

IMF Working Paper

Clusters as a Driving Engine for FDI

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Abstract

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This paper develops a model that highlights the importance of clusters for attracting foreign direct investment. It shows from a game theoretical perspective how the combination of setting up a cluster and implementing policy reforms will be a key engine for attracting FDI. Based on agglomeration externalities, the paper shows that the very emergence of clusters can make investment so profitable that investors can even afford to tolerate more policy-induced distortions than otherwise. With perfect information, it shows the existence of multiple equilibria, in which some countries attract FDI while others do not. An extension to the context of imperfect information refines the analysis to a unique equilibrium, in which some investors respond to reforms. The paper presents case studies to support the findings.

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I. INTRODUCTION

One feature of globalization is the expansion of investment flows. Global foreign direct investment (FDI) grew by 18 percent in 2000, reaching a record \$1.3 trillion.² Developed countries remain the prime destination of FDI flows, accounting for more than three-fourths of global inflows. Even though FDI inflows to developing countries have risen, reaching \$240 billion in 2000, their share in world FDI flows steadily declined from 39.6 percent in 1996 to 18 percent in 2000.³ During the same period, the share of FDI inflows to developed countries increased from 57 to 79 percent.⁴ Even more striking, the least developed countries (LDCs) remained marginal in terms of attracting FDI, with a mere 0.3 percent of world inflows in 2000.

FDI to Africa grew by 28 percent, to \$15 billion in 2003, in contrast to the fall of 40 percent in 2002, but natural resources (especially oil) accounted for the bulk of the increase.⁵ For example, FDI inflows to Equatorial Guinea grew from \$0.3 billion in 2002 to \$1.4 billion in 2003 because of oil discovery. In this paper, I am interested not in natural-resource-driven FDI, but in FDI driven by locational spillovers or agglomeration externalities. By “locational spillovers” I mean both physical spillovers as described in Krugman (1991)—where the presence of one firm lowers the transportation costs for a second—and intellectual spillovers as described in Glaeser et al. (1992). Clearly, despite what seems to be an increase in FDI to Africa, the question of the low share of developing countries in world FDI remains relevant. This paper proposes an in-depth analysis of why the trend of the globally expanding FDI flows is less in favor of developing countries.

In order to attract foreign investment, many developing countries have enacted significant policy reforms. They went through what are known as the first and second generations of investment promotion policies. In the first generation of investment promotion policies, many countries adopted market-friendly policies. They liberalized their FDI regimes by reducing barriers to inward FDI, strengthening standards of treatment for foreign investors, and giving a greater role to market forces in resource allocation. Virtually all countries have taken steps in this direction to varying degrees.⁶ In the second of generation policies, governments went a step further by marketing their countries. This approach led to the setting up of a number of national investment promotion agencies. The World Association of Investment Promotion Agencies, established in 1995, now has more than 100 members.⁷

² UNCTAD (2001).

³ The former IMF research department director Kenneth Rogoff noted on May 27, 2002, in Addis Ababa, during his speech on African economic outlook, that Africa’s share has been steadily declining from 5.3 percent of global FDI in 1980 to 2.3 percent in 2002.

⁴ These percentages are computed using data from UNCTAD. Note that for the computation here, the developing countries are not inclusive of Central and Eastern Europe. The focus here is on Africa, Latin America and the Caribbean, Asia, and Developing Europe.

⁵ UNCTAD (2004).

⁶ Ibid.

⁷ Ibid.

Furthermore, Hanson (2001) reported that countries at all levels of development have created a policy infrastructure to attract multinational firms. For example, many developing countries have taken measures such as expediting the approval process, removing restrictions on the repatriation of profits, strengthening their standard of property rights, providing liberal tax incentives, and allowing foreign participation in the privatization of state-owned enterprises. In addition, a recent study by the United Nations (UN) shows that during 1990-98 more than 135 countries reduced regulatory restrictions on FDI.⁸ These reforms have been accompanied by other types of reform that target macroeconomic stability. A study by the World Bank even reports that a large number of countries have undertaken comprehensive reforms, both macroeconomic and structural, during the last two decades.⁹

Given all these changes and reforms, one should expect a significant increase in the rate of FDI flows into developing countries, yet it is not happening. On the contrary, the continued capital flight from developing countries demonstrates that the private investment response to these reforms has so far been disappointing. For example, estimates of the ratio of capital flight from African countries to Africa's gross national product range from 24 percent to 143 percent.¹⁰ Despite the high net return on investment (20-30 percent in 1990-94 for Africa, and 16-18 percent for developing countries as a group),¹¹ developing countries have not succeeded in substantially attracting foreign investment.

This clearly calls for new research that can generate new investment promotion policies. The existing literature points to a number of determinants such as deep policy reforms, political stability, and economic growth prospects. However, the concept of clusters of complementary firms as a determinant of attracting FDI, while present in policy debate, has not received much attention in the economic literature.

This paper argues that investment promotion policies should focus specifically on the creation of firm clusters. "Clusters" are concentrations of firms in one or a few industries, benefiting from synergies created by a dense network of competitors, buyers, and suppliers. They comprise buyers, specialized suppliers, sophisticated human resources, finance, and well-developed support institutions. Clusters also include producers of complementary products, specialized infrastructure providers, institutions providing specialized training, education, information, research and technical support (such as universities, think tanks, vocational training providers), and standards-setting agencies. Such clusters make investment more efficient, strengthen domestic markets, and increase returns via spillovers.

Ireland's pharmaceutical industry is a good example of the importance of clusters. Foreign Direct Investment for the Pharmaceutical sector in Ireland is 40 years old with Squibb (now

⁸ For an overview, see UNCTAD (1999).

⁹ For an on overview of the reforms, as well as the dismal investment consequences, see World Bank (1988).

¹⁰ See the International Monetary Fund (2001).

¹¹ Ibid.

Bristol-Myers Squibb) being the first pharmaceutical company to locate in Ireland in 1964. Currently thirteen of the top fifteen companies in the world have substantial operations in Ireland.

A survey paper by Surico (2002) finds empirical evidence that increasing returns are the dominant driving force of economic geography in the United States as well as in Europe. Simply opening an economy is no longer enough. There is a need to develop attractive configurations that can generate agglomeration externalities and make investment more efficient. Clearly the focus should be on the interplay of policy reforms and developing attractive configurations of locational spillovers. While domestic investors or firms are important and cannot be neglected for the process of strengthening domestic markets, one must acknowledge that alone, they cannot create dynamic clusters of the type described above. Thus, there is a need to coordinate a number of foreign investors to complement domestic firms and make clusters effective.

