The Effect of Foreign Ownership Limits on FDI and Debt

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Abstract: High indebtedness has usually been the precursor to financial crises in many countries. Following the financial crises in Asia in 1997-98 and the Mexican peso crisis in 1994, there have been calls to raise foreign ownership limits as a way to increase foreign direct investment and reduce reliance on foreign debt. This paper argues that when the probability of a crisis increases with the level of debt, relaxing ownership limits may not necessarily have these intended consequences. The argument hinges on the existence of multiple equilibria (one low-debt/high-FDI and another high-debt/low-FDI) which results from the lack of coordination in the choices of debt and FDI. The results also suggest that debt-relief may be needed to go from a high-debt to a low-debt equilibrium.

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1 Introduction

Countries typically limit the extent of foreign ownership in local firms. In the Philippines, as of the year 2000, foreigners can own up to 40% of firms in industries ranging from energy to transportation to financial services, and anywhere between 0% and 60% of firms in banking and communications. Thailand requires domestic ownership to be at least 51% in many key industries. The same applies in Korea for industries identified as target industries. For these industries, higher limits on foreign direct investment (FDI) often means higher levels of debt financing.

Following the financial crises in Asia in 1997 and 1998, there have been renewed calls for a relaxation of these foreign ownership limits. In the Philippines “Senator-elect Edgardo Angara sounded the need for economic reforms in the Constitution … includ[ing] lifting the provision limiting foreign ownership to any local industry.” (The Manila Standard, June 16, 2001). While in Indonesia: “Although Indonesia was successful in attracting FDI prior to the economic crisis, this is no longer the case … Indonesia will find it even more difficult to attract FDI unless such obstacles are removed.” (The Jakarta Post, August 8, 2001). Raising the limit on foreign ownership is seen as a way to increase capital investment through FDI and to reduce the country’s reliance on debt financing.

Apart from FDI’s potential for technology transfer and human capital development, the longer-term commitment associated with FDI also makes it more attractive than debt, especially the short-term instruments that were a feature of the recent crises in Asia (1997-98) and Mexico (1994).\textsuperscript{1} Cooper and Sachs (1985) also make the point that since

\textsuperscript{1}High indebtedness has been cited as a main cause for recent currency crises. From 1990 up to the Mexican peso crisis in 1994, only one one-fourth of capital inflows to Mexico came in the form of FDI which showed no growth from 1991-93. The growth in foreign capital inflows to Mexico over this period was almost all in the form of foreign debt accounting for over half of foreign inflows in 1993 (Whitt Jr. (1996)). In Korea, the post-crisis reforms enacted in 1998 called for a reduction in the debt to equity ratios of the Chaebols to 200% from over 400% in 1997.
bail-outs of bad direct investments are less common than of bad loans, moral hazard is reduced. The recent calls for relaxation of foreign ownership limits reflect the desire to shift the composition of foreign capital inflows from debt to FDI.

This paper makes the following point. For countries with existing high levels of external debt, easing limits on foreign ownership may not necessarily increase the level of FDI and may not necessarily reduce the country’s reliance on debt as the source of investment. The idea is that a country’s attractiveness to a potential foreign (direct) investor depends on the chance that things might go bad (for example, a run on the currency) and the chance that things will go bad depends on the level of external debt. Thus, if a country has a high level of outstanding debt, investors see a higher chance of a bad shock occurring and will require an even higher share of output to entice them to make longer-term direct investments. For countries starting at a low level of debt, foreign direct investors will find it profitable to invest even for a low share of output. The description is that of multiple equilibria which we show can exist for a wide range of foreign ownership limits. The possibility of multiple equilibria results from a lack of coordination between the choice of debt level and the choice of the amount of FDI. In the model below, the host country chooses its debt level taking FDI as given while the foreign investor chooses the level of FDI given the country’s debt position. This seems to us a better description for the macro context than one where debt and FDI decisions are made jointly.

The implication of multiple equilibria is that the high-debt equilibrium may still prevail even if foreign ownership limits are raised substantially. By the same logic, however, foreign ownership shares need not be so high for the low-debt, high-FDI equilibrium to obtain. This latter result suggests a policy such as debt-forgiveness could help the economy move to a sustained low-debt, high-FDI outcome.

