


The Effects Of Restricting Capital Outflows On Investment In An Open Economy

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ABSTRACT

This paper considers the effects of restricting capital outflows on foreign investment in a developing country. It is shown that a developing country may restrict capital outflows if domestic economic conditions are poor, and it may liberalize capital outflows if domestic economic conditions are strong. Restricting capital outflows has large impact if the investment horizon is short. Furthermore, restricting capital outflows may discourage foreign investors from investing in the developing country. This result is consistent with the home equity bias.

INTRODUCTION

overnment policies, market demands, and business practices fuel the growth in emerging equity markets. Reforms in government policies, the labor market, and banking and corporate sectors are seen as necessary in attracting foreign investment to a developing country.

This paper considers the effects of restricting capital outflows on foreign investment in a developing country.¹ There are three objectives to achieve in this study. The first objective is to derive insights that may be of practical benefit to investors who may face restrictions on capital outflows. The second objective is to derive results that are consistent with the home equity bias, which is a tendency by investors to invest more of their funds in the home equity market than would be implied by the benefits of diversification in the international equity markets. The third objective is to derive policy implications.

The analysis uses game theory in an open market economy. Indeed, empirical evidence suggests that a government tends to act strategically when it imposes restrictions on capital flows (Cardoso and Goldfajn, 1998). The economic agents are the government of a developing country and foreign investors. The government restricts capital outflows to maintain a large quantity of foreign investment funds in the developing country. Foreign investors make investment allocations to the home and foreign equity markets to maximize their expected utility of wealth.

It is shown that the government of a developing country may restrict capital outflows if domestic economic conditions are poor. When the domestic economic conditions are poor foreign investors may withdraw their funds from the developing country in search of higher returns. The government may liberalize capital outflows if domestic economic conditions are strong. When the domestic economic conditions are strong there may not be incentive for foreign investors to withdraw their investment funds from the developing country. The political situation in the developing country may influence the government policy on capital outflows.

Restricting capital outflows has large impact if the investment horizon is short. If the investment horizon is long, foreign investors may repatriate large quantities of their funds from the developing country. Thus any foreign investment funds forfeited to the developing country may be substantially reduced. If the frequency of repatriating foreign funds from the developing country is high, foreign investors may repatriate large quantities of their funds from the developing country over a short period of time. This scenario may generate results similar to those obtained in the case of a long investment horizon. In the last period, restricting capital outflows is similar to imposing a kind of tax on foreign investment. This is because the balance of a foreign investor's funds is forfeited to the developing country. The numerical examples in the appendix illustrate this insight. The insights derived above provide an explanation for why some developing countries might restrict capital outflows during periods of financial distress.

Restricting capital outflows may discourage foreign investors from investing in a developing country. The reason is that foreign investors may view the restriction on capital outflows as a threat to repatriation of funds from a developing country. For instance, when foreign investors have liquidity shocks their funds in the developing country may not be fully available. This is because a restriction on capital outflows may not allow foreign investors to repatriate their funds from the developing country fast enough. This suggests that there is incentive for foreign investors to repatriate large quantities of their funds from the developing country. Indeed, the restriction on capital outflows is found to be binding. One should anticipate that foreign investors would seek loopholes to repatriate their funds faster. For instance, a mutual fund could have a foreign subsidiary and manipulate transfer pricing to allow more funds to flow out of the developing country. Since not all institutional investors may have such arrangements, the analysis abstracts away from this scenario.

Foreign investors are better off if the government liberalizes capital outflows. A constrained economy yields a second best solution. Thus liberalizing capital outflows makes the domestic economy yield a first best solution, all other things being constant. Numerical examples in the appendix illustrate this insight. As the restriction on capital outflow is eased, the value of a foreign investor's utility function increases.

The results suggest that a developing country may restrict capital outflows during periods of weak economic conditions, and it may liberalize capital outflows during periods of strong economic conditions. Restricting capital outflows may mitigate the adverse effects of capital outflows in the short run. This is consistent with the empirical findings of Cardoso and Goldfajn (1998). They document that the government of Brazil restricted capital outflows when the economy did poorly, and it liberalized capital outflows when the economy did well. The results are also consistent with the home equity bias (French and Porteba, 1991; Chan, Covrig, and Ng, 2005).

The remainder of the paper is organized as follows. Section 2 presents literature review and describes the contribution of this paper to the financial economics literature. Section 3 describes the model and states the results. Section 4 concludes the paper.

LITERATURE REVIEW

The financial economics literature emphasizes the benefits of diversification in the international equity markets. Bakaert and Urias (1996) report a 300 percent increase in mutual fund assets invested in emerging equity markets from 1991 through 1993. Dahlquist and Robertsson (2001) report an increase in foreign investment in Sweden, which is a developed country, from 126 billion Swedish Krona 1991 to 280 billion Swedish Krona in 1997.

Empirical evidence suggests that investors do not take advantage of the diversification benefits in their investment allocations. Restrictions on capital flows among other factors have been documented to contribute to the home equity bias. The following are recent restrictions of capital outflows by some developing countries.

In May–June 1997, the Thai authorities introduced temporary selective restrictions on capital outflows by prohibiting the lending and sale of baht to nonresidents and requiring that any purchase before maturity of baht-denominated securities, or purchase of equities, from nonresidents be made in foreign currency. The measures were aimed at limiting speculation by nonresidents against the baht by de-linking the onshore and offshore markets.

In September 1998, the Malaysian authorities introduced temporary restrictions on capital outflows, while pegging the exchange rate to the U.S. dollar. These measures were designed to restore a degree of monetary independence and included, among others, the introduction of a one-year holding period for the repatriation of portfolio investment. In February 1999, the one-year holding period was replaced by a graduated system of exit levy. Principal and profits could be repatriated by paying an exit tax. The amount of this tax was determined by the duration of the investment. In September 1999, the exit levy was abolished, except for profits from portfolio investment brought in after February 1999. The system was entirely abolished in 2001.

In February 2003, the Venezuelan authorities introduced temporary comprehensive foreign exchange controls on both current and capital transactions. The decision was made in an environment of great political

uncertainty and economic difficulties, which had resulted in large capital outflows. At the same time, the exchange rate was fixed, and price controls were also introduced. The domestic currency was devalued by 20 percent one year later.

Chan, Covrig, and Ng (2005) conduct an empirical study of the home equity bias. Their explanatory variables include economic development, capital controls, stock market development, information asymmetry, and investor protection. They find that these explanatory variables have various degrees of statistical significance in explaining the home equity bias.

