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Foreign Direct Investment Patterns in Transition Economies: An Evolutionary Game - Theoretic Perspective of the 1990s

by

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Abstract

The strategic interdependence between market reforms and foreign direct investment (FDI) in transition economies in the 1990s is presented in an evolutionary game-theoretic framework. The static game has two equilibria: in one, FDI contributes to economic restructuring through acquisitions in host countries with rapid market reforms; in the other, slow reform motivates firms to minimize exposure to operational uncertainties through new plant investments. Here FDI plays only a mediating role in economic reform. In a dynamic setting, these equilibria serve to establish conventions about how to invest in countries at different stages of transition. Empirical evidence drawn from U.S. FDI in transition economies further illustrates the model's equilibria.

Keywords: evolutionary game theory, foreign direct investment, transition economies

Foreign Direct Investment Patterns in Transition Economies: An Evolutionary Game-Theoretic Perspective of the 1990s

The liberalization of investment and trade in the early 1990s played a vital role in attracting foreign direct investment (FDI) into the countries of Central and Eastern Europe (CEE) and the republics of the former Soviet Union (FSU). In the process of post-communist restructuring, FDI to these credit-constrained countries was viewed as a vehicle for economic growth (Chadha & Coricelli, 1997). Foreign participation in existing state-owned enterprises (SOEs) generated valuable investment funds, budget revenues from privatization sales, and much needed technical and managerial know-how (Blonigen, 2005; Kalotay & Hunya, 2000). While empirical evidence suggests that, on average, enterprise restructuring was most significant in privatized firms with foreign participation, such participation was highly correlated with other country-specific economic variables such as macroeconomic stability, trade, and investment liberalization (Djankov & Murrell, 2002; Garibaldi, Mora, Sahay, & Zettelmeyer, 2001).

In retrospect, the interdependence of restructuring by host governments and foreign firms in transition economies is interesting for a two reasons. First, prior to the fall of the Berlin Wall in 1989, there was little or no FDI by Western companies in the former Soviet bloc countries. These countries, therefore, provide a natural setting within which to investigate strategic dependency from an evolutionary perspective. Second, differences in the scale and speed of market reforms in transition economies in the 1990s resulted in considerable cross-country variation in economic conditions and consequently, FDI flows.

Furthermore, the surge of FDI to the former Soviet bloc countries in the early 1990s coincided with a period of economic and political turmoil. During this time, both host governments and foreign firms were engaged in a dynamic learning process about policy and investment strategies.

The objective of this paper is to analyze the problem of the interdependence of economic reforms and restructuring by host governments and foreign firms within an evolutionary game-theoretic framework. Such an analysis does not appear to have been undertaken, and the main features of the FDI process in transition economies motivated the choice of the framework: FDI patterns in transition economies and the level of equity commitment by foreign firms are largely shaped by the level of reform and political stability in the host country. Furthermore, over time, interaction between firms and host government establishes a history from which future players of the FDI game learn. Consequently, the game-theoretic framework is one that allows for (a) multiple equilibria, (b) changing players in a dynamic setting, and (c) adaptive learning by agents that have less than perfect foresight.

The model is developed in two parts. As a first step, the players, their actions, and the payoffs are introduced in a static setting. The possibility of multiple equilibria is discussed and some attention devoted to *risk dominance* as an equilibrium selection mechanism (Harsanyi & Selten, 1988). Second, the dynamics of the game are developed using a recurrent game framework (Jackson & Kalai, 1997). Next, a learning-type mechanism, adaptive play, is introduced to formalize the way in which players make decisions in the dynamic setting (Young, 1998). In the discussion of the latter, the focus is on how the formation of conventions can determine which of the game's equilibria is, on average, more likely to emerge as a long-run outcome of the FDI game.

The results of the analysis show that when a transition government and a foreign firm interact strategically in a static setting, two equilibria arise. In one, the host government is committed to rapid economic reform and restructuring, and the foreign firm contributes to such restructuring through the acquisition of an existing enterprise. In the other equilibrium, the host government chooses a gradual approach to reform, and the firm chooses to minimize operational uncertainties through a new plant investment. In the latter scenario, the firm plays only a mediating role in economic restructuring through the indirect transfer of technical and managerial expertise. When players are allowed to learn from the experiences of their predecessors in a dynamic setting, the model's equilibria take on the interpretation of conventions about investing in transition economies at different stages of reform. Finally, the equilibria above are discussed in relation to the evidence drawn from acquisitions and new plant investments made by publicly traded U.S. manufacturing firms in transition economies from 1989 through 1999.

The remainder of the paper is structured as follows. Part II presents a brief overview of the relationship between economic reform and FDI in transition economies. Part III develops the game-theoretic model. First, the static framework is considered, and then the model is extended to a dynamic setting in which players learn from the experience of their predecessors. Part IV discusses conditions under which the game can settle into each of the two equilibria and presents empirical evidence related to the game's equilibria. Part V concludes the paper.