The next section presents a model of debt and FDI. We characterize Nash equilibria
over the full range of foreign ownership shares. Section 3 presents a numerical example illustrating the existence of multiple equilibria. The example highlights the conclusion that raising foreign ownership limits may not necessarily increase the level of FDI nor reduce the level of debt. Section 4 concludes.

2 A Model Of Debt And Foreign Direct Investment

In previous models in the literature (see, for instance, Lachler (1990)), debt and FDI are usually assumed to be choice variables for the host country. We don’t believe this is appropriate in the macro context. While it is reasonable to assume that a country chooses how much to borrow from competitive world credit markets, it typically cannot choose directly the level of FDI in the country. We think of the situation as a non-cooperative game played between a host country choosing the debt level and foreign investors choosing how much to invest directly in the country. The lack of coordination between the choice of the level of debt and the choice of the level of FDI gives rise to the possibility of multiple Nash equilibria: one of high debt and low FDI and another with low debt and high levels of FDI. The set up is formally described below.

A small open economy produces a single traded good, \( Q = XF(I) \), where \( Q \) is output, \( I \) is investment, and \( F(\cdot) \) is assumed increasing, concave, \( F(0) = 0 \). A static set up is sufficient to capture the main point of this paper. The same results would easily follow in a dynamic setting.

The random variable \( X \) takes one of two values: \( X_H \) in the “good” state and \( X_L \) (\( < X_H \)) in the “bad” state. By bad state, we have in mind a crisis of some kind that would result in a reduced level of output. For a small open developing economy, this crisis could be the event of a currency run resulting in a financial crisis that would cause a lower level of output to be realized. The bad state occurs with probability \( p \) while the good state occurs with probability \( 1 - p \). The probability of the bad state, \( p \), is a function
of the level of the country’s debt, B, where \( p'(B) > 0, p''(B) < 0, p(0) = \epsilon(> 0) \), and \( \lim_{B \to \infty} p(B) = 1 \). The probability of the bad state increases with the level of debt but at a decreasing rate. There is still a chance the bad state would occur even when there is no debt. The probability of the bad state occurring approaches one if the country has a very high level of debt.

The dependence of the probability of crisis on the level of debt is a reduced-form relationship. If we think of a crisis as an event where output is not enough to pay back the debt and productivity follows some exogenous distribution then whether or not the realization of the output is low enough to cause a “crisis” depends on the level of debt in the manner assumed in our reduced-form representation.

To focus attention on the role of debt and FDI, we assume that there is no domestic saving (also a consequence of the one-period set up). Debt and foreign direct investment are perfect substitutes in production, that is, \( I = B + T \), where \( T \) is the level of FDI.

A country chooses the level of debt taking as given the level of FDI in the economy. Simultaneously, a representative foreign investor decides on the level of direct investment taking the country’s level of debt as given. Decisions are made at the beginning of the period, the stochastic output is realized, debt is repaid and the residual output is divided between the country and foreign investor.

2.1 The Country’s Problem

The small country has access to the competitive world credit market where it can borrow an amount \( B \) at the exogenous world interest rate, \( R \). Foreign investors can also make direct investments in the country. Unlike with debt, the country can not directly choose \( T \). That decision is made by foreign investors based on the expected return on the investment. The host country takes \( T \) as given and chooses \( B \) to maximize a social welfare function, \( u(c) \), which is increasing in consumption, \( c \). We assume the country is
risk neutral which amounts to the country maximizing expected consumption. In this
one-period world, this reduces to the country maximizing its expected share of output.

After output is realized, a portion is used to pay back the debt with interest,
\((1 + R)B\). The remainder of output is divided between the country and the foreign direct
investor: a fraction \(1 - \theta\) goes to the country and \(\theta\) to the foreign investor.