This paper makes the following contributions to the financial economics literature. First, the game-theoretic analysis provides insights about strategic application of restrictions on capital outflows and foreign investors' strategic investment decisions. It is found that the government of a developing country may restrict capital outflows if domestic economic conditions are poor. Poor domestic economic conditions may cause foreign investors to move their funds out of the domestic country in search of higher returns elsewhere. The government may restrict capital outflows to mitigate the adverse effects of capital outflows. The government may restrict capital outflows if domestic economic conditions are strong. The government's action may be influenced by other factors, which include the political situation in the developing country. These factors are captured in the model by a constant of integration. The government has discretion in setting the value of this constant. Foreign investors estimate the value of this constant. In equilibrium the estimated value is equal to the value set by the government.

Second, the insights derived in this study may be of practical benefit to investors who may face restrictions on capital outflows. Restricting capital outflows has large impact if the investment horizon is short. This provides us with some insight about why some developing countries may restrict capital outflows during periods of financial distress. Restricting capital outflows may discourage foreign investors from investing in a developing country. The restriction on capital outflows is binding, because there is incentive for foreign investors to repatriate large quantities of their funds from the developing country.

Third, the results have empirical implications. A developing country may restrict capital outflows when it is faced with financial distress, and it may liberalize capital outflows when domestic economic conditions are strong. These insights are consistent with the empirical findings of Cardoso and Goldfajn (1998). They document that the government of Brazil restricted capital outflows when the domestic economic conditions were poorly, and the government relaxed the restriction on capital outflows when the domestic economic conditions were strong. The results are consistent with home equity bias (French and Porteba, 1991; Chan, Covrig, and Ng, 2005).

The model may be generalized to analyze the contribution to the home equity bias of other factors in the financial economic literature. These factors include taxes, costs associated with cross-border trade, information asymmetry, economic development, stock market development, and investor protection. Since the analysis in this paper is limited in scope, a detailed discussion about how the model may be modified to include other factors is provided in the conclusion.

Michaelides (2003) and Michaelides and M. Haliassos (2003) consider foreign investment in a developing country subject to liquidity constraints. Their results are able to generate home equity bias. The restriction of capital outflows considered here may be viewed as some form of liquidity constraint. This paper differs from theirs because it considers strategic application of a restriction on capital outflows by the government of a developing country. So, foreign investors make strategic investment decisions.

Scholars provide several non-mutually exclusive explanations for the home equity bias. Black (1974) and Cole and Obstfeld (1991) argue that taxes may contribute to home equity bias. Cooper and Kaplanis (1994) argue that hedging against inflation risk and costs associated with cross border investment may contribute to home equity bias. Merton (1987) and Brennan and Cao (1997) argue that information asymmetry may contribute to home equity bias. Tsar (1993) argues that hedging against price uncertainty of non-traded goods may contribute to home equity bias.

THE ECONOMY

The game-theoretic analysis is conducted in a multi-period open market economy with two countries. One country is a developed country, for example the United States. The other country is a developing country which restricts capital outflows. Basically the developing country restricts the fraction of funds that investors may take out of the country in a given transaction. Further, the developing country restricts the number of times investors may take their funds out of the country in a year.

The analysis focuses on foreign investment, so investors are foreign investors, who are assumed to be residents of the United States. Investors and foreign investors will be used interchangeably. Foreign investors are typically institutional investors such as life insurance, pension funds and mutual funds.² Furthermore small investors may invest in emerging capital markets through mutual funds. Small investors may liquidate their shareholdings in closed-end mutual funds without directly facing restrictions on capital outflows. This is because closed-end mutual funds have fixed number of outstanding shares, so small investors may sell their shares to other investors in close-end mutual funds. Nevertheless, close-end mutual funds are subject to restrictions on capital outflows. Open-end mutual funds may be poorly suited for this type of foreign investment. This is because open-end mutual funds have variable number of outstanding shares, so they cannot reduce the number of their outstanding shares easily.

Assume a continuum of foreign investors, who are uniformly distributed over $[0,1]$. Their preferences are represented by a constant coefficient of relative risk aversion utility function.

There are two assets in the open market economy. The focus is on investment in the international equity markets. One of objectives of this study is to provide insights that are relevant to home equity bias. One asset is located in the developing country. This asset is an index, which serves as a proxy for the market portfolio in the developing country. Currency risk is subsumed in the risk on returns in the developing country. The other asset is located in the United States. This asset is an index such as the S & P 500, which is a proxy for the U.S. market portfolio.

There are no other frictions such as taxes or transaction costs in the developing country. This assumption is made to focus on the effects of restricting capital outflows on foreign investment. Foreign investors consume out of their funds in the home country. The price of a unit of consumption is normalized to unity. This means that foreign investors may exchange one unit of the home currency for one unit of consumption. This assumption permits a foreign investor's wealth to directly enter into the investor's utility function.

The restriction on capital outflows in the developing country is modeled in the following manner. Foreign investors may invest unlimited quantities of their funds in the developing country, but they may face a limit on the fraction of funds they take out of the country in a given transaction. There is also a restriction on how frequently foreign investors may repatriate their funds from the developing country in a year. If the frequency of repatriation of foreign investment funds in a year were arbitrarily high, then foreign investors would be able to repatriate all their funds from the developing country within a year. This means that the government limits the frequency of repatriating foreign investment funds from the developing country. The finite number of periods in the economy reflects this intuition.

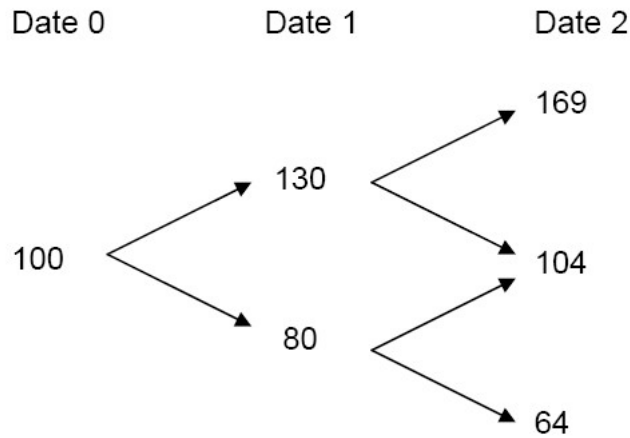
The following example highlights the main insights derived from the model.

Example

Consider a two-period open market economy, which is indexed by dates 0, 1, and 2. Assume a risk-free asset in the United States. The risk-free gross return is normalized to one. Assume a risky asset in the developing country. Uncertainty is represented by two states of the economy, a high state (boom) and a low state (recession). The high state has a probability 0.60 of occurrence, while the low state has a probability 0.40 of occurrence. The rate of return on investment in the risky asset is 30 percent in the high state, and it is -20 percent in the low state.

