An intertemporal analysis of foreign borrowing for developing economies

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Abstract

Understanding the investment role of foreign borrowing is a crucial issue for developing countries. Along this line of inquiry, the present paper analyzes the borrowing behavior of a developing economy that relies on imports for its capital formation. First, the case where the borrowing interest rate goes up with an increase in debt is examined. The model's implications concern the significance of the levels of productivity and the initial domestic capital for the economy not being on the poverty trap but on a growth path. Second, the case where the borrowing interest rate goes up with an increase in debt/total-capital ratio is examined. The results are radically different from the first case. The economy converges to stable equilibrium, irrespective of the initial capital level.

Keywords: Foreign borrowing, Imports of investment good, Poverty trap

JEL Classification: C61; F34; F43

1. Introduction

The foreign debt problem has continued to pose a threat to the integration and fabric of the international financial system. There was the developing-country debt crisis of the 1980s, in which a large number of countries, especially in Latin America and Africa, renegotiated debt obligations to foreign creditors. Eastern Europe followed in 1990. The recent experiences of the Asian Crisis have renewed interest in the problem of foreign debt for some newly-developed countries. In the case of the Asian Crisis, sudden shifts in market expectations and confidence were the key sources of the initial financial turmoil, its propagation over time and regional contagion. Nonetheless, a widespread view holds that high levels of foreign debts along with other weak economic fundamentals were certainly a contributing element in the genesis of the crisis, as well as of its spread across countries (Corsetti *et al*., 1998). Questions arise again as to whether those countries have been borrowing too much and whether creditors have overextended themselves.

Traditionally, foreign borrowing is seen as a source of increased resources for investment in the growth-cum-debt framework. A well-known example is the Harrod-Domar model. However, this approach is not designed to tackle the issue of how much a country should borrow, in that foreign borrowing is modeled to fill the gap between the required level of investment and the level of domestic savings, and also to service outstanding debt. Bardhan (1967), Hamada (1969) and Hanson (1974) are early studies that analyze the optimal level of foreign borrowing by basing the models on the context of intertemporal optimizing principles. Yet, McDonald (1982) observes that the emphasis on growth by investment tends to neglect the role of foreign borrowing in achieving a more efficient intertemporal allocation of consumption. In fact, the recent literature has paid more attention to the use of foreign borrowing for consumption purposes. In a standard setup, foreign borrowing is used mainly to smooth the consumption path over time where consumption and investment decisions are made independently of each other under the assumption of a small open economy facing a given world interest rate.[1]

[1] See Obstfeld and Rogoff (1996: 19) for rationales underpinning the separation of consumption from investment.

The purpose of this paper is to recast the investment role of foreign borrowing in a modern intertemporal framework. We believe that understanding this role of foreign borrowing is a particularly crucial issue for developing countries in which shortages of capital are still common. Along this line of inquiry, the present paper develops a dynamic optimizing model of consumption and foreign borrowing for a developing economy that relies on imports for capital formation. The assumption of a constant interest rate restricts the time discount rate to be equal to the interest rate, a rather unrealistic assumption. Several variations have been proposed in the infinite-horizon framework in order to alleviate this constraint. Sen and Turnovsky (1989) introduces adjustment costs of investment to avoid this constraint. Furthermore, Obstfeld (1982) allows a variable rate of time preference by endogenizing it (making a function of the utility level) through the introduction of Uzawa (1968) preferences. Alternatively, the overlapping generations model allows for effects from finite horizons by assuming that people live a fixed number of discrete periods. Blanchard (1985) retains the essence of the finite-horizon idea in a more tractable framework by assuming a finite probability of death. In this stream, the world interest rate and the rate of time preference do not necessarily have to be equal, and the difference between them becomes a function of financial wealth. Barro and Sali-i-Martin (1995: Chapter 3) provides a comprehensive review on these extensions.

A **distinctive** feature of this paper is to consider the effect of country risk on the interest rate faced by small borrowing economies on world capital markets. Bardhan (1967) was one of the first economists to introduce the assumption that small borrowing countries face a world interest rate that increases with the level of foreign debt. As foreign indebtedness grows, so does the risk of default; to compensate, lenders charge a premium that raise the marginal cost of borrowing over the safe lending rate. The supply curve of funds on world capital markets is therefore upward sloping. Bardhan’s approach has been adopted in numerous studies including papers by Obstfeld (1982), **Edwards** (1984), Sachs (1984), Bhandari *et al*. (1990), Senhadji (1997), Fisher (1995), and Agénor (1997).

