Differential Rate of Return of the Emerging Market Economies

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Abstract

An emerging market economy (EME) is a developing economy where the investment has a potential to attain a higher expected rate of return but is associated with a higher risk. In this paper, an EME is characterized by the bottleneck parameter, which measures the inability of the foreign investor to invest in a particular EME. This paper develops a model to endogenously determine the relationship between the bottleneck parameter and the rate of return of investment in an EME. The equilibrium rate of return and the equilibrium bottleneck parameter is determined by the intersection of the upward sloping profit maximizing rate of return and the downward sloping profitable investment rate of return. An EME with lower bottleneck parameter attracts smaller foreign investment scale, thereby provides a lower equilibrium rate of return to the foreign investor and vice versa. The social planner of the EME can set the bottleneck parameter low or high to drive or deter competition, respectively.

Keywords: Emerging market economy, Equilibrium, Rate of return, Risk.

1. Introduction

Antoine W. Van Agtmael coined the term ‘Emerging Market Economies’ in 1981. Ashoka Mody (2004) in his working paper “What is an Emerging Markets?” mentioned that an emerging market economy (EME) has varied definitions. According to one of the definition in his paper, investment in an EME is characterized by a high level of risk and the possibility of a high return. The International Monetary Fund (IMF) divides the world into two economies: advanced economies, and emerging and developing economies based on criteria such as per capita income and degree of integration with the global economy. IMF has identified 152 countries as emerging and developing economies. Morgan Stanley Capital International (MSCI) divides the world into developed, emerging and frontier markets based on the market size, market liquidity, and level of market access for the foreign investor. MSCI has identified 23 countries as emerging markets. In this paper, the bottleneck parameter captures the degree to which the foreign investor is unable to invest in the market of an EME. Overall, an EME offers a potential higher rate of return on investment and is identified by the bottleneck parameter.

There are two kinds of foreign investment, namely foreign direct investment and foreign portfolio investment. This paper mainly focuses on the direct investment of the foreign investor. The investment decision of the foreign investor is guided by the bottleneck parameter of the EME. The bottleneck parameter is defined in two ways in this paper to capture the level of market access of the EME for the foreign investor. Firstly, the bottleneck parameter is defined as the product of the fraction of the sectors of the EME where the foreign investor cannot invest and the probability that the foreign investor will obtain a rate of return on investment lower than the reservation rate of return of the foreign investor.[1] According to the Make in India initiative, foreign direct investment in India is restricted in sectors such as real estate business or construction of farmhouses, manufacturing of cigars, and services like legal, book keeping, accounting and auditing. The foreign investor knows the historic rate of return of different sectors of the EME. The foreign investor wouldn't invest in a sector when the rate of return on investment in a particular sector is lower than the reservation rate of return of the foreign investor. Therefore, the bottleneck parameter captures the restrictions on the foreign investment in an EME. Secondly, the bottleneck parameter is defined as the ratio of the level of investment to the investment opportunities. Thus, it can be intuitively understood that for a given level of investment by the foreign investor, the lower the investment opportunities, the higher the bottleneck parameter. For example, Thailand offers a lower investment opportunity for the foreign investor. The Foreign Business Act of Thailand prohibits foreign investment in most business categories. The foreign investor can carry out investment in Thailand through an alien business operation permit, which is obtained from Director General of the Department of Commercial Registration with the approval of the Foreign Business Committee. Both the definitions of the bottleneck parameter have the same interpretation. The higher the bottleneck parameter, the higher the number of sectors restricted for the foreign investor, which imply lower investment opportunities for the foreign investor.

Even though the bottleneck parameter can apply to the domestic and the foreign investor of the EME, the foreign investor is the primary agent of this paper and all analysis pertains to the foreign investor. It is important to note that the bottleneck parameter is defined only for the foreign investor in this paper.[2] The foreign investor invests in an EME based on the bottleneck parameter of the EME. So, the expected rate of return of his investment in the EME will depend on the bottleneck parameter of the EME. The motivation of this paper is to determine the relationship between the bottleneck parameter and the rate of return of investment in an EME.

The purpose of this paper is to develop a model of an international investment market to understand how the rate of return of one EME differs from another EME based on their bottleneck parameters. The model includes two crucial decisions of the foreign investor to invest in an EME. The first decision relates to the search and utility maximization of the foreign investor. The model establishes a well-defined search methodology for the foreign investor of developed economies to invest in an EME. The searching decision of the foreign investor results in a rate of return termed as 'profit-maximizing rate of return'. The second decision of the foreign investor relates to the investment in productive profitable projects of an EME. The model builds the foreign investor's demand schedule for investing in productive projects of an EME. The profit-oriented investment decision of the foreign investor result in a rate of return termed as 'profitable investment rate of return'. The model is unique as the profit-maximizing rate of return and the profitable investment rate of return are defined as a function of the bottleneck parameter of the EME.

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[1] The reservation rate of return is equivalent to the rate of the return of the riskless bonds of the foreign investor's home country. The reservation rate of return is determined formally in section 2.

[2] However, the domestic investor may influence the social planner of the EME to set the bottleneck parameter, which is discussed later in section 4.

The structure of the model in this paper is developed in the following manner. First, the utility-maximizing search decision of the foreign investor is incorporated into the model. The foreign investor has a reservation rate of return on investment, which is equivalent to the rate of return of riskless bonds of his home country. The reservation rate of return is endogenously determined using the neoclassical model of Ramsey (1928), Cass (1965) and Koopmans (1965). The model in this paper deviates from the standard neoclassical model in the formulation of the instantaneous flow utility of the foreign investor and net change in his asset position. The instantaneous flow utility of the foreign investor is a function of the consumption goods and the investment. The asset held by the foreign investor can be used either for purchase of the consumption goods or for investment in an EME. The deviations help to formulate the marginal rate of substitution between the consumption goods and the investment as a function of the rate of return of investment in the EME. The foreign investor has a portfolio of EMEs that can be ranked in the increasing value of the bottleneck parameter. The foreign investor derives a lower utility from investment in an EME with higher bottleneck parameter, and so demands a premium on the rate of return of investment in such an EME. This rate of return is endogenously determined using the search model of Courant (1978). Second, the profitable investment decision of the foreign investor is incorporated into the model. The foreign investor takes up the investment in the productive projects of the EME and obtains a rate of return on investment that follows the standard asset-pricing model.

In summary, the foreign investor demands two types of rates of return for investing in the EME. First is the profit-maximizing rate of return that defines the premium rate of return that yields a foreign investor indifferent between investing in an EME with lowest bottleneck parameter and investing in an EME with higher bottleneck parameter. Second is the profitable investment rate of return that allows the foreign investor to invest in productive projects of the EME. Both these rates of return are functions of the bottleneck parameter. The important results of this paper show that the profit-maximizing rate of return is an increasing function of the bottleneck parameter and that the profitable investment rate of return is a decreasing function of the bottleneck parameter. The equilibrium rate of return of investment is the rate of return where the profit-maximizing rate of return is equal to the profitable investment rate of return. Thus, the model endogenously determines the equilibrium bottleneck parameter that pins down the EME for investment and the equilibrium rate of return offered to the foreign investor. The equilibrium rate of return depends on the bottleneck parameter. Essentially, the bottleneck parameter distinguishes one EME from another. So, the equilibrium rate of return of one EME is different from another EME.

The key result of this paper relates to the investment scale of the foreign investor. The foreign investor makes a smaller scale investment in an EME with lower bottleneck parameter and a larger scale investment in an EME with higher bottleneck parameter. This result leads to policy implication for the social planner of the EME to set the bottleneck parameter high or low. Additionally, this result also provides a clear entry and exit strategy to the foreign investor for investment in an EME.

An emerging market economy is characterized with signs of consistent and improved growth for the last two to three decades. The fundamental characteristic of the EME is the transitional phase when it opens up the economy to international investment from its traditionally closed economy structure. A key attribute of any particular EME is the significant increase in the domestic investment and (direct and portfolio) foreign investment. The foreign capital inflow not only adds to the volume of trading in the equity market of the EME that drives the liquidity of the market but also increases the capital formation and hence boosts economic growth in the EME. It is a win-win strategy for both economies. The investors of developed economies find new avenues of expansion for setting up new production lines and generate new sources of revenues by tapping into the emerging markets. On the other hand, the EME is exposed to the new technology and management skills and witnesses an increase in employment opportunities, experiencing overall stimulus in the production that contributes to a higher gross domestic product. However, the EME has not yet captured full stability in its market as the EME is in its transitional phase and has to undergo a series of systematic changes. This contributes to the risk component of the investment in an EME. An EME tends to show the sign of a higher risk than the developed economies. Therefore, the foreign investor demands a higher rate of return on his investment due to the intrinsically risky environment of the EME. In summary, the investor of developed economies demands a premium in the rate of return on his investment in the EME.

Literature has provided various understanding of the typical characteristics of high return on assets of EMEs. Harvey (1995) conducted a detailed analysis of twenty emerging markets and studied their characteristics of high return and volatility. The main finding of his paper is that the expected return of the efficient portfolio will increase and the variance of the efficient portfolio will decrease by including the emerging market asset into the portfolio because of the low correlation between the asset of emerging market with that of developed countries. However, the equilibrium global asset-pricing model assumes complete integration of emerging market with the global capital market. This immediately means that two emerging market assets with the same risk will provide the same rate of return due to complete integration. However, in reality, the emerging markets are partially integrated into the global market. The factors determining the level of integration include, but are not limited to, investment restrictions, political instability, underdeveloped regulatory institutions, and foreign exchange policies. Bekaert (1995) provided a connection with the level of integration to that of investment barriers. Bekaert classified three types of investment barriers: legal, indirect, and country specific risk barriers and defined associated openness measure in relation to each of these barriers. Bekaert, in general, found market integration is positively related to the openness measure. These two studies by Harvey and Bekaert show that there is a relationship between the rate of return of investment in an EME and the investment barriers as those captured by the bottleneck parameter. Also, we can understand that the lower the bottleneck parameter, the higher the level of integration of the EME.

Henry and Kannan (2008) provided empirical justification that higher economic growth in an EME generates high investment opportunities in the EME. They have argued how the expected returns calculated from dividend growth model or earning yields capture better understanding of the higher expected rate of return in EME than the expected rate of return in developed countries. Hence, one of the key components of the model in this paper incorporates the standard asset-pricing model to determine the profitable investment rate of return in the EME. In this paper, the profit flow is evaluated as a function of the bottleneck parameter. The profit flow drives the profitable investment rate of return in EME. Therefore, there exists an implicit relationship between the profitable investment rate of return in EME and the bottleneck parameter of the EME.

The rest of this paper proceeds as follows: Section 2 explains the model and key assumptions. The dynamic optimization is developed to determine the reservation rate of return and the maximum level of utility of the foreign investor. Section 3 provides an understanding of the international investment search model. Section 4 outlines the equilibrium rate of return in the EME as a function of the bottleneck parameter. Section 5 discusses an intuitive model parallel to Wang's (2013) paper on Endogenous Insurance. Finally section 6 concludes with essential insights and caveats of this paper.

2. Model

The following are the simplified assumptions of the model.