The following binomial tree represents the evolution of returns in the developing country.

Figure 1: Evolution Of The Two-Period Open Market Economy



Assume that the developing country has the following policy on capital flows. Foreign investors may invest unlimited quantities of their funds in the developing country, but they may repatriate up to 20 percent of their funds from the developing country in each period.

Under no restriction on capital outflows, a foreign investor maintains one investment account in the home country. This is because a foreign investor is able to repatriate unlimited quantities of the investor’s funds from the developing country in any transaction. However, this is not possible under the restriction on capital outflows. Consequently, a foreign investor keeps two separate investment accounts, one in the home country and one in the developing country.

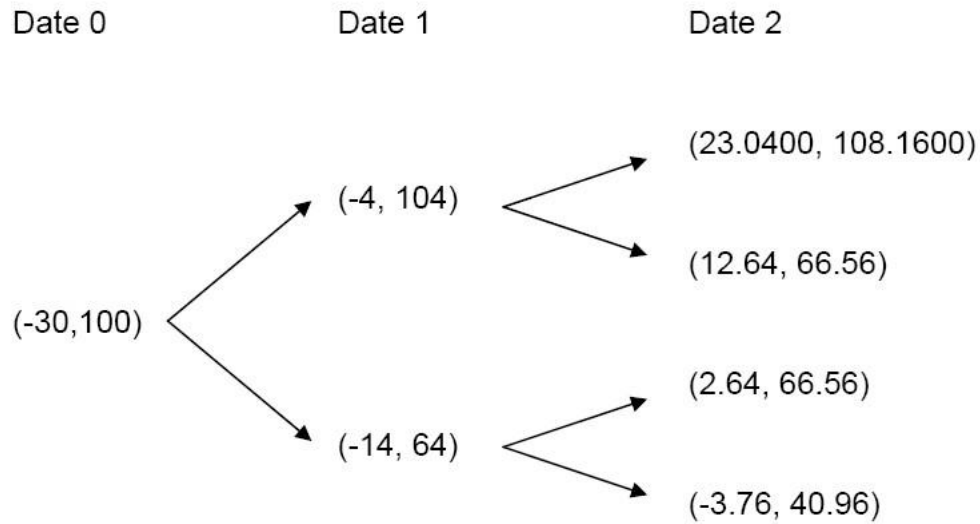
Assume risk-neutral foreign investors who consume at the last date. Under no restriction on capital outflows, assume that foreign investors have the following trading strategy. Foreign investors allocate 75 percent of their funds to the home country and 25 percent of their funds to the developing country. This trading strategy is similar to a regulatory requirement for institutional investors.

Assume that foreign investors repatriate 20 of their funds in each period. Foreign investors do not have incentive to allocate their funds to the developing country at the end of the first period. In the second period foreign investors forfeit any balance of their funds to the developing country.

The analysis now focuses on a foreign investor’s portfolio under the restriction on capital outflows. Let (x, y) denote a foreign investor’s investment accounts, where x denotes the investor’s funds invested in the home market and y denotes the investor’s funds invested in the developing country. Consider the case where a foreign investor takes a short position in the home market and then invests all the funds in the developing country. Suppose the foreign investor starts off with endowment of \$70 and takes a short position of \$30 in the home market. The foreign investor invests the amount \$100 in the developing country. This means that the foreign investor’s initial portfolio is of the form $(-30, 100)$, dropping the dollar sign for convenience.

The following decision tree represents a foreign investor’s portfolio in the two-period open market economy. A foreign investor’s portfolio allocations are made under the restriction on capital outflows.

Figure 2: A Foreign Investor’s Portfolio With A Short Position In The Home Market



In the high state the gross return on \$100 invested in the developing country is \$130. Thus the foreign investor’s total wealth is $\$130 - \$30 = \$100$. The foreign investor is able to pay off the investor’s short position. Under no restriction on capital outflows, the foreign investor’s investment allocations are \$75 to the home country and \$25 to the developing country. Under the restriction on capital outflows, the foreign investor’s investment allocations are $0.20 \times \$130 - \$30 = -\$4$ to the home country and $0.80 \times \$130 = \104 to the developing country.

The next step is to consider date 2 returns on investment under the restriction on capital outflows. In the high state the gross return on \$104 is given by $\$104 \times 1.30 = \135.2000 . The foreign investor’s funds are given by $0.20 \times \$135.2000 - \$4 = \$23.0400$ in the home country and $0.80 \times \$135.2000 = \108.1600 in the developing country. Thus the foreign investor is able to pay off the short position but the balance \$108.1600 of the investor’s funds is forfeited to the developing country.

In the low state the gross return on \$100 is given by $0.80 \times \$100 = \80 . Under no restriction on capital outflows, the foreign investor’s funds are given by $\$80 - \$30 = \$50$ in the home country. The corresponding investment allocations are $0.75 \times \$50 = \37.5000 to the home country and $0.25 \times \$50 = \12.5000 to the developing country. Under the restriction on capital outflows, the foreign investor’s funds in the two investment accounts are $0.80 \times \$80 = \64 in the developing country and $0.20 \times \$80 - \$30 = -\$14$ in the home country. The foreign investor partially pays off the short position at date 1.

The next step is to consider date 2 returns under the restriction on capital outflows. In the low state the gross return on \$64 is given by $0.80 \times \$64 = \51.20 . The foreign investor repatriates $0.20 \times \$51.20 = \10.24 from the developing country. The foreign investor’s funds in the home country are given by $\$10.24 - \$14 = -\$3.76$.

Thus the foreign investor is not able to pay off the short position despite the balance \$40.96 of the investor's funds in the developing country.

The insights derived from this example are as follows. If the investment horizon is short, the restriction on capital outflows has large impact on foreign investment in the developing. In the last period the restriction on capital outflows is like a tax on foreign investment. This is because any balance of a foreign investor's funds is forfeited to the developing country. The restriction on capital outflows may make taking a short position costly. However, the impact may be lower because a foreign investor might have a larger investment opportunity set in the home country than in the example. Indeed, a foreign investor may invest in the S & P 500 index. This means that a foreign investor might take a short position against higher returns in the home equity market.

The multi-period open market economy is indexed by dates t , where $t \in \{0, 1, \dots, T\}$. At each date t , the variables r_t and r_t^* denote gross returns on investment between dates $t-1$ and t in the home and developing countries, respectively. The gross returns in the home country are independent over time. Similarly, the gross returns in the developing country are independent over time. Further, the gross returns in the home and developing countries are independent over time. This assumption ensures that foreign investors get diversification benefits in the international equity markets.