The paper shows that policy reforms and the creation of linkages or clusters (solely based on domestic resources) that would be strong enough to attract FDI may be costly for poor countries. Thus, governments in these countries tradeoff the benefits of attracting foreign investment against the costs of creating dynamic agglomeration advantages. Exploring the insight of coordinated investment, which is based on the concept of the “big push” introduced by Rosenstein-Rodan (1943) and discussed by many others, the paper shows that the simultaneous move of different investors can be so profitable for all of them that they can even afford more policy-induced distortions or weaker initial location factors than otherwise. This alleviates the government’s tradeoff. The idea is that with simultaneous investment projects (domestic and foreign alike), the different investment projects can create positive externalities on each other through backward and forward linkages, which will increase return and attract other investment. Without the simultaneous move of some critical mass of investors to set up an initial cluster, the sequential move of potential foreign investors might be difficult, because the first movers might not be able to derive advantage from clusters (at least for some time).

In this set up, I first present a benchmark model with perfect information. This model predicts the existence of multiple equilibria and helps to rationalize why some developing countries succeed in attracting foreign investment while others do not. Second, I extend the benchmark model and allow foreign investors to have private information about policy-induced distortions in the potential host country. The introduction of private information helps to refine the equilibrium analysis. In particular, it leads to a unique rational-expectations equilibrium, in which every realization of perceived policy-induced distortions uniquely determines whether there will be foreign investment.

To this end, I propose a game theoretic model in which the government of a small open economy introduces policy reforms in the face of a set of foreign investors differentiated by their belief about the sustainability of policy reforms and the goods or externalities they can produce if they choose to invest. Each investor makes its investment decision based not only on the signal it receives from the government concerning reforms, but also on its belief about the

behavior of other investors. The choice of the game theoretic model is justified by the need to have a mechanism that can deliver a self-sustaining simultaneous move.

The remainder of the paper is organized as follows. Section II presents the related literature. Section III lays out the basic model. Section IV describes the equilibrium analysis with no private information. Section V introduces private information and presents the equilibrium analysis in this context. Section VI presents some case studies of clusters and networks and discusses how they help attract foreign investment. Section VII concludes.

II. RELATED LITERATURE

The existing literature, in trying to explain the low capital flow in developing countries, has not focused on the importance of dynamic clusters or analyzed the ability of governments in these countries to attract clusters of foreign investment. For example, Rodrik (1991) has focused on policy uncertainty and has pointed it out as a possible cause of underinvestment in developing countries. He developed a model with no emphasis on linkages which ties policy uncertainty to the private investment response. Focusing on linkages—where each investor makes its investment decision based not only on its own perception of policy reform, but also on the investment decision by other investors—makes a crucial difference with Rodrik’s model. It leads to a different set of results.

Lucas (1990) has also analyzed the issue by examining the question of why capital does not flow from rich to poor countries. He critically explored some candidate answers that are based on human capital and capital market imperfections. With regard to human capital, he shows that the rich country’s optimal policy is to retard capital flows so as to maintain real wages at artificially low levels in the poor country. The present paper is different from his argument in the sense that the focus here is not on human capital. Also, as far as capital market imperfections are concerned, Lucas’s paper analyzes a borrowing contract between poor and rich countries. In this paper, the focus is on linkages and on the rational behavior of different foreign investors in the face of reform uncertainty.

Rodriguez-Clare (1996) explores how multinationals affect underdeveloped regions through the generation of linkages. However, he did not examine the mechanism by which underdeveloped regions can attract them. Also, Matsuyama (1995) studies complementarities in models of monopolistic competition. He discusses how general equilibrium models of monopolistic competition can be applied to explain complementarities in the context of macroeconomics, international and regional economics, as well as growth and development. In contrast, this paper uses the idea of complementarities and shows how, in the context of a simultaneous game, it might help governments in developing countries to attract foreign investment.

Krugman (1991) and Fujita, Krugman, and Venables (1999) study the economic geography, where the theory of the location of economic activity is put up front. Ellison and Glaeser (1997) studies the geographic concentration in the United States manufacturing industries using what they called the “dartboard approach.” However, none of these papers studies the interplay between the concentration of firms (or clusters) and policy reforms in a game theoretical framework and uses it as a key engine for attracting FDI.

In this paper, I explore Rosenstein-Rodan's simultaneous move idea, which I embed in the new economics geography, and show how it can reduce the costs associated with policy reforms through the emergence of clusters and can help attract FDI. Rosenstein-Rodan's original idea is that if various sectors of the economy adopted increasing returns technologies simultaneously, they could each create income that could become a source of demand for goods in other sectors, and so enlarge their markets and make industrialization profitable.¹²

III. THE MODEL

To address all the points raised above, I propose a three-period model that focuses on a small open economy in which the government introduces policy reform to attract investment. The country is populated with a continuum of domestic investors. There is also a continuum of symmetric foreign investors potentially interested in investing in the country. Savings can be invested in the country (home) or abroad. If they are invested abroad they earn some real return r^* . I assume that the economy is small relative to world capital markets, and therefore take r^* as given. If savings are invested at home they earn a rate of return denoted by r , which will be determined in equilibrium.

A. Government's Problem

The country has a domestic capital stock made possible by domestic investors. The government wishes to introduce reforms that will help attract foreign investment. I assume that prior to reforms, the country has a weak system of property rights so that common access to investors' domestic capital stock is possible. The common access to domestic capital stock can occur through outright confiscation, banditry, or through other more subtle mechanisms. For example, one can imagine a situation in which some interest groups in the country have the ability to extract any transfers they desire from the government. Assuming that the government must balance its budget every period, the transfers will result in taxes on domestic capital, which is the only asset the fiscal authority has access to. Clearly the ability to extract transfers gives interest groups common access to the country's capital stock. For a more comprehensive description of the "common access" phenomenon, see Tornell and Velasco (1992).

The distortions that would result from an eventual outright confiscation or tax policy are parameterized by τ , and I refer to such distortions as policy-induced distortions. A high value for τ signals high distortions, for example, through a high tax rate and hence is associated with less investment. I assume that the government is benevolent and uses its revenue to improve the welfare of the population. The government is interested in maximizing its revenue $\tau^1 Y(\tau)$,

¹² This idea has been developed into a doctrine of balanced growth or the big push (see Nurkse, 1953; Scitovsky, 1954; and Fleming, 1955). Later, Murphy, Shleifer, and Vishny (1989) in the context of an imperfectly competitive economy, propose three mechanisms that generate a big push.

where τ^1 can be thought of as the component of τ that directly increases government revenue (e.g., tax, tariff, etc.) and Y is the aggregate output or fiscal base. Notice that the distortions are introduced along many dimensions as mentioned above, and an increase in taxes is one of them. One might think of τ^1 as the tax component of the distortion parameter τ , and high τ^1 will potentially increase government revenue. The optimal strategy for the government is to introduce reforms lowering τ , that is, reducing the distortions, and increasing Y through attracting more investment. However, the sustainability of reforms lowering τ depends on the positive investment response from the private sector. The point is that in case of a negative response from the private sector—that is, a low Y —the government has an incentive to reverse reform by increasing τ^1 and hence τ .

I assume that in the first period ($t = 0$), the government introduces policy reform. I conceptualize the situation before reform as one in which the investors' yield from capital had been depressed to $(1 - \tau_0)r$, where τ_0 stands for the policy-induced distortions before reforms. The effect of the reforms is to reduce τ_0 to τ , with $\tau < \tau_0$. I assume that the pre-reform policies have kept $(1 - \tau_0)r$ at a level no higher than the rate of return abroad r^* , that is $(1 - \tau_0)r < r^*$.