1) There are two agents of analysis. One agent is the EME and other agent refers to the representative foreign investor of the developed countries.
2) The investment market of the EME is characterized by different characteristics. I_i denotes the vector of characteristics. Assuming k characteristics, the investment characteristics satisfies the following property: $I_i \subseteq \mathcal{R}_{+}^{k}$.[3] Though there can be a non-exhaustive list of the characteristics, it suffice by mentioning a few of the environmental characteristics of the EME. An active day-to-day trading in the equity market and volume trading in the debt market will incentivize foreign investment. A stable exchange rate builds confidence in the economy and attracts investment from developed countries. The presence of regulatory bodies as watchdogs helps to safeguard the interest of the investors and provides confidence to the foreign investor. Signs of the government developing market-friendly, competition-inducing policies, curbing corruption, and increasing the ease of doing business are welcoming for the foreign investor. The perceived level of public sentiments towards foreign investment also plays a key feature on the foreign investment level.[4] The EME can increase the number of sectors where the foreign investment is allowed. Additionally, the EME can also relax high limits on direct ownership of equity on certain sectors.[5] The easy and smooth access to profits in an EME with less distortion induces high foreign investment.[6] The investment is characterized by a joint distribution of all of the mentioned (or even more) characteristics. The EME and the foreign investor of the developed countries know this distribution.
3) Both the EME and developed economies know the gross rates of return for each of the characteristics of investment. Additionally, the rates of return of all

[3] The overall investment is a real number. Each investment characteristic corresponds to a positive real number, which determines the relative weights of the investment for those investment characteristics.
[4] With opening of the economy, there may be mild friction among the domestic people who identify their national pride by distrusting foreign establishment and oppose the ownership of their domestic economy by the foreigners.
[5] Generally, EME impose complete barrier to foreign investment to any particular sector or a maximum allowed cap on the foreign investment on certain sector.
[6] EME can reduce the taxes on capital gains and dividends for the foreign investment. Also, EME may withdraw some restrictive policy such as lock-down period of investment for remittance of profit.

characteristics are in perfect hedonic equilibrium.[7] R denotes the vector of gross rate of return of the characteristics.

4) The foreign investor from the developed countries derives utility from the consumption good, Z and the investment, I. I: $\mathcal{R}_+^k \to \mathcal{R}$ is a real valued function of the observable investment characteristics. Similarly, R: $\mathcal{R}_+^k \to \mathcal{R}$ is a real valued function of the vector of gross rate of return. The foreign investor evaluates the investment opportunities in the EME and maximizes his utility by choosing a path of the consumption good and the investment. The utility has the following characteristics:
    a. $U_Z(Z, I) > 0$ and $U_I(Z, I) > 0$
    b. $U_{ZZ}(Z, I) < 0$ and $U_{II}(Z, I) < 0$
    c. $\lim_{Z\to 0} U_Z(Z, I) = \infty$ and $\lim_{I\to 0} U_I(Z, I) = \infty$
    d. $\lim_{Z\to \infty} U_Z(Z, I) = 0$ and $\lim_{I\to \infty} U_I(Z, I) = 0$
    e. $U_{ZI}(Z, I) = 0$ and $U_{IZ}(Z, I) = 0$

    (a-b): The utility function has diminishing marginal returns from the consumption good or investment.
    (c-d): The utility function exhibits Inada condition. The marginal utility from the first unit of consumption good or investment is infinity.
    (e): The utility is additively separable in consumption good and investment. This is assumed for analytical convenience.[8] Additionally, the demand for the consumption good depends on the price of consumption good only. There is no interaction between the demand of the consumption good and the price of the investment.
5) The value of the investment is 'RI'. The economic interpretation of the value of the investment is the value proposition of the investment in the EME. It is the amount that the EME promises or is willing to pay to the foreign investor under its current state of economic and political setup.
6) The foreign investor has a (positive) lower bound of utility level. This lower bound helps the foreign investor in the process of initial screening out of investment opportunities in the EME. The foreign investor then calculates the distribution of utilities that would be obtained by investing in remaining investment opportunities of the EME. $f(U)$ denotes the probability density function of this distribution, where U is the utility derived from the investment. Thus,

$$\int_{\underline{U}}^{\overline{U}} f(U)du = 1 \qquad 1$$

    where $\overline{U}$ is the maximum utility obtained under assumption 4 and $\underline{U}$ is the lower bound of utility level of the foreign investor. The foreign investor obtain an $\underline{U}$ utility level through investment in his home country's riskless bonds.
7) The perfect condition of the characteristics mentioned in assumption 2 causes sufficiently high investment opportunities readily available in the EME and an absence of gestation period to start a business in the EME. This is a simplified

[7] A hedonic equilibrium model is a model where the equilibrium condition is identified by a price function such that the density of demand equals density of the supply for a given distribution of the buyers and distribution of sellers.

[8] Example of additive separable utility function: $U(Z, I) = lnZ + \gamma lnI$

assumption. In reality, the levels of red tape, corruption and ease of doing business determines the waiting period for the actual investment to be carried out in the EME.

8) C denotes the fixed cost of searching an investment opportunity in an EME. It is assumed that the cost of searching is the same for different EMEs. In reality, the search cost in different EMEs will vary. The search cost will depend on the level of openness, access to information, and level of bureaucracy to start an investment project in an EME.
9) Using the search method, the foreign investor finds the best available EME for investment and takes up an investment level of I.
10) α is the fixed cost of entry and doing business or production activity in the EME.
11) The foreign investor reaps an average profit flow of $\overline{\pi}$ from his investment.

A. Utility maximization of the foreign investor

According to assumption 4, the foreign investor obtains utility from the consumption good, Z and the investment, I.[9] The foreign investor plans to invest in an EME for a planning horizon. The planning horizon is considered from 0 to infinity for tractability reason.[10] ρ is the subjective discounting factor of the foreign investor. ρ captures the time preference of the foreign investor i.e. he prefers utility today more than tomorrow. Thus, the foreign investor maximizes the present discounted value of all future utilities given by equation 2.

$$\widetilde{U} = \int_0^\infty e^{-\rho t}\, U(Z(t), I(t))dt \qquad 2$$

The foreign investor has an initial asset, A, that he can either use to purchase the consumption goods or invest in an EME. Here Z is assumed to be numeraire and the price of Z is set to 1. The foreign investor faces the following budget constraint, represented by equation 3, which gives the change of his asset position.[11]

$$\dot{A} = r(A - I) + RI - Z \qquad 3$$

The present value Hamiltonian (PVH) is set up in equation 4 and the regular method of dynamic optimization is carried out. λ is the shadow value of the asset. All calculation is carried out in Appendix A1.

$$PVH\!: e^{-\rho t}U(Z(t), I(t)) + \lambda(t)[r(A - I) + RI - Z] \qquad 4$$

The key result obtained from the first order condition of the control variables (Z and I) is given below in equation 5. Equation 5.1 and 5.2 represent the marginal benefit in

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[9] As mentioned in Assumption 4, here all the investment characteristics are bundled together and collectively represent an investment of I. Similarly, R denotes the collective gross rate of return of I.

[10] The planning horizon can be from 0 to T where T is finite time, which is more realistic. Here, the planning horizon is taken from 0 to infinity for easy computation and easy analysis.

[11] The budget constraint is different from the standard Ramsey model budget constraint of the representative household. The foreign investor doesn't have a wage income. The investor has an initial asset, which he can either invest or use for consumption. His source of income is derived from the investment decision.

the utility (LHS) equal to the corresponding marginal cost of the consumption good and the investment respectively (RHS). When the gross rate of return of investment (R) in EME increases, the RHS of 5.2 decreases (due to the negative sign). It implies that the LHS of 5.2 also decreases to preserve the equality. So, the investment increases due to the diminishing marginal return of utility with respect to investment. Thus, the level of the investment increases with the increase in the gross rate of the return of the EME. Equation 5.3 represents the intra-temporal substitution between the consumption good and the investment. The intra-temporal condition holds at any point of time. It says the marginal rate of substitution of the consumption good and the investment is equal to (negative) ratio of their prices.[12]

$$e^{-\rho t}U_Z(Z,I) = \lambda \qquad 5.1$$

$$e^{-\rho t}U_I(Z,I) = -\lambda(R-r) \qquad 5.2$$

$$\frac{U_Z}{U_I} = -\frac{1}{R-r} \qquad 5.3$$

The utility exhibits additively separable property in Z and I, which implies that $U_{ZI}(Z,I) = 0$. After a few simple algebra manipulations, the Euler equation, which determines the reservation rate of return of the foreign investor, is obtained as in equation 6.

$$r = \rho + \sigma\frac{\dot{Z}}{Z} \qquad 6$$

$\sigma = -\frac{U_{ZZ}(Z,I)Z}{U_Z(Z,I)}$ is the elasticity of inter-temporal substitution. The reservation rate of return, r for the foreign investor is the sum of the rate of time preference, ρ and an additional return required to follow an uneven consumption path.[13] r is the proxy for the rate of return of the riskless bonds of foreign investor's home country.

The consumption at any given point of time is given in equation 7.

$$Z(t) = Z(0)e^{\frac{(r-\rho)t}{\sigma}} \qquad 7$$

Using equation 3 and carrying out simple algebra a key result is obtained which is given by equation 8.

$$Z(t) = \mu(t)[S(t) + A(t)] \qquad 8$$

$\mu(t)$ is the marginal propensity to consume.[14] $S(t)$ is the investment capital that represents the present discounted value of all future earning from the investment in

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[12] The price of the consumption good is 1. The price of the investment is the difference between the gross rate of return in EME and the rate of return of the foreign investor home country.

[13] The foreign investor prefers an even consumption path than an uneven consumption path. σ captures the curvature of the utility with respect to consumption good. $\frac{\dot{Z}}{Z}$ captures the growth rate of consumption. The foreign investor needs to be compensated for choosing an uneven path rather than an even consumption path and is captured by $\sigma\frac{\dot{Z}}{Z}$.

[14] $\mu(t) = \frac{1}{\int_t^\infty e^{(r-\rho)(s-t)/\sigma} * e^{-r(s-t)} ds}$

EME during the planning horizon.[15] $S(t)$ describes the productive nature of the investment and the benefits the foreign investor obtains from his investment decision.

Using equation 8 and 5.3, investment at any given point of time, I (t) can be obtained. The combination of Z(t) and I(t) maximizes the utility of foreign investor which is represented by $\overline{U}$.

The elasticity of the inter-temporal substitution, σ, characterizes the foreign investor. A conservative foreign investor is characterized by σ <1 and a forward-looking foreign investor is characterized by σ >1. For the purpose of the study, flight of investment means decrease in the investment by the foreign investor in an EME as a result of increase in his home country rate of return, r.

<u>*Proposition 1:*</u> For a given gross rate of return, R, of the EME, "flight of investment" occurs only when the conservative foreign investor moves his investment from the EME to his home country due to the increase in his home country rate of return, r.

Proof: In this proposition, the conservative foreign investor is considered which implies σ <1. An increase in the rate of return of the home country of the foreign investor, r, causes the substitution effect to dominate over the income effect.[16] So the marginal propensity to consume decreases. At the same time an increase in his home country rate of return causes the investment capital, S(t) to fall. The decrease in S(t) reinforces the substitution effect and result in the overall decrease in the consumption. Then by the intra-temporal substitution equation (5.3), the numerator of the LHS increases due to diminishing marginal return of utility with respect to consumption. Increase in r causes the RHS to decrease. Thus, the denominator of the LHS has to increase equivalently to preserve the equality. Hence, the investment in the EME by the foreign investor is lowered due to diminishing marginal return of utility with respect to investment.