An Overview of Market Reforms and FDI in Transition Economies

In the early 1990s, newly elected governments in transition economies faced the colossal challenge of stabilizing inflation, declining output, and restructuring production capacities while at the same time maintaining social consensus for reform. Of these components of the reform process, liberalization of investment and privatization were crucial in attracting FDI in most countries (Lankes & Venables, 1996). On average, governments in transition economies sought to encourage foreign participation in the privatization process. Some countries (for example, Hungary) have chosen to adopt direct-sales privatization methods that essentially sell assets to the highest bidder, whether domestic or foreign. The proceeds from such sales serve to raise funds for reform in general, while also contributing to enterprise restructuring.[1] Other countries such as Albania, Bulgaria, Lithuania, Poland, Russia, and the Ukraine stipulated preferential treatment of an enterprise's workforce as a means to ensure social justice and generate public support for the reform process. In some cases, nationalistic sentiments related to the question of foreign ownership of domestic assets prompted governments to deny or restrict foreign participation in the privatization of key sectors of the economy on the grounds of defending the national interest (Sinn & Weichenrieder, 1997).

The success that various countries had with attracting FDI throughout the 1990s also depended on their political stability in addition to economic reform (Wooster, 2006). For example, several years after the fall of the Berlin Wall, socialist parties made a comeback in Bulgaria, Hungary, Lithuania, and Poland. This brought about a new wave of uncertainty about the future of business opportunities in the region.[2] The effect of political risk on FDI has been unambiguous: On average, politically unstable transition economies receive lower FDI inflows (Brada, Kutan, & Yigit, 2006). That is, while the risk of investing in politically unstable countries affects investment strategies by both existing firms and future entrants, the reduction in equity commitment is a direct result of such risk (Eicher & Kang, 2005).

Table 1
Selected Measures of Progress with Economic Reforms in Transition

Individual countries	Large-scale Privatization	Small-scale Privatization	Governance and Restructuring	Trade and Foreign Exchange System	Overall Progress in Reforms: Average Score
Albania	2	4	2	4	2.19
Armenia	3	3	2	4	2.26
Azerbaijan	2	3	2	2.33	1.59
Belarus	1	2	1	1	1.33
Bulgaria	3	3	2.33	4	2.44
Croatia	3	4.33	2.67	4	2.78
Czech Republic	4	4.33	3	4.33	3.18
Estonia	4	4.33	3	4	3.15
FYR Macedonia	3	4	2	4	2.22
Georgia	3.33	4	2	4	2.30
Hungary	4	4.33	3	4.33	3.33
Kazakhstan	3	3.33	2	4	2.33
Kyrgyzstan	3	4	2	4	2.41
Latvia	3	4	2.67	4	2.74
Lithuania	3	4	2.67	4	2.70
Moldova	3	3	2	4	2.22
Poland	3.33	4.33	3	4.33	3.15
Romania	2.67	3	2	4	2.37
Russian Federation	3.33	4	2	4	2.67
Slovak Republic	4	4.33	2.67	4	2.89
Slovenia	3.33	4.33	2.67	4.33	2.85
Tajikistan	2	2	1	2	1.11
Turkmenistan	2	2	1.67	1	1.07
Ukraine	2.33	3.33	2	3	2.07
Uzbekistan	2.67	3	2	1.67	1.89

Note: From *Transition report 1997: Enterprise performance and growth* by European Bank for Reconstruction and Development (EBRD). Copyright 1997 by EBRD. Transition indicators measure progress with market-oriented reforms in four general areas: (1) Enterprise reform (including progress in privatization and governance); (2) progress in the development of markets and trade; (3) progress in developing financial institutions; and (4) legal reform (measuring both the extensiveness and effectiveness of laws). Countries are ranked on a scale of 1 to 4 where 1 = least advanced and 4 = most advanced.

Table 1 provides a general overview of the rank of transition economies in terms of country risk and progress with market reforms using the transition indicators compiled by the European Bank for Reconstruction and Development (EBRD, 1997). Countries at the advanced stages of transition scored an overall transition indicator of 3 or higher, while countries at less advanced stages of transition, for example, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Russia, the Slovak Republic, and Slovenia, registered an overall transition indicator score below 3. Figure 1 shows that countries that have historically been leaders in reform, such as Hungary, Poland, and the Czech Republic, have attracted the lion's share of cumulative FDI flows (Meyer & Pind, 1999). On the other hand, in the republics of the former Soviet Union where progress with transition objectives have been modest, the growth in cumulative FDI flows has been slower than the potential of the region would have suggested. Empirical studies document a similar pattern. For example, Bevan and Estrin (2004) and Altomonte (2000) showed that multinational enterprises (MNEs) are more likely to invest through acquisitions and/or participate in privatization in countries with relatively lower economic and political uncertainty.