The country’s problem can be written as:

\[
\max_{B \geq 0} (1 - p(B))(1 - \theta)(X_H F(B + T) - (1 + R)B) + p(B)(1 - \theta)(X_L F(B + T) - (1 + R)B).
\]  

An interior solution would satisfy the following first order condition equating
expected marginal return and marginal cost of an additional unit of debt:

\[
F(B + T)(X_L - X_H)p'(B) + F'(B + T)[(1 - p(B))X_H + p(B)X_L] = 1 + R.  
\]  

Call this optimal debt level satisfying equation (2) \(B^* = B^*(T; X_H, X_L, R)\). Differentiating
equation (2) with respect to \(T\) gives:

\[
\frac{dB^*}{dT} = \frac{-(X_L - X_H)p''F + ((1 - p)X_H + pX_L)F''}{(X_L - X_H)p''F + 2(X_L - X_H)p'F' + ((1 - p)X_H + pX_L)F''}. 
\]

Useful for our later discussion of equilibrium are the following two assumptions
and lemma.

**Assumption 1.**

\[
(X_L - X_H)p''F + 2(X_L - X_H)p'F' + ((1 - p)X_H + pX_L)F'' < 0. 
\]

The term \((X_L - X_H)p''F\) is positive while the other terms on the left-hand-side of the
inequality are negative. Assumption 1 is satisfied so long as \((X_L - X_H)p''F\) is of
sufficiently low magnitude or that the effect of the debt level on the probability of crisis
(weighted by the potential loss in output) does not diminish too quickly relative to how
fast marginal product diminishes. If this condition were not met, then the country would
want to incur more debt as FDI increases ($\frac{dB^*}{dT} > 0$), a case that is not compatible with
existence of equilibrium and therefore is ruled out.

Assumption 2.

$$\frac{d}{dB}(p'(B)(X_H - X_L)F(B + T)) < 0.$$ 

The term $(X_H - X_L)F(B + T)$ denotes the loss in output in going from the good state
to the bad state. The interpretation of Assumption 2 is that the expected marginal drop
in output from an additional unit of debt decreases with the level of debt. As we show
later, this assumption will imply the possibility of multiple equilibria.

Lemma 1. Given Assumptions 1 and 2, $\frac{dB^*}{dT} < -1$.

Proof. Define $A \equiv -(X_L - X_H)p'F' + ((1 - p)X_H + pX_L)F''$ and rewrite equation (3) as:

$$\frac{dB^*}{dT} = \frac{A}{(X_L - X_H)(p''F + p'F') - A}.$$ 

$$= -\frac{A}{\frac{d}{dB}(p'(B)(X_H - X_L)F(B + T)) + A}.$$ 

Note that $A > 0$. From Assumptions 1 and 2, it follows that $\frac{dB^*}{dT} < -1$. 

At $T = 0$, the level of optimal debt is finite. And as $T$ gets very large, the constraint,$B \geq 0$, binds so that $B^* = 0$. Proofs of these two properties of $B^*(T)$ are provided in the
appendix.

In principle, it is possible the optimal value of debt could be so high such that there
would not be enough output to repay the debt in the bad state. We don’t consider this
possibility of default here. Figure 1 shows $B^*(T)$. For ease of illustration, we show $B^*(T)$
as a line but this need not be the case in general. Note that the foreign investor’s share, \( \theta \), does not affect \( B^* (T) \). This results from the assumption that debt is repaid before output is divided between the country and foreign investor.

### 2.2 The Investor

While the country decides how much to borrow given the level of FDI, the representative foreign investor chooses how much to invest directly in the country taking as given the level of the country’s debt. Intuitively, how much foreigners invest directly in a country will depend on the likelihood of a crisis. And since this probability of crisis increases with the level of debt outstanding in the country, the level of FDI would depend negatively on the level of debt.

A unit of capital in the form of FDI has opportunity cost equal to the world interest rate, \( R \). Debt is repaid first, then the investor would get his share \( \theta \) of the remaining output. If the investor invests a positive amount \( T \), he would get an expected return, \( ES(T) \):

\[
ES(T) = \theta (1 - p(B)) (X_H F(B + T) - (1 + R)B) \\
+ \theta p(B) (X_L F(B + T) - (1 + R)B) \\
- (1 + R)T.
\]  

(4)

\( ES(T) = 0 \) for \( T = 0 \). The risk-neutral investor would choose an optimal investment level, \( T^* \), given by \( \arg \max_{T \geq 0} ES(T) \).

