment. Hence, the MNC is, at the

margin, not inclined to further substitute domestic investment in favour of foreign investment when the associated additional tightening of the financial constraint outweighs the additional total return. This condition holds either if both μ and $\gamma - \beta$ are small or if $\frac{d}{dx}(-R''(x)/R'(x)) > 0$: when the foreign project's marginal collateral value is much lower in comparison to the domestic project (i. e. μ is small) and when the domestic project's collateral value is large compared to the opportunity costs of funds (i. e. $\gamma - \beta$ is small), then the banker's marginal costs of failing renegotiations are much higher when the MNC invests in the foreign project. Hence, since the financial constraint is only slightly affected by variations in domestic investment if $\gamma - \beta$ is small, the MNC will reduce FDI in response to a financial tightening. And this strategy is even more profitable if μ is very small (since the banker honors smaller investments abroad by a substantially eased financial constraint) and, in a way, irrespective of its opportunity costs, which may come from resulting differences in the marginal products of investment. However, a sufficient condition for proposition 4, part 2, to be generally true for any $\mu < 1$ is to require $\frac{d}{dx}(-R''(x)/R'(x)) > 0$, which means that, beyond decreasing marginal returns, the relative change in marginal returns increases with increasing investment (see Appendix).

Proposition 4, part 3, summarises the results of country-specific shocks for $\mu < 1$. Again, a substitution and a lending effect have to be taken into account, but they differ in their relative magnitudes depending on where the shock arises. As in the case of symmetric liquidation skills, we examine the effects of shocks in more detail for different parameter settings: First, if α is too large banker's liquidation skills are irrelevant, i. e. first best investment in both countries is feasible and no spillover effects arise. Second, if the bargaining power of the banker is too weak then the lending effect of the shock is weak as well. Hence, the substitution effect dominates as a result of which investment declines in the country where the shock occurs while investment in the other country rises. However, when

$$\frac{\gamma - \mu\beta}{\gamma - \beta} > \frac{R''(FDI_{sb})}{R''(I_{sb})}$$

holds, FDI increases only slightly if the shock arises at home, whereas domestic investment increases sharply if the shock arises in the developing country. This is because any variation in FDI influences the financial constraint significantly while variations in domestic investment have only slight effects on it.

Finally, consider the case of intermediate bargaining power on the part of bankers. When the shock hits the MNC parent, the argumentation is similar to the case of symmetric liquidation skills with one important exception: although

the impact of the shock on domestic investment is undoubtedly adverse, FDI is now likely to be affected adversely too. This is because the MNC is not inclined to substitute domestic investment in favour of FDI to a great extent since, despite devaluation of the domestic project due to the shock, any shift away from domestic investment tightens the financial constraint sharply as foreign collaterals are of low value to the banker. That is, the substitution effect is relatively weak, whereas the lending effect is relatively strong.

The relative magnitudes of the lending and substitution effects are different when the shock emerges in the developing country. In that case, domestic investment is likely to increase following the shock. The reason is that the willingness of the MNC to substitute the even less profitable FDI in favour of domestic investment is much greater because the banker rewards lower foreign investment by a vigorously increasing willingness to lend. The resulting ample financial scope is used by the MNC primarily to facilitate the domestic project, which does not suffer from the productivity shock. Moreover, since the shock worsens the productivity of the project with a comparatively low investment and low return, its quantitative impact on the MNC's total cash flow is weak, so that the lending effect is not as strong as when the shock affects the domestic project.

Table 2 summarises the main results from propositions 3 and 4 assuming that

$$\frac{\gamma-\mu\beta}{\gamma-\beta} > \frac{R''(FDI_{sb})}{R''(I_{sb})} \text{ holds.}$$

Table 2: Response of a Financially Constrained MNC's Domestic and Foreign Investment to Variations in Wealth and to Country-specific Shocks

	domestic investment	**foreign investment**
symmetric liquidation skills		
responses to		
declining wealth	symmetrically decreasing	
a shock in the industrial country	decreasing	ambiguous
a shock in the developing country	ambiguous	decreasing
asymmetric liquidation skills		
responses to		
declining wealth	weakly decreasing	strongly decreasing
a shock in the industrial country	decreasing	ambiguous, likely to decrease
a shock in the developing country	ambiguous, likely to increase	strongly decreasing

3.3. Extensions

In this section we discuss some further implications of the model for which, for the sake of brevity, we restrict ourselves to the case $\mu < 1$. At first, we look at the response of the optimum investment policy to an increase of the world capital market interest rate and obtain

Proposition 5. A rising world capital market interest rate results in decreasing investment at home whereas the effect on FDI is ambiguous.