B. Foreign Investors' Problem

Foreign investors make their decision to invest or not in the second period ($t = 1$) after the government introduces policy reforms aimed at reducing the distortions in the economy. In fact, they wait until the next period to gain more information about the sustainability of the reform, perhaps through the post-reform dynamics of domestic investment, before making any investment decision. Though the government introduces policy reforms prior to foreign investors' decisions, foreign investors may or may not have perfect information about reforms or their sustainability. I analyze both cases of perfect and imperfect information.

To model foreign investors' problem, I explore Rosenstein-Rodan's simultaneous move idea. A strategy for each foreign investor i is a decision that maps each realization of τ into an action: *to invest* in the country, or *not to invest* in the country. A profile of strategies—one for each foreign investor—is an equilibrium if, conditional on information available to foreign investor i and given the strategies followed by other foreign investors, the action prescribed by i 's strategy maximizes its conditional expected return $(1 - \tau_e^i)r$. τ_e^i is foreign investor i 's expected level of distortions based on the information available to him. The reason why investor i takes into consideration the strategies of other investors before making its decision is because of the need to derive advantage from dynamic clusters through backward and forward linkages. When different potential investors cannot move simultaneously and invest in the country, they cannot create the positive externalities on each other and the resulting effective return will be less attractive. Comparing the expected return at home and abroad, this paper pins down the condition under which foreign investors will be willing to invest in the country.

In the second period, should foreign investors decide to invest, they would benefit only from the externalities of the existing domestic investment. But in the closing period ($t = 2$), each investor now benefits from the externalities of both domestic and foreign investment by other investors. The timing of the game is summarized in Figure 1.

In this setting, the paper shows, depending on the mass of investors, the existence of a threshold τ^* such that each potential foreign investor chooses to invest in the home country if and only if τ is less or equal to τ^* . To see this, I consider the following technology.

The Technology

I assumed earlier that there is a continuum of investors (domestic and foreign alike). Foreign investors are indexed by i and domestic investors by j . Assume that each investor produces a final good y and one intermediate good x . One can think of the intermediate good as being the positive externality that the production of each investor creates on others or the services that each investor provides to others if they cluster in the same area. Consistent with the equilibrium strategy described earlier, if foreign investors choose to invest in the home country, the final good of each foreign investor i is produced with a Cobb-Douglas production function using the investor's capital K_i and a composite intermediate good X , which is assembled from a continuum of differentiated intermediate goods or varieties produced by other investors, domestic and foreign alike:

$$y_1^i = K_i^\beta X_d^{1-\beta} \quad \text{with} \quad X_d = \left(\int_{k \in [0, n_d] - \{i\}} e_k x(k)^\alpha dk \right)^{\frac{1}{\alpha}} \quad (1)$$

$$y_2^i = K_i^\beta X^{1-\beta} \quad \text{with} \quad X = \left(\int_{k \in [0, n_d + n_f] - \{i\}} e_k x(k)^\alpha dk \right)^{\frac{1}{\alpha}}, \quad (2)$$

where the $\{e_k\}$ are Bernoulli random variables equal to one with some probability γ_k that indicates whether the investor producing the variety or spillover of type k is located inside the cluster.¹³ n_d is the measure or mass of domestic investors or, alternatively, the number of intermediate goods produced by domestic investors. n_f is the measure or mass of foreign investors potentially interested in investing in the home country, each of them producing a variety of the intermediate goods. α and β are constant parameters, and I assume $\alpha, \beta \in (0, 1)$.¹⁴ I implicitly assume that transportation costs are so high that any intermediate good

¹³ Of course, $e_k = 0$ with probability $1 - \gamma_k$. This allows me to focus on spillovers produced by the cluster.

¹⁴ The production function of the composite good X uses the functional form first proposed by Dixit and Stiglitz (1977) as a specification for a utility function and later applied to production
(continued...)

or spillover produced by an investor located outside the cluster will not benefit the producers located inside the cluster. Note that for the second period ($t = 1$), which is also the first period of production for foreigners, production benefits only from the services or externalities of the existing (domestic) investment, as foreign externalities will only become available in the next period. For the last period ($t = 2$), production now benefits from the intermediate goods or externalities produced by both domestic and foreign investors. Now, because of convexity and symmetry among varieties of intermediate goods, efficiency requires firms to use the same quantity of all available varieties, that is, $x(k) = x, \forall k \leq n_d + n_f$. Assuming $\gamma_k = \gamma \forall k$, the production function for periods 1 and 2 can be written as:

$$y_1^i = K_i^\beta \left[(\gamma n_d)^{\frac{1}{\alpha}} x \right]^{1-\beta} \quad (3)$$

$$y_2^i = K_i^\beta \left[(\gamma(n_d + n_f))^{\frac{1}{\alpha}} x \right]^{1-\beta} \quad (4)$$

where γn_d (respectively $\gamma(n_d + n_f)$) captures the size of the cluster if it is comprised of only domestic firms (respectively if it is comprised of both domestic and foreign firms).

This leads to the following expected rate of return:

$$Er_1^i = (1 - \tau_e^i) \beta K_i^{\beta-1} \left[(\gamma n_d)^{\frac{1}{\alpha}} x \right]^{1-\beta} \quad (5)$$

and

$$Er_2^i = (1 - \tau_e^i) \beta K_i^{\beta-1} \left[(\gamma(n_d + n_f))^{\frac{1}{\alpha}} x \right]^{1-\beta}. \quad (6)$$

Comparing the foreigners' expected returns (at home and abroad) from the perspective of period ($t=1$), the switching point τ^{i*} for investor i in the equilibrium strategy solves the following equation:

$$(1 - \tau_e^i) \beta K_i^{\beta-1} \left(n_d^{\frac{1}{\alpha}} x \right)^{1-\beta} + \delta (1 - \tau_e^i) \beta K_i^{\beta-1} \left[(\gamma(n_d + n_f))^{\frac{1}{\alpha}} x \right]^{1-\beta} = (1 + \delta) r^*, \quad (7)$$

where I assume that all investors have the same discount factor δ whether they invest at home or abroad.

One can rewrite equation (7) as follows:

theory by Ethier (1982).

$$(1-\tau_e^i) \beta K_i^{\beta-1} \left\{ \left((\gamma n_d)^{\frac{1}{\alpha}} x \right)^{1-\beta} + \delta \left[(\gamma(n_d + n_f))^{\frac{1}{\alpha}} x \right]^{1-\beta} \right\} = (1+\delta) r^*. \quad (8)$$

In order to focus on foreign investors I make the following assumption:

Assumption A1: The number n_d of domestic firms is fixed.

I first derive an immediate result.