We incorporate this idea by assuming that the rate of interest faced by the debtor country rises with the level of foreign debt. The effect of such a constraint on borrowing changes the dynamics in a fundamental way. In particular, the marginal cost of capital facing the agent, and therefore determining his/her investment decisions, is now dependent on the outstanding stock of debt. We analyze the dynamic features of the model when the home country imports only capital stock.

We obtain the following results, depending on whether the stationary state of positive per capita domestic capital k_d and positive per capita consumption c exists. If it does exist, then the economy can reach this stationary state when the initial per capita capital is large enough. However, the economy is on the poverty trap when the initial per capita capital is low, even if such a stationary state exists. Then the existence of such a positive stationary state is realized if the productivity is high or the time discount rate is low. When the productivity is low or the time discount rate is high, then the economy is on the poverty trap even if the import of foreign investment good is positive.

The recommended policy for the economy to reach the optimal growth path is to increase labor productivity by means of, say, import of technology.

Next, we make comparisons with the alternative assumptions in Section 3. Especially when the interest rate depends not on the level of foreign capital but on foreign-capital/total-capital ratio, the economy always moves toward the stationary state irrespective of the level of initial per capita capital, washing away the possibility of the poverty trap. Hence, this assumption radically changes the results.

The remainder of this paper is organized as follows. In Section 2, we develop a model by introducing a realistic assumption for developing economies that they typically face an upward-sloping supply curve of foreign loans. In Section 3, we discuss the alternative assumption – interest rate depends on foreign-capital/total-capital ratio. Section 4 concludes the paper.

2. A Standard Model

We consider the standard borrowing problem facing a planning authority of a small open economy, where it is expected to maximize the discounted utility streams of per capita consumption. The economy produces a composite good which can be either consumed or accumulated as capital stock. The country can borrow to import additional capital stock which is identical with the domestic one. It is assumed that foreign borrowing is exclusively utilized to augment domestic capital stock with a variable interest rate which increases with the increase in the foreign capital stock. In short, the home country can import capital k_f from the foreign country if necessary.

Production of the composite good occurs using capital and labor according to a neoclassical production function exhibiting constant returns to scale. Per capita output is:

$$q_t = f(k), \tag{1}$$

where k is the capital–labor ratio in the production of the composite good. The production function satisfies the following usual assumptions:

$$f'(k) > 0, \quad f''(k) < 0,$$

$$f(0) = 0, \quad f(\infty) = \infty,$$

$$f'(0) = \infty, \quad f'(\infty) = 0.$$

Resources are fully employed and the labor is fixed at $L = L_0$. Of the total amount of capital used in the country, part is domestically owned capital and the rest is foreign capital:

$$k = k_d + k_f, \tag{2}$$

where k_d and k_f are the domestic capital–labor ratio (domestic capital per worker) and the foreign capital–labor ratio (foreign capital per worker), respectively.

Per capita income in period t, y_t, is given by q_t net of per capita interest payments on outstanding foreign debt in the corresponding period:

$$y_t = q_t - rk_f, \tag{3}$$

where r denotes the real rate of interest on foreign debt. Per capita domestic investment in period t, i_d, is the difference between per capita income and per capita consumption:

$$y_t - c_t = i_d . \quad (4)$$

Assuming no capital depreciation, the net change in the level of domestic capital–labor ratio in period t is new domestic investment per person:

$$\dot{k}_d = i_d = f - rk_f - c . \quad (5)$$

The felicity function is specified to be

$$u(c) = \frac{1}{1-\sigma} c^{1-\sigma} \text{, where } 0 < \sigma < 1 . \quad (6)$$