Proof. See Appendix.

Prima facie the second conclusion is somewhat surprising. To shed some light on it inspect first the financial constraint (3). It says that an increase in γ tightens the financial constraint as it raises *ceteris paribus* the face value of debt, which is, however, not renegotiation-proof. The firm must therefore reduce total investment spending to meet the lessened supply of external funds. But in addition to this lending effect a substitution effect is also at work. This effect arises since an increase in the world capital market interest rate changes the banker's relative marginal costs of failing renegotiations given by $(\gamma - \mu\beta)/(\gamma - \beta)$. This ratio is decreasing in γ, i. e. a rise in the interest rate increases the marginal costs of failing renegotiations associated with foreign investment $(\gamma - \mu\beta)$ by less than those associated with domestic investment $(\gamma - \beta)$. The reason is that, when γ increases then differences between the projects' payoffs from liquiation become less significant for the relative marginal costs of failing renegotiations. The MNC may therefore be more inclined to substitute funds in favour of its affiliate towards balanced marginal products of capital.[13] However, this substitution effect may be relatively weak in comparison to the lending effect on foreign investment, which is rather strong as foreign investment suffers more from any tightening of the financial constraint than domestic investment.

The second extension considers the response of investment policy to a change in μ for which we derive

Proposition 6. A worsening of a banker's ability to liquidate foreign assets results in decreasing investment abroad whereas the effect on domestic investment is ambiguous.

13 Note, as μ reaches unity the substitution effect vanishes and both *FDI* and *I* respond identically owing to the lending effect.

Proof. See Appendix.

Once more, a lending and a substitution effect work here. The lending effect stems from the the fact that foreign assets become even less valuable to the banker when μ falls and, hence, her willingness to lend decreases further. Through this lending effect, the MNC has to curtail both investment projects. On the other hand, the MNC reduces FDI in favour of domestic investment since the financial constraint is substantially eased when fewer funds are invested in those projects which are subject to collateral damage. The lending effect is, however, likely to dominate when the bargaining power of the banker is weak because the banker's willingness to grant a loan depends heavily on the total value of collateral so that any deterioration of the value of physical assets has a strong impact on loan supply.

4. Discussion

Although a sophisticated empirical test of the results is far beyond the scope of this paper, they should be put in perspective with respect to some stylised facts about business cycles in developing economies. Before so doing, recognise that our approach contributes to business cycle theory only if FDI has a significant impact on host countries' real investment. Despite the fact that the ratio of inward FDI flows to total private investment in developing countries is remarkable (see Table 1), it is not beyond dispute (1) whether FDI is actually devoted to physical investment, and (2) whether it is associated with additional funds flowing to the host country. Instead, FDI may merely represent a change in ownership, and FDI projects may continue to be financed through local capital markets. If so, business cycles in developing countries would depend on business cycles in industrial countries merely owing to traditional transmission channels. There is, however, evidence that FDI flows into developing countries actually foster those countries' private investment (see RAZIN, 2003).[14]

Next, we confront the results of our model with selected facts about developing countries' business cycles. To the best of our knowledge, AGÉNOR, MCDERMOTT and PRASAD (2000) analyse the most comprehensive set of macroeconomic variables as determinants of fluctuations in industrial output, documenting a

14 As documented by BOSWORTH and COLLINS (1999) for a sample of 58 developing countries, inward FDI flows have a very strong effect on investment: an increase of a dollar in FDI is associated with a nearly one-to-one increase in domestic investment.

wide range of regularities for a sample of 12 middle-income developing countries.[15] Four of their main findings are particularly worth mentioning in our context (see Table 3): (1) Business cycle fluctuations in developing countries are positively correlated with business cycle fluctuations in industrial countries (see also IMF, 2003), (2) there is no consistent relationship between the trade balance and output fluctuations, (3) the correlation between output and the world capital market real interest rate tends to be positive although there are exceptions,[16] and (4) business cycle fluctuations are more volatile in developing than in industrial countries.

