ESSAYS ON DETERRING FOREIGN DIRECT INVESTORS

by

Oleksandr Kikot

A thesis submitted in partial fulfillment
of the requirements for the degree of

Master of Arts in Economics

National University "Kyiv-Mohyla Academy" Economics Education and
Research Consortium Master's Program in Economics

2004

Approved by _____
Ms.Svitlana Budagovska (Head of the State Examination Committee)

_____

_____

_____

Program Authorized to Offer Degree Master's Program in Economics, NaUKMA

Date _____

National University "Kyiv-Mohyla Academy"

Abstract

ESSAYS ON DETERRING FOREIGN DIRECT INVESTORS

by Oleksandr Kikot

Chairperson of the Supervisory Committee: Ms.Svitlana Budagovska,
Economist, World Bank of Ukraine

This paper aims to analyse inability of some transition countries to establish proper business environment to attract desired levels of foreign direct investment. The author argues that notorious ability of 'Bad' business environment to deter entry of foreigners can be exploited by local Oligarchs to prevent competition for the local enterprises in 'fair' privatization and secure their position on local markets. The paper develops two models of Oligarch choice – one with perfect information and the other with imperfect one. The empirical part of the paper tests one of the conditions for observing both local businessmen and foreigners in the same industry simultaneously obtained in the model with perfect information. The bottom line of the paper is that local Oligarchs indeed can use 'Bad' business environment to directly deter the entry of foreign direct investors. They also can produce a credible signal about state of business environment, thereby informing foreign direct investors about their entry and production costs in a country.

TABLE OF CONTENTS

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Prof. Valentin Zelenyuk. His insightful ideas inspired this work, his support at the difficult moments helped author to go ahead and his excellent guidance made it possible for this work to appear. I would like to thank Prof. Roy Gardner, Prof. Tom Coupe and Prof. Bilotkach for their invaluable comments. I am also very grateful to my wife Galina Sosnovska for her patience and support.

Chapter 1

INTRODUCTION

> "Officially speaking, foreigners are welcome. But you also find others who are not very interested in having foreigners. You can even hear people on a very high levels saying, 'We don't need foreigners."

Lennart Dalhgren, Ikea's country manager in Russia.
New York Times February 15, 2003

While most transition countries claim that they welcome foreign direct investments (FDI), many of them don't manage to get the 'desired' level of FDI. Countries like Tajikistan, Uzbekistan, Kyrgyz republics, Ukraine have essentially failed to attract FDI. For example, during 1992-2001 FDI in Ukraine totaled 4.4 billion, or around $88 per capita compared with $3100 per capita in the Czech Republic. The reasons for low volumes of FDI were thoroughly investigated and documented not only in developed and developing nations but also in transition economies. One of those is inadequate legal, institutional, economic and political environment of a country (Ishaq, 1997). Since according to the claims most countries not only just welcome FDI but also do everything to attract them, the question is why many countries that seem to strive for foreign direct investment fail to create the FDI friendly business environment

which appears to be a prerequisite for successful attraction of FDI. The business and political environment is mostly the result of activity and interaction of political institutions in a country, i.e. government, president, parliament and local business groups or so called oligarchs.

> Some oligarchs, their co-opted cronies in parliament and the presidential administration, most of whom came from the communist nomenclature, had an iron grip on most economic activity in Ukraine throughout the nineties. Those groups had captured all organs of the state and used them to their private economic benefit, maintaining weak property rights and an over-regulation of the privatized and emerging new private sector. Konings et. al. (2002, p. 323)

Given the main assumptions of neo-classical economic theory - the optimizing behavior - we can argue that the failure to create 'Good' business environment could be explained by incentives for oligarchs to keep or even to create bad environment and deter entrance of foreign direct investors who could compete with oligarchs' businesses for state enterprises and for lucrative markets. For example, if foreign direct investors are allowed to compete for state enterprise with local oligarchs they will bid up its price and Oligarchs will either pay more for that enterprise or lose a control over it. Hence, we could expect that an FDI unfriendly environment was not an exogenous factor but an endogenous one chosen by profit maximizing economic agents who have strong political power.

Most studies done before concentrated on the factors or determinants of foreign direct investment and their effects on the performance of local enterprises and economy as a whole. They found that the business environment plays prominent role in decision of foreign direct investors to invest or not in a particular country and that FDI are usually beneficial for the local economy. Taking into account those findings we will try to extend the analysis of FDI determinants further and examine possible factors which explain why some countries managed to establish adequate environment and others did not. How economic conditions of a country or of a particular industry within the country could determine what is more profitable for oligarchs (either choose 'bad' environment, easily privatize local enterprises but face low demand or choose 'good', face high demand but allow foreign direct investors to enter the market) and thus, what environment will be chosen. The choice made by a few oligarchs affects all people in a country, i.e. in case of foreign direct investors entry deterrence there could imply consequences for the consumers in form of surplus loss due to worse technologies utilized and continued monopolistic pricing, and loss of overall welfare due to the loss of resources allocated for deterrence. The answer to the above question could help to understand and anticipate the behaviour of the ruling elite.

The paper will proceed as follows: in chapter two we provide the survey of the existing literature on the effects and determinants of foreign direct

investment in a country and of the literature on the entry deterring practices. In chapter three we develop theoretical model which seeks to find the conditions under which the 'Bad' business environment will be the result of Oligarch profit maximization. In chapter four we will look whether there is some evidence which supports the model developed in the chapter two. In chapter five we provide the modification of the limit pricing model (Milgrom and Roberts, 1982) which shows that Oligarch can signal to the potential foreign entrants about the quality of a business environment and the costs of entry in a country via quantity of goods produced.

Chapter 2

LITERATURE REVIEW

Internationalization of business and globalization of the world markets along with the liberalization of FDI regulation and collapse of the Soviet Union in the late 1980th spurred the interest in FDI among academia and policy researchers. The literature on the FDI has been proliferating since then and by now it covers all major aspects and issues concerning the determinants and effects of foreign direct investment in the host and home countries. However, to the best of our knowledge there were neither empirical nor theoretical studies done on the possible foreign entry deterrence by local business groups. Instead two strands in the literature can be identified.

First block of literature concerns the effects of FDI on the host and home countries. Here we should focus on the effects of FDI on the host (recipient) country because it was inflow of FDI that was major concern in transition countries. Generally, analysis of studies shows that the effect of FDI on the host country is ambiguous, it tends to be rather positive than negative, though (Lipsey (2002), Blomstrom (1998)). First, FDI is traditionally considered bringing financial capital, management skills, access to export markets and better technology. However, they could depress wages in the host country and stifle country's growth by displacing local firms. The results of recent research

on the effects of FDI are presented in the papers by Lipsey (2002) and Blomstrom (1998). Some of them are reiterated in the paper by Hanson (2001). Those studies identify several major areas where FDI can have effect on a host country. Lipsey (2002) considers the effects of FDI on wages. Namely, whether foreign investors pay more or less to worker than domestics firms do, whether higher wages at foreign owned enterprises increase wages at domestic enterprises (i.e., spillover effect) and whether the overall level of wages in a country rises if FDI are present. His main findings are that foreign firms indeed pay higher wages than domestic ones and that finding is quite robust, however not all studies surveyed controlled for enterprise and worker characteristics. The overall spillover effect on wages was found to be slightly positive in most studies. It should be noted that the greatest body of research was devoted to the effects of FDI on the host country's productivity. Numerous studies were done; the results are vague and ambiguous, however. To begin with, the least controversial issue was the productivity of the foreign owned firms. In most cases they were found to be more productive than domestic ones. But spillover effects of foreign firms were found to have positive as well as negative effects. Blomstrom (1998) identifies two possible spillover effects for the domestic enterprises: productivity spillover and market access spillover effects. Both can arise due to the linkages between MNC and local firms. For example, training of employees at MNC affiliates, changes in the industry structure,

demonstration and competition effects. Author also summarizes empirical evidence on the spillover effects. Most empirical evidence in that area is obtained in form of case studies and points to the overall positive spillover effect. However, there are a number of studies suggesting negative spillover effects of FDI. Lipsey (2000) mirrors the results on spillover effects presented in the Blomstrom (1998). Further, he considers the introduction of the new industries by FDI which could change the composition of production in the country. The author provides the example of Ireland that quickly went from mainly agricultural country to industrialized one due to liberalization of inward investment.

Now we turn to the particular studies on several transition countries and Venezuela which both aimed at identifying productivity and spillover effects of FDI. Both studies posed two identical questions: whether foreign owned firms were more productive than domestic ones and whether FDI produced positive spillovers. Surprisingly, the results of those studies were almost the same; however the authors utilized slightly different techniques. Konings (2000) analyze the effects of foreign direct investment in three CEE countries: Bulgaria, Romania, and Poland. Using IV and GMM techniques to correct for possible endogeneity, he found that only in Poland foreign firms performed better than domestics and there are negative spillover effects in Bulgaria and Romania and no effects in Poland. The situation in Venezuela

analyzed by Aitken and Harrison (1999) showed the positive productivity effect of FDI only for small firms and negative spillover effect. However, authors do not correct for possible endogeneity in the model.

Studies done for Ukraine (Talavera O (2001), Rybalka O. (2000)) showed that FDI had positive and significant effect on labor productivity and export volumes. Positive spillover effects of FDI were also present. The work by Konchenko (2003) confirms the results obtained by previous studies for the Ukrainian milk industry.

Generally, it is considered that positive effects of FDI such as capital inflow, employment, technology and exports dominate negative ones and therefore most countries liberalized their FDI regulation in 1980es. However, the liberalization seemed to work only in a limited number of countries, others did not benefit from it. Given that most studies tend to find positive effects of FDI on the host country the question remains – why do countries fail to attract FDI?

The other major block of literature concerns the factors and determinants of FDI and is a natural extension of the above mentioned literature. Since most works show positive effects of FDI on the host country, the question is what attracts and deters FDI in the particular country or a group of countries. According to the established eclectic or OLI paradigm proposed by Dunning (1977) the major determinants of the

FDI done by the firm are ownership advantages, internalization advantages and location advantages. The first two belong to firm specific advantages and are of a little interest to us. Most of our interest lies in the last one (location advantages) which refers to country specific factors and is broadly represented by the national policy framework for FDI, business facilitation and economic motives. OLI Paradigm suggests that a firm will make foreign direct investment if all of the determinants exist simultaneously. Studies identify a great number of local factors that affect the decision of the firm to undertake FDI ranging from cheap and abundant resources to stable legal and political environment. Indeed, many studies show that all of the above determinants are equally important for FDI (Jose and Javier(2001), Oxelhiem et al (2001), Kudina (1999)). However, we will focus on those location advantages which can be partly affected by government policies and therefore could be affected by actions of local oligarchs.

For instance, Jose and Javier(2001) identify about 20 different local factors in their survey. By using the survey method to test the OLI paradigm for Spanish firms, author measure the degree of relevance of the particular factor (average score given by companies to factor in the sample), degree of determination of the factor (percentage of firms which have chosen this factor as the determinant one) and degree of adequacy of the factor (percentage of firms which have allotted one point at least to that

factor). What is important for us is that the political stability is relevant and adequate variable; however it is not the determinant one which might mean that political stability is necessary but not sufficient condition for FDI. Since authors use a predetermined set of factors they can fail to get the true picture of the factor importance since they could omit variables considered by firms as important. For example, they do not consider the legal system, level of institution development and bureaucracy which may be important local factors. Further, they do not actually define political stability and therefore it is unclear what it actually includes. Another example is a theoretical study done by Baniak et.al. (2002) which aims at explaining why in many countries FDI inflow is lower than expected and at exploring some important determinants of FDI flows. Namely, using a simple microeconomics model, they investigate the link between macroeconomic and institutional stability and decisions made by a firm concerning FDI. Having solved the model they found that macro economic stability (reduction of the variability of forecasted variables) fosters the inflow of FDI in the country. Further, they found that the uncertainty about fixed and marginal costs in the country relative to other countries will be detrimental for foreign direct investment inflow. Among the variables that influence the costs and profits of foreign investors authors emphasize FDI legal framework, time requirements, and bureaucratic procedures. Based on

those finding they argue for a stable economic and institutional environment. The results obtained are quite interesting to us since the activities of the oligarch and government could affect the costs incurred by foreign investor. If there is a high uncertainty about costs which is there when there is a 'bad' business environment in a country the entry of foreign investor will be most likely deterred. However, authors fail to provide compelling empirical evidence to support their theoretical findings.