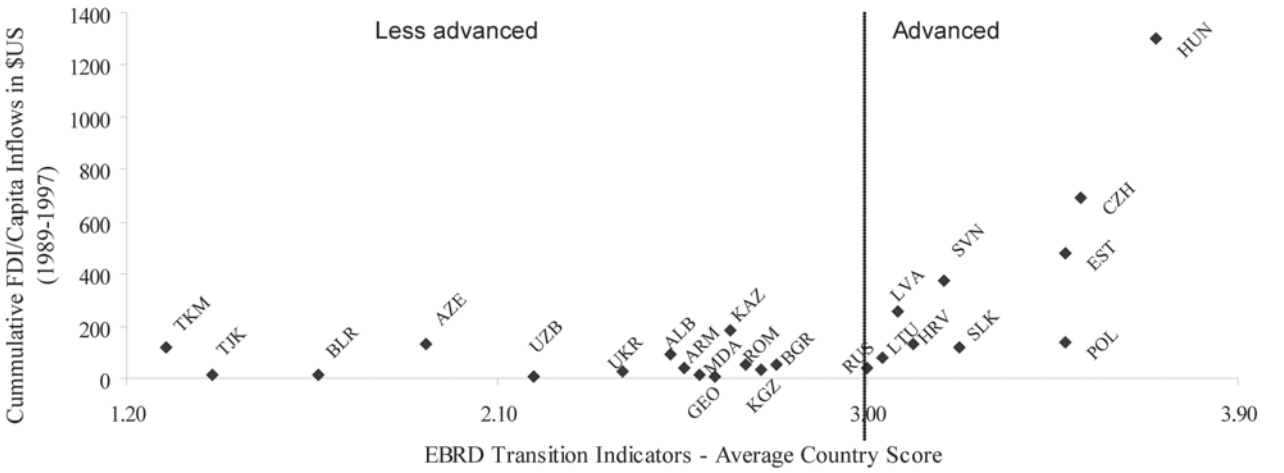

Figure 1: Per capita FDI inflows to advanced and less advanced transition economies (1989 - 1997).

An Evolutionary Model of Strategic Interdependence

FDI as a Static 2x2 Coordination Game

Consider a game played by the government of a transition economy and a foreign firm. The host government can either pursue a fast-track approach to reform, in which case EBRD transition indicators are greater than or equal to 3, or maintain a more gradual transition to a market economy, which reflects indicators below 3. The actions available to the government are therefore denoted FT (for a fast-track regime) and GR (for a gradualist regime).[3] The actions available to a foreign firm investing in a productive capacity are entry via an acquisition (ACQ), or entry via a new plant (NP). The choice of entry strategies is motivated by previous research that suggests that these are the two most common modes of entry with equity (Eicher & Kang, 2005; Estrin, Richet, & Brada 2000).

Definition 1

The FDI game, Γ, has two players each of which has two actions. The row player is the government of a transition economy that either undertakes a fast-track regime (FT) or a gradualist regime (GR). The column player is a foreign firm that can undertake investment in the host country, through either an acquisition (ACQ) or a new plant (NP). The strategy spaces for the government and the firm are denoted $g \in \{FT, GR\}$ and $f \in \{ACQ, NP\}$ respectively.

The payoff functions for the government and the firm capture the consequences that any given choice of action has for each player. It is assumed that players have complete information so that once a pair of actions is chosen, the objective function for each player maps these into a payoff. It is reasonable to assume that the government of a transition economy cares about both efficiency and employment. Because the actions of the foreign firm can affect both of these variables, the government's payoff function in the FDI game takes on the following simple linear form representation[4]:

$$G = E(g, f) + N(g, f) \qquad (1)$$

Both terms in Equation (1) are functions of the actions taken by the firm, $f \in \{ACQ, NP\}$, and the government, $g \in \{FT, GR\}$. The first term, $E(g, f)$, represents the gains in economic efficiency from restructuring by the firm and/or the transfer of technical/managerial expertise. The second term, $N(g, f)$, represents the impact of the firm's actions on employment.

The objective function of the firm is essentially a profit function that captures the costs and benefits from undertaking an investment project in the host country:

$$\Pi = \pi(g, f) - C(g, f) \qquad (2)$$

The first term in Equation (2), $\pi(g, f)$, is a standard operating profit function which gives the discounted present value of profits from future production. The second term, $C(g, f)$, represents the transaction costs associated with entry into the host country such as searching for suitable targets, analyzing their economic viability, negotiating with management and owners, and fulfilling side conditions imposed by governments. Table 2 provides a schematic representation of the static game.

Table 2
The Static FDI Game

		FDI Firm	
		ACQ	NP
Government	FT	G_{11}, P_{11}	G_{12}, P_{12}
	GR	G_{21}, P_{21}	G_{22}, P_{22}

Best Responses for the Government.

Best responses for the government in the static game are motivated below. Suppose a government and a firm are matched to play the FDI game and the firm enters through the acquisition of an existing enterprise. Post-acquisition restructuring, such as reduction in overstaffing, upgrades in production technologies, and implementation of corporate governance structures, is likely to improve efficiency, which has a positive effect on the government payoff function, $\partial G/\partial E > 0$. At the same time, layoffs have a negative effect, $\partial G/\partial N < 0$. Thus, a government that wishes to maximize its payoff when the firm enters via an acquisition is better off choosing the fast-track over a gradualist regime

$$E(FT, ACQ) + N(FT, ACQ) \geq E(GR, ACQ) + N(GR, ACQ) \quad (3)$$

If the government imposes a fast-track regime, rapid privatization makes it more likely that ownership of the SOE is in the hands of the enterprise's workforce or management, hence reducing the probability of lengthy negotiations. Evidence shows that if the SOE is still state-owned (gradualist regime), delays due to bureaucratic foot-dragging and requirements for employment guarantees can significantly prolong negotiations. As a result, the deterioration of assets can quickly erode the value of the target enterprise, forcing the firm to bid down its acquisition price or scale back its planned investment altogether ("Survey of International Mergers and Acquisitions," 1992). Such setbacks imply lower efficiency gains from FDI, or $E(FT, ACQ) > E(GR, ACQ)$.