Table 3: Contemporaneous Cross Correlations between Output of Developing Countries and other Selected Macroeconomic Variables

Country	Industrial-Country Output	Trade Balance	World Capital Market Real Interest Rate
Chile	0.52	−0.54	0.17
Colombia	0.43	−0.20	0.22
India	0.24	−0.10	0.29
Korea, Rep. of	0.36	0.04	0.34
Malaysia	0.59	0.16	0.18
Mexico	0.19	−0.71	0.22
Morocco	−0.06	0.31	−0.16
Nigeria	0.03	0.46	−0.01
Philippines	0.53	0.24	0.26
Tunesia	0.45	0.00	0.04
Turkey	−0.14	−0.49	−0.22
Uruguay	0.21	−0.30	0.19
Average	0.28	−0.09	0.13

Note: Stationary components are derived using the Hodrick-Prescott filter. 10 out of these 12 countries are referred to as among the most favoured host economies as a priority location (UNCTAD, 2002)
Source: Agénor, McDermott and Prasad (2000).

15 Moreover, their results seem to be fairly robust across different detrending procedures.
16 The IMF (2001) considering 66 developing countries states that, on average, this correlation is negative and the semi-interest elasticity of output is about −0.3.

The first two findings indicate that even though output fluctuations between developing and industrial countries are positively correlated, they cannot consistently be explained by the traditional trade channel. The model presented in this paper suggests that output fluctuations may correlate even beyond trade relations owing to the investment decisions of financially constrained multinationals.

A positive correlation between the world capital market real interest rate and output in (at least some) developing countries is somewhat hard to explain within standard models of international business cycles. Often it is argued that this correlation comes due to the fact that real interest rates in industrial countries behave pro-cyclical: if industrial countries experience a cyclical upturn, investment spending as well as loan demand increase and thereby raise interest rates. Since output in industrial and developing countries co-move as a result of trade links one would observe an implicit positive correlation between real interest rates and output in developing countries. However, this story suffers by lacking consistent correlations between output and trade balance movements. Our model indicates that there might be a direct link between interest rates and the business cycle beyond trade. According to proposition 5, foreign investment of MNCs may depend positively on interest rates owing to their impact on relative marginal costs of failing renegotiations.[17]

The fourth observation, strongly supported by KRAAY and VENTURA (2001) and by IMF (2001), can also be seen as consistent with our theoretical results. For example, the model predicts decreasing investment spending in both the industrial and the developing country as a result of macroeconomic disturbances to an industrial country. The effect on foreign investment is, however, further amplified since firms located in industrial countries typically suffer from a devaluation of financial wealth associated with a cyclical downturn (e. g. owing to falling asset prices). Hence, according to proposition 4, foreign investment of MNCs exhibit a stronger decline than domestic investment, which is consistent with the observation of a higher volatility in business cycle fluctuations. On the other hand, shocks to developing countries hit foreign investment hardest while domestic investment is barely adversely affected and may even increase, implying also a higher volatility of fluctuations in developing countries.

The result presented in proposition 6 indicates that industrial countries may be affected adversely by a financial crisis in developing countries. Suppose that there

17 This argument is consistent with evidence that equity-based capital flows (portfolio investment and FDI) tend to be positively correlated with the world real interest rate whereas interest-bearing instruments have been negatively correlated (IMF, 2001).

is a currency crisis in a developing country. The devaluation of its currency then implies that the proceeds from selling assets to residents in developing countries are less valuable to a bank based in an industrial country. This is because, on the one hand, residents buying these assets may pay in their own currency; on the other hand, if residents want to pay in foreign currency they may have to borrow to buy the assets. But, if nominal prices are rigid, the depreciation increases their existing foreign debt obligations and thereby results in decreasing proftits. This tightens residents' financial constraint and reduces their ability to buy assets. Altogether, a currency crisis therefore also restricts the MNCs' debt capacity compelling them to reduce domestic investment as well. In this respect, the mechanism is roughly the same as suggested by currency crisis models of the third generation (cf. Aghion, Bacchetta and Banerjee, 2000; 2001) but is extended here to a mechanism through which shocks may be transmitted internationally.

5. Concluding Remarks

The paper gives reasons why FDI makes developing countries vulnerable to business fluctuations in industrial countries. A standard debt renegotiation approach is used to investigate the combined investment decision of a multinationally operating corporation based in an industrial country and planning investment projects both at home and in a developing country. Since investment in the foreign affiliate is associated with a transfer of specific but inalienable technological and managerial human capital, it can hardly be financed by a cross-border debt contract if contracts are not enforcable due to underdeveloped legal systems. Hence the MNC parent has to raise a bank loan at home collateralised by its tangible assets. These assets are, however, of low value to the banker when they are confined to the foreign affiliate. The MNC's decision concerning the allocation of external funds influences, therefore, the willingness of the banker to grant a loan. The main results are twofold. First, a deterioration of the MNC's financial standing, measured by the amount of financial wealth or internal funds, may lead to a sudden stop or even an outflow of FDI. Second, a macroeconomic disturbance in the industrial country is likely to induce a comparatively strong comovement in domestic and foreign investment, whereas a shock of same type and magnitude affecting the developing country is likely to force the MNC to reallocate funds in favour of its parent.