This has important implication that can be observed by stylized facts. Nechio (2014) mentioned the impact of the US Fed tapering news on the emerging market. On 22nd May 2013 Ben Bernanke, US Fed Chairman announced reversal of the monetary policy and 10-year US bond rate to be slightly higher than 2%. This resulted in about $30 billion net capital outflow from the emerging countries of Asia and Latin America to US. [17]

<u>B. Search mechanism of the foreign investor</u>

Figure 1 shows the decision schedule of the search mechanism of investment in an EME for the foreign investor.[18] At any given point of time, the foreign investor has evaluated the investment (above the lower bound of utility) and found the best option of investment, which provides the maximum utility among the investment opportunities. Now the foreign investor may not decide to make any future search and

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15 $S(t) = \int_t^{\infty}(R - r)Ie^{-r(s-t)}ds$

16 $e^{\frac{(r-\rho)\,t}{\sigma}}$ is the substitution effect and e^{-rt} is the income effect.

17 The withdrawal of foreign investment will cause exchange rate in EME to depreciate. This further discourages foreign investor to invest in EME.I am thankful to Professor Becker for noting the point on exchange rate.

18 The figure is adapted from racial prejudice in a search model of the urban housing market, Lewis Team, 2015.

go forward with the best available option. Alternatively, the foreign investor may decide to make an additional search and incur the search cost. On the one hand, the foreign investor may find a better option and obtain a higher utility by investing in the new investment, on the other hand he may not find an investment worth investing, as the newly found investment will provide a utility below the maximum level found so far.

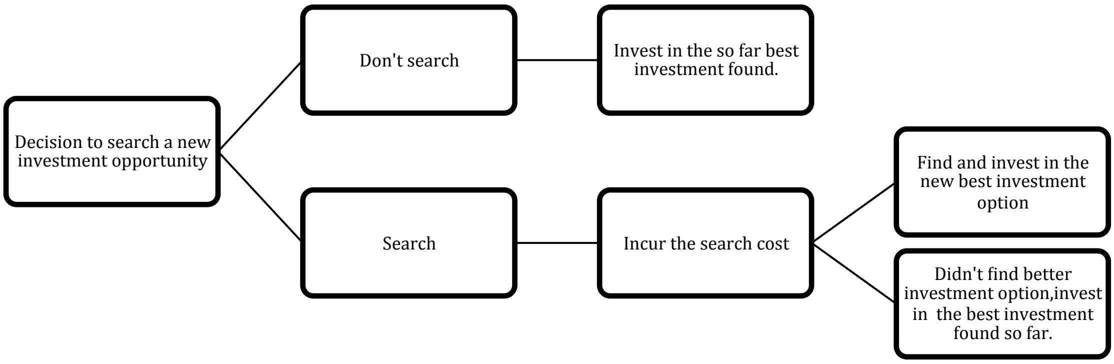

Figure 1: Investment decision schedule of the foreign investor.

Search model of Urban Housing noted by Courant (1978) is adopted. The value of the foreign investor utility function takes the following form when he considers making an additional search.

$$U = max\begin{Bmatrix} U_0 \\ [1 - F(U_0)]E(U|U \geq U_0) + U_0F(U_0) - C \end{Bmatrix} \qquad 9$$

$U_0$is the utility of the best investment found so far. The first line of the max operator corresponds to the decision that foreign investor don't search. The second line of the max operator is the expected utility of an additional search. It is a result of simple cost benefit analysis. The expected utility of an additional search is the sum of first term, corresponding to the probability of finding a better investment multiplied by the expectation of finding a better investment conditional on finding such an investment, and the second term, denoting the probability of inability to find a better investment multiplied by the utility of not finding a better option minus the search cost.

A rational foreign investor decides not to search when the expected return to the decision of not searching is greater than or equal to expected return to the decision of making an additional search. Under such condition the cost of search is determined and given as follows:

$$C = \int_{U_0}^{\overline{U}} (U - U_0)dF \qquad 10$$

The derivation of this condition is done in Appendix A2. The equality sign indicate the indifference point between searching and not searching an additional investment opportunity. The LHS of equation 10 is the expected loss of the utility associated with the cost of search. The RHS of the equation 10 is the expected gain derived from the additional search. When the probability density function, $f(U)$ is known then equation 10 gives the optimal value of U_0, defined as U^*, at which the foreign investor will his cease search. Another insight of this analysis is that the foreign investor deviates from the maximum possible utility if the search is costless.[19] This implies that the foreign investor settles for a lower consumption and investment profile corresponding to U^* than the consumption and investment profile corresponding to $\overline{U}$.

3. International Investment Search Model

The economic openness and integration of an EME will be an essential determinant of the investment decision for the foreign investor. Every sector of the EME is not open for the foreign investment. Some sectors of the EME allow the foreign investment under an automatic route, while some sectors of the EME allow foreign investment with a predetermined cap. Also, there are certain sectors of the EME, which are restricted for foreign investment. The openness of different sectors of India is highlighted as an illustration. According to the Make in India initiative, while the agriculture sector of India allows foreign investment through an automatic route, the pension sector of India allows foreign investment up to 49%, and the real estate business in India restricts foreign investment. The restricted sector of an EME will form an integral part in defining the bottleneck parameter of the EME.

The following assumptions are taken into consideration to develop the investment search model.

1. There are n EMEs indexed by j and j can vary as 1,2,3…n.
2. Different sectors of EME market are not fully open for foreign investment due to the economic, political and social situations [Assumption 2 in section 2]. The foreign investor can fully invest in some sectors, can invest till a certain cap in some sectors, and cannot invest at all in some sectors of the EME. Let f_j represent the fraction of the sectors of the EME where the foreign investor cannot invest. The rate of return, r, calculated in equation 6 can also be viewed as the internal rate of return of investment for the foreign investor. The foreign investor observes the rate of return for a particular level of investment. There is a possibility that the rate of return from the investment opportunities in an EME will be less than the internal rate of return of the investment. So, the foreign investor will face a probability, denoted by p_j, that the investment is not possible at the market rate of return of the EME. Hence, the foreign investor faces probability, $\beta_j = p_j * f_j$, that he will not invest in the j^{th} EME. β_j is called the bottleneck parameter and exhibit the following property: $0 \leq \beta_j \leq 1$.
3. β_j varies across the EMEs i.e. $\beta_i \neq \beta_j$ for $i \neq j$.
4. The foreign investor, who has a portfolio of EMEs to invest, can determine his investment decision in a particular EME based on bottleneck parameter β_j. So the rank order of the EMEs based on their β_j values determine the preference

[19] This deviation from maximum utility is captured by the rate of return later in the paper through proposition 3.The foreign investor has a diminishing marginal utility at any instant. However, he selects an optimal portfolio and acts as a profit-maximizing agent.

of the foreign investor over the EMEs. For tractability reasons, let the rank order be $\beta_1<\beta_2<\beta_3\ldots<\beta_n$ and $\beta_1 < \beta_n$.

The utility of the foreign investor is given as follows:

$$U = \max \begin{cases} U_0 \\ (1-\beta_1)[1-F_1(U_0)]E(U_1 \mid U_1 \geq U_0) + (1-\beta_1)U_0F_1(U_0) + \beta_1U_0 - C_1 \\ (1-\beta_2)[1-F_2(U_0)]E(U_2 \mid U_2 \geq U_0) + (1-\beta_2)U_0F_2(U_0) + \beta_2U_0 - C_2 \\ . \\ (1-\beta_n)[1-F_n(U_0)]E(U_n \mid U_n \geq U_0) + (1-\beta_n)U_0F_n(U_0) + \beta_nU_0 - C_n \end{cases} \quad 11$$

Here the subscripts 1,2,3…n denote particular EMEs. Since $\beta_j \leq 1$, the expected benefit of the search of the investment opportunity in j^{th}-EME decreases by a factor $(1-\beta_j)$. Alternatively, the cost increases by a factor $1/((1-\beta_j)$. The cost calculation is carried out in Appendix A3.

$$\frac{C_j}{1-\beta_j} = \int_{U_j^*}^{\overline{U_j}} (U - U_j^*) dF_j \quad 12$$

Again, for tractability and better understanding, the distribution is assumed to be identical across each EME and cost of search is identical in each EME. So modified equation 11 and 12 are given as follows:

$$U = \max \begin{cases} U_0 \\ (1-\beta_1)[1-F(U_0)]E(U_1 \mid U_1 \geq U_0) + (1-\beta_1)U_0F(U_0) + \beta_1U_0 - C \\ (1-\beta_2)[1-F(U_0)]E(U_2 \mid U_2 \geq U_0) + (1-\beta_2)U_0F(U_0) + \beta_2U_0 - C \\ . \\ (1-\beta_n)[1-F(U_0)]E(U_n \mid U_n \geq U_0) + (1-\beta_n)U_0F(U_0) + \beta_nU_0 - C \end{cases} \quad 13$$

and

$$\frac{C}{1-\beta_j} = \int_{U_j^*}^{\overline{U}} (U - U_j^*) dF \quad 14$$

The implication of the equation 13 and 14 is that the foreign investor will invest in the EME with the lowest value of bottleneck parameter, β_j. The expected gain in utility derived from additional search is decreasing in β_j and the loss of utility with the cost of search is an increasing function of β_j. So, the foreign investor will invest into the first EME that has lowest bottleneck parameter, β_1 (due to assumed rank order). Courant (1978) in his paper outlined the procedure to determine maximum price difference of houses between the neighborhood 1 and the neighborhood j. In this paper, different EMEs will offer different gross rate of return. The utility difference because of difference in rates of return in first EME and j^{th} EME is determined using similar approach of Courant (1978). Let D_j denote the utility difference because of the difference in rates of return between the j[th] EME and the first EME i.e. R_j-R_1.

1. Using equation 13 and 14 the U_1^* of first EME is found out. U_1^* represents the optimal value of U_0 that leads to cease the search in first EME as explained in section 2.
2. The distribution in j[th] EME is $(1-\beta_j)f(U+D_j)$ and distributed from $\underline{U}+D_j$ to $\overline{U}+D_j$ .The distribution of the first EME is $(1-\beta_1)f(U)$ and distributed from $\underline{U}$ to $\overline{U}$. The implication is that the distribution in j[th] EME is decreased by (1-β_j) and shifts right by D_j.
3. Solving equation 15 at which U_j^* is equal to U_1^*, the value of D_j is obtained.

$$C = (1-\beta_j)\int_{U_1^*}^{\overline{U}+D_j}(U-U_1^*)f(U+D_j)dU \quad \forall\, j = 2,3, \dots n \qquad 15$$

So, the optimal value of D_j, given by D_j^* provides the utility difference because of the difference in rate of return in the j[th]-EME and the EME with lowest β . D_j^* ensures foreign investors obtain a utility of U_1^* from all the EMEs.

Proposition 2: D_j^* is an increasing function of β_j for a given value of $\overline{U}$. (Courant, 1978)

Proof: The bottleneck parameter of the EME, β_j, lies between 0 and 1. Hence, the term (1-β_j) is greater than 0. As β_j increases the fraction (1-β_j) decreases, the RHS of equation 15 decreases. The cost of search and value of $\overline{U}$ is fixed. Therefore, D_j has to increase in order to maintain the equality of the equation 15. So, D_j increases with β_j.

The intuition is as follows: Increase in β_j leads to an increase in the probability of the foreign investor not investing in the EME (e.g. due to institutional and policy drawbacks) increases. The foreign investor invests in the EME where the environment is most investment friendly due to the economic openness and other political policy (lowest β_j) and obtains an optimal utility. To achieve the same level of optimal utility in an EME with lower economic integration and less openness (higher β_j), the foreign investor demands a higher rate of return from his investment. This leads to a higher difference in utility because of the difference in the rate of the return between the two EMEs.