Lemma 1. *Under A1, the expected rate of return in the closing period ($t = 2$) increases with the cluster's size $\gamma(n_d + n_f)$, suggesting that the higher the cluster's size, the more attractive the home country is.*

Proof: $\frac{\partial E r_{t+2}^i}{\partial (\gamma(n_d + n_f))} = (1-\tau_e^i) \beta K_i^{\beta-1} x^{1-\beta} \delta \frac{1}{\alpha} (1-\beta) \left[\gamma(n_d + n_f) \right]^{\frac{1}{\alpha}(1-\beta)-1} > 0.$

In order to focus on the dynamic of attracting foreign investors, for the remainder of the paper I make the simplifying assumption that $\gamma = 1$ in such a way that the variation in the size of the cluster is driven by n_d and n_f . Before starting the equilibrium analysis, I first derive the following lemma.

Lemma 2. *Under A1, for given n_f , the LHS of equation (8) is decreasing in τ , and for each foreign investor i there exists a unique $\tau^{i*}(n_f)$, which solves (8). In addition, $\tau^{i*}(\cdot)$ is increasing in n_f , that is, the more foreign investment projects, the more positive externalities, which compensate the high distortions.*

Proof:

Set

$$\Psi(\tau_e^i) = (1-\tau^i) \beta K_i^{\beta-1} \left\{ \left(n_d^{\frac{1}{\alpha}} x \right)^{1-\beta} + \delta \left[(n_d + n_f)^{\frac{1}{\alpha}} x \right]^{1-\beta} \right\}$$

we have

$$\Psi'(\tau_e^i) = -\beta K_i^{\beta-1} \left\{ \left(n_d^{\frac{1}{\alpha}} x \right)^{1-\beta} + \delta \left[(n_d + n_f)^{\frac{1}{\alpha}} x \right]^{1-\beta} \right\}.$$

It is easy to see that $\Psi'(\tau_e^i) < 0$. That is, Ψ' is a strictly decreasing function, hence there exists a unique $\tau^{i*}(n_f)$ solving equation (8).

To see that $\tau^{i*}(\cdot)$ is increasing in n_f , note that an increase in n_f leads to the rise of the LHS of (8). Since the RHS of (8) is unchanged, this requires a higher τ^{i*} for (8) to hold.

IV. EQUILIBRIUM ANALYSIS WITH PERFECT INFORMATION

In this case of perfect information, the policy index or distortions parameter is observed perfectly. As a result τ_e^i is simply τ , the distortion level chosen by the government.

A. The Benchmark Case with no Simultaneous Move

I assume that there is no coordination among the different foreign investors. In addition, suppose that each investor makes its investment decision without internalizing the investment decision by others. In this case, each investor makes its investment decision assuming $n_f = 0$.

The corresponding policy index or distortion parameter threshold is $\tau^{i*}(0)$. From the monotonicity of $\tau^{i*}(\cdot)$ one can infer that $\tau^{i*}(0) < \tau^{i*}(n_f)$, $\forall n_f > 0$. Assuming symmetry among foreign investors yield to $\tau^{i*}(0) = \tau^*(0) \quad \forall i$. This leads to the following result:

Proposition 1. *Under A1, if government reforms reduce distortions from τ_0 to τ such that $\tau < \tau^*(0)$, then the government in the home country will succeed in attracting foreign investors even in the absence of positive externalities from foreign investment.*

Proof:

Note that each foreign investor i will decide to invest in the home country if its expected return in the country is higher than abroad. Under A1, if $n_f = 0$, and $\tau < \tau^*(0)$, it immediately follows from lemma 2 that

$$(1-\tau)\beta K_i^{\beta-1} \left\{ \left(n_d^{\frac{1}{\alpha}} x \right)^{1-\beta} + \delta \left[(n_d)^{\frac{1}{\alpha}} x \right]^{1-\beta} \right\} > (1+\delta)r^*$$

In other words, the return from investing in the home country is higher than that from investing abroad. Hence the home country will succeed in attracting foreign investment.

This result suggests that in the presence of domestic externalities only, if the home country's government can enact policy reforms capable of reducing the distortions to a level no higher than $\tau^*(0)$, the smallest threshold that makes investment profitable for foreigners, then the home country can be successful in attracting foreign investment. However, reducing the distortions to a level lower than $\tau^*(0)$ can be costly for the government. To see this, set

$\tau = \tau^1 + \tau^2$, where τ^1 comprises the policies that directly increase government revenue as defined above, and τ^2 comprises the rest of the policy index. Now, for a given τ^2 , let $\tau^{1*} = \operatorname{argmax}_{\tau^1} \tau^1 Y(\tau^1 + \tau^2)$ and set $\tau^{**} = \tau^{1*} + \tau^2$. Under assumption A1, it is clear that if $\tau^{**} > \tau^*(0)$, then the government in the small country will not be successful in attracting foreign investment. Thus, it can be costly for the government to undertake policy reforms that can reduce τ_0 all the way down to $\tau^*(0)$, as this might call for setting up τ^1 at a level lower than the optimal. In other words, the adoption of policy reforms tradeoffs the benefits of attracting investment against the cost of implementing these reforms. However, as shown below, the simultaneous move of different foreign investors can alleviate this tradeoff. The idea is that the simultaneous move can be so profitable for all of them that they can afford more distortions than otherwise, so the government needs not reduce τ_0 all the way down to $\tau^*(0)$ before being able to attract foreign investment.

Before advancing to the simultaneous move case, note that the result above shows that even though the government can anticipate the behavior of foreign investors and determine the conditions under which each foreign investor might want to invest in the country—unconditional on what other foreign investors do (that is, only based on the existing domestic factors)—it may not be successful in attracting foreign investment. This is because the government's optimal choice of policy to maximize its revenue may not signal to foreigners a perceived policy index that satisfies the necessary conditions for attracting foreign investment. In other words, it can be costly for the government to meet the conditions for attracting foreign investment. However, in this benchmark case, the following proposition, which is derived from equation (8), shows that a dense network of domestic firms can be helpful in attracting foreign investment.

Proposition 2. (1) $\frac{\partial \tau^{i*}(0)}{\partial n_d} > 0 \quad \forall i$, suggesting that the larger the number of domestic firms, the easier it is for the government to attract foreign investment.

(2) $\frac{\partial \tau^{i*}(0)}{\partial r^*} < 0 \quad \forall i$, suggesting that an increase in the world interest rate makes it difficult for the government to attract foreign investment.

Interpretation

One lesson that can be drawn from the first part of this proposition is that a country capable of creating domestic linkages (through a dense network of domestic firms), that is, a country with high n_d , will have a higher $\tau^{i*}(0)$ for every investor i and can easily meet the requirement $\tau \leq \tau^{i*}(0)$. As a result, it will succeed in attracting foreign investment. For example, countries such as China, South Korea, and Singapore, which have succeeded in creating a dense network of domestic firms (high n_d) seem to be successful in attracting significant foreign investment. For some middle-income countries and particularly for the low-income countries, which have not

succeeded in creating a dense network of domestic firms, the tradeoff I highlighted above is particularly relevant.