The paper may signpost some further research. For example, in this paper internal capital allocation can be credibly committed to the bank. But what happens if this commitment is not possible, i. e. if the MNC can use the internal

capital allocation strategically to improve its own bargaining position ex post for renegotiations? If so, the banker is even more cautious to lend, while the MNC's reallocation policy depends on the occurrence of asymmetric shocks. Second, what happens if the MNC parent does not have total effective control over its affiliate. For example, suppose that the headquarters has to hire a local manager who is then trained in the first sub-period of the production cycle to conduct the foreign project. At this moment, the manager may exert additional pressure on the headquarters by defecting to set up a competing firm. When the headquarters is not able to prevent the manager from defecting, the foreign affiliate loses value, either because the costs of replacing the incumbent manager are non-negligible or because competition with a new rival reduces the MNC's profits. Anticipating this, the banker's willingness to lend depends on the effectiveness of the MNC's internal governance structure.

Appendix

All results presented in the propositions are derived from the following model:

The MNC faces the following optimisation problem

$$\max_{I,FDI} R(I) - \gamma I + R(FDI) - \gamma FDI \tag{5}$$

$$s.t.$$

$$\alpha\left[R(I) + R(FDI)\right] + (1-\alpha)\beta\left[I + \mu FDI\right] \geq \max\left[\gamma(I + FDI - W), 0\right]$$

The interior solution (I^*, FDI^*) satisfies

$$R'(I^*) - \gamma + \lambda\left[\alpha R'(I^*) + (1-\alpha)\beta - \gamma\right] = 0 \tag{6}$$

$$R'(FDI^*) - \gamma + \lambda\left[\alpha R'(FDI^*) + (1-\alpha)\mu\beta - \gamma\right] = 0 \tag{7}$$

$$\alpha\left[R(I^*) + R(FDI^*)\right] + (1-\alpha)\beta\left(I^* + \mu FDI^*\right) - \gamma(I^* + FDI^* - W) \geq 0 \tag{8}$$

$$\lambda \geq 0 \tag{9}$$

where λ denotes the Langrangian multiplier associated with the financial constraint. Consolidating (6) and (7) gives

$$R'(FDI^*) = \frac{\gamma - \mu\beta}{\gamma - \beta} R'(I^*) - \frac{\gamma\beta(1-\mu)}{\gamma - \beta} \tag{10}$$

To simplify notations, we define

$$\Omega(I) := \big(\gamma - \beta\big) - \alpha\big(R'(I) - \beta\big)$$

$$\Psi(FDI) := \big(\gamma - \mu\beta\big) - \alpha\big(R'(FDI) - \mu\beta\big)$$

so that for $\mu = 1$ it follows $\Omega(x) = \Psi(x)$. Both Ω and Ψ are strictly positive owing to the first order conditions (6) and (7).

Proof of Proposition 2.

1. If the financial constraint (8) does not bind, then, owing to (10), first best investment in either country implies that first best investment in the other country is optimal too, i. e. if $FDI^* = FDI_{fb}$ then $I^* = I_{fb}$ and vice versa, in fact irrespectively of μ (note, first best investment is given by $R'(FDI_{fb}) = \gamma$ and $R'(I_{fb}) = \gamma$ respectively).
2. As long as decreasing W does not imply that (8) becomes binding, first best investments are still feasible irrespectively of the precise amount of W.
3. A country-specific productivity shock either at home ($\overline{\varepsilon}$) or abroad ($\underline{\varepsilon}$) then implies

$$\frac{\partial FDI_{fb}}{\partial \overline{\varepsilon}} = \frac{\partial I_{fb}}{\partial \underline{\varepsilon}} = 0 \tag{11}$$

$$\frac{\partial FDI_{fb}}{\partial \underline{\varepsilon}} = \frac{\partial I_{fb}}{\partial \overline{\varepsilon}} > 0. \tag{12}$$

Proof of Proposition 3.