Corollary 1: If $D_j<D_j^*$, then the foreign investor will never enter into the j[th] EME for investment.

Intuition: D_j^* is the maximum utility difference that the foreign investor demands for investing into the j[th] EME. So, under the assumption $D_j<D_j^*$ the expected benefit from investing in the j[th] EME is lowered as cost is assumed to be the same for all EMEs.

$$\int_{U_1^*}^{\overline{U}+D_j}(U-U_1^*)f(U+D_j)dU < \int_{U_1^*}^{\overline{U}+D_j^*}(U-U_1^*)f(U+D_j^*)dU$$

So if D_j<D_j^*, the foreign investor will not invest in the j[th] EME and will be better off by investing in the EME with lowest bottleneck.

Proposition 3: If D_j<D_j^*, there will be a difference between the rate of return in j[th] EME and the rate of return of the lowest bottleneck EME i.e. the first EME. This implies R_j is different from R_1.[20] (Courant, 1978)

Proof: (Proof by contradiction). Suppose there are no difference between the rate of return in j[th] EME and the rate of return of the lowest bottleneck EME. Now D_j<D_j^*, then by corollary 1, foreign investor will not invest in the j[th] EME. This means that the set of investment characteristics in both of the EMEs are different. Thus the rate of return in both of the EMEs must be different. This brings to the contradiction to the initial hypothesis. Hence, if D_j<D_j^*, there will be a difference between the rate of return in j[th] EME and the rate of return of the EME with the lowest bottleneck parameter i.e. the first EME.

The intuition is explained as following. Let D_j>D_j^*, then it is attractive for the foreign investor to invest in the j[th] EME and enjoy the same utility as obtained from investing in the EME with the lowest bottleneck i.e. the first EME. As the j[th] EME and the first EME offer the same level of utility, the foreign investor is indifferent between investing in the first or the j[th] EME. This means that the set of investment characteristics in both of the EMEs are similar. So, the rates of return in both EMEs are equal. Therefore, the utility difference because of difference in the rate of return (D_j) must be less than the optimal utility difference for the rate of return of the one EME to vary from the rate of return of another EME.

4. The Rate of Return of the investment in an EME

A. Investment decision of the foreign investor in the EME

The foreign investor invests in an EME and the investment benefits the EME. The EME can use this investment in one of the following activities: to generate productive business ideas, to expand the production of the existing goods, or to improve the technology employed. In all the cases, it is assumed that the EME has profitable investment opportunity during the planning horizon. For simplicity the foreign investment is used in the expansion of the production of the existing goods.

Let $P\ (O,I)$ be the profitability function for the investment. The profitability function is defined by the investment opportunities (O) in the EME and the actual foreign investment (I) in the EME. The profitability function exhibits the following properties.[21]

a. $P_O(O,I) > 0$ and $P_I(O,I) > 0$
b. $P_{OO}(O,I) < 0$ and $P_{II}(O,I) < 0$
c. $P\ (O,I)$ is linearly homogeneous function.

An alternative similar definition of the bottleneck parameter is developed. For a given actual investment (I), the higher the bottleneck parameter of the EME, the smaller the

[20] R_j and R_1 denote the gross rate of return from j[th] EME and first EME.
[21] These are the assumptions of the profitability function.

investment opportunities (O) of that EME. The smaller investment opportunities can arise for the foreign investor in number of ways. There may be lower investment opportunity due to lack of infrastructure in the EME. The lack of infrastructure refers to the deficiencies of the infrastructure requirements according to the foreign investor. For example, Sharma and Mukherji (2013) mentioned in their article that Walmart faced problems initially in opening up its activity in India due to poor preservation facilities and backdates supply chain in India. The smaller investment opportunities can also arise when the foreign investor requires a local partner of the EME or special permission to start the business. For example, the foreign investor in Thailand has to obtain an alien business permit from the Director General of Commercial Registration. So, the bottleneck parameter is defined as the ratio of the investment to that of the investment opportunities. This definition of the bottleneck parameter has the same spirit as the definition of the bottleneck parameter in section 3.[22]

$$\beta_j = \frac{I}{O} \qquad 16$$

Let $\overline{\pi}_j$ be the average profit flow from the investment in j^{th} EME. The average profit flow from the investment is defined as the ratio of the profitability function to that of the actual investment.

$$\overline{\pi}_j = \frac{P(O,I)}{I}$$

The profitability function is assumed linearly homogeneous function. So,

$$\overline{\pi}_j = P\left(\frac{O}{I}, 1\right)$$

The relationship between average profit flow and bottleneck parameter is determined below by using equation 16.

$$\overline{\pi}_j = \pi(\beta_j) \qquad 17$$

where,

$$\pi(\beta_j) = P\left(\frac{O}{I}, 1\right) = P\left(\frac{1}{\beta_j}, 1\right)$$

The profitability function is increasing in O. Now for a given investment (I), the higher the bottleneck parameter, the lower the investment opportunities (O) in EME. Lower the investment opportunities (O) in EME mean lower value of profitability function. Thus, the average profit flow, $\overline{\pi}_j$ will be lower. This implies that the average profit flow, $\overline{\pi}_j = \pi(\beta_j)$, is a decreasing function of the bottleneck parameter, β_j.

Let $\overline{r}_{ej}(s,t) = [\frac{1}{s-t}] \int_t^s r(v)dv$ is the average interest rate between the time period t and s. The value of the investment is the present discounted value of all future profits obtained from the investment and is represented in equation 18.

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[22] In section 3: $\beta_j = p_j * f_j$ represents the probability that the foreign investor will not invest in the j^{th} EME. Higher the value of β_j higher is the fraction of sector where the foreign investor cannot invest. This means lower investment opportunities for the foreign investor.

$$V(t) = \int_t^{\infty} \overline{\pi}_j \,.\, e^{-\overline{r}_{ej}(s,t)(s-t)} ds \qquad 18$$

A deterministic environment for the expansion is assumed for simplification purposes. It requires a deterministic amount of effort, time, and resources for the process of expansion. Hence, the EME has to incur a cost for the expansion activity. The expansion activity has an opportunity cost of foregone production of the existing goods. Let the cost of expansion be α in units of the existing goods. This cost of expansion is assumed to be constant. Now at equilibrium, the EME decides to devote resources to expansion until reaching a marginal condition, $V\ (t) = \alpha$.

Intuition: If $V\ (t) > \alpha$, then the EME will channel infinite amount of resources into the expansion at time t and no resources into the production of existing goods. So, at equilibrium $V\ (t) > \alpha$ cannot hold. Similarly, if $V\ (t) < \alpha$, then no resources will be devoted to expansion at time t. So, there is no expansion because the expansion activity will not be able to recover the associated cost. Hence, in equilibrium,

$$V\ (t) = \alpha \qquad 19$$

Differentiating equation 18 with respect to time (using Leibniz Rule), the following condition for rate of return of the EME is obtained:

$$\overline{r}_{ej}(t) = \frac{\overline{\pi}_j}{V(t)} + \frac{\dot{V}(t)}{V(t)} \qquad 20$$

The derivation of the above condition is done in Appendix A4. The implication of equation 20 is that the rate of return of investment in profitable projects of an EME is equal to the sum of the ratio of average profit flow to the value of investment and the capital gain or loss from the change in the value of investment. The cost of expansion, α, is constant which implies $\dot{V}(t) = 0$. So, the rate of return of investment in profitable project of an EME is given by equation 21.

$$\overline{r}_{ej}(t) = \frac{\overline{\pi}_j}{\alpha} \qquad 21$$

Hence, the average profit flow from the investment is the key driver of the rate of return on investment of the EME.

Proposition 4: For a given α, the rate of return of the investment in profitable projects of an EME, $\overline{r}_{ej}$ decreases with an increase in the bottleneck parameter, β_j.

Proof: Using equation 17 and 21,

$$\overline{r}_{ej}(t) = \frac{\overline{\pi}_j}{\alpha} = \frac{\pi(\beta_j)}{\alpha}$$

The average profit flow, $\pi(\beta_j)$ is a decreasing function of bottleneck parameter, β_j. For a given expansion cost α, a higher bottleneck parameter implies that the average profit, $\pi\ (\beta_j)$ is lower. As the average profit flow is reduced, the rate of return of investment in profitable projects from the EME is lowered.

The intuition here is that β_j is the ratio of the investment of the foreign investor to that of the investment opportunities in the EME. So, for a given investment, the higher the β_j value, the relatively smaller the investment opportunities for the foreign investor in that EME are. The average profit generated will be lower due to fewer investment opportunities in the EME. Hence, the rate of return from the investment is also lower.

Thus, a direct implication is that the EME with the lowest bottleneck parameter value offers the highest rate of return on investment in the profitable projects. Lower β_j means that the EME has an open and integrated economy, with political and institution robustness. Also, it reinforces the idea that foreign investor has a preference over the EME via the bottleneck parameter, β_j. Equivalently, it could be understood that there exists an implicit one-to-one inverse relationship between β_j and $\overline{r}_{ej}$-lower β_j means higher $\overline{r}_{ej}$. So, the foreign investor invests in the EME that provides the highest rate of return on investment in profitable projects. Equivalently, the foreign investor invests in the EME with the lowest bottleneck parameter.

Henry and Kannan (2008) asserted that the opening of the EME to foreign investment reduces the cost of capital; thereby the EME will experience a positive unexpected return. Proposition 4 captures a similar intuition, the lower the bottleneck parameter implies a higher level of integration and openness to the foreign investment, so the rate of return of such EME is higher.

B. Determination of the rate of return in the EME as a function of the bottleneck parameter

As seen in the section 3 with the searching mechanism, the foreign investor observes a difference in utility because of the gap in the gross rate of return in the j^{th} EME and first EME (lowest β_j). The difference in utility is denoted by D_j. This D_j parameter, which corresponds to utility difference because of difference in gross rates of return (R_j) in the EMEs, can be mapped to a rate of return $\overline{r}_{dj}(\beta)$. In summary, the foreign investor wants to have the same indirect utility by investing in any of the EMEs. $\overline{r}_{dj}(\beta)$ denotes the '*profit-maximizing rate of return'*. The profit-maximizing rate of return, $\overline{r}_{dj}(\beta)$, reflects the rate of return of the j^{th} EME relative to the first EME (lowest β_j) that provides the same utility to the foreign investor to invest in the first EME (lowest β_j) or the j^{th} EME.[23] Hence, $\overline{r}_{dj}(\beta)$ captures the fact the foreign investor acts as a profit-maximizing agent and obtains the same indirect utility as a result of his utility maximization decision. Moreover, the profit-maximizing rate of return is increasing in β_j as D_j is increasing in β_j as per proposition 2. The profit-maximizing rate of return, $\overline{r}_{dj}(\beta)$ reflects the (inverse) international capital offer curve.[24]

Additionally, in this section the EME promises the foreign investor to pay a rate of return $\overline{r}_{ej}$, denoted as the '*profitable investment rate of return'*, by investing the foreign investment into the expansion (productive) projects. The profitable investment

[23] As mentioned in previous section, the foreign investor obtains a utility U_1^* by investing in 1st EME and in order to obtain the same utility level U_1^* by investing in j^{th} EME, the foreign investor demands a higher rate of return. $\overline{r}_{dj}(t)$ represents the difference in the rate of return.