In an alternative scenario, a gradualist government may wish to minimize the impact of FDI on employment and impose restrictions on post-acquisition restructuring, for example, employment guarantees. However, the loss in efficiency from such restrictions can offset the political gain from imposing them. For example, Gatling (1993) shows that operation under conditions of 20% to 50% overstaffing for 12 to 18 months served to delay restructuring and further lower efficiency, $\partial G^2/\partial E \partial N < 0$. In the end, the impact of restructuring on employment will be comparable under both regimes, but the gains in efficiency will differ. For this reason $G_{11} > G_{21}$.

The firm may also choose to enter through a new plant investment. Although this mode of entry implies that the foreign firm does not actively participate in the restructuring of an existing enterprise, improvement in production efficiency comes from the indirect transfer of technical and managerial expertise as the firm sets up operations in the host country, $\partial G/\partial E > 0$. In addition, the firm employs local labor force which serves to increase the government's payoff through the employment term in its payoff function, $\partial G/\partial N > 0$. To maximize its payoff when the firm enters via a new plant, the government is better off choosing a gradualist over a fast-track regime

$$E(GR, NP) + N(GR, NP) \geq E(FT, NP) + N(FT, NP) \quad (4)$$

Intuitively, a new-plant operation by the foreign firm is an investment project that the credit-constrained government cannot afford to realize (Schröder, 2000). This increases the efficiency parameter in the government's objective function under both FT and GR. The indirect transfer of technical and managerial expertise benefits the government under both regimes, but it is reasonable to assume that the firm will operate more efficiently if the surrounding economy and its institutions are more advanced; therefore, $E(GR, NP) \leq E(FT, NP)$. While a new plant operation results in job creation under both regimes, political dividends to a gradualist government from the creation of new jobs under NP may be slightly higher because of positive social sentiments toward the investment. Anecdotal evidence shows that foreign firms that create jobs are perceived as heroes, while firms that make drastic layoffs in an acquired enterprise are painted as villains (Gatling, 1993; Sinn & Weichenrieder, 1997). Such social sentiments are likely to be more pronounced under a gradualist regime where a more restrictive investment environment implies fewer investors who, in turn, receive more media attention and greater social scrutiny. In general, therefore, $N(FT, NP) < N(GR, NP)$. The inequality combined with the relationship between the efficiency terms suggests that gains to the government may be higher if it chooses a gradualist over a fast-track regime, $G_{22} \geq G_{12}$.[5]

Best Responses for the Firm.

Best responses for the firm in the static game are also based on the losses from unilateral deviation. For example, suppose the government imposes a fast-track regime. Assuming that a viable target enterprise exists in the host country, a best response for the firm is to choose an acquisition over a new plant:

$$\pi(FT, ACQ) - C(FT, ACQ) > \pi(FT, NP) - C(FT, NP) \quad (5)$$

Intuitively, the firm's goal is to minimize costs, $\partial \Pi/\partial C < 0$ and maximize the discounted present value of future profits, $\partial \Pi/\partial \pi > 0$. An acquisition allows for speedy entry because the foreign firm inherits established supply/distribution networks and/or taps into the established

customer base for the products of the acquired enterprise (Caves, 1996; Nocke & Yeaple, 2007); thus $\pi(FT, ACQ) > \pi(FT, NP)$. Under a fast-track regime, the firm is also less likely to incur higher than expected costs in the process of negotiating and restructuring the target enterprise. It is reasonable to assume, therefore, that the cost of entry via an acquisition is less than, or comparable to, that of building a new plant and establishing a supply/distribution network, $C(FT, ACQ) \leq C(FT, NP)$. The inequality when combined with the relationship between profits under both modes of entry implies $\Pi_{11} > \Pi_{12}$.

On the other hand, if the government chooses a gradualist regime, a best response for the firm is to enter via a new plant

$$\pi(GR, ACQ) - C(GR, ACQ) < \pi(GR, NP) - C(GR, NP) \quad (6)$$

In general, the transaction costs that the firm faces with an acquisition can be reasonable under a fast-track regime, but quite high under a gradualist regime.[6] For example, American apparel manufacturer, VF Corporation, began negotiations in September 1990 for the acquisition of an enterprise in Hungary. After trying to close the deal for more than a year, the company withdrew from the acquisition process and took the new plant approach in mid-1993 (Gatling, 1993). The VP Corporation experience suggests that when the institutional framework in the host country is relatively undeveloped, the discounted present value of future profits is likely to be higher with a new plant, $\pi(GR, ACQ) < \pi(GR, NP)$ and the cost of entry lower, $C(GR, ACQ) > C(GR, NP)$. The combination of the two inequalities suggests that the payoff from entering via a new plant when the regime is gradualist is larger than that from choosing an acquisition: $\Pi_{22} > \Pi_{21}$.