1. If (8) is not met for (I_{fb}, FDI_{fb}) and $\mu = 1$ then (10) implies $I^* = I_{sb}$ and $FDI^* = FDI_{sb}$ where $I_{sb} = FDI_{sb}$ irrespectively of the level of total investment and, hence, of the MNC's financial wealth.
2. It follows by applying the general implicit function theorem to (8) and (10) that

$$\frac{\partial FDI_{sb}}{\partial W} = \frac{\partial I_{sb}}{\partial W} = \frac{\gamma}{2\Omega(I_{sb})} > 0. \tag{13}$$

3. Responses to country-specific shocks

– at home ($\overline{\varepsilon}$):

At any point (FDI_{sb},I_{sb}) where $FDI_{sb} = I_{sb}$, the comparative statics for $W < W_{crit}$ result in

$$\frac{\partial I_{sb}}{\partial \overline{\varepsilon}} = \frac{1}{2}\left(\frac{\alpha R(I_{sb})}{\Omega(I_{sb})} - \frac{R'(I_{sb})}{R''(I_{sb})}\right) > 0 \tag{14}$$

$$\frac{\partial FDI_{sb}}{\partial \overline{\varepsilon}} = \frac{1}{2}\left(\frac{\alpha R(I_{sb})}{\Omega(I_{sb})} + \frac{R'(I_{sb})}{R''(I_{sb})}\right) \gtreqless 0 \tag{15}$$

where the first quotients in brackets indicate the common responses of the investment in either country to the financial tightening caused by the shock (lending effect) and where the second quotients denote the substitution effect between domestic and foreign investment. If the substitution effect is not too strong, it follows $\partial FDI_{sb}/\partial \overline{\varepsilon} \geq 0$ and from (8) we obtain

$$\frac{\partial W_{crit}}{\partial \overline{\varepsilon}} = -\frac{\alpha R(I_{fb}) + \Omega(I_{fb})\dfrac{R'(I_{fb})}{R''(I_{fb})}}{\gamma} \geq 0. \tag{16}$$

A necessary condition for $\partial FDI_{sb}/\partial \overline{\varepsilon} \geq 0$ is to require

$$\alpha R(I_{sb}) \geq -\Omega(I_{sb})\frac{R'(I_{sb})}{R''(I_{sb})}, \tag{17}$$

which is likely to hold if $\gamma - \beta$ is small and if α is not too small. For $\alpha \to 0$ the sign of $\partial FDI_{sb}/\partial \overline{\varepsilon}$ is unquestionably negative.

Finally, comparing (14) and (15) yields

$$\frac{\partial I_{sb}}{\partial \overline{\varepsilon}} > \frac{\partial FDI_{sb}}{\partial \overline{\varepsilon}} \tag{18}$$

implying that the bulk of the shock is absorbed by the investment in that country where the shock occurs.

– abroad ($\underline{\varepsilon}$):

Because of the symmetry of the projects it follows

$$\frac{\partial I_{sb}}{\partial \underline{\varepsilon}} = \frac{\partial FDI_{sb}}{\partial \overline{\varepsilon}} \tag{19}$$

$$\frac{\partial FDI_{sb}}{\partial \underline{\varepsilon}} = \frac{\partial I_{sb}}{\partial \overline{\varepsilon}} \tag{20}$$

$$\frac{\partial W_{crit}}{\partial \overline{\varepsilon}} = \frac{\partial W_{crit}}{\partial \underline{\varepsilon}}. \tag{21}$$

Proof of Proposition 4.

1. If (8) is not met for (I_{fb}, FDI_{fb}) and $\mu < 1$ then (10) implies $FDI_{fb} < I_{fb}$.
2. By applying the general implicit function theorem to (8) and (10) for $W < W_{crit}$ it follows

$$\frac{\partial I_{sb}}{\partial W} = \gamma \frac{R''(FDI_{sb})}{\Omega(I_{sb})R''(FDI_{sb}) + \dfrac{\gamma - \mu\beta}{\gamma - \beta}\Psi(FDI_{sb})R''(I_{sb})} > 0 \tag{22}$$

$$\frac{\partial FDI_{sb}}{\partial W} = \gamma \frac{R''(I_{sb})}{\Omega(I_{sb})R''(FDI_{sb}) + \dfrac{\gamma - \mu\beta}{\gamma - \beta}\Psi(FDI_{sb})R''(I_{sb})} \frac{\gamma - \mu\beta}{\gamma - \beta} > 0 \tag{23}$$

where

$$\frac{\partial FDI_{sb}}{\partial W} > \frac{\partial I_{sb}}{\partial W} \Leftrightarrow \frac{\gamma - \mu\beta}{\gamma - \beta} > \frac{R''(FDI_{sb})}{R''(I_{sb})} \tag{24}$$