The game-theoretic analysis uses the equilibrium concept of sub-game perfect Nash equilibrium for a continuum of economic agents (Schmeidler, 1973). This is because the players are the government of a developing country and a continuum of foreign investors. At each date t , the government chooses the restriction on capital outflows $\alpha_t \in (0, 1]$ that will be put into effect at date $t+1$. This restriction on capital outflows depends on domestic economic conditions in the period defined by dates t and $t+1$. The political situation in the developing country may influence the choice of the restriction on capital outflows. The government seeks to maximize the quantity of foreign investment funds in the developing country. Indeed, when the domestic economy is not doing well foreign investors may take their funds out of the developing country in search of higher returns. The motivation is to mitigate the adverse effects of capital outflows. A foreign investor allocates x_t and y_t of the investor's funds to the home and developing countries respectively. A foreign investor chooses the fraction β_t of the investor's funds in the developing country that will repatriated at date $t+1$. This variable is bounded above by the restriction on capital outflows. A foreign investor seeks to maximize the investor's expected utility of wealth.

The following problems formalize the sub-games described above.

Problem 1

Given a foreign investor's strategy (x_t, y_t, β_t) , the government chooses capital outflow restriction α_t to determine the minimum balance of foreign investment funds in the developing country at date $t+1$. That is, the government seeks to solve

$$\max_{\alpha_t \in (0, 1]} (1 - \alpha_t) r_{t+1}^* y_t.$$

The total quantity of foreign investment funds in the developing country is obtained by multiplying a foreign investor's funds in the developing country by one, because foreign investors are assumed to be identical and have mass equal to one.

Problem 2

Given that the government chooses the restriction on capital outflows α_t which will be put into effect at date $t+1$, a foreign investor allocates the x_t and y_t of the investor’s funds to the home and developing countries respectively. This foreign investor also chooses the fraction β_t of the investor’s funds which will be repatriated from the developing country at date $t+1$. The foreign investor maximize the investor’s expected utility of terminal wealth

$$E[u(w_T)] = \frac{1}{\gamma} E\left[\left(r_T x_{T-1} + \beta_{T-1} r_T^* y_{T-1}\right)^\gamma\right]$$

subject to

$$\beta_t \leq \alpha_t \tag{1}$$

$$x_t + y_t \leq r_t x_{t-1} + r_t^* y_{t-1} \tag{2}$$

$$y_t \geq (1 - \beta_{t-1}) r_t^* y_{t-1}. \tag{3}$$

The expectation operator E is based on date 0 information. A foreign investor’s risk aversion is defined by the parameter $\gamma < 1$ and $\gamma \neq 0$. A foreign investor consumes at the last date to make the problem tractable. Constraint (1) is a description of the restriction on capital outflows at date t . The variable α_t defines the largest fraction of funds which a foreign investor may repatriate from the developing country at date $t+1$. The government sets the restriction on capital outflows. Constraint (2) describes a foreign investor’s budget constraint. The funds allocated to investment at date t should not exceed the gross returns on funds invested at date $t-1$. Constraint (3) says that the funds a foreign investor invests in the developing country at date t are at least equal to the balance of the gross returns in the developing country at date $t-1$. A foreign investor may allocate additional funds from the home country to the developing country. A foreign investor maintains two investment accounts, one in the home country and one in the developing country. To maintain one investment fund in the home country, a foreign investor would need to be able to move around arbitrarily large quantities of funds. But the restriction on capital outflows makes it impossible for a foreign investor to achieve this. The game is solved backwards. A sub-game is solved in each period. The Nash equilibriums obtained for the individual sub-games constitute a sub-game perfect Nash equilibrium for the game.

Propositions 1 and 2 below formalize the Nash equilibriums for the sub-games.

Proposition 1

For every period defined by dates t and $t+1$, let $\alpha = \alpha_t$, $r^* = r_{t+1}^*$, and $c = c_t$. The government’s choice of the restriction on capital outflows is given by

$$\alpha = \frac{r^* - c}{r^*},$$

where c denotes a constant of integration.

Proof: This is provided in the appendix.

Generally, a constant of integration is determined from initial conditions or some boundary conditions, which do not exist here. The constant c has an interesting economic interpretation. It reflects the impact of factors not captured by domestic economic conditions. These factors include the political situation in the developing country. The government has discretion in setting the value the constant c . For a given value of c the restriction on capital outflows is a concave function of gross returns. This means that for higher returns the government may be willing to allow foreign investors to take out of the country larger quantities of their funds, all other things being constant.

The implications of Proposition 1 are as follows. If domestic economic conditions are weak, which means that gross returns are low, the government decreases the quantity of funds that foreign investors can repatriate from the developing country. If domestic economic conditions are strong, which means that gross returns are high, the government increases the quantity of funds that foreign investors can repatriate from the developing country. The determination of the restriction on capital outflows might be influenced by factors other than domestic economic conditions. For example, the government may take the political situation into consideration when setting the restriction on capital outflows. This means that even if the domestic economic conditions are weak, the government may allow foreign investors to repatriate larger quantities of their funds from the developing country. This policy may be induced by liberalization pressures in the international equity markets.

A solution to Problem 2 is provided in the following proposition.

Proposition 2

For every period defined by dates t and $t+1$ a foreign investor's investment decisions are as follows. If $\alpha_t r_t^* < r_t$, then a foreign investor will not invest additional funds in the developing country. That is, a foreign investor's investment allocations are given by $x_t = r_t x_{t-1} + \alpha_t r_t^* y_{t-1}$, $y_t = (1 - \alpha_t) r_t^* y_{t-1}$, $\beta_t = \alpha_t$. If $\alpha_t r_t^* = r_t$, then a foreign investor is indifferent between investing and not investing additional funds the developing country. This is because this foreign investor's utility is not improved by allocating additional funds to the developing country. If $\alpha_t r_t^* > r_t$, then a foreign investor will invest additional funds in the developing country. In other words, a foreign investor's investment allocations are given by $x_t = 0$, $y_t = r_t x_{t-1} + r_t^* y_{t-1}$, $\beta_t = \alpha_t$. In general, a foreign investor's investment allocations depend on returns and benefits of diversification weighed against risk and restriction on capital outflows.

Proof: This is provided in the appendix.

The implications of Proposition 2 are as follows. The restriction on capital outflows may discourage foreign investors from investing in the developing country. The impact of the restriction on capital outflows is large if the investment horizon is short. In the last period the restriction on capital outflows is similar to a tax or transaction cost. This is because the balance of funds in the developing country is forfeited. Liberalizing capital outflows makes foreign investors better off. This is because the constrained economy moves towards a frictionless economy, which yields a first best solution.