Two more studies focus on the factors and deterrents of FDI in Ukraine. The one done by Ishaq (1997) provides us with qualitative analysis of FDI and its deterrents. The author identifies major problem areas for foreign direct investors in Ukraine such as legal, institutional, economics and political environment. He points towards a plethora of problems in those areas which together significantly hinder foreign direct investment in Ukraine. The other study by Kudina (1999) parallels the one by Ishaq (1997) with respect to the major deterrents of foreign investment. The author conducts a survey among thirteen foreign companies in Ukraine and the results obtained point to the high economic uncertainty, ambiguity of the legal system and political instability as the major deterrents of the foreign direct investment. Those are almost the same as in the study by Ishaq (1997). Both studies support the idea that the business environment was detrimental for FDI. However, we cannot infer from those studies why

those detrimental factors kept influencing the business environment during the whole transition period.

One more study which does not explicitly deals with the issue of foreign direct investment but addresses the problems of rent-seeking, corruption and oligarchy in Ukraine is one by Aslund (2002). The author argues that the country was in the full control of a rent-seeking government, parliament and oligarchs who favoured maximum state interference in the economy to maximize corruption and rent-seeking. Those activities are exactly the ones which deter foreign direct investment according to the above studies.

Though most works analyzing factors and determinants of FDI identify favourable legal, political and institutional environment as necessary condition for attraction of FDI none seem to take up the issue why 'bad' business environment can be sustained for a long time spans in any country. The issue becomes even more interesting given the fact that most studies identify positive effects of FDI on the local economy.

Summarizing the results of the works presented above we could conclude that though FDI have positive effects on the host countries, many of those countries did not hurry to establish proper legal, political and institutional environment to attract much needed foreign direct investments. The problem could be that local business groups being afraid

of competition with better equipped foreigners tried to deter the entry by the foreigner in the first place. The theory of industrial organization developed numerous models which could be applied to analyze and investigate the behaviour of profit maximizing agents in their endeavour to deter undesired entry.

The book by Shy (2001) provides an introduction to the game theoretic approach of modelling the behaviour of economic agents and presents us to the theory of entry deterrence. The book covers major ideas of particular theories that are fully developed in articles by Eaton and Lapsy(1980), Stiglitz (1987), Dixit (1982), and Milgrom and Roberts (1982). The main idea of that set of literature is that incumbent firm will try to deter entry of potential entrant. To do so the incumbent should make entry unprofitable. However, not only the incumbent action should deter the entry but also the incumbent should have no incentive to deviate from that action. In most models to deter the entry incumbent should carry out a costly activity to make his threat credible. For example, in the model developed by Eaton and Lipsey (1980) incumbent has to overinvest into the fixed capital to make the threat to operate in the next period credible. In a sense, since the capital is durable, investment 'today' ensures that the incumbent will be in the industry 'tomorrow'. In that model the market can sustain only one firm which means that the incumbent can deter the entry

by ensuring its existence in the industry in the future. In another model by Milgrom and Roberts (1982), limit pricing of the incumbent works as cost-signalling device to the potential entrant. The potential entrant does not know the cost structure of the incumbent but it infers the cost structure from the price signals made by incumbent. Since the potential entrant knows that a high cost incumbent will never charge the low price, the low price could be used as a signal by a low-cost firm to scare potential entrant away. Some of models together with the extensive form game which describe options to oligarchs and foreign direct investors will be used to analyze the behaviour of local oligarchs and obtain necessary and sufficient conditions for establishment of different business environments in a country.

The effects and determinants of foreign direct investment were extensively analyzed and investigated by foreign and Ukrainian researchers and few unanswered questions remained. However, better understanding of FDI determinants seemed not to help many transition countries attract desired levels of FDI. Hence, it would be interesting to extend the analysis of FDI factors and consider the determinants of local legal, institutional and political environment. Namely, we argue that some components of business environment can be used by local oligarchs to deter entry of foreign direct investors.

Chapter 3

ESSAY ONE

THE MODEL OF OLIGARCH CHOICE OF BUSINESS ENVIRONMENT

3.1 INFORMAL DESCRIPTION OF THE MODEL

With the start of the transition there was a drive for structural reforms (economic liberalization and the reform of the state and legal system) in former Soviet republics and CEE countries. The economic liberalization stipulated among others the privatization of the state owned enterprises and allowed foreign economic agents to operate in a country. However, the transition period produced not only free markets but also local business groups which struggled for the control over the most profitable enterprises and markets within a country. Locals and foreigners quickly became competitors and for the profit maximizers various means and tools have been used in the fight against the competitor. In this work we argue that local Oligarchs have a powerful tool which can help to deter the entry of foreign direct investors into a lucrative industries – this tool is business environment. Instability and exorbitance of the government's regulation, ambiguity of the legal system, corruption, high tax burden and problems with establishing clear ownership conditions can be a great impediment for the entry of foreign firms into a particular industry or a country and may therefore be used by local business groups to deter entry of

foreigners. To tackle the issue formally we use the extensive - form game in which we try to explicitly incorporate the decisions made by local Oligarchs and foreign direct investors in their struggle for control over the local enterprises and markets.

To start with, we assume that there is a local Oligarch that can affect government decisions. Since it has influence on the decisions of the government it will be able to use that influence to maximize its profits. As we know from the theory of Industrial Organization theory, the industry structure that gives the highest profits to producer, ceteris paribus, is monopoly. Therefore, the local oligarch may be trying to establish the control over the local monopoly at lowest possible cost and deter the entry of Foreign Direct Investor into the industry to ensure highest possible profits. Basically, it can be done by two methods: the first is to get the government to prohibit the entry of the foreign direct investor in the industry by law and the other is to make the entry unprofitable by increasing the costs of entry and operation for the foreigner in the industry. Both methods may work well as long as it pays for Oligarch to use them. In our work we will try to analyse how local Oligarch could maximize its profits by manipulating with the business environment in the industry or country; thus making the business environment an endogenous variable determined by the industry and market economic conditions and profit maximizing behaviour of a local business group. Therefore, we make Oligarch

move first and determine the environment in a country by lobbying its interests and paying 'political' costs for it. At that stage we make the choice of environment for Oligarch discrete – it can choose either 'bad' or 'good'. If Oligarch chooses 'bad', it gets the enterprise subject to privatization for free, but the internal demand falls because of the bad business environment. Hence, as the result of such actions Oligarch could ensure that it gets monopolistic profits under the low demand conditions. As we mentioned above the monopolistic profits are the highest possible, ceteris paribus. However, in our model as in the real life the 'ceteris paribus' assumption does not hold. Since the bad environment in the country reduces the demand for goods, the reduction may be so huge that it will be unprofitable for Oligarch to stick to the bad environment forever and it may choose to change the environment once again to increase the internal demand and profits. However, when the good environment is in place, we assume there are no barriers for the foreigners to enter. They can do it with either purchasing the enterprise from the local Oligarch that previously acquired it or they can build a new plant and directly compete with Oligarch for the local market. We also assume that if both players are in the industry they compete with quantities, i.e., we have the Cournot market structure. On the other hand, if the fall in demand is huge and the technology used by foreigners is superior enough, the Oligarchs may choose not to change the environment for bad in the first place. Then there will be a

'fair' privatization auction and the agent that pays the highest price will get the local enterprise. If that player will be the local Oligarch, then the foreign investor may choose whether to enter or not. Solving for the payoffs at the terminal nodes and using backward induction method we will determine conditions for each terminal node be Subgame Perfect Nash Equilibrium. These in its turn will give us the conditions under which the choice of bad or good environment will be a by-product of Oligarch profit maximization.

3.2 THE MODEL SETUP AND SOLUTION

Assumptions:

A1. When the game starts there is only one firm operating in the industry, i.e. we have the monopoly which is characterized by the constant marginal costs of production MC_0. The firm is state owned and is subject to privatization.

A2. There are two economic agents who want to serve the local market – the local Oligarch and Foreign Direct Investor. The only way for the Oligarch to start serving the market is to purchase the existing plant in privatization. We assume that the learning cost of entry with new enterprise for Oligarch is high enough to ensure that it will not enter with it. The Foreigner has two options – it can either purchase the existing plant or build a new one.

A3. There can be no collusion between the Oligarch and the Foreign Direct Investor neither in privatization nor in market competition.

A4. Both agents are profit maximizers.

A5. If the foreigner builds a new plant, the plant has constant marginal costs MC_n of production and the sunk costs associated with constructing a new plant are E. The products produced by the new and old plants are homogenous.

A6. The Oligarch, as a local, can greater influence the local government and other political institutions and can more effectively lobby particular government decisions than Foreign direct investor can. Therefore, it can affect business environment in a country (under which we understand government regulations of the industry and market, government policies, openness and freedom of trade, legal system, level of property rights protection etc).

A7. The Oligarch has discrete choice between two states of business environment – Bad and Good. Each time the Oligarch wants to change the environment (no matter in which direction) it has to pay 'political' costs in the amount of C_p, except initially if Good is chosen at the first decision node.

A8: The internal demand for goods produced by the industry depends on the business environment chosen by Oligarch. It is assumed that under the bad environment the demand will be lower by factor λ, $0 \le \lambda \le 1$. Bad environment demand: $Q^d(P) = \lambda A - P$ and inverse demand is $P(Q^d) = \lambda A - Q^d$

Good environment demand: $Q^d(P) = A - P$ and inverse demand is $P(Q^d) = A - Q^d$

A9: Both agents possess complete and perfect information about the game. They know the internal demand function; they know the cost structure of both new and existing plants etc.

A10: If the business environment in the industry or country is bad, then foreign direct investor can not entry either because it is directly prohibited or the entry costs are high enough to make entry unprofitable and the plant goes to Oligarch for free.

A11: If the business environment in the country is good then the government conducts a privatization on which the existing enterprise is sold to the agent which offers the highest price. If the prices offered by both agents are the same, the enterprise goes to the local Oligarch.

A12. The game starts with the move of Oligarch. He can choose either Bad or Good business environment in a country.

Derivation of the payoffs

Now armed with the assumptions we will proceed to the formal development of the model. There are two players in the game: Oligarch and Foreign Direct Investor. Oligarch can either control an existing plant or does

not control any plant, and foreign direct investor can control existing plant, new plant or no plant. Let q_o be the amount of the goods sold by the existing plant and the q_n is the amount of the goods sold by the newly established plant. Let $MC_0 = c_o$ and $MC_n = c_n$ and E be the sunk cost associated with the installation of a new plant. The above means that the cost functions of both plants will be

1) Existing plant cost function : $TC_0=c_oq_o$

2) Newly established plant cost function : $TC_n= c_nq_n+E$

Now when we specified the demand and supply conditions we may proceed to the formulation of the extensive form of the game. The game is represented by the tree in the appendix #5.

Definition. The extensive-form representation of a game specifies: (1) the players in the game, (2a) when each player has the move, (2b) what each player can do at each of his or her opportunities to move, (2c) what each player knows at each of his or her opportunities to move, and (3) the payoff received by each player for each combination of moves that could be chosen by the players.

The tree for the extensive form game begins with the decision node for the player 1 (Oligarch) where Oligarch chooses between bad (B) and good (G) business environments. If the Oligarch chooses B then it immediately gets the existing enterprise for free and goes to its next decision node because under bad business conditions foreigner will not enter by definition. At that decision node Oligarch, faced with low demand, has the option to change the environment or

leave it as it is, i.e. bad. If Oligarch chooses not to change the environment it gets to the terminal node where it possesses the monopoly but faces low demand. At that terminal node the payoff to the foreign direct investor will be zero and the payoff to the Oligarch can be calculated by solving the monopoly profit maximization problem, under low demand.

Proposition 3.1. (Terminal node #4) Given assumptions A1-A12, the payoffs to the Oligarch and Foreign Direct Investor at the terminal node #4 (when Oligarch chooses B at both decision nodes) are

$$\Pi^{o}(q_o^*) = \frac{(\lambda A - c_o)^2}{4} - C_p$$

$$\Pi^{f} = 0$$

Proof: Oligarch maximizes total profits of the monopoly

$$\max_{q_o} \pi_o(q_o) = \max_{q_o}\{TR_o(q_o) - TC_o(q_o)\}$$

And the solution to the optimization problem will give us the payoff to the Oligarch.

$$q_o^* = \arg\max_{q_o} \pi(q_o) = \arg\max_{q_o}\{(\lambda A - q_o)q_o - c_o q_o\}$$

The first order condition for the problem are given by

$$\frac{\partial \pi_o(q_o)}{\partial q_o} = (\lambda A - q_o^*) - q_o^* - c_o \overset{set}{=} 0$$

Second-order condition is clearly satisfied here:

$$\frac{\partial^2 \pi_o(q_o)}{\partial q^2{}_o} = -2 < 0$$

Solving for q_0 gives

$q_0^* = \frac{\lambda A - c_o}{2}$ And the price is $P = \lambda A - q_0^* = \frac{\lambda A + c_o}{2}$

And the monopolistic profit equals

$$\pi_o(q_0^*) = q_0^* P - c_o q_0^* = (P - c_o) q_0^* = \left(\frac{\lambda A - c_o}{2} \right)^2$$

Subtraction of the 'political' costs of changing the environment gives the payoff presented in the Proposition 3.1. Since foreign direct investor does not enter the industry its payoff equals to zero. Q.E.D.