The analysis reveals that creating an agglomeration advantage through linkages or clusters of complementary firms will make investment return more attractive. But, how to achieve this remains a key challenge for many countries. For low-income countries with limited domestic firms due to low savings or lack of entrepreneurial spirit, the simultaneous move of complementary foreign investors might be a solution. But the recommendation that emerges here is clear: policies aimed at attracting foreign investment should focus on the creation of clusters of complementary firms.

Another implication from the above analysis (see lemma 1) is that the first investors that would move to the country might at first experience some periods of low return compared to the investor groups that would come in later. This calls—contrary to the conventional wisdom—for a discriminatory tax incentive to attract foreign investment. To be precise, when a government sets up an export processing zone, for example, additional special conditions should be made for the first investors that invest in the zone. This can help to compensate for the cost of experimentation that those investors face.

B. The Case of Simultaneous Move

Let us now consider the initial situation where each foreign investor internalizes the behavior of other investors before making its investment decision. From lemma 2, the game described above leads to multiple equilibria summarized in the following proposition.

Proposition 3. *Under A1, for given n_f , if the government chooses a policy index τ such that $\tau \leq \tau^*(n_f)$, then there are two equilibria—one in which no foreign investor invests in the country (bad equilibrium), and the other in which all the foreign investors (n_f) invest in the country (good equilibrium).*

Proof

If $\tau \leq \tau^*(n_f)$, and other investors are investing in the country, then the optimal strategy for investor i is to invest as well. Because in this case, based on lemma 2, the expected return from investing in the country is higher than investing abroad. However, if $\tau \leq \tau^*(n_f)$, but other investors are not investing in the country, the optimal strategy for investor i is not to invest in the country. To see this, note if other investors are not investing in the country it has to be the case that τ is higher than $\tau^*(0)$ (i.e. $\tau > \tau^*(0)$); otherwise, they would have invested regardless of the decisions made by other investors (see proposition 1). This leads to $\tau^*(0) < \tau \leq \tau^*(n_f)$. But for any value of τ belonging to this interval, the externalities from clustering investment from other investors are crucial in making investment in the country more attractive. In the absence of such externalities investor i 's expected return from investing in the

country is lower than that from investing abroad. That is, investor i 's optimal strategy is not to invest in the country. A graphical illustration is shown in figure 2.

Also from lemma 2, one can immediately derive the following proposition:

Proposition 4. *Under A1, if $\tau > \tau^*(n_f)$, then there is only one equilibrium in which the government in the home country will not succeed in attracting foreign investment.*

Proof

If $\tau > \tau^*(n_f)$, then it is not optimal for any investor to invest in the country, because from lemma 2, the expected return from investing in the country is lower than that from investing abroad. That is, the government will not succeed in attracting foreign investment.

Discussion

To see the implications of the result in proposition 3, note that because there exists a good equilibrium for $\tau \leq \tau^*(n_f)$, the government needs not bear the high cost associated with reducing τ_0 all the way down to $\tau^*(0)$. Government can just reduce τ_0 down to $\tau^*(n_f)$, which is higher than $\tau^*(0)$ and may still succeed in attracting foreign investment.

This highlights the importance of clusters or linkages which emerge once the n_f foreign investors invest. The very emergence of such clusters alleviates the government's tradeoff in its process to attract further foreign investment. The presence of clusters makes foreign investment attraction possible even if the distortion level is higher than $\tau^*(0)$. In other words, the emergence of clusters or linkages makes investment so profitable that investors can even afford more distortions than otherwise. Note from lemma 2 that the larger the number of potential foreign investors n_f , the higher the policy threshold index or the distortion threshold level $\tau^*(n_f)$, and the less costly it is for the government to attract foreign investment.

A concern one might have is that there is a risk that the bad equilibrium might occur. One recommendation that can help alleviate such a risk is that the government not only needs to strengthen the domestic condition through incentives for domestic firm creation, but also needs to engage in aggressive marketing that targets a number of complementary investors. Those investors need to be targeted at the level of industries and firms in order to meet their specific locational needs at the activity and clusters level, in light of the country's development priorities. This can help to coordinate investors' decisions in order to allow the good equilibrium to emerge.

It is important to note that the good equilibrium *Pareto*-dominates the bad equilibrium. This result perhaps helps to rationalize why, given two countries with almost the same level of risk, one may end up attracting clusters of foreign investment, while the other may fail. For example, Mauritius and Senegal are both former French colonies, which benefit from preferential arrangements with the European Economic Community (EEC) under the Lome conventions, also known as the Cotonou conventions. Both initially engaged in the same type of policy reforms and established export processing zones (EPZs). Both are poor but not landlocked. Senegal has a comparative advantage from its larger size, greater amount of arable land, and has a higher population. Yet it was Mauritius that somehow managed to attract considerable foreign investment, to become one of the few African countries with relatively high per capita income. It has transformed itself from a hungry, hopeless nation to one of the impressive success stories in the postcolonial era. Senegal has not achieved such an impressive performance. Some may argue that the geographical location of Mauritius is the key determinant of its success. However, other islands such as Seychelles or Comoros, in the same region as Mauritius, have not achieved Mauritius's result in terms of attracting FDI. In section VI, I present a more detailed case study of Mauritius, which points to an initial cluster in the textile industry as a key factor in its success in attracting further FDI.

Another insight that emerges from this result is that even though some foreign investors may have perceived the government's policy as relatively positive, they may not decide to invest in the country if they believe that other investors (foreign and domestic alike) will not invest. This is because they are forward-looking and take into consideration the expected positive externalities from other investors. This result can help rationalize why even though governments in many developing countries may be doing the right thing, they have not succeeded in attracting substantial investment. The result here is clearly different from existing results according to which each investor would decide to invest based only on its own perception about policy reform (see Rodrik 1991). Here, each investor not only responds to policy reform, but also internalizes the behavior of other investors.

V. EQUILIBRIUM ANALYSIS WITH PRIVATE SIGNALS

Here, I analyze the case of asymmetric information. The government's problem is the same as before. However, foreign investors' problem will no longer be the same. To model the problem faced by foreign investors here, on top of Rosenstein-Rodan's insight, I explore the idea of risk coordination (see e.g., Morris and Shin, 1998, 1999, and forthcoming), which draws on analysis of games without common knowledge of payoffs.¹⁵ At time $t = 0$, when reforms are introduced, foreign investors know that τ is normally distributed with mean τ_e and variance σ_τ^2 , that is, with precision $\frac{1}{\sigma_\tau^2}$. They wait until the next period to gain more information about the sustainability of the reform before making any investment decision.

¹⁵ See, e.g., Rubinstein (1989); Monderer and Samet (1989); Carlson and Van Damme (1993a and 1993b); Kajii and Morris (1997).