CONCLUSION

This paper considers the effects of restricting capital outflows on foreign investment in a developing country. The analysis is conducted in a game-theoretic framework in a multi-period open market economy. The economic agents are the government of a developing country and foreign investors. It is shown that the government of the developing country may restrict capital outflows if domestic economic conditions are weak. The government may liberalize capital outflows if domestic economic conditions are strong. The government's decision may be influenced by the political situation in the developing country. The restriction on capital outflows may discourage foreign

investors from investing in the developing country. The restriction on capital outflows has large impact if the investment horizon is short.

An empirical implication of the results is that a developing country might restrict capital outflows during a period of financial distress. Cardoso and Goldfajn (1998) document that the government of Brazil restricted capital outflows when the domestic economy was poor. The government of Brazil liberalized capital outflows when the economy was strong. Another empirical implication of the results is that the restriction on capital outflows may contribute to the home equity bias. French and Porteba (1991) Chan, Covrig, and Ng (2005) provide supporting empirical evidence.

The model may be extended in the following manner to analyze the contribution to the home equity bias by other factors in the financial economics literature. These factors include taxes, transaction costs, information asymmetry, economic development, stock market development, and investor protection. These factors lead to deadweight costs incurred by foreign investors (Chan, Covrig, and Ng, 2005). To analyze the contribution of other factors, consider a one-period open market economy. This is a reasonable assumption in the financial economics literature. The Cooper and Kaplanis (1986) theoretical model used by Chan, Covrig, and Ng (2005) is based on a one-period open market economy. Another example is the now textbook example of capital market pricing model (CAPM).

A good example is the capital market pricing model (CAPM). One sees that there are costs associated with the restriction on capital outflows considered in the model. These costs may be viewed as a kind of tax on foreign investment. The reason is that the balance of a foreign investor's funds is forfeited to the developing country. Thus the deadweight costs associated with the above mentioned factors may be represented by the costs associated with the restriction on capital outflows. But how can one achieve this in equilibrium? It is explained as follows. The restriction on capital outflows depends on equity returns and government discretion, which may be influenced by the political situation in the developing country. Government discretion in the model is captured by a constant of integration, whose value is chosen by the government. This means that in equilibrium the costs associated with the restriction on capital outflows can be set equal to the deadweight costs associated with the above mentioned factors. This suggests that the model in this paper may be modified to analyze the contribution to the home equity bias by other factors considered in the financial economics literature.

NOTES

1. There are several reasons for a developing country to restrict capital outflows. A developing country may restrict capital outflows to protect a fixed exchange rate. A developing country may restrict capital outflows to channel domestic saving into domestic capital formation. A developing country may restrict capital outflows to manage a financial crisis.
2. Gompers and Merrick (2001) and He, Ng, and Wang, (2004) find empirical evidence that institutional investors have similar investment strategies. Institutional investors prefer large and liquid stocks. Foreign investors are risk averse.

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APPENDIX A:

Proof of Proposition 1

For the period between dates t and $t+1$ denote the capital outflow restriction by $\alpha = \alpha_t$ and denote the gross return on investment in the developing country by $r^* = r_{t+1}^*$. Then the first order condition associated with Problem 1 is given by

$$\frac{d(r^*(1-\alpha)y_t)}{d\alpha} = \left((1-\alpha)\frac{dr^*}{d\alpha} - r^* \right) y_t = 0.$$

Since the investment allocation y_t is not zero, it follows that

$$(1-\alpha)\frac{dr^*}{d\alpha} - r^* = 0.$$

This is a separable differential equation, so it can be written it in the form

$$\frac{dr^*}{r^*} = \frac{d\alpha}{1-\alpha}.$$

Integrating both sides of differential equation yields

$$\int \frac{dr^*}{r^*} = \int \frac{d\alpha}{1-\alpha} + c_0.$$

Therefore the general solution is of the form

$$\ln(r^*) = -\ln(1-\alpha) + c_0.$$

Write the above general solution in the form

$$\alpha = \frac{r^* - c}{r^*}, \tag{4}$$

where c denotes a constant of integration. Initial and boundary conditions do not determine this constant because they are not present here. Instead, the government sets c through a political process. For a specified constant of integration the capital outflow restriction is a concave function of gross returns.

To check the second order condition, differentiate the first order condition with respect to the restriction on capital outflows.

$$\frac{d^2 \left((1-\alpha)r^* y_i \right)}{d^2 \alpha} = (1-\alpha) \frac{d^2 r^*}{d^2 \alpha} y_i - 2 \frac{dr^*}{d\alpha} y_i.$$

The second order condition is satisfied because the capital outflow restriction is a concave function of gross returns. This implies the optimal capital outflow restriction is given by (4).

Proof of Proposition 2

The idea is to solve Problem 2 backwards, starting at date $T - 1$. Given the government's choice of a restriction on capital outflows α_{T-1} , a foreign investor chooses the quantities x_{T-1} and y_{T-1} of the investor's funds to invest in the home and developing countries, respectively, and the fraction β_{T-1} of the investor's funds to be repatriated from the developing country at the last date in order to maximize the investor's expected utility of terminal wealth

$$E[u(w_T)] = \frac{1}{\gamma} E \left[\left(r_T x_{T-1} + \beta_{T-1} r_T^* y_{T-1} \right)^\gamma \right]$$

subject to

$$\beta_{T-1} \leq \alpha_{T-1} \tag{5}$$

$$x_{T-1} + y_{T-1} \leq r_{T-1}x_{T-2} + r_{T-1}^*y_{T-2} \tag{6}$$

$$y_{T-1} \geq (1 - \beta_{T-2})r_{T-1}^*y_{T-2}. \tag{7}$$

Here expectation is taken at date $T - 1$. This means that information at earlier dates is known. The Kuhn-Tucker conditions imply that the restriction on capital outflows (5) and the budget constraint (6) are binding. The restriction on outflows is binding because, at the last date, any balance of the foreign investor’s funds is forfeited to the developing country. The budget constraint is binding to ensure that all funds are invested. Thus

$$x_{T-1} + y_{T-1} = r_{T-1}x_{T-2} + r_{T-1}^*y_{T-2} \text{ and } \beta_{T-1} = \alpha_{T-1}.$$

Substitute these values into the foreign investor’s wealth and get

$$w_T = r_T r_{T-1} x_{T-2} + r_T r_{T-1}^* y_{T-2} + (\alpha_{T-1} r_T^* - r_T) y_{T-1}. \tag{8}$$