which is likely to hold true for any $W < W_{crit}$ if both μ and $\gamma - \beta$ are small. In consideration of (10), this condition can be reformulated as

$$\frac{R''(I_{sb})/R'(I_{sb})}{R''(FDI_{sb})/R'(FDI_{sb})} + \frac{\gamma\beta(1-\mu)}{R''(FDI_{sb})(\gamma - \beta)} \frac{R''(I_{sb})}{R'(I_{sb})} > 1 \tag{25}$$

which holds true irrespectively of further restrictions on μ and $\gamma - \beta$ at least if

$$-\frac{R''(I_{sb})}{R'(I_{sb})} \geq -\frac{R''(FDI_{sb})}{R'(FDI_{sb})},$$

for which it suffices to require $\frac{d}{dx}\left(-R''(x)/R'(x)\right) \geq 0$.

3. Responses to country-specific shocks

– at home ($\overline{\varepsilon}$):

From the general implicit function theorem it follows for $W < W_{crit}$

$$\frac{\partial I_{sb}}{\partial \overline{\varepsilon}} = \frac{\alpha R(I_{sb}) R''(FDI_{sb}) - \dfrac{\gamma - \mu\beta}{\gamma - \beta} \Psi(FDI_{sb}) R'(I_{sb})}{\Omega(I_{sb}) R''(FDI_{sb}) + \dfrac{\gamma - \mu\beta}{\gamma - \beta} \Psi(FDI_{sb}) R''(I_{sb})} > 0 \tag{26}$$

$$\frac{\partial FDI_{sb}}{\partial \overline{\varepsilon}} = \frac{\gamma - \mu\beta}{\gamma - \beta} \frac{\alpha R(I_{sb}) R''(I_{sb}) + \Omega(I_{sb}) R'(I_{sb})}{\Omega(I_{sb}) R''(FDI_{sb}) + \dfrac{\gamma - \mu\beta}{\gamma - \beta} \Psi(FDI_{sb}) R''(I_{sb})} \gtreqless 0. \tag{27}$$

As in the case of $\mu = 1$, a necessary condition for $\partial FDI_{sb} / \partial \overline{\varepsilon} > 0$ is again to require

$$\alpha R(I_{sb}) > -\Omega(I_{sb}) \frac{R'(I_{sb})}{R''(I_{sb})} \tag{28}$$

which is likely to hold if $\gamma - \beta$ is small but α is not too small. For $\alpha \to 0$ the sign of $\partial FDI_{sb} / \partial \overline{\varepsilon}$ is unquestionably negative.

– abroad ($\underline{\varepsilon}$):

From the general implicit function theorem it follows for $W < W_{crit}$

$$\frac{\partial I_{sb}}{\partial \underline{\varepsilon}} = \frac{\alpha R(FDI_{sb}) R''(FDI_{sb}) + \Psi(FDI_{sb}) R'(FDI_{sb})}{\Omega(I_{sb}) R''(FDI_{sb}) + \dfrac{\gamma - \mu\beta}{\gamma - \beta} \Psi(FDI_{sb}) R''(I_{sb})} \gtreqless 0 \tag{29}$$

$$\frac{\partial FDI_{sb}}{\partial \underline{\varepsilon}} = \frac{\alpha R(FDI_{sb}) \dfrac{\gamma - \mu\beta}{\gamma - \beta} R''(I_{sb}) - \Omega(I_{sb}) R'(FDI_{sb})}{\Omega(I_{sb}) R''(FDI_{sb}) + \dfrac{\gamma - \mu\beta}{\gamma - \beta} \Psi(FDI_{sb}) R''(I_{sb})} > 0. \tag{30}$$

A necessary condition for $\partial I_{sb} / \partial \underline{\varepsilon} > 0$ is to require

$$\alpha R(FDI_{sb}) > -\Psi(FDI_{sb}) \frac{R'(FDI_{sb})}{R''(FDI_{sb})} \tag{31}$$

which is less likely to hold ceteris paribus if μ is small, since $\Psi(FDI)$ is decreasing in μ.