In the next period ($t = 1$), foreign investors receive information about the reform and make their investment decision, but the information is not perfect. The imperfection of information can be justified by the fact that domestic investors are likely to have some informational advantage compared to foreign investors. As evidence, Gordon and Bovenberg (1996) note that domestic investors, by living and working in a particular country, know much more about the economic prospects of that country and about future government policies than do foreign investors. In addition, an IMF report¹⁶ noted that, during the period of Mexican devaluation in December 1994, domestic investors shifted large amounts of funds into foreign currencies prior to the devaluation, whereas foreign investors started to liquidate their Mexican holdings only in February 1995. Thus, evidence suggests that foreign investors do have an informational disadvantage compared to domestic ones. I then assume that each potential foreign investor i observes privately the realization of a noisy signal:

$$s^i = \tau + \varepsilon_i, \quad (9)$$

where ε_i is normally distributed with mean 0 and variance σ_ε^2 , that is, with precision $\frac{1}{\sigma_\varepsilon^2}$, and is independent across potential foreign investors.

A foreign investor's signal can be thought of as its private opinion regarding the prospects of the business environment in the country. The signal provides information concerning the effective return if the investor chooses to invest. The higher the signal, the higher the posterior distribution attributed by the investor to the true value of τ , and the lower the incentive to invest. Perhaps more importantly, the signals force investors to coordinate their actions. The point is that observing a high signal makes the investor believe that other investors observe a high signal as well. Consequently, the investor attributes a low likelihood to the possibility that other investors will invest, and this reduces its incentive to invest.

In this environment of imperfect information, a strategy for each foreign investor i is a decision that maps each realization of s_i to an action: *to invest* in the country, or *not to invest* in the country. A profile of strategies—one for each foreign investor—is an equilibrium if, conditional on information available to investor i and given the strategies followed by other investors, the action prescribed by i 's strategy maximizes its conditional expected return. When investor i observes the realization of the signal s^i , he updates its belief concerning the distribution of τ . Since both τ and s_i are normally distributed, the i 's posterior distribution of τ is normal with mean:

$$\tau_i = \frac{\frac{1}{\sigma_\tau^2} \tau_e + \frac{1}{\sigma_\varepsilon^2} s_i}{\frac{1}{\sigma_\tau^2} + \frac{1}{\sigma_\varepsilon^2}} \quad (10)$$

¹⁶ See Folkers-Landau and Ito (1995).

and precision $\frac{1}{\sigma_i^2} + \frac{1}{\sigma_e^2}$. The structure of the game is the same as above. Considering the same technology as above, equation (8) changes to

$$(1 - \tau_i) \beta I_i^{\beta-1} \phi(\tau_i) \left\{ \left(n_d^{\frac{1}{\alpha}} x \right)^{1-\beta} + \delta \left[(n_d + n_f)^{\frac{1}{\alpha}} x \right]^{1-\beta} \right\} = (1 + \delta) r^*,$$

where ϕ is the cumulative distribution of τ_i . It is obvious to see that lemma 1 and 2 still holds.

The introduction of private information forces coordination and helps to refine the equilibrium analysis. It leads to a unique rational-expectation equilibrium, in which every realization of the signal and hence of the perceived policy-induced distortions uniquely determines whether there will be foreign investment. Specifically, the analysis with private information predicts that foreign investment will occur if and only if the realization of the perceived policy-induced distortions is lower than some critical value. In particular, it leads to the following proposition:

Proposition 6. *Under A1 and for a given n_f , there is a unique threshold $\tau^*(n_f)$, such that each foreign investor that receives a signal above $\tau^*(n_f)$ will not invest, while each foreign investor that receives a signal below $\tau^*(n_f)$ will invest in the home country.*

The proof of this proposition is based on the usual argument that shows that the introduction of noisy signals—in a game with simultaneous move—forces coordination and pins down the multiplicity of equilibria to a unique one (see Carlsson and van-Damme, 1993a and 1993b), Morris and Shin (1998), and Goldstein and Pauzner (2000).¹⁷ Intuitively, given the symmetry of the investors, as investor i perceives a signal strong enough that makes its posterior distribution τ_i below some threshold, it believes that other investors have perceived a posterior distribution below the threshold as well. In other words, a strong signal for investor i leads it to rule out the belief that other investors will not invest. As a result, given the property of strategic complementarities, investment occurs. This result highlights that in the presence of imperfect information foreign investors respond to reforms in a heterogeneous manner, depending on the way they perceive the reforms. This justifies the heterogeneous behavior that one sometimes observes from foreign investors mulling the decision to invest or not. It rationalizes the partial nature of the outcome of attracting investment that follows reforms in many countries.

VI. SOME CASES OF EFFECTIVE CLUSTERS AND NETWORKS

The Shoe Cluster of the Sinos Valley in Brazil. The case of Brazil deserves attention, because in 20 years, Brazil managed to raise its share of world leather shoe exports from a mere 0.5

¹⁷ The three-page proof actually follows closely Morris and Shin (1998). Here I simply prefer to focus on the intuition.

percent in 1970 to 12.3 percent in 1990, and became in 1992 the world's third biggest exporter of leather shoes. The yearly growth rate of Brazilian shoe exports was about 24.1 percent. Even though the Brazilian shoe manufacturers spread over about 25 states, the fastest growing shoe industry has been that of the state of Rio Grande de Sul. Within this state, most of the industry is concentrated in the small town of Sinos Valley.

This industry, even though accounting for only 30 percent of total production of Brazil's leather shoes, manufactured 80 percent of its shoe exports. This impressive performance has been possible because an initial cluster of local firms was set up. The Sinos Valley shoe industry was in the beginning a concentration of about 400 local shoe firms. But quickly, these firms have become surrounded by a range of other firms (domestic and foreign alike), which produce inputs for the industry, market its outputs, or render special services. By 1991, the Sinos Valley initial cluster had already become an impressive and dynamic cluster with a total of 1,821 firms. An explicit account of the different types of firms is presented in Table 1.

One characteristic of this cluster is that the proportion of small firms has declined from 85 percent in 1971 to 48 percent in 1991, while the proportion of large firms has increased from 1 percent in 1971 to 17 percent in 1991.¹⁸ Schmitz (1995) reports that large firms in 1991 were small two decades earlier and that central to their growth was the location in a cluster with deep forward and backward linkages. The Sinos Valley's rapid transition from producing only for the internal market to being a major exporter was due to the geographical concentration of firms and government incentives. Indeed, based on economic efficiency, there were increasing demands from U.S. importers of new shoes from low-wage countries. At the same time, with government incentives, local manufacturers took a collective action and organized a national fair, which was promoted overseas, and foreign buyers and journalists were invited with paid airfares. In addition, aggressive marketing took place where a consortium of producers took their products to Europe and the United States (Schmitz, 1995).

As Schmitz (1995) notes, based on interview with importers, the Sinos Valley manufacturers were successful in launching their first contracts because importers recognized the advantages of buying from an established cluster which included some specialized local input suppliers. Once the connection between the Brazilian producers and the U. S. market was established, U.S. manufacturers became themselves importers. But this did not last. The U.S. retail chains immediately set up offices in the valley to carry out the intermediary role between the U.S. market and local producers. Other independent foreign agents set up business in the valley to carry out similar and other transaction roles. Schmitz (1995) reports that in addition to their conventional role of negotiating trade between buyers and producers, these export agents built up other technical departments that inspected product quality on site. These new departments also developed models that required setting up model shops in the valley to produce samples. They provided technical assistance and organized transport and payment arrangements. As a result, the Brazilian shoe export to United States increased remarkably.