An interior solution satisfies the first order condition equating expected marginal return and marginal cost of investment:

\[
\theta F'(B + T) ((1 - p(B)) X_H + p(B) X_L) = 1 + R.
\]  

(5)
Equation (5) implicitly defines the foreign investor’s best response $T^*(B; X_H, X_L, R)$ to the country’s debt level $B$. The slope of $T^*$ is given by:

$$\frac{dT^*}{dB} = \frac{(X_H - X_L)p'F'}{((1 - p(B))X_H + p(B)X_L)F''} - 1. \quad (6)$$

The first term on the right-hand-side is negative which means $dT^*/dB < -1$. Above some critical value of debt and above, the constraint $T \geq 0$ binds and $T^* = 0$. Figure 2 shows the investor’s best response function. As $\theta$ decreases, $dT^*/dB$ is unaffected but the curve $T^*(B)$ shifts inward toward the origin. As the investor’s share falls, the level of direct investment for any given level of debt drops.

### 2.3 Equilibrium

A Nash equilibrium in this model is a pair $(T^*, B^*)$ that simultaneously satisfies the foreign investor’s and country’s best response functions.

Three types of equilibria are possible depending on the value of the share of output going to the foreign investor, $\theta$. For low levels of $\theta$, there exists a unique high-debt, low-investment equilibrium. For high levels of $\theta$, there exists a unique low-debt, high-investment equilibrium. When $\theta$ takes on values in some intermediate range, there exists two equilibria: one characterized by low-debt, high-investment and the other high-debt, low-investment. Both equilibria are stable. To see these possibilities, refer to Figure 3.

In figure 3, let $\overline{B}$ be the country’s optimal debt level when $T = 0$, or $\overline{B} = B^*(0)$. Let $\overline{T}$ be the level of foreign direct investment at which the optimal level of debt is zero, $B^*(\overline{T}) = 0$. Let $\bar{B}$ be a debt level at which investor invests zero capital in the country, $T^*(\bar{B}) = 0$ and $\bar{T}$ be the investor’s optimal level of direct investment when there is zero debt, $\bar{T} = T^*(0)$.
**Proposition 1.** When $\theta$ is sufficiently close to one, a unique equilibrium with zero debt and a high level of foreign direct investment results.

**Proof.** It is sufficient to show that $B^*(T)$ is everywhere below $T^*(B)$ when $\theta$ approaches one. Define $\bar{T}$ as the level of foreign direct investment at which the optimal level of country debt is zero, $B^*(\bar{T}) = 0$. The first order condition, equation (2), for the country’s optimum for $T = \bar{T}$ is:

$$F(\bar{T})(X_L - X_H)p'(0) + F'(\bar{T})[(1 - p(0))X_H + p(0)X_L] = 1 + R.$$ 

Define $\hat{T}$ as the investor’s best response level of foreign direct investment when $B = 0$, $\hat{T} \equiv T^*(0)$. The first order condition for the foreign investor’s optimum, equation (5), when $B = 0$ is:

$$\theta F'(\hat{T})[(1 - p(0))X_H + p(0)X_L] = 1 + R.$$ 

Equating the left-hand-sides of the two above equations gives:

$$\frac{F(\bar{T})(X_L - X_H)p'(0)}{(1 - p(0))X_H + p(0)X_L} = \theta F'(\hat{T}) - F'(\bar{T}).$$  (7)

By inspection, the left-hand-side is negative. When $\theta$ approaches one, $F'(\hat{T})$ has to be smaller than $F'(\bar{T})$, which means $\hat{T} > \bar{T}$.