– A sufficient condition for

$$\frac{\partial I_{sb}}{\partial \underline{\varepsilon}} < \frac{\partial FDI_{sb}}{\partial \overline{\varepsilon}} \tag{32}$$

for all $W < W_{crit}$ is to require $\partial FDI_{sb}/\partial W > \partial I_{sb}/\partial W$. This can be proved as follows:

– Since $W < W_{crit}$ implies $FDI_{sb} < I_{sb}$, we have

$$R(FDI_{sb}) < R(I_{sb}),$$
$$R'(FDI_{sb}) > R'(I_{sb}).$$

– Owing to (6) and (7) it follows

$$\frac{\Psi(FDI_{sb})}{\Omega(I_{sb})} = \frac{R'(FDI_{sb}) - \gamma}{R'(I_{sb}) - \gamma} > 1.$$

– As shown in proposition 4, part 2, $\partial FDI_{sb}/\partial W > \partial I_{sb}/\partial W$ holds iff

$$\frac{\gamma - \mu\beta}{\gamma - \beta} > \frac{R''(FDI_{sb})}{R''(I_{sb})}.$$

– Finally, from (10) it follows

$$R'(FDI_{sb}) > \frac{\gamma - \mu\beta}{\gamma - \beta} R'(I_{sb}).$$

Rearranging (27) and (29) yields

$$\frac{\partial FDI_{sb}}{\partial \overline{\varepsilon}} = \left(\frac{\gamma - \beta}{\gamma - \mu\beta} \frac{R''(FDI_{sb})}{R''(I_{sb})} \frac{\Omega(I_{sb})}{\alpha R(I_{sb})} + \frac{\Psi(FDI_{sb})}{\alpha R(I_{sb})} \right)^{-1} \tag{33}$$
$$+ \left(\frac{\gamma - \beta}{\gamma - \mu\beta} \frac{R''(FDI_{sb})}{R'(I_{sb})} + \frac{\Psi(FDI_{sb})}{\Omega(I_{sb})} \frac{R''(I_{sb})}{R'(I_{sb})} \right)^{-1}$$

$$\frac{\partial I_{sb}}{\partial \underline{\varepsilon}} = \left(\frac{\Omega(I_{sb})}{\alpha R(FDI_{sb})} + \frac{\gamma - \mu\beta}{\gamma - \beta} \frac{R''(I_{sb})}{R''(FDI_{sb})} \frac{\Psi(FDI_{sb})}{\alpha R(FDI_{sb})} \right)^{-1} + \left(\frac{\Omega(I_{sb})}{\Psi(FDI_{sb})} \frac{R''(FDI_{sb})}{R'(FDI_{sb})} + \frac{\gamma - \mu\beta}{\gamma - \beta} \frac{R''(I_{sb})}{R'(FDI_{sb})} \right)^{-1}. \tag{34}$$

Hence, for the first quotients in (33) and (34) we obtain

$$\left(\frac{\gamma - \beta}{\gamma - \mu\beta} \frac{R''(FDI_{sb})}{R''(I_{sb})} \frac{\Omega(I_{sb})}{\alpha R(I_{sb})} + \frac{\Psi(FDI_{sb})}{\alpha R(I_{sb})} \right)^{-1} > \left(\frac{\Omega(I_{sb})}{\alpha R(FDI_{sb})} + \frac{\gamma - \mu\beta}{\gamma - \beta} \frac{R''(I_{sb})}{R''(FDI_{sb})} \frac{\Psi(FDI_{sb})}{\alpha R(FDI_{sb})} \right)^{-1},$$

i. e. the lending effect is stronger if the shock arises in the industrial country. For the second quotients, respectively, we have

$$\left(\frac{\Omega(I_{sb})}{\Psi(FDI_{sb})} \frac{R''(FDI_{sb})}{R'(FDI_{sb})} + \frac{\gamma - \mu\beta}{\gamma - \beta} \frac{R''(I_{sb})}{R'(FDI_{sb})} \right)^{-1} < \left(\frac{\gamma - \beta}{\gamma - \mu\beta} \frac{R''(FDI_{sb})}{R'(I_{sb})} + \frac{\Psi(FDI_{sb})}{\Omega(I_{sb})} \frac{R''(I_{sb})}{R'(I_{sb})} \right)^{-1},$$

i. e. the substitution effect is stronger if the shock emerges in the developing country. Combining these results yields

– if a shock occurs in the developing country, there will be a strong substitution effect and a weak lending effect, so that investment at home is not necessarily adversely affected but likely to increase as a response to the shock,
– if a shock occurs in the industrial country, there will be a weak substitution effect and a strong lending effect, so that investment abroad is likely to be adversely affected too.

Proof of Proposition 5.