The solution concept motivated by the best response analysis above is the Nash equilibrium (Nash, 1950). From the preceding discussion, it is possible that the government's payoffs are related through the inequalities $G_{11} > G_{21}$ and $G_{22} \geq G_{12}$. Similarly, the firm's payoffs are related through the inequalities $\Pi_{11} > \Pi_{12}$ and $\Pi_{22} > \Pi_{21}$. With these restrictions on the players' payoffs, the FDI game has two Nash equilibria that lie on the diagonal of the payoff bi-matrix in Table 2 (FT, ACQ) and (GR, NP). Such a configuration makes the FDI game a *coordination game*[7] in which the existence of two equilibria poses an equilibrium selection problem. That is, in the absence of some convention about how the game should be played, it is not clear which equilibrium should be expected. Fortunately, analyses of equilibrium refinement in coordination games provide various sets of conditions that make it possible to predict which equilibrium is more likely to be selected (see for example, Andrelini, 1999; Carlsson & Damme, 1993). The selection criterion that turns out to be important in this paper is risk dominance (Harsanyi & Selten, 1988).

Definition 2

In the 2x2 FDI game, equilibrium is risk dominant if and only if the product of the losses from unilateral deviation by the government and the firm is maximized at that equilibrium. For each of the two equilibria in the FDI game, the conditions for risk dominance are the following: Equilibrium (FT, ACQ) is risk dominant if and only if $(G_{11} - G_{21})(\Pi_{11} - \Pi_{12}) \geq (G_{22} - G_{12})(\Pi_{22} - \Pi_{21})$; and equilibrium (GR, NP) is risk dominant if and only if $(G_{11} - G_{21})(\Pi_{11} - \Pi_{12}) \leq (G_{22} - G_{12})(\Pi_{22} - \Pi_{21})$.

The losses from unilateral deviation in the FDI game are defined as follows:

1. $(G_{11} - G_{21}) > 0$ represents the strictly positive loss incurred by the government if it chooses GR over FT when a Western firm makes an acquisition.
2. $(\Pi_{11} - \Pi_{12}) > 0$ represents the strictly positive loss to the FDI firm from choosing NP over ACQ when the government implements a fast-track regime.
3. $(G_{22} - G_{12}) \geq 0$ represents the loss to the government from choosing FT over GR when the firm enters via a new plant. This loss can be either positive or zero.
4. $(\Pi_{22} - \Pi_{21}) > 0$ represents the loss to the FDI firm from choosing ACQ over NP when the government chooses a gradualist regime. This loss is strictly positive.

A 2x2 Recurrent Game with Adaptive Learning

The FDI coordination game can now be extended to a dynamic setting. To account for the fact that in every period[8], the government, firm, or both players may be different from the players in the previous period, it is useful to adopt a recurrent game framework (Jackson & Kalai, 1997). In the 2x2 recurrent game with adaptive learning, even though the agents playing the game may be changing over time, what they all have in common are the actions available to them when it is their turn to play. It is therefore convenient to think of the game as having two roles rather than two players. Thus, the FDI game has a role called *Government* and a role called *FDI Firm*. For each role, there exists a non-empty population of individuals eligible to play that role. The population of governments is denoted by C_G and the population of firms is denoted by C_F. It is assumed that these populations are disjoint and that within each class, all players are equally likely to be drawn to play the FDI game.

The requirement that the two populations are disjoint simply means that an agent from the population of governments cannot play in the role of a firm and vice versa. The pure strategy space for the player in the role of government, as above, contains two elements that can be interpreted as publicly observable actions: $g \in \{FT, GR\}$. Similarly, the pure strategy space for the player in the role of FDI Firm is $f \in \{ACQ, NP\}$. The payoff functions, G and Π, are as defined above. The elements $(g, f; G, \Pi; C_G, C_F)$ constitute a recurrent game.

The recurrent game is played as follows. In period t (t = 1, 2, ..), a government and a firm are drawn at random from each of the two populations to play the FDI game. A pair of actions is chosen independently and this pair of actions is known as *the record*, or play, at time t. At the end of period t, the history of the game consists of m records. The value of m determines how far back in time the players are able (or willing) to look. It is assumed that the government and the firm are not completely knowledgeable about the processes they are engaged in and have limited information about the history of play up to period t.[9] The history of interaction between foreign firms and host governments at the end of period t is a sequence of the last m plays, denoted as $h^t = \{(g^{t-m+1}, f^{t-m+1}), ..., (g^t, f^t)\}$.