We assume that the interest rate in the home country rises with the levels of foreign capital per worker:

$$r = r(k_f), r' > 0 . \quad (7)$$

Assumed further is that the interest rate changes at an increasing rate so that

$$r''(k_f) > 0 . \quad (8)$$

The planning problem faced by a representative agent with an infinite terminal time and positive discount rate is to choose paths for consumption (c) and foreign capital stock (k_f) as control variables and (k_d) as state variable so as to

$$\underset{c, k_f}{Max} \int_0^{\infty} e^{-\rho t} u(c) \, dt \quad (9)$$

subject to

$$\dot{k}_d = f(k) - c - rk_f . \quad (5)$$

This is solved by taking the current value Hamiltonian

$$H = u(c) + \lambda(f(k) - c - r(k_f) \cdot k_f)$$

and obtaining the first order conditions

$$c^{-\sigma} = \lambda , \quad (10)$$

$$\dot{\lambda} = (\rho - f'(k))\lambda, \quad (11)$$

$$f'(k) = r + r' \cdot k_f , \quad (12)$$

and the transversality condition (TVC)

$$\lim_{t\to\infty} k_d \lambda e^{-\rho t} = 0 . \tag{13}$$

From (12) we observe

$$k = \underset{+}{k(k_d)}$$

with $dk/dk_d = 1/(dk_d/dk) = 1/(1 - dk_f/dk) = 1/(1 - f''/(r''k_f + 2r'))$, so that

$0 < dk/dk_d < 1$ and hence $dk_f/dk_d < 0$ holds. From (12), there exists $k = k_M = k_d$ such that $f'(k_M) = r(0)$, i.e., the maximum value of k where foreign capital k_f becomes zero. In short, an increase in k_d decreases the foreign capital k_f but increases the total capital stock $k(= k_d + k_f)$.

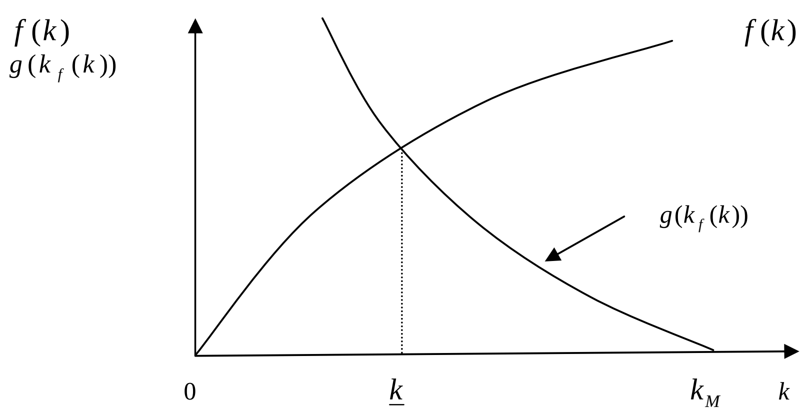
From (11) and (12), we obtain

$$\dot{c}/c = \sigma^{-1}(f'(k) - \rho) . \tag{14}$$

Using (5) with $\dot{k}_d = 0$, the $\dot{k}_d = 0$ curve is expressed as

$$c = f(k) - g(k_f(k)), \tag{15}$$

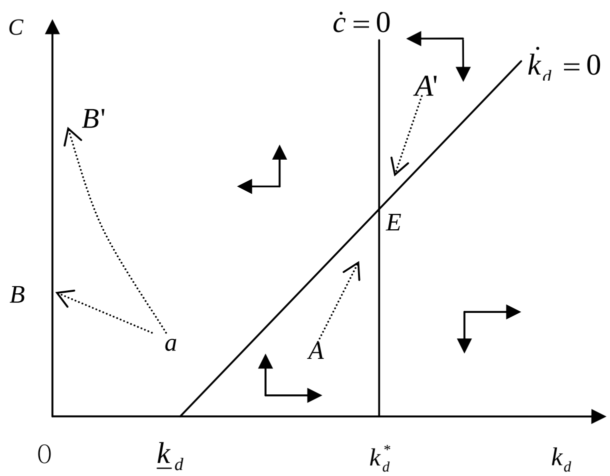
where $g(k_f(k)) = r(k_f) \cdot k_f$.



[Fig. 1]

Recalling $g' > 0$ and $dk_f/dk < 0$, we obtain from (15) and Fig. 1 that there exists $k = \underline{k}$ such that $c = 0$ at $k = \underline{k}$ and $c > 0$ for $k > \underline{k}$ with $dc/dk > 0$ for $k \geq \underline{k}$. Recalling further that k depends on k_d, we obtain along the $\dot{k}_d = 0$ curve, $dc/dk_d > 0$ for $k_d > \underline{k}_d$ where $\underline{k} = k(\underline{k}_d)$, i.e. $\underline{k}_d$ is the value of k_d corresponding to $k = \underline{k}$, and the $\dot{k}_d = 0$ curve is positively sloped as drawn in Fig. 2.