[24] I am thankful to Professor Becker for this interpretation.

rate of return, $\overline{r}_{ej}(\beta)$, reflects the (inverse) demand for the foreign capital, which is equal to supply of profitable investment opportunities in the EME.[25]

As per proposition 2, the profit-maximizing rate of return is increasing in the bottleneck parameter and as per proposition 4, the profitable investment rate of return is decreasing in the bottleneck parameter.[26] Intuitively, higher bottleneck parameter requires higher profit-maximizing rate of return to convince the foreign investor to move from the lowest bottleneck EME to a higher bottleneck EME. However, the higher the bottleneck parameter, the lower the profitable investment rate of return due to a low average profit flow. The profit-maximizing rate of return and the profitable investment rate of return are shown below in (β,r) space.

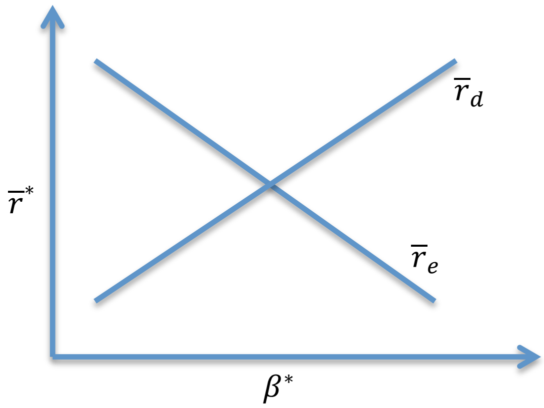


Figure 2: Equilibrium rate of return and bottleneck parameter

In equilibrium, the profit-maximizing rate of return is equal to the profitable investment rate of return. Thus, β^* denotes the equilibrium bottleneck parameter and $\overline{r}^*$ denote the equilibrium rate of return. This implies that the foreign investor has pinned down the EME, which corresponds to the bottleneck parameter, β^*, where the foreign investor carries out his investment. Also, the foreign investor has determined the rate of return, $\overline{r}^*$ that he will obtain from his investment.

The equilibrium rate of return must be greater than or equal to the rate of return of foreign investor's home country, r. The equality of the rates of return implies that the foreign investor is indifferent between the investment in his home country and the investment in the EME. The equality case is an uninteresting case. The greater than relation between the rate of return of the EME and the rate of return of foreign investor's home country ensures that EME act as an attractive destination of investment for the foreign investor. Mathematically, equation 22 is satisfied to ensure EME is an attractive destination for investment.

$$\overline{r}^* > r \qquad 22$$

C. Dynamics of the Equilibrium Rate of Return of the EME

The profit-maximizing rate of return can exhibit any of the following dependence with the bottleneck parameter: increasing concave up, increasing linear, and

25 Again I am thankful to Professor Becker for this insight.

26 There is one to one monotone positive mapping between D_j^* and $\overline{r}_{dj}$.

increasing concave down. Similarly, the profitable investment rate of return can exhibit any of the following functional relationships with the bottleneck parameter: decreasing concave up, decreasing linear, and decreasing concave down. It is assumed that the functional forms of the $\overline{r}_{ej}(\beta)$ and $\overline{r}_{dj}(\beta)$ results in a unique interior equilibrium and thus the investment is greater than zero. Appendix A5 details each of the cases with an example. Note that the profitable function, $P\ (O, I)$ is assumed to exhibit no scale economies. On the contrary, if the EME exhibits a scale economy, then the capital formation in the EME will expand at an increasing rate. Then it is possible that the corresponding functional form of $\overline{r}_{ej}(\beta)$ would decrease with the bottleneck parameter at a rate such that it doesn't intersect the $\overline{r}_{dj}(\beta)$ in (β,r) space. This results in no interior equilibrium rate of the return, $\overline{r}^*$. This case is also highlighted in Appendix A5. The absence of the interior equilibrium rate of return cases in (β,r) space is avoided from the present study.

There exists an instantaneous static equilibrium in (β,r) space determined by the intersection of the profit-maximizing rate of return curve and the profitable investment rate of return curve. The equilibrium $(\beta^*, \overline{r}^*)$ is a unique combination of the bottleneck parameter and the rate of return for the foreign investor. The equilibrium rate of return drives the level of the investment taken up by the foreign investor in an EME. Hence, whether the foreign investor decides a small investment level or a large investment level in the EME will depend on the bottleneck parameter of the EME.

Proposition 5:

For a given profile of $\overline{r}_{dj}(\beta)$,

(i) The foreign investor invests a smaller investment level in an EME with lower bottleneck parameter.
(ii) The foreign investor invests a larger investment level in an EME with higher bottleneck parameter EME.

Proof: The bottleneck parameter signifies the probability that the foreign investor will not invest in a particular EME. So, the bottleneck parameter of an EME implies that the foreign investor needs to incur a fixed cost in that particular EME. The cost associated with accounting standard compliance, necessary responsibility to maintain a minimum standard of disclosure, maintenance of a minimum market capitalization, and listing fees to be listed in the trading exchanges of the EME constitute the fixed cost.[27] An EME with lower bottleneck parameter has a low fixed cost and vice versa. The foreign investor has to invest on an optimal scale to overcome the fixed cost. So, foreign investor invests at a smaller investment level when he invests in an EME with lower bottleneck parameter and vice versa.

Implication: According to the proposition 5, the profit-maximizing rate of return is fixed for the foreign investor. When the foreign investor invests a smaller investment level in an EME with lower bottleneck parameter, the profitable investment rate of return is smaller because of the properties of the profitability function. So, the foreign obtains a lower equilibrium rate of return from a smaller scale of investment in an

[27] The fixed cost idea is adapted from Stijn Claessans and Sergio L. Schmukler (2007) paper on "International Financial Integration through Equity Markets".

EME with lower bottleneck parameter. The foreign obtains a higher equilibrium rate of return from a larger scale of investment in an EME with higher bottleneck parameter by similar reasoning. Figure 3 captures the intuition explained above.

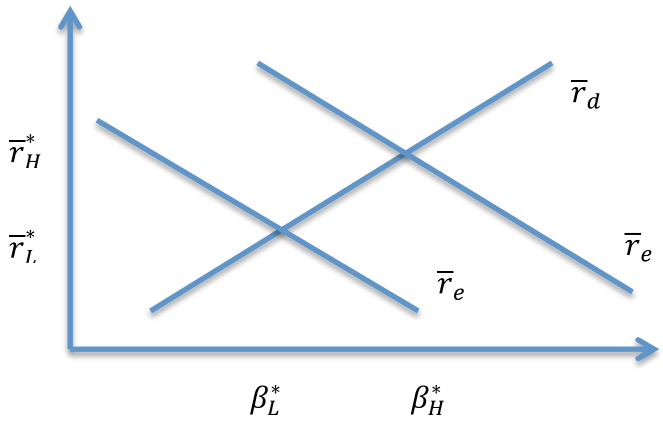


Figure 3: Investment Level and equilibrium rate of return

D. Discussion

(i) Policy implications for the EME:

First, the bottleneck parameter of the EME represents the degree of restrictions on the foreign investment in the EME due to the political and economic conditions. The social planner of an EME can choose to set the bottleneck parameter based on the relative importance of the domestic investment and the foreign investment. On the one hand, influential domestic entrepreneurs and large domestic firms can impact the bottleneck parameter of the EME. The large domestic firms are major contributors of the government income. It is likely that the social planner of the EME will set a high bottleneck parameter if the influential domestic entrepreneurs and the large domestic firms wish to deter competition. On the other hand, in the absence of significant dominant domestic firms, the social planner of an EME will set a low bottleneck parameter to attract foreign investment into different sectors of the economy and drive up the competition.

Second, when the social planner of an EME sets a low bottleneck parameter, the EME will attract foreign investors into different sectors. However, according to the proposition 5, the foreign investor invests a smaller investment level and obtains a relatively low rate of return. However, when the social planner of an EME sets a high bottleneck parameter then the EME will draw specific firms such as extractive industries.[28] Generally these firms make large-scale investment and obtain a high rate of return. This is consistent with result of proposition 5.

(ii) Strategy for the foreign investor:

The bottleneck parameter characterizes an EME. Therefore, the bottleneck parameter of one EME is different from another EME. The equilibrium rate of the return of the EME varies with the bottleneck parameter. If the assumption of proposition 5 holds, an EME with higher bottleneck parameter offers a higher equilibrium rate of return to

[28] The extractive industries carry out the operations of extracting oil, natural gas, minerals, and metals from the earth.

the foreign investor. The implication is that when there is a change in the bottleneck parameter of the EME, the foreign investor has to make two decisions. If the bottleneck parameter of the EME increases, then the foreign investor can make a higher investment level and gain a higher equilibrium rate of return. However, if the foreign investor maintains his old investment level, then he has to choose a different EME. Thus, the equilibrium bottleneck parameter and the investment level of the foreign investor are decisive in the entry and exit strategy for the foreign investor.

5. Matching

Wang (2013) in her paper "Endogenous Insurance and Informal Relationship" describes the conditions for positive-assortative matching (PAM) and negative-assortative matching (NAM).[29] NAM occurs when the least risk-averse individuals are matched with the most risk-averse individuals. On the other hand, PAM occurs when the least risk-averse individuals are matched with the least risk-averse individuals. Wang in her paper mentions that concavity (convexity) of the marginal cost is a sufficient condition for PAM (NAM) to exist as a unique equilibrium.

In the present setting, the foreign investor is assumed to be risk-neutral. The EME with the lowest bottleneck parameter can be thought of the safest place to invest and hence the most risk-averse destination. As the bottleneck parameter of the EME increases, the risk aversion decreases. This makes the EME less risk-averse destination, equivalently a risker destination to invest. So, NAM occurs when the foreign investor invests in the EME with low bottleneck parameter, i.e. high risk-averse EME. Similarly, PAM occurs when the foreign investors invest in the EME with high bottleneck parameter, i.e. low risk-averse EME.

The sufficient condition for PAM and NAM can be formed as a corollary of proposition 5.

Corollary 2:

a) The sufficient condition for NAM is that the foreign investor invests a smaller investment level in an EME.

b) The sufficient condition for PAM is that the foreign investor invests a larger investment level in an EME.

Proof: The proof is straightforward.

a) According to proposition 5(i), it is clear that the foreign investor invests in an EME with lower bottleneck parameter or the safest EME at a smaller investment level. The foreign investor is assumed to be a risk-neutral agent and is matched with most risk-averse EME. Thus, this condition results in negative-assortative matching.

b) Similarly, according to proposition 5(ii), it is clear that the foreign investor invests in an EME with higher bottleneck parameter or a risky EME at a larger investment

[29] I am thankful to Gene Burinskiy for suggesting a suitable heading for this section.

level. The foreign investor is assumed to be risk-neutral agent and is matched with least risk-averse EME. Thus, this condition results in positive-assortative matching.[30]

The intuition behind the corollary is as follows. The slope of the profitable investment rate of return and the profit-maximizing rate of return captures the speed of decrease and increase of the rate of return, respectively with the small change in the bottleneck parameter. The profitable investment rate of return is decreasing with the bottleneck parameter. If the speed of decrease of profitable investment rate of return is rapid with the increase in the bottleneck parameter, then the foreign investor benefits from investing in the EME with lower bottleneck parameter that results in NAM. On the contrary, if the speed of decrease of profitable investment rate of return is gradual with the increase in the bottleneck parameter, then the investor can benefit from the increase in the profit-maximizing rate of return, which increases at rapid speed. Hence, the foreign investor invests in the EME with higher bottleneck parameter that results in PAM. Thus, foreign investor is likely to obtain a higher equilibrium rate of return when invest in an EME with higher bottleneck parameter and vice versa.