As previously described, in each period a player chooses an action based on the expectation of what the other player will do. However, because the government and the firm in any given period may have never played each other before, they require some mechanism by which to form their expectations. In this game, the way expectations are formed is modeled as an adaptive learning-type mechanism. Essentially, a firm develops expectations about the government's behavior based on precedent, in other words, on information about what players in the role of government have done in the past. Similarly, the government forms its expectations about what the firm will do based on information about how other players in the role of FDI Firm behaved in the past. In this game, such information is considered part of an agent's situation rather than the result of an optimal search. Because agents in both populations are assumed to be boundedly rational, the information is frequently fragmentary. That is, the government and the firm in this period will generally know only a small portion of the relevant precedents, which are learned via a social network. Furthermore, players do not know, or perhaps do consider relevant, the situations and events that occurred long ago; specifically, only recent events matter.

Given that both the firm and the government are part of social networks through which they have access to information about what has been done in the past by players in the opponent's role, it is standard to model the information transmission process as a random variable (Young, 1998). For instance, suppose that the process is in state h^t at the end of period t and consider a government and a firm that are matched to play the FDI game in period t+1. Each player independently draws a sample of size s from the set of actions taken by past players in the other role over the last m periods. Based on the information from their respective samples, both players construct a simple assessment of how the opponent is likely to behave. For example, when the government is trying to choose between its actions, it will draw an independent sample of size s from the actions that agents in the firm's role have played in the past. It will then use this sample to compute the observed frequency distribution of the actions taken by past players in the role of FDI Firm.

Based on the distribution, the government constructs a maximum likelihood estimate of what action the firm will take this period and gives a best response to it. The firm acts in a similar manner. It draws a sample of size s and uses it to compute the observed frequency distribution of the actions taken by past players in the role of Government. The firm then uses the distribution to construct a maximum likelihood estimate of what action the government will take this period and gives a best response to it. Although players usually give a best reply given their expectations of what their opponent will do, sometimes idiosyncrasies in their behavior can result in arbitrary or unexplained choices. Even though such behavior is modeled as a small positive probability of a player making an error, the interpretation of this error is not necessarily that of making a mistake. In the present framework, such minor disturbances to the adaptive process can also be interpreted as experimentation by governments and firms who are continuously learning about how to play the FDI game. The error rate is denoted by $\varepsilon > 0$. With probability $(1- \varepsilon)$, each player will give a best reply to what he or she expects the other will do, and with probability ε, he or she will choose an action at random. The probability of making an error is assumed to be independent across players. Therefore, the three components characterize the choices of governments and firms in each period: the players' memory size, players' sample size, and the error rate. Taken together, these factors define a Markov process, also known as adaptive play (Young, 1998). That is, in the recurrent FDI game, Γ, adaptive learning by governments and firms is a Markov process with memory size m, sample size s, and error rate ε.

As the game is played repeatedly over time, precedents accumulate. Thus, records in a player's sample can be any combination of the players' actions. If in each period players choose a best response to what they think their opponent will do, the process will eventually arrive at a state in which the last m records are of the form $\{(g^*, f^*),..., (g^*, f^*)\}$, where (g^*, f^*) is one of the two Nash equilibria of Γ. Such a state is considered a convention. Because the FDI game has two Nash equilibria, it is implicit that two conventions can develop over time: h_1 = {(FT, ACQ),..., (FT, ACQ)} or h_2 = {(GR, NP),..., (GR, NP)}.

Specifically, suppose that the process is currently in convention h_1 where (FT, ACQ) has been the outcome of the game for the last m periods. When the firm or the government consider past strategies taken by individuals in the opponent's role, they predict that the opponent in this period will also choose to play the Nash equilibrium (g^*, f^*). In the absence of errors, a best response to this prediction will be for the player to also play his part in (g^*, f^*). Therefore, equilibrium (g^*, f^*) will persist. In the model developed above however, the government and

the firm are allowed to exhibit idiosyncratic behavior. In the presence of such behavior, the question is whether experimentation (or errors) can upset a convention and affect the outcome of the game in the long run. In order to make a prediction about which of these two conventions is more likely to prevail in the long run, an understanding of how random errors by players can switch the FDI process from one convention to the other is required.

To this end, suppose that the player in role of Government makes a mistake in period *t*. Such a mistake can, for example, be an unexpected comeback of ex-communist regimes like the ones witnessed in Poland, Bulgaria, Russia, and Mongolia ("The Ex-Communists Storm Back," 2000). In period (*t+1*), the player in role of FDI Firm can draw a sample in which all records but one are of the form (FT, ACQ). Based on this sample, the firm computes a maximum likelihood estimate of the distribution the government is using. A best response to this distribution will most likely be the strict Nash equilibrium strategy ACQ. Such an outcome would imply that the error made by the player in role of Government in period *t* is most likely insufficient to upset the convention. However, it is possible that an error was made by several players in the role of Government in the periods preceding (*t*+1). A question then arises about whether such persistent errors are sufficient to upset the convention and make the process switch from one convention to the other.