The foreign investor’s investment in the developing country satisfies

$$(1 - \beta_{T-2})r_{T-1}^*y_{T-2} \leq y_{T-1} \leq r_{T-1}x_{T-2} + r_{T-1}^*y_{T-2}.$$

If $\alpha_{T-1}r_T^* < r_T$, the foreign investor’s wealth defined in (8) is largest when investment in the developing country is given by $y_{T-1} = (1 - \beta_{T-2})y_{T-2}$. Thus the foreign investor’s investment allocations and utility function are given by

$$x_{T-1} = r_{T-1}x_{T-2} + \beta_{T-2}r_{T-1}^*y_{T-2}$$

$$y_{T-1} = (1 - \beta_{T-2})r_{T-1}^*y_{T-2} \tag{9}$$

$$E[u(w_T)] = \frac{1}{\gamma} E \left[\left(r_T r_{T-1} x_{T-2} + (\beta_{T-2} r_T r_{T-1}^* + \alpha_{T-1} (1 - \beta_{T-2}) r_T^* r_{T-1}^*) y_{T-2} \right)^\gamma \right].$$

If $\alpha_{T-1}r_T^* = r_T$, then the foreign investor is indifferent between allocating and not allocating additional funds to investment in the developing country. This is because allocating additional funds to the developing country will not improve utility. If $\alpha_{T-1}r_T^* > r_T$, the foreign investor allocates more funds to the developing country which are given by $y_{T-1} = r_{T-1}x_{T-2} + r_{T-1}^*y_{T-2}$. Even if the foreign investor may forfeit funds to the developing country, the investor’s utility is increased by executing this investment strategy. In general, where the above relationships are not easily established, a foreign investor’s investment allocations depend on high returns and diversification benefits derived from investing in the developing country.

At date $T - 2$, a foreign investor’s problem is as follows. Given the government’s choice of a restriction on capital outflows α_{T-2} , a foreign investor chooses the quantities x_{T-2} and y_{T-2} of the investor’s funds to invest in the home country and developing countries and the fraction β_{T-2} of the investor’s funds to be repatriated from the developing country at the date $T - 1$ to maximize the investor’s expected utility of terminal wealth

$$E[u(w_T)] = \frac{1}{\gamma} E \left[\left(r_T r_{T-1} x_{T-2} + (\beta_{T-2} r_T r_{T-1}^* + \alpha_{T-1} (1 - \beta_{T-2}) r_T^* r_{T-1}^*) y_{T-2} \right)^\gamma \right]$$

subject to

$$\beta_{T-2} \leq \alpha_{T-2} \tag{10}$$

$$x_{T-2} + y_{T-2} \leq r_{T-2} x_{T-3} + r_{T-2}^* y_{T-3} \tag{11}$$

$$y_{T-2} \geq (1 - \beta_{T-3}) r_{T-2}^* y_{T-3}. \tag{12}$$

The Kuhn -Tucker conditions imply that the restriction on capital outflows constraint (5) and the budget constraint (8) are binding. The restriction on capital outflows is binding because at the last date any balance of the foreign investor’s funds is forfeited to the developing country. The budget constraint is binding to avoid waste of funds. Thus

$$x_{T-2} + y_{T-2} = r_{T-2} x_{T-3} + r_{T-2}^* y_{T-3} \text{ and } \beta_{T-2} = \alpha_{T-2}.$$

Substitute these values into a foreign investor’s wealth and get

$$w_T = r_T r_{T-1} r_{T-2} x_{T-3} + r_T r_{T-1} r_{T-2}^* y_{T-3} + \left((\alpha_{T-2} r_{T-1}^* - r_{T-1}) r_T + \alpha_{T-1} (1 - \alpha_{T-2}) r_T^* r_{T-1}^* \right) y_{T-2}. \tag{13}$$

At date $T - 2$, investment in the developing country satisfies

$$(1 - \beta_{T-3}) r_{T-2}^* y_{T-3} \leq y_{T-2} \leq r_{T-2} x_{T-3} + r_{T-2}^* y_{T-3}.$$

If $\alpha_{T-2} r_{T-1}^* < r_{T-1}$, then a foreign investor’s wealth (13) is largest when investment in the developing country is given by $y_{T-2} = (1 - \beta_{T-3}) r_{T-2}^* y_{T-3}$. This implies that the foreign investor’s investment allocations and utility of wealth are given by

$$x_{T-2} = r_{T-2} x_{T-3} + \beta_{T-3} r_{T-2}^* y_{T-3}$$

$$y_{T-2} = (1 - \beta_{T-3}) r_{T-2}^* y_{T-3}$$

$$E[u(w_T)] = \frac{1}{\gamma} E \left[\left(r_T r_{T-1} r_{T-2} x_{T-3} + \alpha_{T-2} (1 - \beta_{T-3}) r_T r_{T-1}^* r_{T-2}^* y_{T-3} + \alpha_{T-1} (1 - \alpha_{T-2}) (1 - \beta_{T-3}) r_T^* r_{T-1}^* r_{T-2}^* y_{T-3} \right)^\gamma \right].$$

If $\alpha_{T-2} r_{T-1}^* = r_{T-1}$, then a foreign investor is indifferent between allocating and not allocating additional funds to investment in the developing country. If $\alpha_{T-2} r_{T-1}^* > r_{T-1}$, the foreign investor allocates more funds to the developing country which are given by $y_{T-2} = r_{T-2} x_{T-3} + r_{T-2}^* y_{T-3}$. In general, where the above relationships are not easily established, the foreign investor’s investment allocations depend on returns and benefits of diversification weighed against risk and the restriction on capital outflows.

At date $T - i$, a foreign investor chooses the quantities x_{T-i} and y_{T-i} of the investor's funds and a fraction of the investor's funds β_{T-i} to be withdrawn from the developing country in order to maximize the investor's utility of terminal wealth

$$E[u(w_T)] = \frac{1}{\gamma} E \left[\left(r_T r_{T-1} \dots r_{T-i+1} x_{T-i} + \alpha_{T-2} (1 - \alpha_{T-3}) \dots (1 - \alpha_{T-i+1}) (1 - \beta_{T-i}) r_T r_{T-1}^* \dots r_{T-i+1}^* y_{T-i} \right)^\gamma \right].$$

$$+ \alpha_{T-1} (1 - \alpha_{T-2}) \dots (1 - \alpha_{T-i+1}) (1 - \beta_{T-i}) r_T^* r_{T-1}^* \dots r_{T-i+1}^* y_{T-i}$$

subject to

$$\beta_{T-i} \leq \alpha_{T-i} \tag{14}$$

$$x_{T-i} + y_{T-i} \leq r_{T-i} x_{T-i-1} + r_{T-i}^* y_{T-i-1} \tag{15}$$

$$y_{T-i} \geq (1 - \beta_{T-i-1}) r_{T-i}^* y_{T-i-1}. \tag{16}$$

The Kuhn -Tucker conditions imply that the restriction on capital outflows constraint (14) and the budget constraint (15) are binding. The restriction on the capital outflows is binding because at the last date any balance of the investor's funds is forfeited to the developing country. The budget constraint is binding to avoid waste of funds. Thus

$$x_{T-i} + y_{T-i} = r_{T-i} x_{T-i-1} + r_{T-i}^* y_{T-i-1} \text{ and } \beta_{T-i} = \alpha_{T-i}.$$