An EME with higher bottleneck parameter is likely to have domestic entrepreneurs who can build strong association with the foreign investor investing at a larger investment level. The EME with higher bottleneck parameter attracts extractive industries like oil companies that invest a lot of capital. The EME finds it easy to design contracts with these industries. The extractive industries are risk takers and operate in highly risky environment, which corresponds to an EME with higher bottleneck parameter. Naturally, this association is PAM and the extractive industries earn a higher equilibrium rate of return.

6. Conclusion

The model incorporates two important decisions of the foreign investor. First decision corresponds to the utility-maximizing searching decision and second decision corresponds to the profit oriented investment decision of the foreign investor. Each decision is associated with a rate of return: the profit-maximizing rate of return and the profitable investment rate of return respectively. The bottleneck parameter is the most key variable of the EME. The novelty of this model lies in the formulation of the profit-maximizing rate of return and profitable investment rate of return as functions of the bottleneck parameter.

In summary the key results of the model are as follows. First, the conservative foreign investor moves the investment away from an EME with an increase in his home country rate of return. Second, the profit-maximizing rate of return is an increasing function of bottleneck parameter and the profitable investment rate of return is decreasing function of the bottleneck parameter. Finally, there exists a unique equilibrium of the bottleneck parameter and the rate of return for the foreign investor. The foreign investor invests in the EME with lower (higher) bottleneck a smaller (larger) investment level and obtains a lower (higher) equilibrium rate of return.

The analysis of the model is straightforward due to the simplified assumptions. Additionally, the simple (yet powerful) parametric function of the equilibrium rate of return is beneficial to understand the dynamics of the system based on a single

[30] Investment level is chosen rather than the bottleneck parameter in the sufficient condition of NAM and PAM because investment decision is easily observable than the bottleneck parameter of the EME.

variable, i.e. the bottleneck parameter. However, the model has its own caveats. The incorporation of the nuances provides scope for expanding to a richer model.

This model did not incorporate the exchange rate shocks. The exchange rate fluctuations can have a significant impact on the rate of the return obtained from the EME. The analysis of the equilibrium rate of return with the exchange rate channel would be an interesting topic. The effect of the exchange rate can be understood by incorporating the exchange rate variability as a function of the bottleneck parameter. Additionally, the relationship between the equilibrium rate of return and the exchange rate needs to be determined. This interpretation is challenging, as exchange rate can depend upon other factors, but interesting as the interaction between the exchange rate and the equilibrium rate of return may lead to new outcomes.

A strong assumption of the model is that EMEs can be arranged in strict increasing order of their bottleneck parameter. The model will be more robust by analyzing the effect when there are two EME having the same bottleneck parameter. Then, an additional decision point needs to be incorporated to rank two EMEs with identical bottleneck parameter. This will enrich the model, however the analysis will be more intense as the equilibrium rate of return will depend on two decision points (one bottleneck parameter and one parameter that define the new decision point). Thus, the sensitivity of the equilibrium rate of return due to both parameters will be tricky as it may entail cross relationship.

The model is analyzed under deterministic and perfect information. It would be appealing to understand the model under information asymmetry and in stochastic environment. Future papers could incorporate the stochastic environment into the model to understand its impact on the equilibrium rate of return of the EME. The major impact will be on the profitable investment rate of return. The average profit flow will no longer be deterministic but have expectations over different states of economy. Though the mathematical derivation could be intense, it may shed interesting insights on the investment decision of the foreign investor.

Finally, the model characterized only the benefit side of the decision process as a function of the bottleneck parameter. The model assumes fixed search cost and expansion cost. Now, the cost can also depend on the bottleneck parameter. Then the cost-benefit analysis will generate the rate of return in both the decision processes as a result of net benefit. The two rates of return may not possess the monotonicity with respect to the bottleneck parameter. Such analysis may change the implication of the equilibrium rate of return with an increase in the bottleneck parameter.

7.Appendix

A1. Dynamic Optimization to solve the utility maximization of the foreign investor

The foreign investor maximizes the present discounted value of the flow utility. The flow utility is a function of the consumption good (Z) and investment (I). So the control variables are Z and I. The state variable is asset (A) of the foreign investor. So, the maximization problem is given by equation 1.1 subject to the budget constraint given by equation 1.2.

$$\widetilde{U} = \int_0^\infty e^{-\rho t} U(Z(t), I(t))dt \qquad 1.1$$

Subject to

$$\dot{A} = r(A - I) + RI - Z \qquad 1.2$$

The present value of Hamiltonian (PVH) is given by equation 1.3. λ is the shadow price of the asset.

$$PVH: e^{-\rho t}U(Z(t), I(t)) + \lambda(t)[r(A - I) + RI - Z] \qquad 1.3$$

Taking the derivative of PVH with respect to first control variable Z and setting it to 0 yields the following:

$$\begin{gathered} \frac{\partial PVH}{\partial Z} = 0: e^{-\rho t}U_Z(Z, I) - \lambda = 0 \\ e^{-\rho t}U_Z(Z, I) = \lambda \end{gathered} \qquad 1.4$$

Similarly, taking the derivative of PVH with respect to second control variable I and setting it to 0 yields the following:

$$\begin{gathered} \frac{\partial PVH}{\partial I} = 0: e^{-\rho t}U_I(Z, I) + \lambda(R - r) = 0 \\ e^{-\rho t}U_I(Z, I) = -\lambda(R - r) \end{gathered} \qquad 1.5$$

Taking the derivative of PVH with respect to state variable A and setting it to negative rate of change in shadow value of asset yields the following:

$$\begin{gathered} \frac{\partial PVH}{\partial A} = -\dot{\lambda}: \lambda r = -\dot{\lambda} \\ \frac{-\dot{\lambda}}{\lambda} = r \end{gathered} \qquad 1.6$$

Taking the derivative of PVH with respect to shadow value of asset and setting it to rate of change in asset position yields the following:

$$\begin{gathered} \frac{\partial PVH}{\partial \lambda} = \dot{A}: (A - I)r + RI - Z = \dot{A} \\ (A - I)r + RI - Z = \dot{A} \end{gathered} \qquad 1.7$$

Transversality condition (TVC) states at the end of the planning horizon, the value of the asset i.e. the asset multiplied by the shadow value of the asset is equal to 0.

$$\lim_{t \to \infty} \lambda(t)A(t) = 0 \qquad 1.8$$

Dividing 1.4 and 1.5, the intratemporal condition is obtained in equation 1.9.

$$\frac{U_Z}{U_I} = -\frac{1}{(R-r)} \qquad 1.9$$

Taking log of equation 1.4

$$-\rho t + lnU_Z(Z,I) = ln\lambda$$

Taking time derivative

$$-\rho + \frac{U_{zz}(Z,I)\dot{Z} + U_{ZI}(Z,I)\dot{I}}{U_z(Z,I)} = \frac{\dot{\lambda}}{\lambda}$$

The utility exhibits additive separability in Z and I so $U_{ZI}(Z,I) = 0$

$$-\rho + \frac{U_{zz}(Z,I)\dot{Z}}{U_z(Z,I)} = \frac{\dot{\lambda}}{\lambda}$$

$$-\rho + \frac{U_{zz}(Z,I)Z}{U_z(Z,I)}\frac{\dot{Z}}{Z} = \frac{\dot{\lambda}}{\lambda}$$

From 1.6

$$-\rho + \frac{U_{zz}(Z,I)Z}{U_z(Z,I)}\frac{\dot{Z}}{Z} = -r$$

$$\rho + \left(-\frac{U_{zz}(Z,I)Z}{U_z(Z,I)}\right)\frac{\dot{Z}}{Z} = r$$

$\sigma = -\frac{U_{zz}(Z,I)Z}{U_z(Z,I)}$ is the elasticity of intertemporal substitution

$$r = \rho + \sigma\frac{\dot{Z}}{Z} \qquad 1.10$$

So

$$\frac{\dot{Z}}{Z} = \frac{1}{\sigma}(r-\rho) \qquad 1.11$$

$$Z(t) = Z(0)e^{\frac{(r-\rho)t}{\sigma}}$$

Equation 1.11 gives the time path of the consumption good. Z(0) is the initial consumption good at time t=0.

From 1.2

$$\dot{A} - rA = (R-r)I - Z$$

Multiplying both sides by the integrating factor e^{-rt} and integrating from 0 to ∞

$$\int_0^\infty (\dot{A} - rA)e^{-rt}dt = \int_0^\infty (R - r)Ie^{-rt}\,dt - \int_0^\infty (Z)e^{-rt}dt$$

$$A(t)e^{-rt}\Big|_0^\infty = \int_0^\infty (R - r)Ie^{-rt}dt - \int_0^\infty (Z)e^{-rt}\,dt$$

$$-A(0) = \int_0^\infty (R - r)Ie^{-rt}dt - \int_0^\infty (Z)e^{-rt}dt$$

The present discounted value of all future earning from the investment is S(0).

$$S(0) = \int_0^\infty (R - r)Ie^{-rt}dt$$

Substituting S(0) in the above equation yields:

$$\int_0^\infty (Z(t))e^{-rt}dt = S(0) + A(0)$$

From 1.11

$$Z\,(0)\int_0^\infty e^{\frac{(r-\rho)t}{\sigma}}e^{-rt}dt = S(0) + A(0)$$

Marginal Propensity to consume $\mu(0) = \frac{1}{\int_0^\infty e^{\frac{(r-\rho)\,t}{\sigma}}e^{-rt}dt}$

So

$$Z\,(0) = \mu(0)[S(0) + A(0)]$$

In general at any point of time,

$$Z\,(t) = \mu(t)[S(t) + A(t)] \qquad 1.12$$

Using 1.9 and 1.12, I (t) can be obtained. The combination of Z (t) and I (t) gives the U_0.

A2. Condition to cease searching process

$$U_0 \geq (1 - F(U_0))E(U|U \geq U_0) + U_0F(U_0) - C$$

$$C \geq (1 - F(U_0))E(U|U \geq U_0) - U_0(1 - F(U_0))$$

$$C \geq (1 - F(U_0))[E(U|U \geq U_0) - U_0]$$

$$C \geq (F(\overline{U}) - F(U_0))[E(U|U \geq U_0) - U_0]$$

$$C \geq \int_{U_0}^{\overline{U}} (U - U_0)dF$$

A3. Condition to cease searching process in each EME

$$U_0 \geq (1-\beta_j)\left(1-F_j(U_0)\right)E(U|U \geq U_0) + (1-\beta_j)U_0F_j(U_0) + \beta_jU_0 - C_j$$

$$C_j \geq (1-\beta_j)\left(1-F_j(U_0)\right)E(U|U \geq U_0) + (1-\beta_j)U_0F_j(U_0) - (1-\beta_j)U_0$$

$$C_j \geq (1-\beta_j)\left(1-F_j(U_0)\right)E(U|U \geq U_0) - (1-\beta_j)U_0(1-F_j(U_0)$$

$$C_j \geq (1-\beta_j)\left(1-F_j(U_0)\right)[E(U|U \geq U_0) - U_0]$$

$$\frac{C_j}{1-\beta_j} \geq \int_{U_j^*}^{\overline{U}_j}(U-U_j^*)dF_j$$

A4.