To answer the question, how stable each convention is in the presence of random errors requires assessment. In previous literature, the problem has been addressed through the analysis of the stochastic stability of equilibria. Specifically, the stochastically stable state will be the one in which the process will spend the most time in the long run. Intuitively, the process will spend most of its time in the state that requires the fewest number of errors to get to and the largest number of errors to move away from. Thus in the FDI game, if the number of errors it takes to switch the process to h_2 is less than the number it takes to switch it back to h_1, then the state h_2 is said to be stochastically stable. Note that there is a one-to-one correspondence between conventions and Nash equilibria in a coordination game, and therefore the stochastically stable state will correspond to the one of the Nash equilibria in the static game. The following proposition identifies the stochastically stable state as the convention corresponding to the risk dominant equilibrium (Young, 1998).

Proposition

Let G be a 2x2 coordination game, and let $P^{m,s,\varepsilon}$ be adaptive learning with memory size *m*, sample size *s*, and error rate ε. If information is sufficiently incomplete ($s/m \leq 1/2$), and *s* and *m* are sufficiently large, the stochastically stable states of the perturbed process correspond one-to-one with the risk dominant conventions.

Discussion

It may be useful to illustrate the conditions under which the FDI process in transition economies can settle in one of the two conventions. Previous empirical literature (see for example Dunning, 2001; Estrin et al., 2000; Wooster, 2006) points to evidence suggesting that either convention may be a possible outcome. Suppose that repeated interaction between governments and firms has isolated (FT, ACQ) as the outcome of the recurrent FDI game. By definition 2, the equilibrium implies the following:

$$(G_{11} - G_{21})(\Pi_{11} - \Pi_{12}) \geq (G_{22} - G_{12})(\Pi_{22} - \Pi_{21}). \quad (7)$$

The inequality in Equation 7 can be satisfied if restructuring has been a priority for the governments that played the FDI game and access to supply/distribution networks has been prioritized in the expansion strategy of foreign firms. As suggested when discussing best responses for players, if the government is committed to rapid restructuring, the loss in efficiency resulting from deviation to a gradualist regime when firms invest via an acquisition outweighs the gain obtained by changing to such a regime when firms invest via new-plant operations: $(G_{11} - G_{21}) > (G_{22} - G_{12}) \geq 0$. Similarly, by deviating from (FT, ACQ), the foreign firm loses in terms of lower profits and possibly higher costs. Such a loss outweighs the gain from abandoning the acquisition process and switching to a new plant under a gradualist regime: $(\Pi_{11} - \Pi_{12}) > (\Pi_{22} - \Pi_{21}) \geq 0$. Taken together, the inequalities over the unilateral losses of governments and firms posit sufficient conditions for risk dominance of equilibrium (FT, ACQ).

With respect to the other equilibrium, suppose that the interaction between governments and firms has isolated (GR, NP) as the outcome of the recurrent FDI game. In terms of definition 2, this equilibrium implies the following:

$$(G_{11} - G_{21})(\Pi_{11} - \Pi_{12}) \leq (G_{22} - G_{12})(\Pi_{22} - \Pi_{21}). \quad (8)$$

The inequality in Equation 8 can be obtained if the host government wishes to benefit from FDI and foreign expertise but is not ready to undertake rapid restructuring. The outcome implies that the firm is better-off entering via NP than via ACQ, which is generally true when the firm possesses intangible or firm-specific assets. Thus, if the government is not committed to rapid restructuring, the loss incurred by deviating to a fast-track regime in the case where the firm enters via a new plant is more pronounced than the gain obtained by changing to such a regime if the firm enters via an acquisition, $(G_{22} - G_{12}) > (G_{11} - G_{21}) \geq 0$. Similar reasoning can be applied when interpreting the actions of the firm at this equilibrium. The internalization theory suggests that if the firm possesses intangible or firm-specific assets, it is better-off entering via a new plant than via an acquisition (Morck & Yeung, 1992). For

a firm with such characteristics, the cost of deviating at (GR, NP) is strictly greater than that at (FT, ACQ), hence $(\Pi_{22} - \Pi_{21}) > (\Pi_{11} - \Pi_{12}) \geq 0$. Therefore, in the long run, in a country where the government has taken a gradual approach to reform, firms are likely to undertake new plant investments more often than acquisitions, playing a more mediating role in economic restructuring. Formally, the inequalities over the unilateral losses of governments and firms with the above characteristics posit sufficient conditions for risk dominance of equilibrium (GR, NP).

The features of the recurrent FDI game developed above provide a good framework for interpretation of empirical evidence with respect to the distribution of acquisitions and new plant operations across transition economies in the 1990s. The information provided in Table 3 is based on a sample of 96 investments made by U.S. publicly traded manufacturing companies, of which 60 were acquisitions and 36 new-plant operations established in transition economies over the period 1989 and 1999.[10] Information about the mode of entry was obtained from company announcements and classified as follows: acquisitions (ACQ) were recorded when a U.S. firm acquired an existing domestic company, and a new plant operation (NP) was recorded when a U.S. firm established a wholly–owned subsidiary or built a new plant.

Table 3 used the EBRD overall transition scores presented in Table 1 to tabulate the percent of the 96 investments that fall in each cell of the FDI game depicted in Table 2. Over the 11 sample years, 58% of all observed investments were acquisitions in countries at the more advanced stages of economic reform or countries with an overall transition indicator of 3 or higher. New plant operations in these countries were 27% of all investments. In contrast, 10% of the sample were new plant investments made in countries at less advanced stages of transition or countries with an overall transition indicators below 3; only 4% were acquisitions in such countries. These statistics provide support for the model's predictions: over time, the data suggest that the likely convention that emerged in transition economies is (FT, ACQ).