If after choosing Bad at the first decision node Oligarch opts to pay additional political costs and change the business environment to Good, the Foreign Direct Investor now has options to enter, not enter or purchase the existing enterprise from the Oligarch. If Foreign Direct Investor chooses not to enter which could happen if the sunk costs of entry are high enough, it will have zero payoff and the Oligarch will get monopolistic profit under high local demand.

Proposition 3.2. (terminal node #1) Given the assumptions A1-A12, if Oligarch chooses Bad environment at the first decision node and Good

environment at the second, and Foreign Direct Investor chooses not to enter, the payoffs to the Oligarch and Foreign Direct Investor are

$$\Pi^o(q_o^*) = \frac{(A - c_o)^2}{4} - 2C_p$$

$$\Pi^f = 0$$

Proof: the same as in proposition 3.1, except that high demand is used. Subtracting twice 'political' costs of changing the environment once again gives the payoff presented in the proposition 3.2. Since foreign direct investor does not enter the industry its payoff equals to zero. Q.E.D.

Should the Foreign Direct Investor choose to enter to the industry there will be a competition between it and Oligarch. Since we assume that competition will be in quantities (Cournot Game) we may state the following proposition.

Proposition 3.3. (terminal node # 3) Given the assumptions A1-A12, if Oligarch chooses Bad environment at the first decision node and Good one at the second, and Foreign Direct Investor chooses to enter, the payoffs to the Oligarch and Foreign Direct Investor are

$$\Pi^o(q_o^*, q_n^*) = \frac{(A + c_n - 2c_o)^2}{9} - 2C_p$$

$$\Pi^f(q_o^*, q_n^*) = \frac{(A - 2c_n + c_o)^2}{9} - E$$

Where q_o^* *and* q_n^* is Nash equilibrium quantities produced by Oligarch and Foreign Direct Investor?

Proof: Oligarch maximizes its existing enterprise profits

$$\max_{q_o} \pi_o(q_o, q_n) = \max_{q_0} \{TR_o(q_o, q_n) - TC_o(q_o)\}$$

And Foreign Direct Investor maximizes its new enterprise profits

$$\max_{q_n} \pi_n(q_o, q_n) = \max_{q_0} \{TR_n(q_o, q_n) - TC_n(q_n)\}$$

Assuming that both player choose the quantity simultaneously we will solve the above maximization problems for $q_o^{'}$ and $q_n^{'}$ to get best response functions, which in turn will give us the payoffs.

For Oligarch the $q_o^{'}$ and for Foreign Direct Investor the $q_n^{'}$ can be obtained from

$$q_o^{'} = \arg\max_{q_o} \pi(q_o, q_n) = \arg\max_{q_o} \{(A - q_o - q_n)q_o - c_o q_o\}$$

$$q_n^{'} = \arg\max_{q_n} \pi(q_o, q_n) = \arg\max_{q_n} \{(A - q_o - q_n)q_n - c_n q_n - E\}$$

Since the amount produced by one player depends on the amount produced by the other player, both equations should be solved simultaneously.

The first order conditions for the above problem are given by

$$\frac{\partial \pi_o(q_o, q_n)}{\partial q_o} = (A - q_0^{'} - q_n) - q_0^{'} - c_o \overset{set}{=} 0$$

$$\frac{\partial \pi_n(q_o, q_n)}{\partial q_n} = (A - q_0 - q_n^{'}) - q_n^{'} - c_n \overset{set}{=} 0$$

Second-order conditions are also satisfied here:

$$\frac{\partial^2 \pi_0(q_o)}{\partial q^2{}_o} = -2 < 0 \quad \text{and} \quad \frac{\partial^2 \pi_n(q_o)}{\partial q^2{}_n} = -2 < 0$$

Solving for $q_o^{'}$ *and* $q_n^{'}$ gives the best response functions:

$$R_o(q_n) = \frac{1}{2}(A - c_o - q_n) \quad \textit{and} \quad R_n(q_o) = \frac{1}{2}(A - c_n - q_o)$$

$$\Rightarrow \quad q_o^* = \frac{A - 2c_o + c_n}{3} \quad \textit{and} \quad q_n^* = \frac{A - 2c_n + c_o}{3}$$

$$\Rightarrow Q^* = q_o^* + q_n^* = \frac{2A - c_o - c_n}{3}$$

$$\Rightarrow P^* = \frac{A + c_o + c_n}{3}$$

$$\Rightarrow \pi_o(q_o^*, q_n^*) = \frac{(A + c_n - 2c_o)^2}{9} \quad \text{and} \quad \pi_n(q_o^*, q_n^*) = \frac{(A + c_o - 2c_n)^2}{9} - E$$

This allows us to derive the payoffs specified in the proposition 3.3.

Q.E.D.

If the Foreign Direct Investor chooses to purchase the existing enterprise from the Oligarch, the Oligarch's profits will be the price foreigner pays for the enterprise minus twice the political costs Oligarch pays, and the foreigner will get the difference between the monopolistic profits and the price paid for the enterprise.

Proposition 3.4. (terminal node # 2) Given the assumptions A1-A12, if the Oligarch chooses Bad environment at the first decision node and Good one at

the second and the Foreign Direct Investor chooses to purchase the existing enterprise from the Oligarch, the payoffs to the Oligarch and the Foreign Direct Investor are

$$\Pi^o(q_o^*, q_n^*) = \max\{\frac{(\lambda A - c_o)^2}{4} + C_p, \frac{(A + c_n - 2c_o)^2}{9}\} - 2C_p$$

$$\Pi^f(q_o^*, q_n^*) = \frac{(A - c_o)^2}{4} - \max\{\frac{(\lambda A - c_o)^2}{4} + C_p, \frac{(A + c_n - 2c_o)^2}{9}\}$$

if $\frac{(A + c_o - 2c_n)}{9} - E > 0$

and

$$\Pi^o(q_o^*, q_n^*) = \max\{\frac{(\lambda A - c_o)^2}{4} + C_p, \frac{(A - c_o)^2}{4}\} - 2C_p$$

$$\Pi^f(q_o^*, q_n^*) = \frac{(A - c_o)^2}{4} - \max\{\frac{(\lambda A - c_o)^2}{4} + C_p, \frac{(A - c_o)^2}{4}\}$$

if $\frac{(A + c_o - 2c_n)}{9} - E \leq 0$

Proof: The Oligarch will sell the enterprise to the foreign direct investor only if it pays at least the maximum the Oligarch can get under both sets of action (i.e. if Oligarch chooses Bad environment at the first and second decision nodes or it chooses Bad environment at the first decision node and Good at the second).

Under $\frac{(A + c_o - 2c_n)}{9} - E > 0$ we can eliminate one outcome by common sense, the one where foreign direct investor does not enter into the industry after the Oligarch plays Good. Therefore, the Foreign Direct Investor will have to pay

maximum of what Oligarch can get either under the monopoly and low demand conditions or under the Cournot market structure. So it will pay $\max\{\frac{(\lambda A - c_o)^2}{4} + C_p, \frac{(A + c_n - 2c_o)^2}{9}\}$ and it will collect monopolistic profits $\frac{(A - c_o)^2}{4}$ the payoff will be the difference between the profits and the price paid for the enterprise. The payoff to the Oligarch will be the price paid for the enterprise minus twice the political costs paid for changing the environment.

Consider the case when $\frac{(A + c_o - 2c_n)}{9} - E \leq 0$ now Oligarch will want for the existing enterprise the maximum of profits attained by monopoly under Good and Bad environment. Therefore, the price paid by foreign direct investor will be the maximum of the two. The above reasoning gives us the second set of payoffs.

Q.E.D.

On the other hand, if the Oligarch plays Good at its first decision node then the privatization takes place. We assume that the agent that pays the highest price gets the enterprise, and the price paid can not be negative. If the Oligarch gets the enterprise, the foreign direct investor has the option to enter the industry with the new enterprise after privatization. The part of the overall strategy for the Oligarch will be the price it offers for the existing enterprise at the privatization node $P^o \in [0, \infty)$. The part of the overall strategy for the

Foreign Direct Investor will be the price it offers for the existing enterprise at the privatization node $P^f \in [0,\infty)$ and the choice of the action at its next decision node (either enter or not to enter).

To find the payoffs we have to consider each terminal node gross returns (i.e. without the prices paid at the privatization node) and then find net returns by subtracting the price paid by each agent at the privatization node. If the foreign direct investor offers the highest price for the enterprise it will have the monopoly with the existing plant and therefore, it will get the gross return of $\frac{(A-c_o)^2}{4}$ Which we got while proving the proposition 3.2. Let M = $\frac{(A-c_o)^2}{4}$. If we subtract the price (P^f) that the foreign direct investor pays for the enterprise from M, we will get its payoff at that terminal node #5. The payoff to the Oligarch is zero in that case. If Oligarch offers the highest price for the enterprise and the foreign direct investor does not enter the market then the Oligarch enjoys the monopolistic status and gets the gross return of M as well. When the price will be subtracted from the gross return we will get the payoff to the Oligarch at that terminal node #7. The payoff to the foreigner will be zero because it does not enter the industry. Now consider the case when Oligarch buys the enterprise and the foreigner enters the industry. In that case we have competition in quantities (Cournot competition) and the gross returns will be equal to those obtained in the proof of the proposition 3.3. Namely, the

Oligarch will get gross return $\pi_o(q_o^*, q_n^*) = \frac{(A + c_n - 2c_o)}{9}$ = K. Its net profits will be obtained by subtracting the price P^o it pays for the enterprise at the privatization node from K. The gross return to the foreigner will equal its net return and will be $\pi_n(q_o^*, q_n^*) = \frac{(A + c_o - 2c_n)}{9} - E$ = B.

Privatization solution

Proposition 3.5. If $B \leq 0$ (i.e. entry costs for foreign direct investor are higher than Cournot competition profits) $\Rightarrow$ $P^o = P^f = M$ $\Rightarrow$ Given Assumption A11, the Oligarch controls the plant and the payoffs are as follows

$$\begin{cases} \Pi^o = 0 \\ \Pi^f = 0 \end{cases}$$

Proof: If $B \leq 0$ $\Rightarrow$ if the Oligarch buys the plant, the foreigner will not enter. Therefore, foreigner has the only option - to compete for the existing plant. Potential gross returns for the Oligarch and the foreign direct investor are equal to M. Therefore, both will offer the same price which will equal M and Oligarch will acquire the plant under assumption A11.

Q.E.D.

Proposition 3.6. If $B > 0$ $\Rightarrow$ and $K \leq 0$ $\Rightarrow$ Oligarch does not participate in the privatization and foreigner either gets the enterprise for free $P^f = 0$ if $B \leq M$, and

if B>M it does not participate in the privatization and enters with the new enterprise. The payoffs are

$$\begin{cases} \pi^o = 0 \\ \pi^f = \max\{M, B\} \end{cases}$$

Proof: Since K $\leq$0 and B>0 there is no incentive for the Oligarch to buy the enterprise because it will suffer losses or get at most zero. Therefore, when it is profitable for the foreigner to engage in the Cournot competition but it is not profitable to do so for Oligarch, the foreigner is free to choose the most suitable option which gives us the above payoffs. Q.E.D.

Proposition 3.7. If B>0 and K>0 and B+K>M $\Rightarrow$ Payoffs are

$$\begin{cases} \pi^o = (K + B) - M \\ \pi^f = B \end{cases}$$

Proof: Since foreigner will certainly enter if Oligarch buys the existing enterprise (it is ensured by B>0), the maximum the Oligarch can get is K. Oligarch participates in the privatization and the maximum price it can pay is K. Foreign Direct Investor also participates in the auction and the maximum price it can pay is M. However, P^f should satisfy $P^f \leq$M-B (otherwise it is more profitable for the foreign direct investor to enter)and B+K>M $\Rightarrow$ K > M-B $\Rightarrow$ P^o=M-B $\Rightarrow$Oligarch purchases the existing enterprise and foreign direct investor enters the industry with the new one.

Q.E.D.