The comparative statics results for an interest rate change are given by

$$\frac{\partial I_{sb}}{\partial \gamma} = -\frac{R''(FDI_{sb})\left(I_{sb} + FDI_{sb} - W\right) - \Psi(FDI_{sb})\beta\frac{1-\mu}{(\gamma-\beta)^2}\left(R'(I_{sb}) - \beta\right)}{\Omega(I_{sb})R''(FDI_{sb}) + \frac{\gamma-\mu\beta}{\gamma-\beta}\Psi(FDI_{sb})R''(I_{sb})} < 0$$

and

$$\frac{\partial FDI_{sb}}{\partial \gamma} = -\frac{\frac{\gamma-\mu\beta}{\gamma-\beta}R''(I_{sb})\left(I_{sb} + FDI_{sb} - W\right) + \Omega(I_{sb})\beta\frac{1-\mu}{(\gamma-\beta)^2}\left(R'(I_{sb}) - \beta\right)}{\Omega(I_{sb})R''(FDI_{sb}) + \frac{\gamma-\mu\beta}{\gamma-\beta}\Psi(FDI_{sb})R''(I_{sb})} \gtreqless 0.$$

Proof of Proposition 6.

The comparative statics results for a change in μ are given by

$$\frac{\partial I_{sb}}{\partial \mu} = \frac{R''(FDI_{sb})(1-\alpha)\beta FDI_{sb} + \Psi(FDI_{sb})\beta\frac{R'(I_{sb})-\gamma}{\gamma-\beta}}{\Omega(I_{sb})R''(FDI_{sb}) + \frac{\gamma-\mu\beta}{\gamma-\beta}\Psi(FDI_{sb})R''(I_{sb})} \gtreqless 0$$

and

$$\frac{\partial FDI_{sb}}{\partial \mu} = \frac{\frac{\gamma-\mu\beta}{\gamma-\beta}R''(I_{sb})(1-\alpha)\beta FDI_{sb} - \Omega(I_{sb})\beta\frac{R'(I_{sb})-\gamma}{\gamma-\beta}}{\Omega(I_{sb})R''(FDI_{sb}) + \frac{\gamma-\mu\beta}{\gamma-\beta}\Psi(FDI_{sb})R''(I_{sb})} > 0.$$

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SUMMARY

We consider a financially constrained multinational corporation with investment projects in both an industrial and a developing country. Since the collateral values of the projects' tangible assets diverge, the willingness of banks to grant a loan depends not only on the firm's financial wealth but also on the share of FDI in total investment. We investigate the impact of variations in wealth and of country-specific macroeconomic shocks on the firm's investment decision. The results are twofold. First, decreasing wealth affects both foreign and domestic

investment but the effect on foreign investment tends to be stronger. Second, country-specific macroeconomic shocks have asymmetric effects on investment depending on where the shock occurs.

ZUSAMMENFASSUNG

Es wird ein kreditbeschränktes multinationales Unternehmen mit Projekten in einem Industrieland und in einem Entwicklungsland betrachtet. Da die Werte der mit den Projekten verbundenen verpfändbaren materiellen Vermögensgegenstände divergieren, hängt die Kreditvergabebereitschaft von Banken nicht nur vom Finanzvermögen des Unternehmens sondern auch vom Anteil der Auslandsinvestition am Gesamtinvestitionsvolumen ab. Es werden die Auswirkungen von Schwankungen im Finanzvermögen und von länderspezifischen makroökonomischen Schocks auf die Investitionsentscheidung des Unternehmens untersucht und folgende Ergebnisse abgeleitet. Erstens verringert ein Rückgang im Finanzvermögen die Investitionen in beiden Projekten, wobei die Auslandsinvestition hiervon in der Regel härter betroffen ist. Zweitens haben länderspezifische Schocks asymmetrische Auswirkungen auf die Investitionsvorhaben, deren Ausmaße davon abhängig sind, wo ein Schock auftritt.

RÉSUMÉ

L'article considère une entreprise multinationale soumise à une contrainte financière et ayant dans le même temps des projets d'investissement dans un pays industriel et dans un pays en développement. Comme les valeurs des actifs matériels liés à ces projets divergent, la propension des banques à accorder des crédits dépend non seulement du patrimoine financier de l'entreprise mais aussi de la part de ses ID à l'étranger dans le total de ses investissements. L'article examine les effets des fluctuations du patrimoine financier et de chocs macro-économiques spécifiques à des pays sur la décision d'investissement de l'entreprise. Deux sortes de résultats s'en dégagent. Premièrement, une baisse du patrimoine réduit les investissements dans les deux projets, avec un recul plus marqué pour les ID à l'étranger. Deuxièmement, les chocs spécifiques à des pays exercent des effets asymétriques sur l'investissement; l'ampleur de ces effets dépend du lieu d'apparition du choc.