Next, we consider the $\dot{c} = 0$ curve. This is obtained from (14), with $\dot{c} = 0$, as a vertical line with $k_d = k_d^*$, where $f'(k^*) = \rho$ and $k^* = k(k_d^*)$, i.e. k_d^* is the value of k_d such that $k^* = k(k_d^*)$ holds and at $k = k^*$, $f'(k^*) = \rho$ holds, as drawn in Fig. 2.



[Fig. 2]

First, we consider

Case 1. $\underline{k}_d < k_d^*$,

That is, two curves $\dot{k}_d = 0$ and $\dot{c} = 0$ intersect at $E(k_d^*,\ c^*)$. Then we obtain the phase diagram as drawn in Fig. 2 from (14) and (15).

From Fig. 2, it is seen that

(i) if initial per capita domestic capital k_{d0} is larger than $\underline{k}_d$ but less than k_d^*, i.e., $\underline{k}_d < k_{d0} < k_d^*$, then the economy is on the growth path with both k_d and c increasing toward the equilibrium E.

(ii) if k_{d0} is larger than k_d^*, i.e., $k_{d0} < k_d^*$, then again the economy is on the stable path with both k_d and c decreasing toward E;

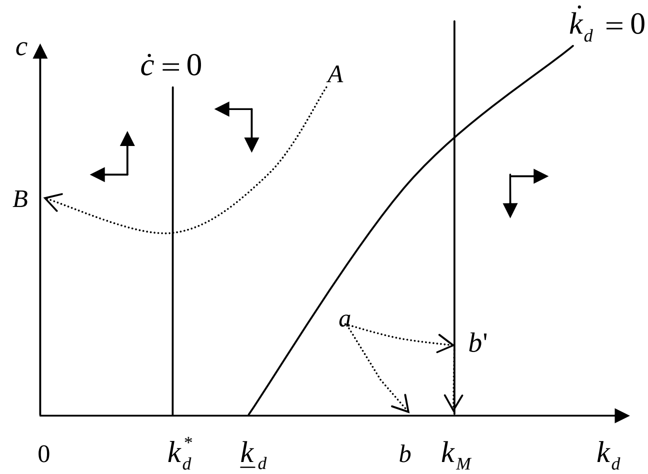
(iii) if initial k_d is less than $\underline{k}_d$, then the economy is on the poverty trap.[2] That is, as drawn in Fig. 2, k_d keeps decreasing and c and k_f keep increasing, but k_d becomes zero (i.e., $k = k_f$) in a finite time $t = T < +\infty$, and then c and k_f also become zero at $t = T$. That is, at $t = T$, all foreign capital stock k_f is withdrawn from the home country.

Here we note for (iii) the path $(k_d,\ c) \to (0,\ \infty)$ as $t \to +\infty$ (shown by arrowed dotted line aB') violates the transversality condition. One transversality condition for this case is that the present value Hamiltonian $\tilde{H} = e^{-\rho t} H$ vanishes as $t \to +\infty$.[3] However $\tilde{H}$ does not vanish if $k_d \to 0$, $c \to +\infty$.[4]

We note that (iii), i.e., poverty trap occurs if initial per capita domestic capital k_{d0} is smaller than k_d^* even if the stationary state E^* which would be realized if k_{d0} were larger than $\underline{k}_d$ does exist.

Next, we consider

Case 2. $\underline{k}_d \geq k_d^*$



[Fig. 3]

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[2] The so called vicious circle of poverty was argued earlier by Rosenstein-Rodan (1943) and Nurkse (1953) among others. See Basu (1997) Chapter 2 for its lucid survey.

[3] See, e.g., Léonard and van Long (1992) Chapter 9.6.

[4] Let $x = u(c)e^{-\rho t}$, then $\dot{x}/x = (u'/u)\dot{c} - \rho = (1-\sigma)^{-1}\dot{c}/c - \rho = (1-\sigma)^{-1}\sigma^{-1}(f' - \rho) - \rho >> 0$ as $k_d \to 0$. (As seen from $k = k(\underset{+}{k_d})$, k decreases as $k_d \to 0$. Hence we may assume $\dot{x}/x >> 0$ as $k_d \to 0$.)