Proposition 3.8. If B>0 and K>0 and B+K<M $\Rightarrow$ Oligarch offers P^o=K and P^f=K+ε $\Rightarrow$ payoffs are

$$\begin{cases} \pi^o = 0 \\ \pi^f = M - K - \varepsilon \end{cases}$$

Proof: Oligarch participates in the privatization and the maximum price it can pay is K. Foreign Direct Investor also participates in the privatization and the maximum price it can pay is M. Since Oligarch can not offer the price which is higher than K and M-K is strictly bigger than B the Foreign Direct investor will offer higher price than the Oligarch can and will purchase the enterprise.

Q.E.D.

Proposition 3.9. If B>0 and K>0 and B+K=M $\Rightarrow$ Oligarch offers P^o=K and P^f=K $\Rightarrow$ Oligarch purchases the enterprise and the payoffs are

$$\begin{cases} \pi^o = 0 \\ \pi^f = B \end{cases}$$

With the above obtained payoffs we will be able to find the strategies the Oligarch and Foreign Direct Investor will choose under different parameters of the internal demand and the different technologies employed on the new and existing plants. The strategy chosen by the Oligarch will determine its move at the starting node and thus will determine business environment in a country. However, there is one issue that can be discussed immediately. The solution to the privatization gives us the necessary condition for the Oligarch to

choose Good environment at the first decision node provided it can secure the positive profits from choosing Bad environment. Since there is only one set of conditions under which Oligarch gets non-zero profits from choosing Good environment immediately, those conditions will be the necessary one for choosing Good at the first terminal node. They are B>0 K>0 and K+B>M. Those conditions are already quite restrictive since they require the monopolistic profit be less than sum of duopilists' profits when one of the plants has the same cost structure as monololy plant has. This only can happen when the new plant built by foreign direct investor provides the significant improvement in production technology. The marginal costs should fall enough to cover entry costs (E), the loss in profit of the other duopolist and generate profits which will ensure that K+B>M. So the good business environment may be chosen at the first terminal node only if the Foreign Direct Investor has superior technology than existing enterprise possesses.

To go further we will remind how we denoted the profits obtained by Oligarch and Foreign Direct Investor under the different market structure.

$$M=\frac{(A-c_o)^2}{4},\quad D=\frac{(\lambda A-c_o)^2}{4},\quad K=\frac{(A+c_n-c_o)^2}{9},\quad B=\frac{(A+c_o-2c_n)^2}{9}-E$$

Utilizing that notation the payoffs at each terminal node can be presented in the table 3.1:

Table 3.1

Payoffs to Oligach and Foreign Direct Investor at Each Terminal Node

Node	Payoff to Oligarch	Payoff to foreign direct inverstor
#1	$M-2C_p$	0
#2 (B>0)	$\max\{D+C_p,K\}-2C_p$	$M-\max\{D+C_p,K\}$
#2 (B ≤0)	$\max\{D+C_p,M\}-2C_p$	$M-\max\{D+C_p,M\}$
#3	$K-2C_p$	B
#4	$D-C_p$	0
#5	0	$M-P^f$
#6	$K-P^{o*}$	B
#7	$M-P^o$	0

P^0 and P^f are prices paid by Oligarch and foreign direct investor for the existing enterprise.

With these payoffs we may proceed to establishing necessary and sufficient conditions for each terminal node be the Subgame Perfect Nash Equilibrium (SPNE), and thus establish the conditions for the Bad environment be the by-product of Oligarch profit maximization.

The Necessary and Sufficient conditions for each terminal node be SPNE

Since our main interest lies in the business environment that will be established in an industry or country as a result of profit maximization by Oligarch and Foreign Direct Investor, we have to find the conditions that will be necessary and sufficient for each terminal node be the outcome of the Subgame Perfect Nash Equilibrium. Business environment conditions will be the by-product of Oligarch profit maximization. The intuition suggests that there may be three mutually exclusive outcomes with respect to business environment in a country.

One is when Oligarch opts for Good business environment at the first terminal node. Another when Oligarch chooses Bad first, but subsequently it switches to Good environment. The last one is when the Bad business environment is the ultimate by-product of Oligarch's choice.

We will tackle each case separately below. However, to derive necessary and sufficient conditions formally we will make one additional assumption which will facilitate our analysis without imposing severe restrictions on the model.

A13: $D-C_p > 0$

The above assumption ensures that the payoff to Oligarch at the terminal node #4 is positive. What it actually tells us is that Oligarch will not suffer losses if it makes Bad environment his ultimate choice. The assumption may be justified on the grounds that Bad business environment has been observed during long periods of time in many transition and developing countries and particular industries (e.g. Iraq).We will not include the assumption explicitly into the conditions derived below. However, the reader should remember that the condition $D>C_p$ is always satisfied and the results obtained are conditional upon it. It can be seen from the payoffs derived at the first stage that under that assumption the terminal nodes # 5 and #7 can not be the result of Subgame Perfect Nash Equilibrium of the game because their payoffs to Oligarch are strictly dominated by those at the terminal node #4. Therefore, the only conditions under which Oligarch chooses Good business environment at the

first decision node are those that make the terminal node #6 be the outcome of SPNE.

First, we will derive the necessary conditions for the Good business environment be the first and ultimate choice of the Oligarch. These will be the conditions for the industry or country never experience Bad environment. Given the A1-13 the sufficient and necessary conditions for the Good environment be the first and ultimate choice of Oligarch are presented in proposition 3.10

Proposition 3.10 *(proves of propositions #3.10 through 3.14 can be found in appendix #1)* For the Good business environment be chosen at the first decision node by Oligarch the following sufficient and necessary conditions must be satisfied.

$$\begin{cases} D + M \le K + B + C_p \\ M \le B + 2C_p \\ B > 0 \\ K > 0 \end{cases} \qquad (3.1)$$

The above sufficient conditions imply that the terminal node #6 is the result of the SPNE. Oligarch opts for Good at the first decision node when the above conditions are satisfied.

The most interesting necessary conditions for the terminal node be the SPNE are

$$\begin{cases} M < K + B \\ K > 0 \\ B > 0 \end{cases} \qquad (3.2)$$

Necessary conditions tell us that the industry will never experience Bad business environment only if the improvement in the technology brought by Foreign Direct Investor is high enough to make sum of profits under Cournot duopoly higher than monopolistic profit under old technology. In this case necessary conditions provide us with more valuable information than sufficient conditions do. We now know that for Good environment to be chosen, foreign direct investor should bring better technology with new enterprise. If the improvement in technology is not enough, bad business environment will be chosen by Oligarch at the first decision node.

The above outlined sufficient conditions ensure that the Good environment will be immediately chosen and kept thereafter. Now we would like to proceed to the sufficient and necessary conditions that will make Bad environment be ultimate choice of the Oligarch, i.e. the terminal node #4 will be the outcome of SPNE of the entire game. Those conditions are outlined in the proposition 3.11

Proposition 3.11. The sufficient conditions for the terminal node #4 be the result of SPNE and Bad environment be ultimately kept in the industry are either

$$\begin{cases} B \le 0 \\ M \le D + C_p \end{cases} \quad (3.3)$$

or

$$\begin{cases} B > 0 \\ B + D + C_p \ge M \\ D + C_p \ge K \\ M + D > K + B + C_p \end{cases} \quad (3.4)$$

depending on whether $B \le 0$ or otherwise.

The most interesting necessary conditions for the Bad environment be the ultimate result of Oligarch maximization are

$$\begin{cases} D > C_p \\ K \le D + C_p \end{cases} \quad (3.5)$$

It can be seen from the above conditions that Bad environment in the industry would be the ultimate result of Oligarch maximization only if it is not only profitable for Oligarch to do so (i.e. $D>C_p$) but also it generates more profits than switching to Good environment and engaging into Cournot competition with Foreign Direct Investor after acquiring an existing enterprise for free. Let us consider the set of conditions (3.3). $B \le 0$ means that it is unprofitable for the Foreign Direct Investor to enter with the new enterprise under the Good environment. Therefore, it implies that Foreign Direct Investor has only one option to enter the industry – to take part in 'fair' privatization conducted by government in the good environment. However, Oligarch has two options to

acquire the existing enterprise – he can either do Bad and get it for free or play Good and take part in the privatization. Under $B \leq 0$ privatization option is unprofitable for the Oligarch because both it and foreign direct investor value the enterprise the same and therefore the price offered will be exactly all profits generated by enterprise. Since playing Bad brings Oligarch some positive profits, it will choose Bad at the first terminal node. Condition $M \leq D+C_p$ ensures that the strategy when Oligarch plays Bad at the second decision node is the most profitable for it. In words: if the fall in demand is small enough to satisfy $M \leq D+C_p$ it will be unprofitable for the Oligarch to change the environments from Bad to Good to stimulate the demand. For example, such situation may be observed in the transportation of the Gas from Russia to Europe through Ukraine. It seems unprofitable for Russian companies to build a new pipeline and therefore $B \leq 0$ maybe satisfied. Further, the most of the demand for transportation services comes from abroad and therefore the fall in demand would be minor if the business environment is Bad in the industry. So if political costs of choosing Bad environment are low enough not to violate $D>C_p$ but at the same time are such that condition $M \leq D+C_p$ is satisfied and we then may look whether business environment in Gas transportation is Bad in Ukraine. The second set of sufficient conditions allows for the profitable entry of Foreign Direct Investor with new enterprise (i.e. $B>0$). Under $B>0$ 'fair' privatization may be profitable for the Oligarch and therefore conditions

(3.4) include $D+M>K+B+C_p$ which ensures that doing Bad and getting monopoly with low demand is more profitable then buying enterprise in 'fair' privatization and $K \leq D+C_p$ implies that it is unprofitable for Oligarch to switch from Bad to Good at the second decision node.

The above two propositions identified sets of necessary and sufficient conditions which ensure the opposite cases – either the Good environment is immediately chosen and kept ever since or the Bad environment is established forever. The intermediate case would be the transitory choice of the Bad environment by Oligarch with the subsequent shift to the Good environment. That would be the case if the one of the terminal nodes #1, #2 and #4 is the result of SPNE of the whole game. The following three propositions identify the necessary and sufficient conditions for each of the above three terminal nodes be the outcome of the game.

Proposition 3.12 The sufficient and necessary conditions for the terminal node #1 be the outcome of the SPNE of the entire game are

$$\begin{cases} B \leq 0 \\ M > D + C_p \end{cases} \qquad (3.6)$$

The condition $M> D+C_p$ is reverse to that found in the set of conditions (3.3). It means that after the Oligarch got rid of competitor for the enterprise and aquired it for free by doing Bad at the first decision node, it has a incentive to

switch to Good business environment to stimulate the demand for goods produced by aquired enterprise.

Now we will consider the case when it is profitable for the foreign direct investor to purchase the enterprise from Oligarch and it is profitable for Oligarch to sell it. Consider the proposition 3.13.

Proposition 3.13 The sufficient conditions for the terminal node #2 be the outcome of the game are either

$$\begin{cases} B > 0 \\ M > K + B \\ K > D + C_p \end{cases} \quad (3.8)$$

or

$$\begin{cases} B > 0 \\ D + C_p \geq K \\ M > B + D + C_p \end{cases} \quad (3.9)$$

The most interesting necessary conditions for the terminal node #2 be the outcome under assumption A13 are as follows

$$\begin{cases} B > 0 \\ M > K + B \end{cases} \quad (3.10)$$

Consider first condition M>K+B. It means that by entering with the new enterprise foreign direct investor will reduce the total 'pie' availiable to producers. Furthermore, if that condition is satisfied Oligarch will never choose Good business environment at the first decision node. It can be concluded

from the fact that necessary condition K+B>M for it is violated. Therefore, the payoffs at terminal nodes #5, #6 and #7 are strictly dominated by the payoff at terminal node #4 under assumption A13. In words: though it is profitable for foreign direct investor to enter with new enterprise, the entry produces reduction in the total profits obtained by both. Moreover, the fall in demand under Bad environment is also huge enough to make selling the enterprise profitable strategy.

Consider the case when foreign direct investor enters with the new enterprise and Cournot competition occurs at the terminal node number 3. The conditions for that are outlined in the proposition 3.14.

Proposition 3.14 There are two sets of sufficient conditions for the terminal node #3 be the outcome of the game:

$$\begin{cases} M = K + B \\ B > 0 \\ K > D + C_p \end{cases} \qquad (3.11)$$

The M=K+B eliminates the possibility of the immediate choice of Good by Oligarch because under that condition the payoffs at the terminal nodes 5-7 are strictly dominated by the payoff at terminal node 4. It seems unlikely that the condition will be satisfied, however. K should be greater than $D+C_p$ which means that it ia more profitable for Oligarch to engage in the competition with foreign direct investor than to keep Bad environment after getting the enterprise for free.