Similarly, define $\bar{B}$ as the country’s best response level of debt when $T = 0$. $\bar{B}$ will satisfy the necessary condition, equation (2):

$$F(\bar{B})(X_L - X_H)p'(\bar{B}) + F'(\bar{B})[(1 - p(\bar{B}))X_H + p(\bar{B})X_L] = 1 + R.$$ 

Define $\hat{B}$ as the level of country debt where the foreign investor’s best response is $T^* = 0$. The first order condition for the foreign investor’s optimum, equation (5),
when $B = \hat{B}$ is:

$$\theta F'(\hat{B})[(1 - p(\hat{B}))X_H + p(\hat{B})X_L] = 1 + R.$$  

Equating these two expressions and rearranging yields:

$$F(\hat{B})p'(\hat{B})(X_L - X_H) = \theta F'(\hat{B})[(1 - p(\hat{B}))X_H + p(\hat{B})X_L] - F'(\hat{B})[(1 - p(\hat{B}))X_H + p(\hat{B})X_L].$$  \hspace{1cm} (8)

By inspection, the left-hand-side is negative which means that as $\theta$ approaches one,

$$F'(\hat{B})[(1 - p(\hat{B}))X_H + p(\hat{B})X_L] < F'(\hat{B})[(1 - p(\hat{B}))X_H + p(\hat{B})X_L].$$  \hspace{1cm} (9)

Suppose $\hat{B} < \bar{B}$. That would imply

$$F'(\hat{B}) > F'(\hat{B}), \text { and } (1 - p(\hat{B}))X_H + p(\hat{B})X_L > (1 - p(\hat{B}))X_H + p(\hat{B})X_L.$$  

But this would contradict inequality (9). Therefore, $\hat{B} > \bar{B}$.

Since $\hat{B} > B$ and $\hat{T} > T$ while $\frac{dT}{dB} < -1$ and $0 > 1/\frac{dB}{dT} > -1$, the two best response curves $B^*(T)$ and $T^*(B)$ do not have an interior crossing. Therefore, equilibrium is at the point $B^* = 0$, $T^* = \hat{T}$. \hfill \Box

**Proposition 2.** When $\theta$ is sufficiently close to zero, a unique equilibrium with a high level of debt and zero foreign direct investment results.

**Proof.** From equation (7):

$$\frac{F(\hat{T})(X_L - X_H)p'(0)}{(1 - p(0))X_H + p(0)X_L} = \theta F'(\hat{T}) - F'(T),$$

and the proof of Proposition (1), we know that as $\theta$ approaches one, $\hat{T} > \bar{T}$. We also
know that since debt is repaid first, \( \theta \) affects only the investor’s decision, and that the lower \( \theta \), the lower is \( \hat{T} \). As \( \theta \) approaches zero, \( \hat{T} \) will also approach zero. Therefore, when \( \theta \) falls below some critical value, \( \bar{T} > \hat{T} \).

Now consider the proof that \( \bar{B} > \hat{B} \) when \( \theta \) reaches a sufficiently low value. We know that \( \hat{B} \) decreases with decreasing \( \theta \) equivalent to \( T^*(B) \) shifting inward toward the origin. This means that \( \hat{B} \) or the level of debt when the foreign investor ceases to invest in the country also falls. Below some critical \( \theta \), \( \hat{B} \) will fall below \( \bar{B} \).

Given Lemma (1) and that \( dT^*/dB < -1 \), it follows that a unique zero-debt equilibrium will result for sufficiently low \( \theta \).

**Proposition 3.** When \( \theta \) is in some intermediate range between zero and one, two stable equilibria result: a high-debt, zero-foreign-direct investment equilibrium and a zero-debt, high-foreign-direct-investment equilibrium.

*Proof.* As shown above, when \( \theta \) is close enough to one, the investor best response curve \( T^*(B) \) lies entirely above the country best response curve \( B^*(T) \) and when \( \theta \) is close enough to zero, \( T^*(B) \) lies entirely below \( B^*(T) \). Since the value of \( \theta \) does not affect \( B^*(T) \) and will shift \( T^*(B) \) while not affecting its slope, and since \( dT^*/dB < 1/(dB^*/dT) \), it follows that for a range of values for \( \theta \) between zero and one, there is one unstable interior equilibrium and two stable corner equilibria: one at \( (B, T) = (0, \hat{T}) \) and one at \( (B, T) = (\bar{B}, 0) \).