Substitute these values into the investor's wealth and get

$$w_T = r_T r_{T-1} \dots r_{T-i} x_{T-i-1} + r_T r_{T-1} \dots r_{T-i}^* y_{T-i-1} + \left(r_T r_{T-1} \dots r_{T-i+2} (\alpha_{T-i} r_{T-i+1}^* - r_{T-i+1}) + \alpha_{T-1} (1 - \alpha_{T-2}) \dots (1 - \alpha_{T-i}) r_T^* r_{T-1}^* \dots r_{T-i+1}^* \right) y_{T-i}. \tag{17}$$

A foreign investor's funds invested in the developing country satisfies

$$(1 - \beta_{T-i-1}) r_{T-i}^* y_{T-i-1} \leq y_{T-i} \leq r_{T-i} x_{T-i-1} + r_{T-i}^* y_{T-i-1}.$$

If $\alpha_{T-i} r_{T-i+1}^* < r_{T-i+1}$, then a foreign investor's wealth (17) is largest when investment in the developing country is given by $y_{T-i} = (1 - \beta_{T-i-1}) r_{T-i}^* y_{T-i-1}$. This implies that the foreign investor's investment allocations and wealth are given by

$$x_{T-i} = r_{T-i} x_{T-i-1} + \beta_{T-i-1} r_{T-i}^* y_{T-i-1}$$

$$y_{T-i} = (1 - \beta_{T-i-1}) r_{T-i}^* y_{T-i-1}$$

$$E[u(w_T)] = \frac{1}{\gamma} E \left[\left(r_T r_{T-1} \dots r_{T-i} x_{T-i-1} + \alpha_{T-2} (1 - \alpha_{T-3}) \dots (1 - \alpha_{T-i}) (1 - \beta_{T-i-1}) r_T r_{T-1}^* \dots r_{T-i}^* y_{T-i-1} \right)^\gamma \right].$$

$$+ \alpha_{T-1} (1 - \alpha_{T-2}) \dots (1 - \alpha_{T-i}) (1 - \beta_{T-i-1}) r_T^* r_{T-1}^* \dots r_{T-i}^* y_{T-i-1}$$

If $\alpha_{T-i} r_{T-i+1}^* = r_{T-i+1}$, then a foreign investor is indifferent between allocating and not allocating more funds to investment in the developing country. This is because utility is not improved by allocating additional funds to the developing country. If $\alpha_{T-i} r_{T-i+1}^* > r_{T-i+1}$, the foreign investor allocates more funds to the developing country which are given by $y_{T-2} = r_{T-2} x_{T-3} + r_{T-2}^* y_{T-3}$. In general, where the above relationships are not easily established, a foreign investor's investment allocations depend on returns and the benefits of diversification.

APPENDIX B: Numerical Examples

The numerical examples provided here illustrate the insights derived from the model.

We consider a two-period open market economy indexed by date 0, 1 and 2. Consider the solution to Problem 1 given by

$$x_1 = (1 - \kappa) (r_1 x_0 + \alpha_0 r_1^* y_0)$$

$$y_1 = \kappa r_1 x_0 + (1 - (1 - \kappa) \alpha_0) r_1^* y_0$$

$$E[u(w_2)] = \frac{1}{\gamma} E \left[(r_2 x_1 + \alpha_1 r_2^* y_1)^\gamma \right],$$

where $\kappa \in [0, 1]$. The solution lies on the budget line $x_1 + y_1 = r_1 x_0 + r_1^* y_0$. If $\kappa = 0$, then the restriction on capital outflows is binding. If $\kappa = 1$, then a foreign investor allocates all of the investor's funds to the developing country in the second period. The other possible solutions are interior solutions.

The initial allocations of funds are $x_0 = 0.65$ to the home country and $y_0 = 0.35$ to the developing country.

There are two policy levers for the government of the developing country. These are the gross returns and the constant c which captures other factors including the political situation. These two parameters determine the restriction on capital outflows. It is seen from Figure 3 that once c is chosen, the government eases the restriction on capital outflows as the gross returns increase. That is, investors may repatriate larger quantities of their funds from the developing country.

The parameters are $r_1 = 1.16$, $r_1^* = 1.25$, $\alpha_1 = 0.25$, $\alpha_0 = 0.35$, $\kappa = 0.25$. The initial allocations of funds are $x_0 = 0.65$ to the home country and $y_0 = 0.35$ to the developing country. The feasible region is enclosed by the lines $x_1 + y_1 = r_1 x_0 + r_1^* y_0 = 1.1915$ and $y_1 = (1 - \alpha_0) r_1^* y_0 = 0.2625$.

Figure 3: Effects of domestic economic conditions on the capital outflow control.