Fig. 3 shows the phase diagram of this case 2.[5] The only viable path for this case is, as seen from Fig. 3, the poverty trap like the arrowed dotted curve starting from A and reaching the vertical axis in a finite time $t = T < +\infty$ and at $t = T$, both k_d and c become zero. For completeness, we assume that for $k > k_M$, the home country can export capital with rental price $r(0)$. Then, from $f'(k_M) = r(0)$ (12), the path starting from a hits the vertical line $k_d = k_M$ and reaches $(k_M, 0)$ in a finite time, although this path violates TVC as discussed in footnote 5. Here, we note that such paths as ab and $ab'k_M$ also violate the transversality conditions.[6]

This case arises as the $\dot{c} = 0$ curve and the $\dot{k}_d = 0$ curve does not intersect due to the high value of $\underline{k}_d$ or low value of k_d^*. Recalling Fig. 1, this happens when the values of the labor production function $f(k)$ are relatively low, in short, low labor productivity prevails or time discount rate ρ is so high that k_d^* is low. It is interesting to note that Case 2 happens irrespective of the initial value of k_d, k_{d0}.

3. Comparison with Alternative Assumptions

Here, we make a comparison with some alternative models. Chatterjee and Turnovsky **(2003, 2005)** make two alternative assumptions in their growth model of small country borrowing from abroad to finance public investment. One is the behavior of the representative consumer. The consumer takes borrowing interest rate r given, even if it goes up with the aggregate debt/capital ratio, which the individual agent assumes not to be capable of influence. Second

[5] For $k > k_M$, k_f becomes zero and the $\dot{k}_d = 0$ curve is expressed as $c = f(k_d)$ from (15).

[6] For ab, $c = c(T) = 0$ at $t = T < +\infty$ and $k = k(T) < \infty$ at $t = T$. Then $\lambda = u'(c) \to +\infty$ as $t \to T$ and hence $\tilde{\lambda} = \lambda e^{-\rho t} \to \lambda(T)e^{-\rho t} = +\infty$, violating TVC. (TVC at $t = T$ is $\tilde{H}(T) = 0$. See e.g., **Léonard** and van Long (1992) Chap.7.5.) In fact at $t = T$, $\tilde{H}(T) = \tilde{\lambda}(T)\dot{k}_d(T)$, where $\dot{k}_d(T) = f(k(T)) - rk_f >> 0$. For $ab'k_M$, $(k_d, c) \to (k_M, 0)$ as $t \to T < +\infty$. In fact, after (k_d, c) reaches b', it moves toward $(k_M, 0)$ along the vertical line $b'k_M$. Then again, $\tilde{H}(T) > 0$ follows at $(k_M, 0)$, violating TVC.

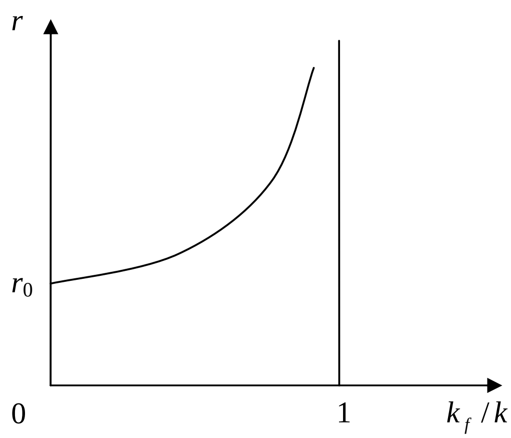
is as already mentioned above, that the borrowing interest depends not on debt itself but the debt/capital ratio. In our model where debt equals foreign capital, interest rate depends on foreign capital/total capital ratio, i.e., $k_f/(k_d + k_f)$. We first discuss the former assumption. When the consumer assumes r to be given, then the first order condition (12) is changed into

$$f'(k) = r = r(k_f). \qquad (12)'$$

Then we obtain immediately $dk_f/dk < 0$, and hence $g'(k) = r'(k_f)k_f'k_f + rk_f' < 0$. As a result we can derive the same conclusions as with our original model.

Next we discuss the assumption of interest-rate dependence on k_d/k, i.e. $r = r(k_f/k)$ with $r' > 0$ and $r'' > 0$. This assumption radically changes the conclusions. No poverty trap exists and the economy can attain equilibrium irrespective of the level of initial capital. The same results follow, whether the consumer regards interest rate as given or controllable.