The possible equilibria for the three ranges of \( \theta \) are shown in figure (3). There are two critical values of \( \theta \) that delineate the transition from one type of equilibrium to another. First, there exists a \( \theta_1 \) which for \( 0 \leq \theta < \theta_1 \), a unique high-debt equilibrium
results. $\theta_1$ is defined by the condition:

$$\frac{F(T)(X_L - X_H)p'(0)}{(1-p(0))X_H + p(0)X_L} = \theta_1 F'(T) - F'(T),$$
or

$$\theta_1 = 1 - \frac{F(T)(X_H - X_L)p'(0)}{F'(T)((1-p(0))X_H + p(0)X_L)}.$$

As $\theta$ increases further, there exists a $\theta_2$ which for $\theta_2 \leq \theta \leq 1$, a unique zero-debt equilibrium obtains. $\theta_2$ is defined by the condition:

$$\theta_2 = 1 - \frac{F(B)(X_H - X_L)p'(B)}{F'(B)((1-p(0))X_H + p(0)X_L)}.$$ 

For $\theta \in [\theta_1, \theta_2]$, both low and high debt equilibria exist and are stable. All else equal, when the difference in output levels in the bad and good states is low, both $\theta_1$ and $\theta_2$ are high, approaching unity in the limit. That is, with no uncertainty in output, debt is the only source of finance of the country’s investment. In Figure (3), the country’s best response function is everywhere above the investor’s best-response function. With no uncertainty in output, the country will opt to finance its investment with debt for any level of foreign direct investment that would be selected by foreign investors. As the variance in output increases, both $\theta_1$ and $\theta_2$ decrease. This shrinks the range of ownership shares under which the debt equilibrium exists.

For higher expected values of the output, all else equal, $\theta_1$ increases meaning the unique high-debt equilibrium obtains for a wider range of $\theta$. The value of $\theta_2$ also increases meaning the unique low-debt, high-FDI equilibrium exists for a smaller range of $\theta$. Foreign ownership shares must reach higher levels for the high-debt equilibrium to be eliminated altogether.
3 A Numerical Example

To illustrate how the different equilibrium debt levels depend on the share of foreign ownership, in this section we present an example for one set of functional forms and parameter values.

Assume the probability of the bad state takes the following functional form

\[ p(B) = 1 - \frac{1}{B + 1.1} \tag{10} \]

where \( p \) increases with \( B \) but at a decreasing rate. Also, \( p(0) \) is a small positive number and \( \lim_{B \to \infty} p(B) = 1 \).

Production is Cobb-Douglas, \( Q = XI^\alpha \), with \( \alpha \) assumed to be 0.3. The world interest rate, \( R \), it is set at 6%. We simulate the results for three sets of values for \((X_H, X_L)\): (70,10), (100,40), and (120,60).

Figure 4 shows the equilibrium \((B, T)\) pairs over the range of \( \theta \) between zero and one, and Figure 5 is a schematic summarizing the equilibria over the entire range. Consistent with the analytical results of the previous section, we see that for low \( \theta \), there is a unique high-debt low-direct-investment equilibrium; for high \( \theta \), there is a unique low-debt high-direct-investment equilibrium and for \( \theta \) in an intermediate range, both these equilibria exist.

The interesting thing to note is that the range of \( \theta \) over which multiple equilibria can occur is large in some instances. Alternatively, we can say that the parameter \( \theta \) must reach some very high value before the high-debt equilibrium is eliminated altogether. For instance, in the case where \((X_H, X_L)\) equals (120,60), the foreign ownership share must reach 95% to guarantee that the economy moves out of the high-debt equilibrium. This suggests that a high-debt equilibrium can be very stable and insensitive to changes in the level of foreign ownership of equity allowed.
However, note that $\theta$ needs to only reach 24% for the no-debt equilibrium to come into existence. Therefore, it is possible to move the economy out of debt when $\theta$ is between 24% and 95% but it would take an additional alternative policy that would move the economy from high-debt to no-debt. One obvious policy that might achieve this would be debt relief. This policy implication should be read with a caveat: this one-period model abstracts away from issues such as moral hazard which are clearly important in considering policies of debt relief. However, the presence of moral hazard does not affect the central policy point of this paper which is that raising foreign ownership limits may not necessarily have the intended consequence of taking the country out of a high-debt equilibrium.