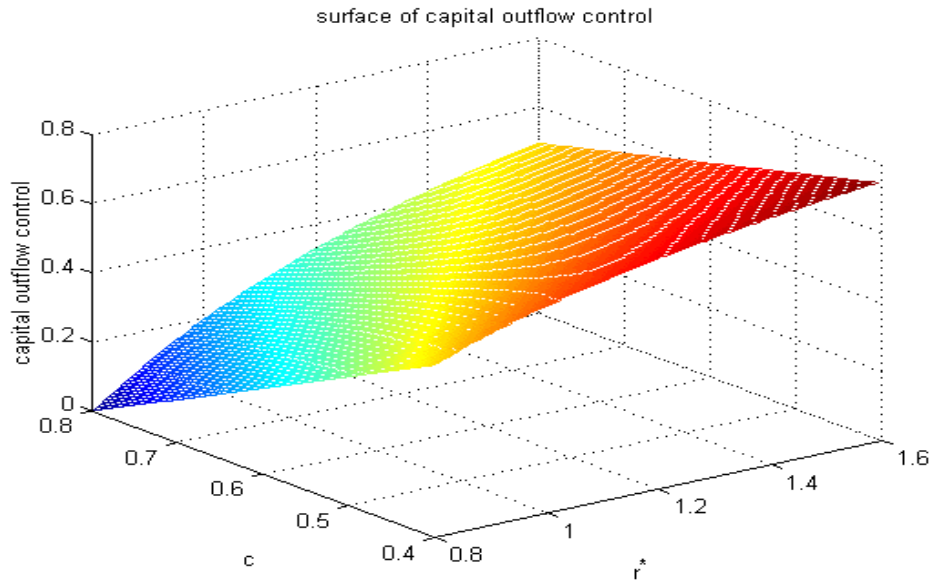
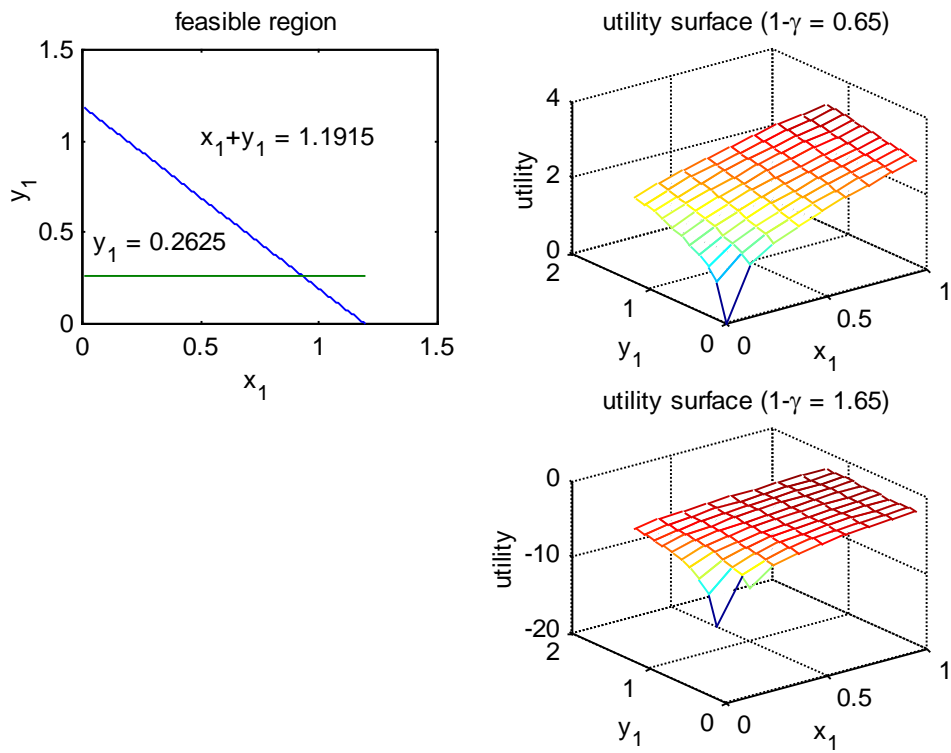
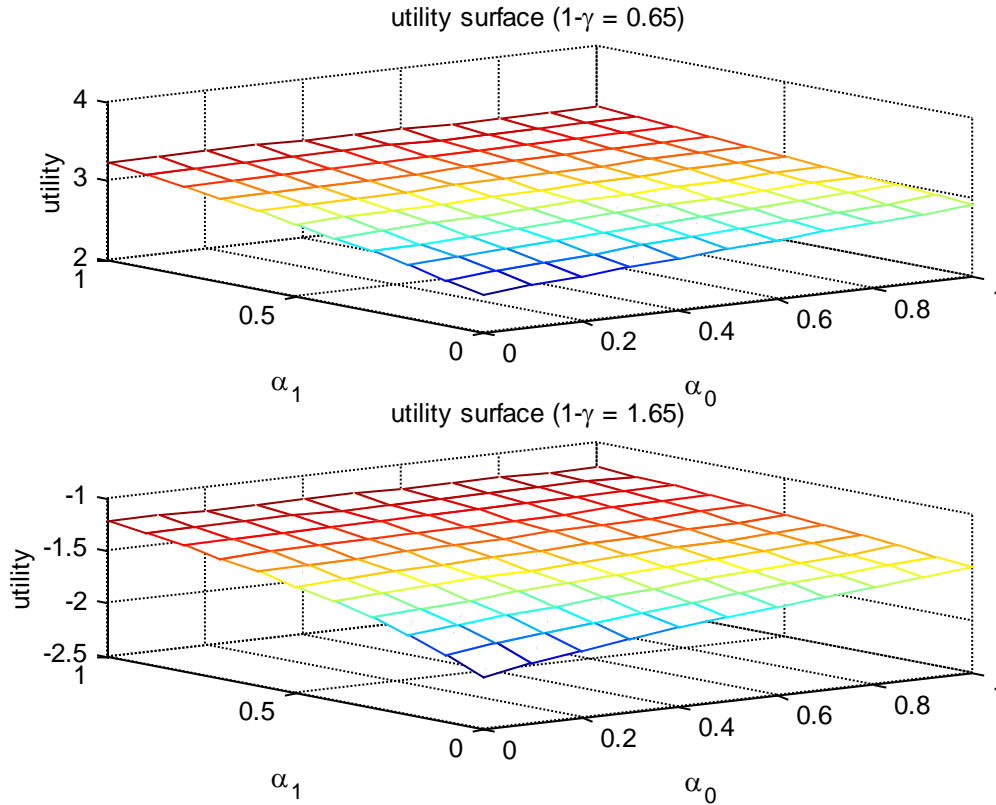


Figure 4: Feasible region and an investor's utility function



From the diagrams it appears that investment allocations that would lead to corner solutions are suboptimal. This means that the optimal solution is mostly likely to be an interior solution. Indeed, a foreign investor’s investment allocations are a tradeoff between the adverse effects of the restriction on capital outflows and the benefits derived from high returns and diversification in the international equity markets.

Figure 5: Effect of capital outflow control on a foreign investor’s utility



The parameters are $r_1 = 1.16$, $r_2 = 1.18$, $r_1^* = 1.23$, $r_2^* = 1.25$ and $\kappa = 0.25$. The initial allocations of funds are $x_0 = 0.65$ to the home market and $y_0 = 0.35$ to the developing country.

Foreign investors are better off as the government the developing country eases the restriction on capital outflows in each period. The reason is that foreign investors may repatriate larger quantities of their funds from the developing country. It is seen that the period one restriction on capital outflows has relatively less effect on enhancing a foreign investor’s utility. This is because any balance of foreign investment funds in the second period may be forfeited to the developing country whereas a fraction of the balance of a foreign investor’s funds in the first period will be repatriated in the second period. Thus easing the restriction on capital outflows in each period is beneficial to foreign investors.