¹⁸ See Nadvi (1995) for details.

This development has strengthened the cluster because the export growth increased the demand for local inputs and machinery and contributed to further specialization and deepening of the cluster in which local and foreign investors took part. This clearly shows the importance of linkages or externalities between firms. In addition, it confirms the claim that I formally derived earlier (proposition 2) according to which a geographic concentration of domestic firms is a powerful tool for attracting foreign investors.

The EPZ experience in Mauritius. There is agreement that the small island of Mauritius with a population of less than 2 million has realized the unthinkable by successfully moving from a monocrop culture highly dependent on the export of sugar to one diversified into manufactured exports and tourism. The agricultural sector actually accounts for only 10 percent of GDP, while the manufacturing sector accounts for 29 percent and services for 61 percent. The success of the manufacturing sector has critically depended of the establishment of EPZs in 1970. To see the particularity of the Mauritius experience notice that by 1986, 11 EPZs were already in operation in Sub-Saharan Africa.¹⁹ Countries that established EPZs include Ghana, Liberia, Senegal, and Togo, but these countries have not been as successful as Mauritius in attracting FDI and exporting manufactures. One might ask why this is.

The answer seems not to lie in political instabilities, since Ghana and Senegal have been as politically stable as Mauritius. The same is true for Togo until recently. While the preferential access to the European market through the Lome Conventions has been helpful for Mauritius, it cannot be the end of the story, since countries such as Senegal and Togo also benefit from the same arrangements. Why has Mauritius succeeded in reaping the benefits of these arrangements while Senegal and Togo have not? A close look at how the EPZs took off in Mauritius helps to elaborate on its success. At the core of this success was the Mauritian government, which provided the support institutions and a dynamic domestic entrepreneurial class. Given the remarkable surge in sugar prices from 1970 to 1974 of more than twentyfold, the local business community responded positively, leading to a boom with a record of 718,000 tons of sugar in 1973. As a result, the balance of payments situation improved from a surplus of Rs90 million to Rs365 million in 1974.²⁰ This helped to increase the country's overall investment; in particular, domestic entrepreneurs clustered their investment by locations mostly in the textiles sector.

This take-off, combined with an aggressive marketing of EPZs, led to impressive FDI inflows. As Durbarry (2001) notes, an international campaign was launched to attract foreign investors from Europe and Southeast Asia. In 1984, the government established the Mauritius Export Development and Investment Authority (MEDIA) as a corporate body with executive and advisory functions. Its main objective was to promote the export of goods and services from Mauritius, by engaging in investment promotion activities aimed at promoting Mauritius as an attractive base capable of providing complementary services or externalities necessary for the establishment of manufacturing industries. As a result, FDI inflows on a cumulative base over

¹⁹ Computed from the International Labour Office Statistics.

²⁰ Rs stands for Mauritian rupees. The exchange rate was 17.94 per U.S. dollar in 1996 and 27.9 in 2001. Source: Central Statistical Office, Economic Indicators, various issues, Mauritius.

the period 1985-94 amounted to nearly Rs2 billion. Consequently, Mauritius's GDP per capita, in current prices, rose from US\$270 in 1970 to US\$3,640 in 1997. To summarize, the interplay of the government leadership (through incentives and institutions) and the dynamism of domestic entrepreneurs, which make available positive externalities for foreigners by clustering their investments, was a key factor in Mauritius's success for attracting FDI. This interplay seems to have not been present in many other African countries.

The Danish Networking Program. The program was inspired by the industrial districts in the Third Italy. It was based on the idea that together, enterprises can overcome obstacles and conquer markets beyond their reach and that external assistance can play a role in facilitating cooperation. The aim then is to foster cooperation between enterprises. The program was designed by the Danish Technological Institute, funded by the central government, and implemented by the National Agency for Industry and Trade.

The key player that brings about cooperation is the network broker, which helps to identify opportunities, brings participants together, and assists in implementing new ideas and projects. The National Agency had successfully played such a role in the Danish program. Participating enterprises tend to produce similar or complementary products. For a more in-depth description of the program, see Humphrey and Schmitz (1995). They report that cooperation between enterprises can be successfully promoted through skilled external assistance and that the leverage of public resources can be increased by working with groups of enterprises. They also report that the program has been overall successful. Over the five years of the program's existence 5,000 enterprises became involved in forming networks out of a target group of 10,000—12,000 enterprises. In addition, in the interim survey, 75 percent of participating enterprises expressed that the networking was making them more productive and raising their ability to compete, and 90 percent of respondents expressed their willingness to continue the practice of networking beyond the subsidy period. Finally, the success of the program has positively impacted the Danish business culture, as the idea has disseminated widely and networking has become a natural option to consider in the face of new business challenges.

The lesson to be drawn is straightforward. Public policy or government intervention can be a catalyst for creating clusters and networks, which make participating enterprises more competitive. This, of course, and, in particular, the possibility of using networks to conquer markets make networks or clusters more attractive for new investment.

VII. CONCLUDING REMARKS

In this paper, I propose a simple framework in which the interplay of clusters and reforms reducing policy-induced distortion emerges as a key engine for attracting foreign investment.

Five conclusions emerge from the analysis. First, the paper shows that the locational factors combined with the policy reforms necessary to attract foreign investment can be costly for many developing countries. This leads governments in these countries to trade off the benefits of attracting foreign investment against the costs of creating business-friendly conditions in their countries.

Second, the analysis points out that, contrary to conventional wisdom, even if policy reforms are not complete, countries can succeed in attracting foreign investment. More specifically, the paper shows that a simultaneous move of complementary investors can alleviate the government's tradeoff. The idea is that with a simultaneous move, different investment projects can exercise positive externalities on each other, leading to a higher return. As a result, the simultaneous move can be so profitable that foreign investors can afford to tolerate even more policy-induced distortions than they could otherwise. As an initial critical mass of foreign investors invests in the home country and establishes an initial cluster, this will create an incentive for other foreign investors to come follow. This should not be a reason to defend the status quo since reforms are always useful, as they make the effective return even higher.

Third, the analysis shows that a dense network of domestic firms can compensate for policy-induced distortions (even without the simultaneous move of foreign investors) and attract foreign investment. This may explain why some countries, despite some policy-induced distortions, succeed in attracting foreign investment. Fourth, the analysis leads to the emergence of multiple equilibria, one in which all potential foreign investors invest, and the other in which no foreign investors invest. Fifth, the introduction of private information in the analysis helps refine the equilibrium analysis. In particular, it leads the model to predict the existence of unique rational-expectation equilibrium, in which some investors choose to invest while others do not. This highlights the fact that, in the presence of imperfect information, foreign investors respond to reforms in a heterogeneous manner, depending on the way they perceive reforms. It rationalizes the partial nature of the outcome of attracting investment that follows reforms in many countries.