Here, to obtain definite results, we make the following specifications: (1) The production function is of Cobb-Douglas, i.e. $y = f(k) = k^{\alpha}$ with $1 > \alpha > 1/2$ where α is the capital share, and (2) $r(k_f/k) = r_0/(1 - k_f/k)$, where r_0 is the world interest rate level with no borrowing.



[Fig. 4]

The shape of the function r is drawn in Fig. 4. This implies that as k_f/k approaches 1, the borrowing interest rate goes up to infinity. Under these specifications in the following we show that the economy approaches the equilibrium E irrespective of the initial level of per capita capital k_0 as shown in Fig. 7 below.

The results crucially depend on the shape of the function $g(k) = r(k_f / k) \cdot k_f$ with $k_f = k_f(k)$.

(1) First, we consider the case of (12)', i.e.

$$f'(k) = r(k_f / k), \tag{12)'$$

which is equal to $\alpha k^{\alpha-1} = r_0 /(1 - k_f / k)$.

From this we obtain

$$k_f = (\alpha k^{\alpha} - r_0 k) / \alpha k^{\alpha-1} = k - (r_0 / \alpha) k^{2-\alpha}, \tag{16}$$

$$dk_f / dk = k_f' = 1 - (2-\alpha) r_0 \alpha^{-1} k^{1-\alpha}, \tag{17}$$

implying

$$k_f' > 0 \Leftrightarrow k < \left(\frac{\alpha}{(2-\alpha) r_0} \right)^{1/(1-\alpha)}.$$

Then from (16) and $k_d = k - k_f = (r_0 / \alpha) k^{2-\alpha}$

we obtain

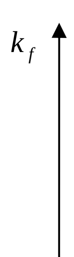
$$dk_d / dk = k_d' = \frac{(2-\alpha) r_0}{\alpha} k^{1-\alpha} > 0. \tag{18}$$

Similarly by calculation we observe from (16)

$$g(k) = \alpha k^{a} - r_0 k.$$

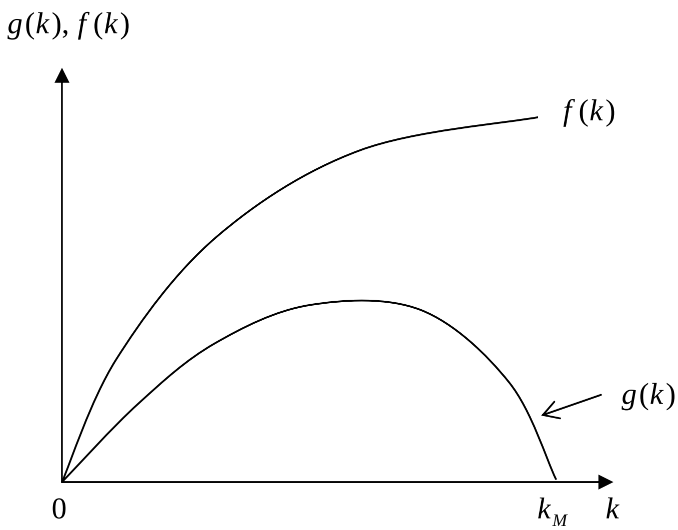
Hence

$$g'(k) > 0 \;\Leftrightarrow\; \alpha^2 k^{\alpha-1} - r_0 > 0 \;\Leftrightarrow\; \left(\frac{\alpha^2}{r_0} \right)^{1/(1-\alpha)} > k > 0.$$



[Fig. 5]

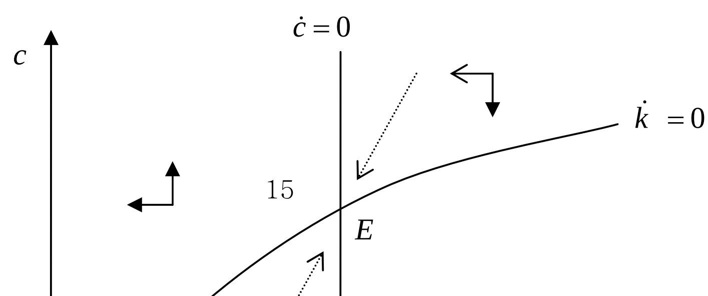
From (16) and (17) we can draw $k_f(k)$ as a function of k as shown in Fig. 5.



[Fig. 6]

Furthermore recalling $g'(k) < rk_f / k \le r$ we can show $g(k)$ from (15) as shown in Fig. 6.