The value of investment is the present discounted value of all future profits obtained of all future profits obtained from the investment. The integral varies from T to t and T approaches infinity. Mathematically, it is easy to deal with T than infinity.

$$V(t) = \int_t^T \overline{\pi}_j \,.\, e^{-\overline{r}_{ej}(s,t)(s-t)}ds$$

The above equation is differentiated with respect to t by using Leibniz rule and the following result is obtained.

$$\dot{V}(t) = \int_t^T \frac{\partial\left(\overline{\pi}_j.\, e^{-\overline{r}_{ej}(s,t)(s-t)}ds\right)}{\partial t} + \left(\overline{\pi}_j.\, e^{-\overline{r}_{ej}(s,t)(T-t)}\right).\frac{dT}{dt} - \left(\overline{\pi}_j.\, e^{-\overline{r}_{ej}(s,t)(t-t)}\right).\frac{dt}{dt}$$

$$\dot{V}(t) = \int_t^T \overline{r}_{ej}(s,t).\left(\overline{\pi}_j.\, e^{-\overline{r}_{ej}(s,t)(s-t)}ds\right) + \left(\overline{\pi}_j.\, e^{-\overline{r}_{ej}(s,t)(T-t)}ds\right).0 - \left(\overline{\pi}_j.\, e^{-\overline{r}_{ej}(s,t).0}\right).1$$

$$\dot{V}(t) = \overline{r}_{ej}(t)\int_t^T \left(\overline{\pi}_j.\, e^{-\overline{r}_{ej}(s,t)(s-t)}ds\right) - \left(\overline{\pi}_j.1\right).1$$

$$\dot{V}(t) = \overline{r}_{ej}(t).V(t) - \overline{\pi}_j$$

$$\overline{r}_{ej}(t).V(t) = \overline{\pi}_j + \dot{V}(t)$$

$$\overline{r}_{ej}(t) = \frac{\overline{\pi}_j}{V(t)} + \frac{\dot{V}(t)}{V(t)}$$

A5. General properties of the functional form and examples

Table 1: Properties of the functional form

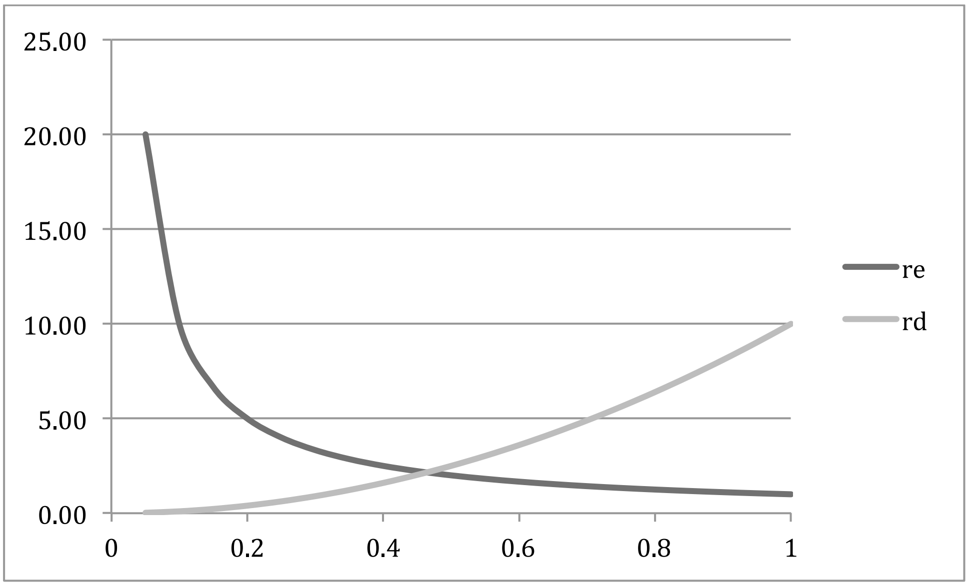
$f(x)$	$f'(x)$	$f''(x)$
Increasing Concave Up	>0	>0
Increasing Concave Down	>0	<0
Decreasing Concave Up	<0	>0
Decreasing Concave Down	<0	<0

Table 2: List of different cases

Case	$\overline{r}_{ej}(\beta_j)$	$\overline{r}_{dj}(\beta_j)$
1	Decreasing Concave up	Increasing Concave up
2	Decreasing Concave up	Increasing Linear
3	Decreasing Concave up	Increasing Concave down
4	Decreasing Linear	Increasing Concave up
5	Decreasing Linear	Increasing Linear
6	Decreasing Linear	Increasing Concave down
7	Decreasing Concave Down	Increasing Concave up
8	Decreasing Concave Down	Increasing Linear
9	Decreasing Concave Down	Increasing Concave down

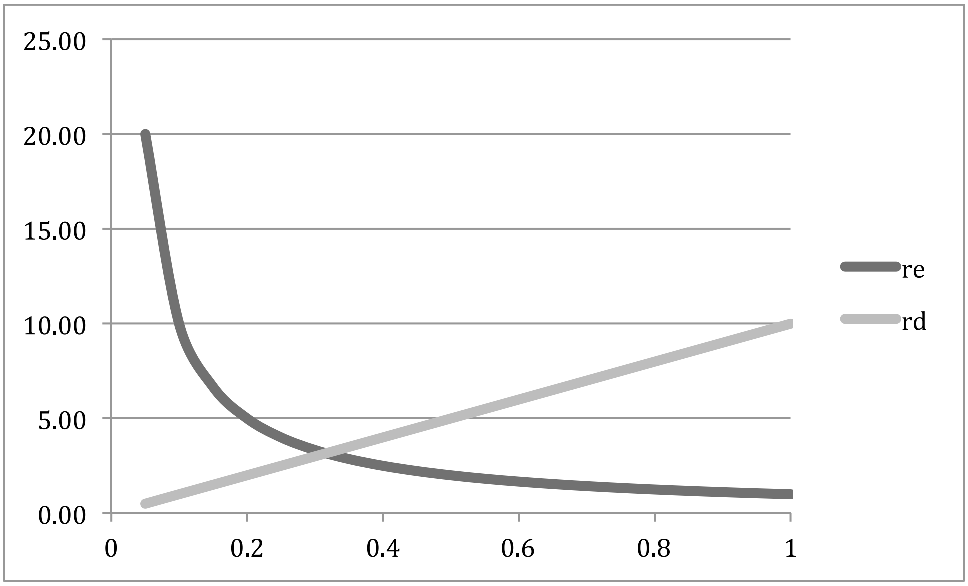
Case 1:

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Concave up $1/\beta_j$	Increasing Concave up $10 * \beta_j^2$	$1/\sqrt[3]{10}$



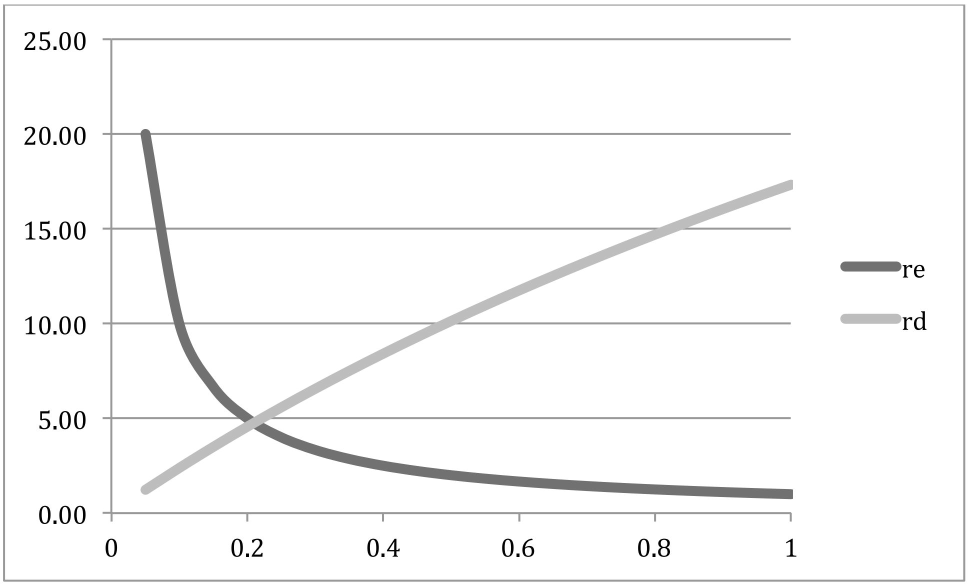
Case 2:

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Concave up $1/\beta_j$	Increasing Linear $10 * \beta_j$	$1/\sqrt{10}$



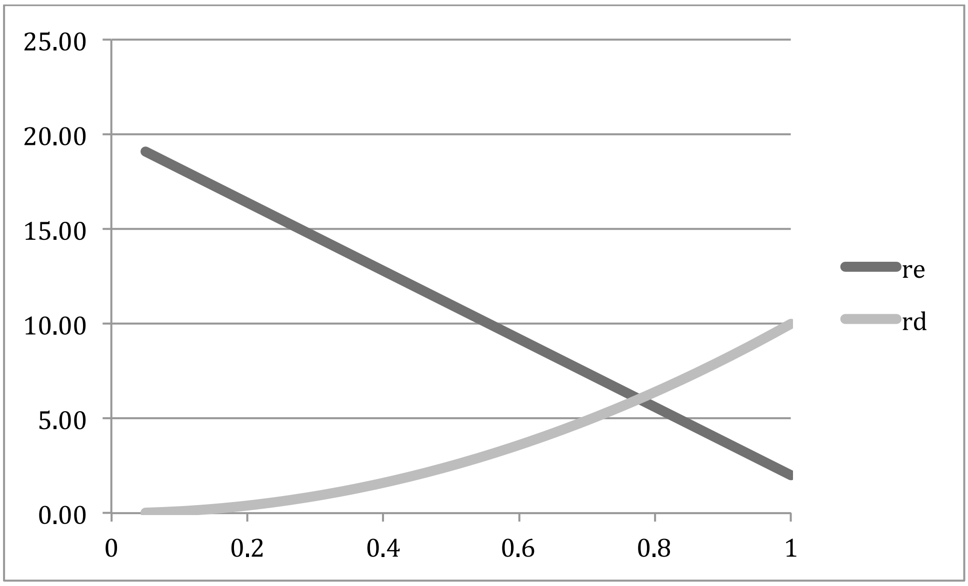
Case 3:

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Concave up $1/\beta_j$	Increasing Concave down $25 * \ln(1 + \beta_j)$	≈ 0.21



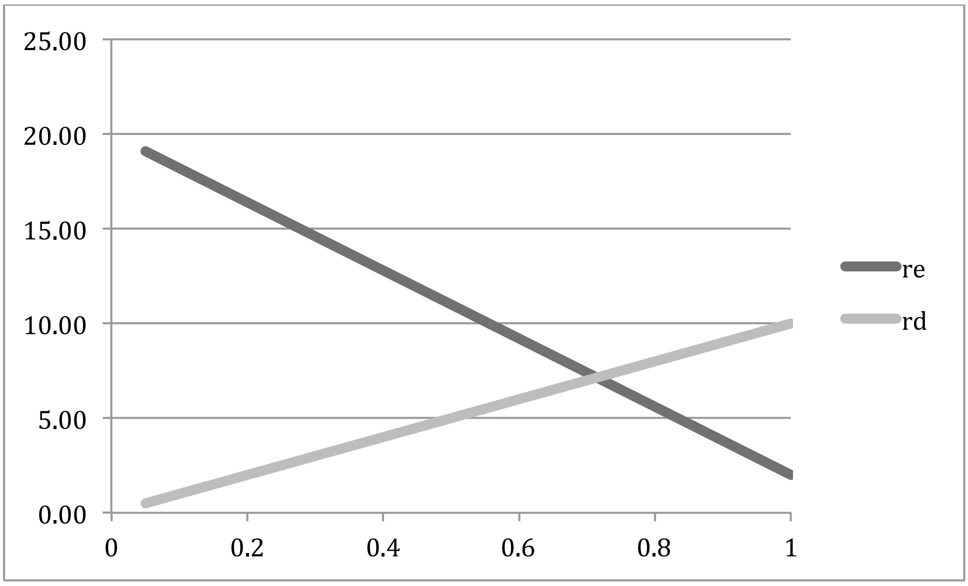
Case 4:

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Linear $20 - 18 * \beta_j$	Increasing Concave up $10 * \beta_j^2$	≈ 0.776



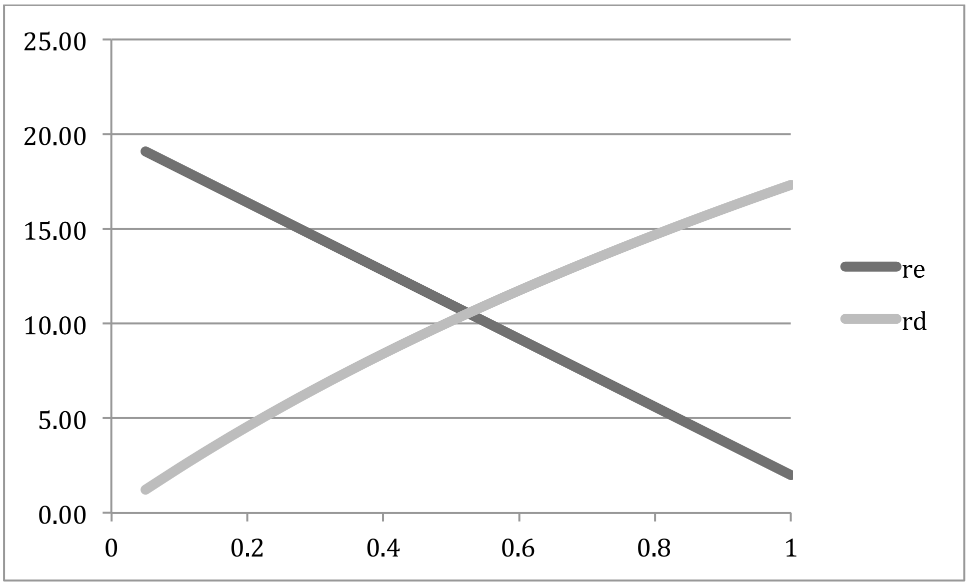
Case 5:

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Linear $20 - 18 * \beta_j$	Increasing Linear $10 * \beta_j$	≈ 0.714



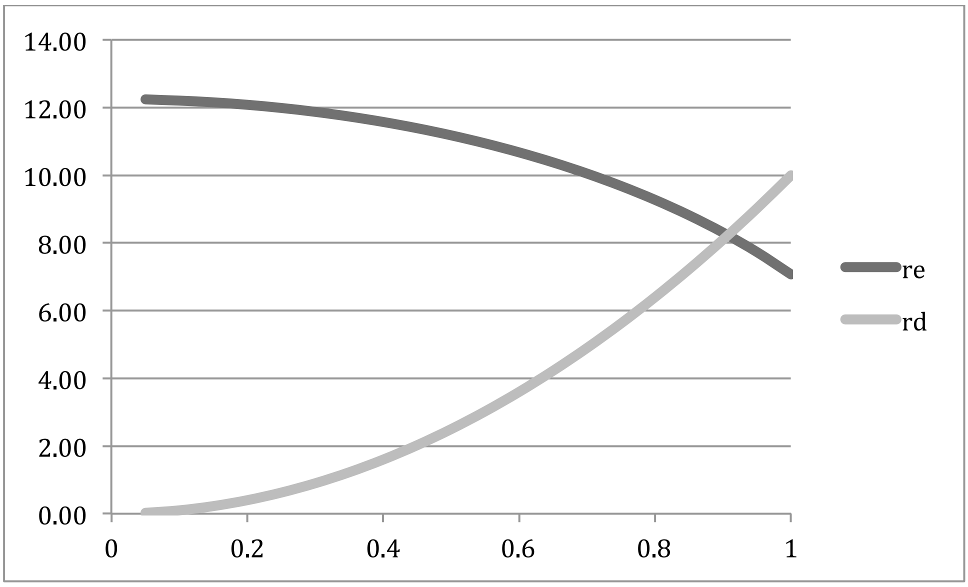
Case 6:

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Linear $20 - 18 * \beta_j$	Increasing Concave down $25 * \ln(1 + \beta_j)$	≈ 0.57



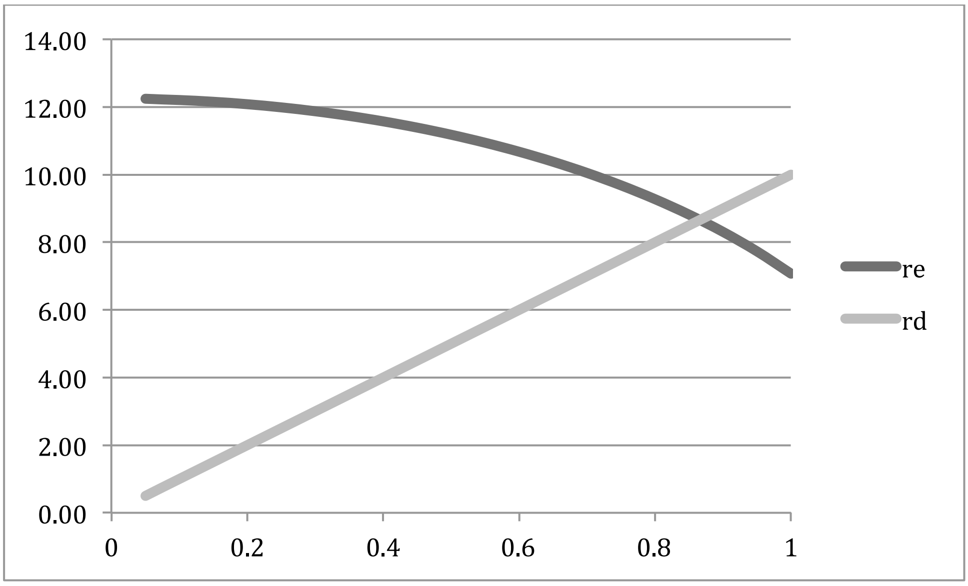
Case 7:

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Concave Down $10\sqrt{1.5 - \beta_j^2}$	Increasing Concave up $10 * \beta_j^2$	≈ 0.92



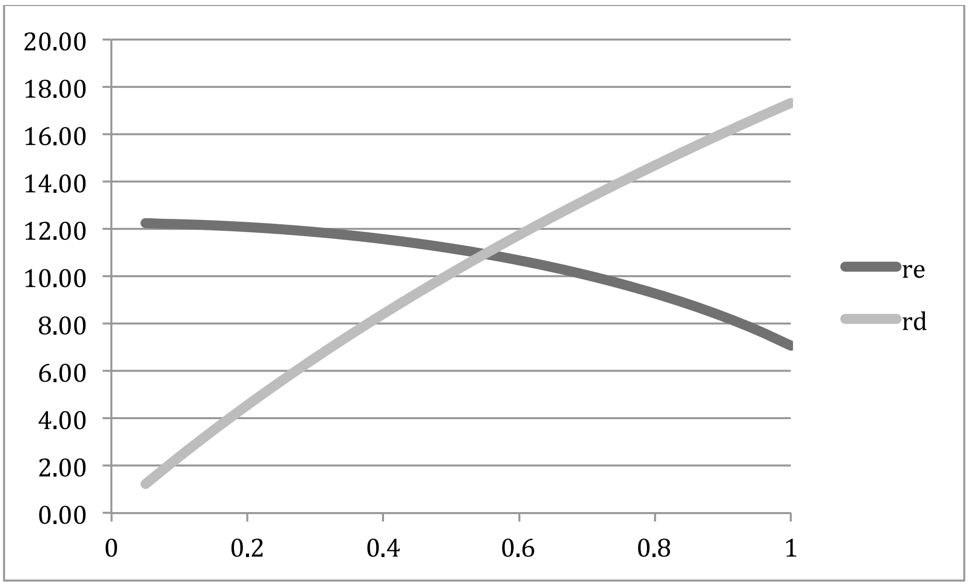
Case 8:

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Concave Down $10\sqrt{1.5-\beta_j^2}$	Increasing Linear $10 * \beta_j$	≈ 0.866



Case 9:

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Concave Down $10\sqrt{1.5-\beta_j^2}$	Increasing Concave down $25 * \ln(1+\beta_j)$	≈ 0.54



Case 10: No interior Solution

$r_{ej}(\beta_j)$	$r_{dj}(\beta_j)$	β^*
Decreasing Concave Down $10\sqrt{1.5-\beta_j^2}$	Increasing Concave up $10*\beta_j^2$	No

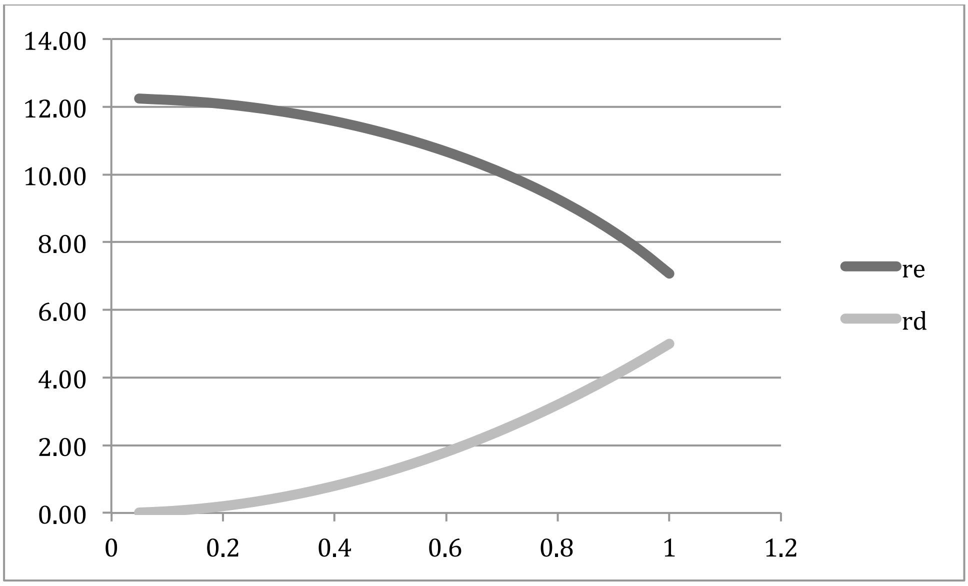


Table 3: List of Key Variables

Variables	Description
Z	Consumption good
I	Investment
O	Investment opportunities in an EME
U (Z, I)	Utility of the foreign investor
P (O, I)	Profitability function
$\bar{\pi}_j$	Average profit flow from the investment in EME
C	Fixed search cost
α	Fixed cost of expansion
β_j	Bottleneck parameter of the j^{th} EME
$\bar{r}_{dj}$	Profit-maximizing rate of return of the j^{th} EME
$\bar{r}_{ej}$	Profitable investment rate of return of the j^{th} EME
β^*	Equilibrium bottleneck parameter
$\bar{r}^*$	Equilibrium rate of return

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