The other set of conditions which ensures terminal node #3 are

$$\begin{cases} M < K + B \\ B > 0 \\ K > D + C_p \\ M > B + 2C_p \end{cases} \qquad (3.12)$$

The necessary conditions for the terminal node #3 be the result of the SPNE are

$$\begin{cases} B > 0 \\ K > D + C_p \\ M \leq K + B \end{cases} \qquad (3.13)$$

From the above conditions we can infer that for the foreign direct investor to enter the total 'pie' which is distributed between Oligarch and foreign direct investor should be no less than 'pie' obtained under monopoly with old technology. Furthermore, Oligarch will switch from Bad to Good only if profits obtained by engaging in competition with foreigner are higher than monopolistic profits under Bad environment. In fact it will happen if the fall in demand is high enough to ensure that $K>D+C_{p.}$. The fall of demand should be indeed high because foreigner enters with better technology (which ensured by $M \leq K+B$)and therefore it gets more of the total 'pie' without entry costs.

3.3 EXAMPLE WITH OLIGARCH AND FOREIGNER POSSESSING THE SAME TECHNOLOGY

Suppose that both Oligarch and Foreign Direct Investor has the same technologies. In our model it means that $c_n = c_o$ and $B=K-E \Rightarrow M \geq K+B$. From the above discussion we know that $M \geq K+B$ means that terminal nodes #5 through #7 can not be the result of SPNE and Oligarch will not opt for Good at the first decision node. Hence, when existing enterprise has the same or better technology Oligarch will do everything to avoid 'fair' privatization and get rid of a potential foreign competitor. In our case it will choose Bad business environment at the first decision node. Further, consider the case when $B \leq 0$. That condition implies that neither terminal nodes #2 nor #3 can be SPNE of the game. Therefore, the conditions for the terminal node #1 be the outcome of the SPNE are

$$\begin{cases} K \leq E \\ M > D + C_p \end{cases} \quad (3.14)$$

The conditions for the terminal node #4 be the outcome are

$$\begin{cases} K \leq E \\ M \leq D + C_p \end{cases} \quad (3.15)$$

On the other hand, when B>0 is true it rules out the possibility of the terminal node #1 be the outcome of SPNE and the terminal nodes #3 and #6 can not be attainted either.

The sufficient conditions for the terminal node #2 be the outcome of the game are

$$\begin{cases} K > E \\ K > D + C_p \end{cases} \qquad (3.16)$$

The sufficient conditions for the terminal node #4 be the result of profit maximization are

$$\begin{cases} K > E \\ K \leq D + C_p \end{cases} \qquad (3.17)$$

We see that under the same technology assumption the conditions for the bad business environment be ultimately established in a country are less restrictive than they are in the general case. Special interest attract set of conditions (3.17). The intuition behind it as follows: if the entry with new enterprise is profitable for foreign direct investor K>E than for the Oligarch to opt for Bad at the second decision node it would be enough to have monopolistic profits under Bad environment plus political costs higher than profits from competing with foreign direct investor which is quite plausible if the fall in demand is not too

high. What is interesting is that the possibility of Bad environment be the outcome of SPNE is rising with political costs (though untill the assumption A13 is violated).

Concuding we have to note that technology of new and old enterprises, and total profits obtained under the Cournot competition relative to monopoly profits of existing plant matter for the equilibrium of the game and thus for business environment established in a country. If the technology possessed by foreign direct investor is the same or worse than that of an existing plant, choice of Good environment at the first decision node will never be a part of the Subgame Perfect Nash Equilibrium strategy of Oligarch. Hence, at least at the initial stage the entry will be deterred. This happens because foreigner will be a threat to Oligarch in 'fair' privatization. Therefore, Oligarch will get rid of it by choosing Bad at the first decision node. That may partially explain the tendency of previous works to find that foreign direct investment brings better technology in transition and developing countries. Our model tells that the entery of foreigners that bring little improvement in technology will be deterred. Hence, when researchers found foreign direct investors those were with better technology simply because the entry of others was deterred by locals. Further, if the entry with new enterprise is unprofitable for the foreign direct investor either because the sunk costs of entry are high or technology is bad, Good environment chosen at the first decision node will not be a result of SPNE.

One additional comment can be made here. When entry with new enterprise is not profitable for foreign direct investor, rise in political costs makes Bad environment be the ultimate choice of Oligarch more likely (untill assumption A13 is not violated) which can be seen from conditions (3.3)and (3.15). So essentially the model is in line with common sense. If local enterprises are competitive, i.e. have up-to-data technology or at least not very outdated one, Oligarch will do everything to avoid competition with foreigner in privatization and obtain existing enterprise for the lowest price as possible.

Chapter 4

ESSAY TWO

TESTING THE DIFFERENCE IN THE TECHNOLOGY OF FIRMS WITH AND WITHOUT FOREIGN OWNERS

4.1 METHODOLOGY

In this empirical work we tests one of the necessary conditions found in the previous chapter. There, we derived sufficient and necessary conditions to observe different (Bad and Good) business environment and market structure in the industry. To motivate our empirical research we reiterate necessary conditions we would like to test here. In the previous chapter we found that if we observe the foreign direct investors in some industry then the necessary conditions for that are as follows. First, both the foreign direct investors and local Oligarch earn non-zero profits. Second, the sum of their profits should be no less than the monopolistic profit of the enterprise equipped with the old type technology. We can infer from that conditions that the technology of the enterprise owned by Foreigner should be better than the technology of the existing plant. The conditions of non-zero profitability we would always expect to be satisfied if players are in the industry at least in the long run. Hence, in this section we are interested in testing whether when we observe foreign direct investors in the industry, the technology they possess is better than that of enterprise owned by locals. Ideally, we would like to consider all industires

where we observe foreigners; however time and data constraints do not allow us to do so. Therefore, we take one particular industry – confectionery industry in Ukraine where we observe firms owned by local and foreigners operating at the same time and investigate whether the technologies of enterprises possessed by both types of agents are diffrenet and how they are different.

Economic literature have devised many of approaches to test for the superior technology from which to choose. In our work we opt for the non-parametric one - Data Envelopment Analysis (DEA). We adopt regularity axioms on the technology used in the context of the DEA estimator which are provided and extensively discussed in Zelenyuk (2004) and are not stated here for the sake of brevity. Specifically, using the Activity Analysis Models we will estimate the Farrell (1957) output oriented technical efficiency measure for each enterprise which is defined as follows,

$$TE_o(x,y) \equiv \max_{\theta}\{\theta : \theta y \in P(x)\}, \quad x \in R_+^N \quad y \in R_+^M .$$

Where y is the vector of outputs, x is the vector of inputs and P(x) is the set of all y that can be produced by the given x. The choice of the Farrell efficiency measure is not an accidental one. It was shown that the measure possesses the desirable properties for efficiency measures, and in most cases outperforms alternative measures on that ground. The output oriented technical efficiency measure takes the values between one and infinity with one indicating 100% efficiency and greater number signaling higher levels of inefficiency. In

the context of the DEA estimator the above stated efficiency measure under constant returns to scale (CRS) assumption will be estimated using the following linear programing problem

$$\hat{TE}(x^j, y^j) \equiv \max_{\theta, z_1, \ldots z_n} \theta$$

$$s.t.$$

$$\sum_{k=1}^{n} z^k y_m{}^k \geq \theta y_m{}^j, m = 1, \ldots, M$$

$$\sum_{k=1}^{n} z^k x_i{}^k \leq y_i{}^j, i = 1, \ldots, N,$$

$$\theta \geq 0, \quad z^k \geq 0, \quad k = 1, \ldots, n$$

Which is estimated for each firm j=1,…., n. To assume variable returns to scale (VRS) technology we have to add another constraint to the above linear programming problem $\sum_{i=1}^{n} z^i = 1$. The DEA estimator assumes that all enterprises have access to the same technology. In the context of out research, however, lower technical efficiency measure will signal that the firm either uses the existing technology better or uses better technology which is consistent with the assumption stated above because the access itself does not mean that all firms use the same technology. So in our analysis technical efficiency measure will serve as a proxy for the technology used by the enterprise with the lower score indication better technology employed.

We will divide the sample of the enterprise into two groups those that have Foreign Direct Investors in its ownership structure and those that have

only locals in it. We will pool both groups to estimate the technology frontier and individual technical efficiency scores. Then we have to analyze whether the efficiency scores obtained for each enterprise in those groups are different across groups. If they are then we have to identify whether on average the efficiency scores are lower for the Foreign Direct Investors (i.e. the are less inefficient). The tempting approach for comparison would be to take simple and weighted averages of efficiency scores for two groups and compare them. Indeed that would be our first step to take. However, recently, the statistical properties of DEA estimator have been discovered by Kneip, Simar and Wilson (2003). Furthermore, it was shown that DEA estimator is biased in finite samples but it is consistent. The limiting distribution has been shown to exists. It is not in the closed form, however and thus it is not very useful for making statistical inferences. Therefore, the way out is to use bootstrap to correct obtained efficiency scores for the bias and to find confidence intervals. One way to apply it is to use smooth group-wise heterogenous bootstrap which is computationally intensive but performs better in finite samples then limiting distribution law does. So using the smooth group-wise heterogenous bootstrap, we will correct the efficiency scores for the bias and establish confidence intervals for them. However, to use the statistical properties of the DEA estimator we have to pay the price and adopt the assumptions[1] under which the

[1] for the exact set of assumption see paper by Zelenyuk and Simar (2003)

DEA estimator possesses desirable properties. Moreover, we will use the Kernel Density Estimator (KDE) by Rosenbladt (1956) to estimate the probability density function of the estimated efficiency score for the both groups separately. Then we will test whether the distributions of efficiency scores of both groups are different or not by using Li-test of equality of distributions adapted to DEA context by Simar and Zelenyuk (2004).

Therefore we would proceed as follows:

1) We will estimate efficiency score for each firm using Farrel output oriented efficiency measure under CRS and VRS assumptions. Different assumptions on the technology will allow us to check whether our results are robust to the assumed technology.

2) Then we would apply smooth group-wise heterogenous bootstrap with 2500 iterations to correct the efficiency scores obtained in the first stage for the bias and to establish confidence intervals of the efficiency scores.

3) We will calculate simple and weighted averages (by revenue shares which is justified by the neo-classical theory to be optimal under some assumptions)[2] of the uncorrected efficiency scores and simple average of bias corrected scores for each groups of enterprises.

[2] See paper by Zelenyuk and Simar (2003)

4) Then using Kernel Density Estimator with the Gaussian Kernel, we will obtain the estimated probability density functions of bias corrected output oriented efficiency scores for both groups.

5) The last thing to do will be to test the equality of the estimated probability density functions of the efficiency score of two groups using Simar and Zelenyuk(2004)adapted version of Li (1996) test of equality of two probability density functions.

Our conclusions would be based on whether the estimated means and estimated probability distributions of the efficiency scores for two groups are different and how they are different. If averages are lower for the foreigners and probability density functions of the foreigners efficiency scores contain more probability mass close to low inefficiency region and are statistically different from the local's probability density functions of efficiency scores then foreigner indeed possess better technology on average. If the reverse holds then we will have to conclude that the locals have better technology. The impossibility to find the difference in technology is possible. With the above in mind, we will proceed to the empirical part of our study.

4.2 DATA DESCRIPTION

The empirical investigation of that paper would be based on the sample of the firms drawn from the Confectionary industry in Ukraine. We use the data sets kindly provided by the EERC Kyiv library. First, we use PFTS data base which

contains the information on the firm financial statements and owners who possess more then 5% of the shares of a company. PFTS data base contains information only on the joint stock companies (open and closed). The other data set that we use is 'registry' data base that contains the information not only on the joint stock companies but also on firms with other forms of ownership. We draw the sample of firms from the confectionary industry in Ukraine which are only joint stock companies or joint –ventures with foreigners. The size of the initial sample was 77 observations. We have dropped 18 observations because either the ownership could not be identified or there was no observation for a particular variable for the dropped enterprise. The 'registry' data base contains the information on the sales revenues of the company, material expences, personnel expences and value of capital employed in production. For most of the enterprises the information on the owners was obtained from the internet site of the State Securities and Stock Exchange Committee (smida.gove.ua) and from the PFTS site (www.istock.com.ua). The data is for the year 2001. We assume that the sample is random and the enterprises dropped from the sample randomly (i.e. independently of the level of their efficiency and ownership). However, we should be aware that we are dealing mostly with the joint stock companies in the confectionary industry. Therefore the conclusions which will be drawn are conditional on that fact and on the industry under study.