Then from $\dot{k}_d = f(k) - g(k) - c = 0$ and $k_d = k_d(\underset{+}{k})$, the $\dot{k} = 0$ curve is drawn in Fig. 7 from Fig. 6.



[Fig. 7]

By adding the $\dot{c}=0$ vertical line in Fig. 7, we observe that there exists a globally stable saddle point path toward the equilibrium point *E* with $c = c(\underset{+}{k})$, irrespective of the level of initial per capita capital k_0.

(2) Next, we consider the case where *r* is not taken as given but as dependent on k_f / k by the consumer.

Then, (12) is changed into

$$f'(k) = r + r' \cdot (k_f / k) \cdot k_d / k \,. \tag{12)''$$

Recalling $f'(k) = \alpha k^{\alpha-1}$, $r'(x) = r/(1-x)$ and $k_d / k = 1 - x$, where $x = k_f / k$, we can rewrite the above as

$$\alpha k^{\alpha-1} = r \cdot (1 + k_f / k) = r_0 \cdot (1 + k_f / k)/(1 - k_f / k) \,,$$

from which we obtain

$$k_f = (\alpha k^{\alpha} - r_0 k)/(r_0 + \alpha k^{\alpha-1}). \tag{20}$$

Then, from $g = r \cdot k_f = \alpha k^{\alpha-1}(1 + k_f / k)^{-1} k_f$ and (20) we obtain

$$g(k) = (\alpha k^{\alpha} - r_0 k)/2 \,. \tag{21}$$

Then, it follows that

$$g'(k) = (\alpha^2 k^{\alpha-1} r_0)/2 < \alpha k^{\alpha-1} = f'(k)$$

and hence we obtain similar growth of $f(k)$ and $g(k)$ to that shown in Fig. 6.

Next, from (20) we derive

$$k_d = k - k_f = 2r_0 k/(r_0 + \alpha k^{\alpha-1}), \tag{22}$$

from which we obtain

$$dk_d / dk = k_d' = 2r_0(r_0 + \alpha(2-\alpha)k^{\alpha-1})/(r_0 + \alpha k^{\alpha-1})^2 > 0.$$

Then we observe a similar phase diagram to Fig. 7 and hence the same conclusion as to the global stability of the path $c = c(k)$ with $c'(k) > 0$.

This conclusion holds whether the representative consumer takes the interest rate as given or recognizes it as controllable, i.e., knows that it depends on foreign capital/total capital ratio, and chooses the optimal level of foreign capital.

The crucial factor for this result is the assumption that borrowing interest rate r increases as the increase in k_f / k, i.e. foreign capital/total capital ratio. Under this specification, domestic capital moves in the same direction as the total capital, but the foreign capital does not always do so. To be more precise, when the initial domestic capital is low, so is the foreign capital, and as the domestic capital increases, so does the foreign capital, while leaving both consumption and investment positive. However as the domestic capital exceeds a certain level, then the foreign capital starts decreasing with the total capital and consumption still increasing, and the economy approaches the stationary state. When the initial level of domestic capital is high, the domestic capital keeps decreasing while the foreign capital increases. The total capital stock and consumption keep decreasing and the economy moves toward the stationary state. In our original model, foreign capital always moves in the opposite direction to both the domestic capital and total capital, which causes the interest payment $g(k)$ to decrease as total capital k increases, and hence causes the poverty trap.

However, in the alternative model where the interest rate depends on foreign-capital/total-capital ratio, $g(k)$ increases as k increases but, after a certain level of k, it decreases as k increases further as shown in Fig. 6. This negates the possibility of the poverty trap and instead causes the global stability of the economy toward the stationary state.

4. Concluding Remarks

In order to avoid being trapped in a vicious circle of poverty, the only recommended policy is to increase labor productivity through various means. As seen from our arguments, importing capital stock does not suffice to achieve a growth path. Of course, we can generalize further by considering the case of importing composite good (i.e. good used both for consumption and for investment), or comparing the symmetric case of a developed country that exports investment good or owns foreign assets due to trade surplus.