Table 1. Number of Firms in the Sinos Valley Shoe Cluster

Activity	Firms
Footwear industry	480
Service rendering industries-workshops	710
Tanning industry	135
Leather and footwear machines industry	45
Components industry	223
Rubber industry	26
Leather articles industry	52
Export and Forwarding agents	70
Others	80
Total	1,821

Source: Based on Schmitz (1995).

Figure 1. Timing of the Game

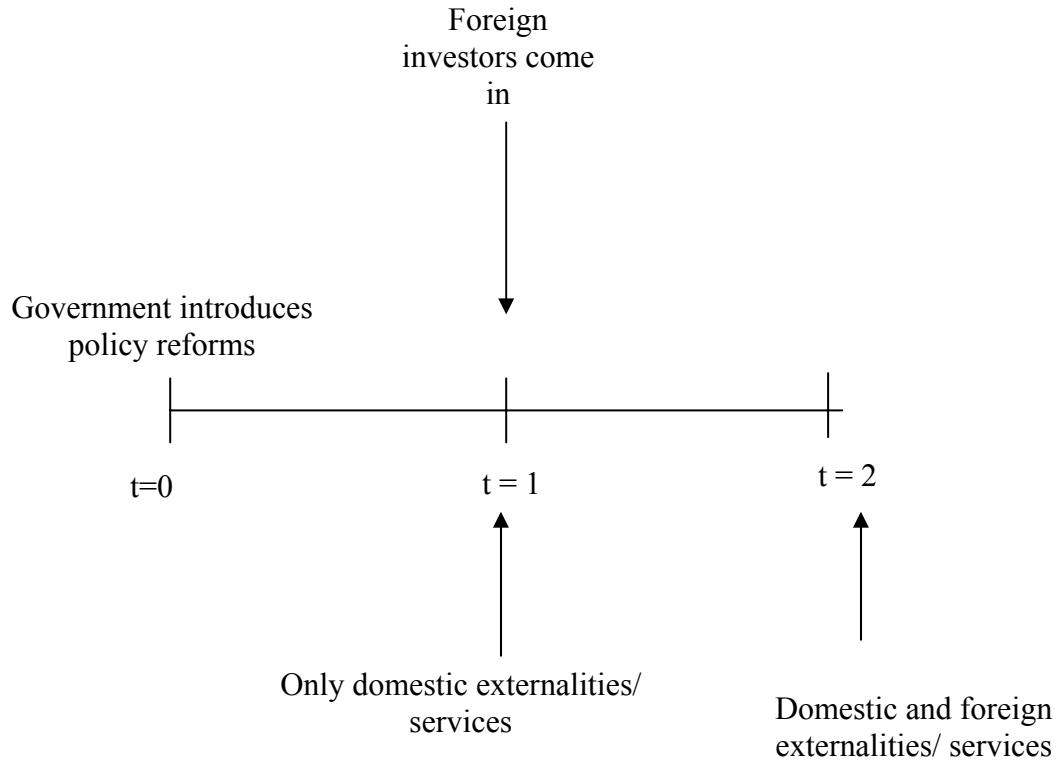
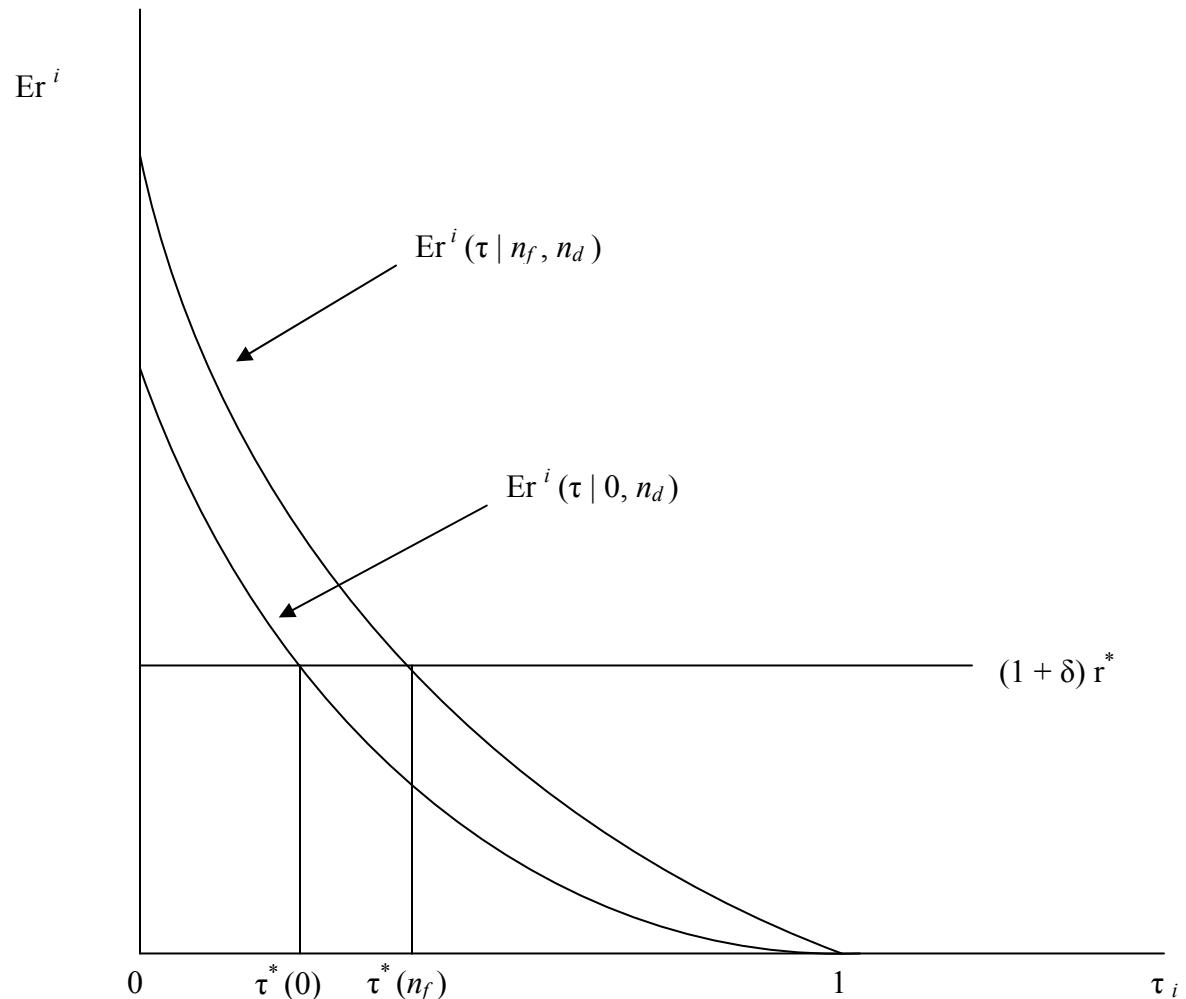


Figure 2. Comparing the Expected Returns at Home and Abroad



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