4 Concluding Remarks

This paper illustrates by way of a simple model that policies intending to promote FDI by raising the ceiling on foreign ownership shares may not, by themselves, be effective in raising the level of FDI or in reducing debt. When a country is already in a high-debt equilibrium, the higher probability of crisis due to the higher level of debt discourages FDI enough that the country will continue to find itself relying on debt as the source of capital investment when the share of output going to foreign investors does not rise enough. This logic, however, has a flip side. Because of the positive relationship between debt and probability of crisis, once an economy finds itself in a low-debt equilibrium, the probability of crisis also falls and thus foreign investors would not need to have as high a share in output for them to invest directly in the economy.

The lack of coordination in the choices of debt and FDI give rise to the multiple equilibria described above. Multiple equilibria can exist over a wide range of values for foreign ownership share. This suggests that calls for an increase in this share would not necessarily take a country from a high-debt to a low-debt regime. Debt-forgiveness in
the short run and a debt ceiling along with policies to promote direct investment over
the long run may be needed to move the country out of a debt trap.

A Proof Of The Existence Of Optimal Debt At Small Level Of Direct Investment

To show that there always exists a finite level of optimal debt at small values of direct
investment, we need to show that the schedule of marginal return on debt (MR) and the
marginal cost schedule (MC) has an interior intersection when direct investment is small.

Take the limit of equation (2) as $T$ goes to zero:

$$\lim_{T \to 0} \text{MR} = F(B)(X_L - X_H)p'(B) + F'(B)(1 - p(B))X_H + p(B)X_L \equiv \Gamma.$$ 

As $B$ goes to zero, the first term goes to zero while the second term approaches infinity.
Thus $\lim_{B \to 0} \Gamma = \infty$. In other words, when there is very little direct investment, the
marginal return to an additional unit of debt gets very large as the level of debt goes to
zero.

Now consider what happens to $\Gamma$ as $B$ gets very large. The second term in the
expression for $\Gamma$ goes to zero as $B$ approaches $\infty$. For the first term, $\lim_{B \to \infty} p'(B) = 0$
while $\lim_{B \to \infty} F(B) = \infty$. Therefore, $\lim_{B \to \infty} \Gamma$ depends on the relative rates of
convergence of $F(\cdot)$ and $p'(\cdot)$. We assume that $p'(\cdot)$ converges faster than $F(\cdot)$ so that
$\lim_{B \to \infty} \Gamma = 0$. Since MR is continuous in $B$, this guarantees that MR intersects MC
($= 1 + R$) at some finite value of $B$. 

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B Proof that the Optimal Debt is Zero at Sufficiently Large Values of Direct Investment

In words, we want to prove that the country will not engage in borrowing when the level of foreign direct investment in the country is high. Take the limit of MR as direct investment goes to infinity:

\[
\lim_{T \to \infty} (X_L - X_H)p'(B)F(T + B) + F'(\cdot)((1 - p(B))X_H + p(B)X_L)
\]

The second term approaches zero at any level of debt. For the first term, \(F(T + B)\) goes to infinity when \(T\) approaches infinity. Therefore, MR approaches \(-\infty\) regardless of the debt value. Therefore, MR is less than MC \((= 1 + R)\) for any value of debt implying that \(\lim_{T \to \infty} B^*(T) = 0\).

References


Figure 1. The country’s optimal debt given the level of foreign investment.

Figure 2. The foreign investor’s optimal direct investment level given the country’s debt.
Figure 3. Equilibria for different values of $\theta$
Figure 4. Equilibrium \((B, T)\) pairs over a range of \(\theta\) for different values of \((X_H, X_L)\).

Figure 5. Three types of equilibria for different values of random output.