As shown from the discussion of the alternative assumption in Section 3, the results crucially depend on whether the interest rate is an increasing function of foreign capital (=foreign debt) or of foreign-capital/total-capital ratio. While the latter assumption may seem more realistic, it at the same time washes away the possibility of the emergence of the poverty trap which is observed in many developing countries. At the same time, the latter assumption is destined to cause the convergence theory – any economy can attain the stationary state irrespective of the initial capital stock – which is often criticized (see, e.g. Bénabou, 1996)

REFERENCES

Agénor, Pierre-Richard (1997), Capital-market imperfections and the macroeconomic dynamics of small indebted economies, Princeton Studies in International Finance No. 82, International Finance Section, Princeton University.

Bardhan, Pranab (1967), Optimum foreign borrowing, in K. Shell (ed.), *Essays on the Theory of Optimal Economic Growth*, Cambridge, MIT Press, 117–128.

Barro, Robert and Xavier Sali-i-Martin (1995), *Economic Growth*, New York, McGraw Hill.

Basu, K. (1997), *Analytical Development Economics*, The MIT Press, Cambridge, Massachusetts.

Bénabou, Roland (1996), *Inequality and Growth in NBER Macroeconomics Annual*, eds. by Ben S. Bernanke and Julie J. Retemberg 11-92, MIT Press/Cambridge.

Bhandari, Jagdeep, Nadeem Haque, and Stephen Turnovsky (1990), Growth, external debt, and sovereign risk in a small open economy, *IMF Staff Papers* 37, 388–417.

Blanchard, Olivier (1985), Debt, deficits, and finite horizons, *Journal of Political Economy* 93, 223–247.

Chatterjee, Sentana and Stephen J. Turnovsky (2003), Sustainability of Capital, Investment Costs, and Foreign Aid, in Steve Dowrick, Rohan Pitchford and Stephen J. Turnovsky eds.,Economic Growth and Macroeconomic Dynamics: *Recent Developments in Economic Theory,* Cambridge University Press/Cambridge, 138-170.

-- (2005), Financing Public Investment through Foreign Aids: Consequences for Economic Growth and Welfare, *Review of International Economics* 13(1), 20-44.

Corsetti, Giancarlo, Paolo Pesenti, and Nouriel Roubini (1998), What caused the Asian currency and financial crisis? National Bureau of Economic Research Working Paper No. 6833–6844.

Fisher, Walter (1995), An optimizing analysis of the effects of world interest disturbances on the open economy term structure of interest rates, *Journal of International Money and Finance* 17, 271–291.

Hamada, Koichi (1969), Optimal capital accumulation by an economy facing an international capital market, *Journal of Political Economy* 77, 684–697.

Hanson, James (1974), Optimal international borrowing and lending, *American Economic Review* 64, 616–630.

Léonard, Daniel and Ngo Van Long (1992), *Optimal Control Theory and Static Optimization in Economics*, Cambridge University Press, Cambridge.

McDonald, Donough (1982), Debt capacity and developing country borrowing: A survey of the literature, *IMF Staff papers* 29, 603–646.

Nurkse, R. (1953), *Problems of Capital Formulation in Underdeveloped Countries*, Oxford University Press, New York.

Obstfeld, Maurice (1982), Aggregate spending and the terms of trade: Is there a Laursen-Metzler effect? *Quarterly Journal of Economics* 97, 251–270.

Obstfeld, Maurice and Kenneth Rogoff (1996), *Foundations of International Macroeconomics*, Cambridge, MIT Press.

Rosenstein-Rodan, P.N. (1943), "Problems of Industrialization in Eastern and Southern Europe", *Economic Journal* 53, 202-211.

Sachs, Jeffrey (1984), Theoretical issues in international borrowing, Princeton Studies in International Finance No. 54, International Finance Section, Princeton University.

Samuelson, Paul (1965), A catenary turnpike theorem involving consumption and the golden rule, *American Economic Review* 55, 486–496.

Sebastian, Edwards (1984), LDC's Foreign Borrowing and Default Risk: An Empirical Investigation, 1976-1980, *American Economic Review* 74, 726-734.

Sen, Partha and Stephen J. Turnovsky (1989), Deterioration of the Terms of Trade and Capital Accumulation : A Re-examination of the Laursen-Metzler Effect, *Journal of International Economics* 26, 227-250.

Senhadji, Abdelhak (1997), Sources of debt accumulation in a small open economy, International Monetary Fund Working Paper No. 146.

Uzawa, Hirofumi (1968), Time preference, the consumption function, and optimum asset holdings, in J. Wolfe (ed.), *Value, capital and Growth: Papers in honor of Sir John Hicks*, Chicago, Aldine, 485–504.