Let us now consider the information contained in the constructed data set. The data set contains the information on 59 enterprises from the Confectionary industry which are from the different regions of Ukraine. There 14 enterprises out of 59 which have foreign direct investors in their ownership structure. The variables that are used as inputs are material costs, personnel expenses and initial capital value at the beginning of the year plus initial capital value at the end of the year divided by two(to smooth fluctuations of capital during the year). The output variable is sales revenue of the company. What the above data implies for the resutls obtained is that we have aggregate data for inputs and output instead of actually many of inputs and products produced by companies in our sample. It brings "aggregation bias" (see Fare and Zelenyuk, 2003) but at the same time it reduces the estimation bias of DEA estimates because it reduces dimension of the problem. Furthermore, it does change the interpretation of our efficiency measure. Those efficiency scores will capture the managerial, marketing and other sources of inefficiency besides the technical inefficiency. However, in our case we are not very much interested in the source of the superiority of the foreigners but whether they possess it or not. For example, if foreign chocolate producers can buy the cocoa beans much cheaper than locals can, it reduces their marginal costs though they may not have better production technology. In fact we understand

technology not in engineering but in a broad sense as transformation of inputs to output or in our case as transformation of costs into revenue.

The descriptive statistics of the inputs and output below are provided for the total sample and different groups separately for each variable used in the estimation. Descriptive statistics for the whole sample are as follows

Table 4.1

Total sample inputs and output statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
salesrevenue	59	537448.7	1113956	800	5414512
materials	59	308860.8	660433.3	97	2913553
labor	59	34473.39	59421.39	101	345676
capital	59	139406.3	231027.5	1231	1082650

We clearly see that there is a significant variation in the data: the range is big for all variables, the ratio of the maximal to the minimal observation for each variable is more then 100 times, variation is also reflected by the big standard deviations which are almost two times bigger than the means for each variable. The personnel expenses take relatively small fraction of the total expenses of the firms in the industry. Complete description of each variable one may obtain in the appendix #2.

The descriptive statistics for the enterprises only with local owners are presented in the table 4.2. From that table we may observe that when only local enterprises are considered the variation in the data reduces significantly: the

range reduces for all varibles, the ratios of standard deviations and max to min values fell as compared to the total sample. Though, maximum values fell for all variables the minimum values rose. Therefore, firms owned by foreigners contain the biggest and the smallest firms in terms of revenue and other varibles.

Table 4.2

Local firms statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
salesrevenue	45	255882.4	504556.3	2283	2197001
materials	45	160157.9	353211.8	1541	1605198
labor	45	20548.84	32758.58	277	135241
capital	45	92696.57	146266.7	3461.5	641642.5

However, we can observe that mean values of varibles of locally owned firms fell which might suggest that the enterprises owned by foreigners are bigger on average than those owned by locals. Which is confirmed by the table 4.3.

Table 4.3

Firms with foreign ownership statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
salesrevenue	14	1442483	1875672	800	5414512
materials	14	786834.4	1095976	97	2913553
labor	14	79230.86	96398.36	101	345676
capital	14	289544.9	365910.7	1231	1082650

What can be inferred from the above table is that the foreign owned companies are bigger in size than local owned are. Whether the size is related somehow to

the efficiency or not in the confectionary industry is unclear at that stage. However, if bigger enterprises are more efficient then probably the above data description suggests us some clues about the situation in the industry. With that data set in hands we proceed to the estimation and analysis of technological differences of foreign and local owned enterprises.

4.3 EMPIRICAL INVESTIGATION AND RESULTS

Following the layout outlined in the methodology section we will proceed with estimation of the individual efficiency scores under the CRS and VRS assumptions on technology. Then we will use group-wise heterogenous bootstrap to correct those scores for the bias and establish individual confidence intervals. We will also present simple and weighted averages. The estimation of the individual efficiency scores was conducted using the MATLAB program utilizing the code of Simar and Zelenyuk (2003). Whereas we provide the general description of the results obtained here, the efficiency scores under CRS assumption for each decision making unit with the confidence intervals and biases may be observed in the appendix #3 (for the VRS case the results are similar). The descriptive statistics for the whole sample are presented in the table 4.4

Table 4.4

Summary statistics for total sample output oriented effciciency scores

Variable	Obs	Mean	Std. Dev.	Min	Max
Efficiency scores CRS	59	1.603517	.4785277	1	2.8758
Bias corrected Efficiency scores CRS	59	1.811878	.5317148	1.0989	3.2367
Efficiency scores VRS	59	1.505988	.4823152	1	2.8707
Bias corrected Efficiency scores VRS	59	1.685371	.5138825	1.0978	3.1594

The bias was corrected using the smooth group wise heterogenous bootstrap with 2500 iterations. Though, we did not see the efficiency score for different groups, some inference may be made form the above table. Before we proceed to the analysis of the results it should be noded that Farrel output oriented efficiency scores are defined from one to infinity with one indicating 100% and higher values indicating lower levels of efficiency. First, we see that there are no outliers in terms of the inefficiencies; though the maximal values of efficiency scores suggest that there are firms that are only about 30% efficient with respect to the best practice frontier. Another finding may be that the results differ not much on average when we change the assumption of the returns to scale. It may suggest that CRS assumption quite closely resembels the reality. Further analysis of the assumption on technology would require the test of the CRS versus VRS. We do not provide it here because the essence of the

conclusions obtained do not depend much on the technology assumed. Clearly the bias corrected DEA estimates are larger than uncorrected ones; however, that should be anticipated since DEA estimator always has downward bias

Now let us proceed with the analysis of the group wise average efficiencies. The simple averages with other statistics for the firms owned by locals and by foreigners are presented in the tables 4.5 and below

Table 4.5

Summary Statistics For The Output Oriented Efficiency Scores of Locally Owned Enterprises.

Variable	Obs	Mean	Std. Dev.	Min	Max
Efficiency scores CRS	59	1.735662	.459443	1	2.8758
Bias corrected Efficiency scores CRS	59	1.963904	.5066591	1.0989	3.2367
Efficiency scores VRS	59	1.62366	.4830649	1	2.8707
Bias corrected Efficiency scores VRS	59	1.822862	.5030308	1.0978	3.1594

Table 4.6

Summary Statistics For The Output Oriented Efficiency Scores of Enterprises Owned by Foreigners

Variable	Obs	Mean	Std. Dev.	Min	Max
Efficiency scores CRS	14	1.178764	.229023	1	1.8456
Bias corrected Efficiency scores CRS	14	1.323221	.2353083	1.1421	2.0352
Efficiency scores VRS	14	1.127757	.2146598	1	1.7844
Bias corrected Efficiency scores VRS	14	1.243436	.2144106	1.1122	1.9179

Information provided in the above two tables allows us to concluded that on average enterprises that are owned by the foreign direct investors are more efficient than firms owned by locals. Furthermore, the finding is robust to the assumption of the technology and to the bias correction, i.e. from the above tables we may conclude that foreign owned enterprises are on average (simple average) are more efficient than locally owned ones. The other finding that supports the conclusion is that maximal values of efficiency scores are lower for foreign owned enterprises as well. Further, it should be noted that there is less variation in the efficiency scores of enterprises owned by foreigners than in that of locally owned firms. In context of our anaalysis it means that those results support the finding of our model. The technology of the foreigners seems to be better than that of locally owned enterprises in confectionary industry.

However, to strenthen the results obtained we will present weighted averages and estimated probability density functions of efficiency score below. Here we present the weighted averages of the efficiency scores, where weights are derived from optimizing behaviour assumption (see Simar and Zelenyuk, 2003). The weights are sales revenues of firms and weighted efficiencies are presented in the table 4.7

Table 4.7

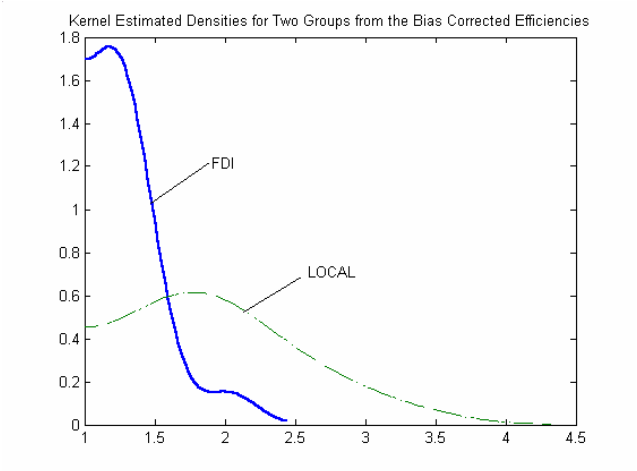
Mean Efficiency Scores of Locals and Foreigners

Returns to scale	Foreigners	Locals
CRS	1.16	1.43
VRS	1.06	1.38

The above table provides further support for our findings that the foreign owned enterprises on average are more efficient than locally owned ones. Therefore, based on the above findings we may conclude that weighted averages of efficiency score of both groups suppot finding outlined above, i.e. we find that when the foreigners are observed in the Confectionary industry their technology is better which is reflected in the lower inefficiency of the enterprises owned by foreigners. However, there is a caveat with which our results should be interprited. We analyze only one industry; therefore, the results support the model finding but only for that specific industry under analysis. Hence, results depend on the industry chosen.

Now we will tackle the fourth item in the methodology section, i.e. estimating the probability density functions with Kernel Density Estimator employing the Gaussian Kernel. The essence of the Kernel estimator is that it is 'smoothed histogram' normalized to have area equals to 1. The Kernel Density Estimator of the probability density functions for bias corrected efficiency scores of both local owned enterprises and those owned by foreigners under CRS assumption are presented figure4.1 below and for the VRS in the appendix #4.

Figure 4.1



The blue line (the one that is more like a spike) is the estimated probability density function of the efficiency scores of foreign owned enterprises and the other probability density function is for locals. It can be easily seen that the probability mass for foreigners is concentrated more closely to the lower values of the efficiency scores (i.e. more efficienct region) than that for the locally

owned firms. The results are in line with our previous finding that foreign owned firms are more efficient than companies owned by locals. The figure for the VRS case in appendix # 4 mimics the pattern in the figure 4.1 and provides further evidence for higher efficiency of enterprises owned by foreign direct investors. Now we will present the results of the Simar and Zelenyuk (2004) Li test of equality of distributions of efficiency scores adapted to DEA context. The null hypothesis is that distributions are equal and the alternative is that they are different. The p-value for the test of equality of efficiency scores distribution of foreign and local owned firms under CRS assumption is almost zero and under VRS aassumption is 0.0008. We may conclude that the distributions are indeed differerent. Given that mean efficiency is higher for foreigners and the estimated probability density function of efficiency score has more mass to more efficient region for foreigners, we can conclude that foreign owned firms are better than local owned firms in transforming costs into revenue, i.e. they have better technology at least in the confectionary industry in Ukraine. That finding is consistent with our model presented in the previous chapter.

Chapter 5

ESSAY THREE.

MODEL OF SIGNALING BY OLIGARCH

In the chapter three we have assumed complete and perfect information which may seem uncomfortable when we consider the entry of the foreign direct investor in any country. Most often when the entry to a country is concerned, information asymmetry is a pervasive phenomenon. For example, foreign firms do not know the how to interact with the local governments, how to interact with local counterparties, what the business practices in a particular industry are etc. In that section our interest lies in the information asymmetry on the business environment. Suppose that if a country has Bad business environment it is unprofitable for the foreign direct investor to operate in it. Further, suppose that before foreign direct investor enters it does not know type of the business environment in the country for certain. Thus it does not know its production and entry costs, and production costs of 'Oligarch' because those can depend on business environment conditions in a country. Now assume that the local 'Oligarch' can not affect busines environment in a country (it is political weak and can not affect the decisions of the government). Can Oligarch somehow inform foreign direct investor about bad business environment in a country to deter its entry. It turns out that Oligarch can do it and the mechanism of the information transmission is similar to that described

by Milgrom and Roberts (1982). Local Oligarch can signal the Foreigner about the business environment in a country via quantity produced that would never be chosen in a good environment. From that signal foreign direct investor can infer its entry and production costs. If it is unprofitable for the foreign direct investor to enter under 'Bad' environment conditions and the signal about the environment is credible, the entry will be deterred.