Conclusion

The game-theoretic framework presented in this paper captures how the level of restructuring efforts by host governments of transition economies are strategically interrelated with the amount of restructuring-oriented FDI foreign firms will undertake. The actions of the government capture the tradeoff between catering to political objectives and the goal of attracting foreign equity. The actions of the firm capture the two most common forms of entry into the region, acquisitions and new plants. An important outcome of the analysis is the possibility that the game has two equilibria. In one equilibrium, (FT, ACQ), the host county is committed to rapid economic restructuring and market-oriented policies. Because, at this equilibrium, the foreign firm chooses to enter via the acquisition of an existing SOE, it plays an active role in industrial restructuring. In the other equilibrium, (GR, NP), the host country chooses a more gradualist approach to reform. Here the firm plays more of a mediating role in economic restructuring through the indirect transfer of technical and managerial know-how via a new plant investment.

The interpretation of the game's equilibria as long-run conventions about how firms invest in countries at different stages of transition has important policy implications. In future research, the analysis and the model's results can be applied to the evolution of FDI in other emerging economies, such as the countries of Latin America, for example. Because economic restructuring

Table 3
Modes of Entry by U. S. Firms in Transition Economies (1989-1999)

		Distribution of Equity Investments by Manufacturing Firms	
		Acquisitions (% of 96 Investments)	New Plants/Subsidiaries (% of 96 Investments)
Host Country Characteristics	Advanced (FT)	58	27
	Less Advanced (GR)	4	10

Note. Data above are based on a sample of 60 acquisitions and 36 new-plant investments by U.S. publicly traded manufacturing companies. Data were collected over the period 1989-1999. Mode-of-entry information regarding these investments was obtained from company announcements and classified as follows: *ACQ* = firm acquired an existing company; NP = firm established wholly-owned subsidiary or built a new plant. Of the total acquisitions, 93% (or 56 acquisitions) were made in relatively more advanced transition economies (EBRD overall average score >3.0) and 6.7% (or 4 acquisitions) were made in countries at the less advanced stages of reform (EBRD overall average score < 3.0). Of the total new plant/subsidiary operations, 72% (or 26 new plant investments) were made in relatively more advanced transition economies and 27.8% (or 10 new plant investments) were made in countries at the less advanced stages of reform. Percentages are computed based on the total of 96 investments.

cannot succeed without adequate external financial support, collaboration between host governments and international financial institutions can serve to elevate a country out of the equilibrium with low restructuring-oriented FDI. For instance, funding can be directed toward improving local institutions, assisting with privatization, and helping foreign investors with acquisition costs such as large inter-enterprise debt. Moreover, the importance of securing financial support from multilateral institutions points to a need for increased credibility of reform efforts by host governments. The contribution of FDI to economic restructuring is only as effective as the commitment of host governments to initiate and execute market reforms.

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Footnotes

1 For example, Frydman, Gray, Hessel, and Rapaczynski (1999) analyzed how ownership affects performance. They found that firms owned by insiders did worse with respect to investment and access to finance compared to firms under a dominant outside owner.

2 Furthermore, ethnic wars in the republics of the former Yugoslavia in 1991 increased tensions on the Balkan Peninsula, and subsequently, the investment risk for foreign firms in neighboring countries. Despite the political turmoil in the region, market-based institutions had replaced communist structures in most countries by 1997 (Estrin & Meyer, 1998).

3 This terminology does not parallel that used by Sachs (1995) in the context of the Chinese approach to reform where a gradualist approach is defined as the liberalization of the non-state sector combined with continuous subsidization of the state sector.

4 A reduced form representation of the government's objective function has been used previously in studies of endogenous protection (Hillman & Ursprung, 1999) where the government is seen as setting economic policies in order to maximize a political support function. Grossman and Helpman (1994) also adopted this approach in their study of the effect political contributions have on trade policy. For a more recent analysis of special interest political influence, see Grossman and Helpman (2001).

5 It should be noted, however, that in the case where the operations of the firm are significantly dependent on the efficiency of the surrounding economy, a gradualist regime may result in efficiency losses that outweigh the gains from increased employment, $G22 < G12$.

6 Higher additional costs under a gradualist regime stem not only from lengthy negotiations, valuation disputes, environmental liabilities, and restructuring costs, but are also due to bad press surrounding the restructuring process, resulting in reputation losses.

7 In a coordination game, each player has the same number of actions that can be indexed so that it is a strict Nash equilibrium for play actions having the same index.

8 In this model, time is measured in periods that correspond to distinct events. Specifically, each interaction between a pair of players marks the beginning of a new period.

9 Note that t captures all instances of interaction between governments and foreign firms in transition economies, which makes it reasonable to assume that it is large enough to be used in long-term analysis of a stochastic process such as the pattern of investment behavior.

10 The author collected the data.