To substantiate the idea, we modify the model of Milgrom and Roberts (1982) to show that Oligarch indeed may resort to signaling allowing foreigner infer its production and entry costs from quantities of output produced by Oligarch before entry. That signal will eliminate the information asymmetry and deter the entry of foreigner when it is indeed unprofitable to do so. To proceed formally, we assume that there are two agents – local Oligarch and foreign direct investor. Business environment is determined exogenously and Oligarch knows the type of environment in a country. However, foreign direct investor can not observe the environment directly but it knows the distribution of the possible types of business environment in a country. The environment is a discrete variable and can take values either 0 or 1 which is summarized below

$$F=\begin{cases}1 & if \quad environment \quad is \quad Bad \quad (with \quad probability \quad p)\\ 0 & if \quad environment \quad is \quad Good \quad (with \quad probability \quad (1-p))\end{cases}$$

Where p is the probability of observing 'Bad' environment in a country. The environment affects the production and entry costs of foreign direct investor

and production costs of Oligarch. Hence, we assume that $TC_o = \varphi(F)q_o$ and $TC_f = \gamma(F)q_f + \phi(F)$ where $\gamma(F)$ *and* $\varphi(F)$ are costs of producing unit of output of foreigner and Oligarch respectively and $\phi(F)$ is entry cost for the foreigner. It should be noted that entery costs of foreign direct investor $\phi(F)$ are non-decreasing function of F, i.e. they do not fall with worsing of the business environment conditions. Production costs of foreign direct investor are not falling with worsing of business environment $\gamma(F)$. Whereas production costs of local Oligarch $\varphi(F)$ can either rise or fall with respect to worseing of business environment. For simplicity, we assume that the good is homogenous, the demand is time invariant and environment independent, and takes the form: P=a-bQ. The game consists of two stages. At the first stage Oligarch possesses monopoly and chooses its output. At the second stage foreign direct investor may either enter or not enter. If it enters, it immediately learns the environment and the competition in quantities occurs (i.e. Cournot game). No time discounting for simplicity.

For the moment suppose that there is no information asymmetry on the business environment. Following the Friedman (1979) argument, Oligarch will never resort to the limit pricing because it is inconsistent with the Subgame Perfect Nash Equilibrium. What it means is that since the type of environment is known to foreign direct investor, Oligarch's choice of quantity or price in the previous period will never affect the entry decision of the foreign direct investor

in the second one. Hence, Oligarch can gain nothing by deviating from the monopoly output in the first stage under complete and perfect information.

Now consider the case where there is asymmetric information about the business environment in a country and there is no signaling by the Oligarch at the first stage. In that case, at the first stage the Oligarch sets the monopolistic price and produces the monopolistic output and gets the profit of

$\Pi^{o}_{t=1} = \frac{(a-\varphi(F))^2}{4b}$ (which is obtained by maximizing (a-bQ)Q-$\varphi(F)$ Q with respect to Q). At the second stage foreign direct investor does not know the exact type of business environment in a country but only the probabilities of each type of environment to occur. Assuming that foreign direct investor is risk neutral, we can say that it will enter if the expected profit of entry will be positive. To obtain the expected profit of foreign direct investor we have to maximize profits of Oligarch and Foreign Direct Investor with respect to quantities taking into account the strategic interaction between them.

$$\begin{cases} \Pi^{o}_{t=2}(F) = \max\limits_{q_0}\{(a-b(q_o+q_f))q_o - \varphi(F)q_o\} \\ \Pi^{f}_{t=2}(F) = \max\limits_{q_f}\{(a-b(q_o+q_f))q_f - \gamma(F)q_f - \phi(F)\} \end{cases}$$

which after some algebra gives us payoffs to Oligarch and foreign direct investor under any business environment in Cournot Nash Equilibrium,

$$\begin{cases} \Pi^{o}_{t=2}(F) = \dfrac{(a-2\varphi(F)+\gamma(F))^2}{9b} \\ \Pi^{f}_{t=2}(F) = \dfrac{(a-2\gamma(F)+\varphi(F))^2}{9b} - \phi(F) \end{cases}$$

If there is no signaling at the first stage of the game and foreign direct investor is risk neutral enters it will enter if and only if the following condition is satisfied

$$\mathrm{E}(\Pi^{f}_{t=2}) = p\left[\frac{(a-2\gamma(1)+\varphi(1))^2}{9b} - \phi(1)\right] + (1-p)\left[\frac{(a-2\gamma(0)+\varphi(0))^2}{9b} - \phi(0)\right] > 0 \quad (5.1)$$

i.e. the expected value of the entry is positive. There are also other two cases which produce entry decision independently of the business environment and thus of the information on it possessed by foreign direct investor. It happens when profitability of entery is either positive or negative for both types of business environment. In those cases Foreigner will enter or not enter independently of the information Oligarch has.

In case of no signaling the entry will occur if the expected profit of the entry is positive. Note, however that entry of Foreigner is undesirable for Oligarch. Therefore, Oligarch is interested in providing credible signal to foreign investor through choosing the output at the first stage such that foreign direct investor will infer the type of business environment and its costs from it. The signal about environment will have any sense only if it will alter the behavior of the foreign direct investor, i.e. the additional information provided by the Oligarch

will change the expected payoff of the entry from positive to negative. Therefore, we first have to eliminate cases with certain entry or no entery as independent of the information possessed by Oligarch and not by foreign direct investor because there is no work for the signal here. Further, if the expected payoff to the foreigner is negative the entry will not occur even if there is no signal. It means that for the signal to have a value to Oligarch the unconditional expected profit to foreign direct investor should be positive, i.e. (1) holds, and the conditional on 'Bad' environment (credible signal) expected profit should be negative one. Therefore, for the signaling be considered as a possible entry deterring strategy by Oligarch at the first stage we have to impose the following restrictions on foreign direct investor payoffs:

a) $\Pi_{t=2}^{f} = \frac{(a+\varphi(0)-2\gamma(0))^2}{9b} - \phi(0) > 0$ (5.2)

b) $\Pi_{t=2}^{f} = \frac{(a+\varphi(1)-2\gamma(1))^2}{9b} - \phi(1) < 0$ (5.3)

c) condition (1) holds

However, the above conditions do not guarantee that signaling about 'Bad' business environment will be either credible or optimal for Oligarch to employ. To instill credibility in the signaling Oligarch has to exercise something which will be unprofitable to do for it in the 'Good' business environment at the first period. Hence, 'Oligarch' has to choose quantity that satisfies the condition (5.4).

$$\Pi_1^o(q^{sign} \mid F=0) + \Pi_2^o(q^M \mid F=0) < \Pi_1^o(q^M \mid F=0) + \Pi_2^o(q^C \mid F=0) \quad (5.4)$$

where q^{sign} quantity produced which serves as a signal, q^M is monopolistic value of output produced, q^C output produced in the Cournot type of competition by Oligarch.

At the same time, signaling should be profitable to employ under 'Bad' environment conditions, i.e. the loss of profits from choosing other than optimal output at the first stage should be covered by increased profitability at the second stage of the game. The condition for this is

$$\Pi_1^o(q^{sign} \mid F=1) + \Pi_2^o(q^M \mid F=1) \geq \Pi_1^o(q^M \mid F=1) + \Pi_2^o(q^C \mid F=1) \quad (5.5)$$

Proposition 5.1. With the 'Bad' environment in place, signaling of Oligarch (q^{sign}) at the first stage and no entry of the foreign direct investor at the second stage will be the equilibrium in the described game if condition (5.1), (5.2) and (5.3) for the foreign direct investor are satisfied and q^{sign} satisfies both conditions (5.4) and (5.5) and is optimal in a sence that it brings highest profit among possible signals.

An example:

Suppose business environment in a country is bad. However, foreign direct investor does not know that it is bad but knows the probability of it being bad. Let us assume that a=10, b=1, p=1/2 and other papameters may be summarized in the table 5.1

Table 5.1

Production and Entry costs of Oligarch and Foreigner

Environment	$\phi(F)$	$\gamma(F)$	$\varphi(F)$	p- probability
Good	0	1	2	0.5
Bad	10	1	1	0.5

We see that in the above example the foreigner produces goods with less costs per unit in good environment. However, under the bad environment that advantage disappears. Under the above structure on the demand and production costs the second stage the payoffs to both Oligarch and Foreign direct investor are summarized in the table 5.2:

Table 5.2

Second stage payoffs

	Enter		Not enter	
Environment	Oligarch	Foreigner	Oligarch	Foreigner
Good	5.4	11.1	16	0
Bad	9	-1	20.25	0

Proposition 5.2 Under the Bad environment Oligarch would produce 7.25 at t=1, and entry of foreign direct investor will not occur in second period. Hence, under the above assumptions Oligarch will resort to the signaling to provide additional information to the foreigner about the environment in a country.

Proof: First we have to find the range on which q^{sign} that satisfies conditions (5.4) and (5.5) in our case credible signal would be $q^{sign} \in [7.25, 7.85]$, which is

obtained by solving two quadratic equations obtained from (5.4) and (5.5) with assumed values of parameters. By picking the value which the most profitable to Oligarch and is credible one (in our case it is 7.5), Oligarch will eliminate asymmetry of information of the Foreigner. Now Foreigner knows the environment in a country and profitability of the entry under that environment (-1) with certainty. Therefore, it will not enter and entry is deterred. Second, from table 5.1 we see that conditions (1), (4) and (5) are satisfied and it is profitable for Oligarch to produce signal.

The implications of the above model are quite interesting: In case when there is asymmetric information, firms in the host countries may use their quantities as a signal to foreign direct investors about the state of business environment in their country. That signal will convey the information about realized entry and production costs for the Foreigner before entry occurs and thus can deter it in the first place. The model does not show however that under bad environment there would never be entry of foreigners. The idea presented here can be summaries as follows. If it is unprofitable for the foreign direct investor to enter under 'Bad' business environment conditions in a country, but type of environment is uncertain to Foreigner and expected profitability of entry is positive then Oligarch may utilize this to produce a credible signal to the foreigner about the environment conditions in a country

to deter its entry. In fact given that environment is exogenous in the model, it is beneficial for the Foreigners to receive such as signal.

CONCLUDING REMARKS

The main result of this paper is that indeed under certain economic conditions profit maximizing local business groups can utilize their political influence and power to create Bad business environment in a particular industry or even the whole country to deter the entry of foreign direct investors. This finding suggests that FDI unfriendly business environment observed in some transition countries may be not just a mistake and carelessness of the local governments but a result of profit maximizing actions of the local Oligarchs.

Utilizing our model in chapter 3 we found that technology that foreign direct investor can bring to a country matters for the Oligarch choice of business environmant If foreign direct investors have worse technology or the one that is just on the par with the technology of existing enterprises in a country, local business groups have very strong incentives to create FDI unfriendly business environment to get rid of potential competitors for state owned enterprises and lucrative markets.

We also found empirical evidence that supports our model. Testing for the technological differences between enterprises owned by foreigners and locals in

the Confectionary industry in Ukraine, we found that foreign owned enterprises have on average better technology than locally owned enterprises have. That finding is consistent with the necessary conditions provided by the model in chapter 3 for observing both foreign and local owned firms in the industry. In that sense the empirical evidence supports the model developed in chapter 3.

Furthermore, in essay three we showed that local business groups can also utilize bad business environment conditions even if they can not influence business environment in a country. They can devise a credible signal (in our case quantity produced) which will eliminate the asymmetry of information of foreign direct investors about the business environment in a country. If it is unprofitable for foreigners to enter when the environment is FDI unfriendly, that signal can deter their entry in the first place. However, in contrast to the model provided in the chapter 3 that signal may be beneficial for both agents, saving foreign direct investor from bankruptcy and local business groups from losses stemming from competition.

Some extensions and reservations are also due. First, we assumed one Oligarch in the model. However, we usually observe several of them in a particular country. Some of them may want to deter foreigners and some not. Therefore, it would be helpful to find conditions under which 'Bad' environment will be

the result of the Nash Equilibrium strategies of different Oligarchs. Second, it would be interesting to consider whether 'Bad' business environment can be a credible signal of Oligarchs about their political and economic power to deter the entry of foreign direct investors. In fact, we tackle that issue right now and the results are due soon. There is also some reservation concerning the empirical part of the paper. Since we are testing necessary conditions we should be aware that any counterexample would be enough to reject our theory. Therefore, the ideal way to test this necessary condition would be to do it for each industry in a country. However, the lack of time makes it impossible for us to undertake such an exercise.

The main message of that paper is that if local Oligarchs will be able to affect business environment in a country they will manipulate it in a way that is most profitable to them and not to the entire society living in that country. However, the results obtained in the paper lie mainly in the dimension of the positive economics. Policy implications produced by the models developed have little chance to be ever implemented because those whom they concern are exactly those who benefit from manipulating environment to maximize their profits.

BIBLIOGRAPHY

Aitken J. Brian and Harrison E. Ann 1999 *'Do Domestic Firms Benefit from Direct Investment? Evidence from Venezuela'* The American economic review, Vol 89, #3 pp. 605-618.

Aslund Anders 2002. *'Why Has Ukraine Returned to Economic growth?'* working paper # 15. Institute for Economic Research and Policy Consulting.

Baniak Andrzej, Cukrowski Jacek, Herczynski Jan (2002) *'On determinant of foreign direct investment in transition economies'* Centre for Social and Economic Research (CASE).

Blomstrom Magnus and Kokko Ari (1998) *'Multinational Corporations and Spillovers,'* Stokholm School of Economics.

Dixit Avinash 1982. *'Recent Development in Oligopoly Theory'* The American Economic Review, Vol 72, # 2 p14.

Eaton B. Curtis, Lipsey G. Richard. 1980. *'Exit barrier and entry barrier the durability of capital as a barrier to entry'* Bell Journal of Economics 11:721-729.

Dunning, John H. 1997. *'Trade, location economics activity and the MNE: a search for an eclectic approach'* in Bertil Ohlin, Per O. Hesselborn & Per M. Wijkman, editors. The international allocation of economic activity. New York: Holmes and Meier: 395-418.

Galan I. Jose, Gonzalez-Benito Javier (2001) *'Determinant factors of foreign direct investment: some empirical evidence'*, European Business Review, Vol 13 Number 5 pp. 269-278.

Gibbons Robert (1992) *'Game Theory for Applied Economists'*, Princeton University Press, Princeton New Jersey.

Hanson H. Gordon 2001. *'Should Countries Promote Foreign Direct Investment?'* G-24 Discussion Paper Series, Centre For International development Harvard University.

Ishaq Mohammed 1997. *'Foreign direct Investment in Ukraine Since Independence'* CERT discussion Paper # 97/16.

Konchenko Iryna 2003. *'The Effects of Foreign Direct Investment on the Efficiency of Ukrainian milk enterprises'* Master's Thesis, mimeo, EERC-Kyiv.

Konings Jozef 2000. *'Effects of Direct Foreign Investment on Domestic Firms: Evidence from Firms Level Panel Data in Emerging Economies,'* William Davidson Institute Working Paper 344.

Konings Jozef, Olga Kupets and Hartmut Lehmann 2003 *"Gross Job Flows in Ukraine: size, ownership and trade effects."* Economics of Transition Vol. 11 (2) 2003, 321-356.

Kudina A. 1990. *'Motives for foreign direct investment in Ukraine,'* Master's Thesis, mimeo, EERC-Kyiv.

Lipsey E. Robert 2002. *'Home and Host Country Effects of FDI,'* Paper for ISIT Conference on challenges to globalization.

Milgrom, P., and J. Roberts. 1982. *"Limit Pricing and Entry Under Incomplete Information: An equilibrium Analysis."* Econometrica 50: 443-459.

Oxelheim Lars, Randoy Trond and Stonehill 2001. *'On treatment of Finance-Specific Factors Within the OLI Paradigm',* The research institute of industrial economics, working paper # 554.

Rosenblatt, M. (1956), *"Remarks on Some Nonparametric Estimates of a Density Function,"* Annals of Mathematical Statistics, 27 pp. 642-669.

Rybalka, O. 2000. *'Foreign Direct investment and Economic development of transition countries. The case of Ukraine'*, Master's Thesis, mimeo, EERC-Kyiv.

Simar and Zelenyuk (2003) *"Statistical inference for Aggregates of Farrel-type Efficiencies"* Discussion paper.

Shy Oz 2001. *'Industrial Organization Theory and Application'* p169-217

Stiglitz E. Joseph 1987. *"Technological Change, Sunk costs, and Competition."* Brooking Papers on Economic Activity 3 (Special Issue on Microeconomics: 883-947.)

Talavera, O (2001), *'The effect of foreign Direct Investments on firms Performance in Ukraine*,' Master's Thesis, mimeo, EERC-Kyiv.

Zelenyuk V. (2004) *"Efficiency Analysis of economic Systems."* Book in progress.

APPENDIX 1

PROOFS OF PROPOSITIONS IN CHAPTER 3

Proposition 3.10

To find sufficient and necessary conditions for node #6 be the SPNE of the entire game we have to use beckward induction and substitute choices of players with their maximizing behavior. Since foreign direct investor makes the last choice whether to enter or not after privatization, let us start with it and find the conditions under which it will enter and the terminal node #6 will be the outcome its choice. That condition is B>0. Moving up we go to the privatization node and look for the conditions under which privatization will result in the Oligarch buying the plant because it is those conditions that will lead to the choice of the foreign direct investor. Looking at the privatization solution we find that the condition for Olig arch to buy the plant are either $B \leq 0$ or B>0 K>0 and $M \leq K+B$. We see that there are two sets of conditions that ensure that enterprise will be bought by Oligarch in privatization. However, we can also notice that one of those contradicts conditions imposed on the payoff to foreign direct investor B>0. Therefore, for the node #6 be the outcome of the SPNE of the privatization subgame the following sufficient conditions must be satisfied B>0, K>0 and $M \leq K+B$. However, to ensure that the Good environment will be chosen by Oligarch we have to ensure that the payoff to

Oligarch at the terminal node #6 will be greater than what it can get by choosing Bad evironment first. To find the payoffs to Oligarch, we have first to consider the choice of Foreign direct investor when it choose among enter, purchase and not enter. Since its choice will matter for the payoff to Oligarch. However, investigating conditions (i.e. $B>0$, $K>0$ and $M \leq K+B$), we can notice that they impose restrictions on the foreign direct investor choice. First, $B>0$ implies that foreign direct investor will never choose Not Enter because it brings zero profit. Hence, we do not consider not enter possibility in that conditions. Further, we see that $B>0$ makes the payoff to foreign direct investor at the purchase option be $M-\max\{D+C_p,K\}$ and the payoff to the Oligarch at that option be $\max\{D+C_p,K\}-2C_p$. Now we have to consider the choice of foreign dirct investor between Enter and Purchase options. Under Enter option foreign direct investor gets B and under Purchase option it gets $M-\max\{D+C_p,K\}$. Therefore, it will choose Enter if $B \geq M-\max\{D+C_p,K\}$ and Purchase otherwise. Combining it with $M \leq K+B$ we see that $B<M-\max\{D+C_p,K\}$ is not satisfied. Therefore, Foreign direct investor has no choice but Enter in that case(note: the case when foreign direct investor is indifferent between the Enter and Purchase was considered and it adds nothing to the conditions). Now we see that if Oligarch chooses 'Bad' at the first decision node it may get to the two possible terminal nodes #4 and #3. Hence, we are in a position to consider the first decisions node at which Oligarch chooses

business environment. The move chosen by Oligarch at the first decision node is completely depend on payoffs to it. Since we are interested in the terminal node #6 be the result of SPNE, it should bring higher profits than either #4 or #3. (We assume that Oligarch has preference for doing nothing than doing something even if the payoffs are equal, e.g. lazy guy). The conditions for that will be $K-2C_p \leq (K+B)-M$ and $D-C_p \leq (K+B)-M$. Basically, it should be no less profitable to choose Good than Bad at the first decision node for Oligarch. Furthermore, since by assumption $D>C_p$ we have to rule out equality in the condition $M \leq K+B$. Therefore, the complete set of sufficient conditions can be found below

$$\begin{cases} D + M \leq K + B + C_p \\ M \leq B + 2C_p \\ B > 0 \\ K > 0 \\ M < K + B \end{cases}$$

That under assumption A13 $D>C_p$ is reduced to the set of conditions found in the proposition 5.1. The necessary conditions we are interested in are just those that ensure terminal node #6 be the result of privatization but without equality.

Q.E.D.

Proposition 3.11

To find necessary and sufficient conditions for the terminal node #4 be the result of the SPNE we first have to consider the choise of the foreign direct investor among Enter, Note Enter and Purchase. When foreign direct investor

does not enter it get zero when it enters it gets B and when it purchases it gets either M-max{D+C_p,K} if B>0 or M-max{D+C_p,M} otherwise. We clearly see that there two distinct cases which are relevant for the choice of Foreign direct investor B>0 and B ≤ 0. Therefore, we will consider both of the in turn. Let us start with B ≤0. This case rules out the entry option for the foreign direct investor and makes it consider only Not Enter and Purchase. However, with the purchase option foreign direct investor can get at most zero (0) which can be easily seen from the payoff under B ≤0. So the only choice for it is Not enter if B ≤0. Now consider choice of Oligarch between Bad and Good at the second decision node. It will choose Bad if the following is true D-C_p≥ M-2C_p where we substituted the choice of foreign direct investor with its maximizing behavior. Since when B ≤0 Oligarch will get at most zero by choosing Good at the first decision node, it will never do so under assumption A13. Therefore, the sufficient conditions for the terminal node #4 be the result of SPNE are as follows

$$\begin{cases} B \le 0 \\ M \le D + C_p \end{cases}$$

Now we will derive another set of sufficient conditions consider the case when B>0. That condition immediately rules out the possibility of Not Enter be chosen by foreign direct investor. Further, when B>0 the payoffs to foreign direct investor at the terminal node #2 is M-max{D+C_p,K} and at the terminal node #3 is B. Consider now the terminal node #2. For the foreign direct investor to choose Purchase option B<M-max{D+C_p,K}. Further, for Oligarch to choose Bad at the second decision node it should be that max{D+C_p,K}-2C_p<D-C_p. We see that the condition on the Oligarch payoffs contains

contradiction. Therefore, when foreign direct investor chooses Purchase Oligarch will not choose Bad at the second decision node. Now consider the case when foreign direct investor choose Enter. For it to do so the following conditions must be satisfied $B>0$ and $B \geq M-\max\{D+C_p,K\}$. Now for Oligarch to opt for Bad at the second decision node it should be that $K-2C_p \leq D-C_p$ and for Oligarch to choose Bad at the first decision node the following condition must be satisfied $D-C_p>(K+B)-M$. Together conditions on Oligarch and foreign direct investor payoffs give set of sufficient conditions for the terminal node #4 be the result of SPNE.

$$\begin{cases} B > 0 \\ B \geq M - \max\{D + C_p, K\} \\ K - 2C_p \leq D - C_p \\ (K + B) - M < D + C_p \end{cases}$$

which can be reduced to

$$\begin{cases} B > 0 \\ B + D + C_p \geq M \\ K \leq D + C_p \\ M + D > K + B + C_p \end{cases}$$

which gives the conditions outlined in the proposition 2.2 in the text.

Proposition 3.12

To establish the conditions for the terminal node # 1 be the result of the Subgame Perfect Nash equilibrium we first have to consider the choice of

foreign direct investor. As we know from the proof of proposition 2.2 it will choose Not enter if $B \leq 0$. We also know that with $B \leq 0$ Oligarch will never choose Good at the first decision node. For Oligarch to choose Good at the second decision node it should be that $M-2C_p > D-C_p$. Therefore, when $B \leq 0$ the terminal node #1 we be the result of the SPNE if and only if the following conditions are satisfied

$$\begin{cases} B \leq 0 \\ M > D + C_p \end{cases}$$

which are exactly the conditions specified in the proposition 2.3.

Proposition 3.13

The necessary and sufficient conditions for the terminal node #2 be the outcome of the profit maximization can be found by first considering the choice of foreign direct investor. From the proof of the proposition 2.2 we know that foreign direct investor will choose purchase only if $B>0$. Foreign direct investor will prefer Purchase to Enter if $B<M-\max\{D+C_p,K\}$ and Oligarch will opt for Good at the second decision node if the following holds $\max\{D+C_p,K\}-2C_p \geq D-C_p$. The condition on Oligarch payoffs is always satisfied because the price offered by foreign direct investor is designed in such a way that it has to be satisfied. Further, since $B<M-\max\{D+C_p,K\}$ implies that $K+B<M$ it means that Oligarch will not choose Good at the first decision node. Therefore, the sufficient conditions for the terminal node #2 be the result of SPNE are

$$\begin{cases} B > 0 \\ B < M - \max\{D + C_p, K\} \end{cases}$$

There are two possible cases hidden in the above conditions:

First, when $D+C_p \geq K$ then the above conditions may be restated as

$$\begin{cases} B > 0 \\ D + C_p \geq K \\ M > B + D + C_p \end{cases}$$

Second, when $K>D+C_p$ and conditions may be written as

$$\begin{cases} B > 0 \\ K > D + C_p \\ M > B + K \end{cases}$$

which is the set of conditions presented in the proposition 2.4

Proposition 3.14

To find the conditions for the terminal node #3 be the result of SPNE, we again start with the choice of foreign direct investor. For it to choose Enter the following conditions must be satisfied $B>0$ and $B \geq M-\max\{D+C_p,K\}$. In that case Oligarch will get $K-2C_p$ and it should be strictly greater than $D-C_p$ and strictly greater than $(K+B)-M$ for the terminal node # 3 be the result of profit maximization by Oligarch and foreign direct investor. Therefore, we have the following set of condition

$$\begin{cases} B > 0 \\ B \geq M - \max\{D + C_p, K\} \\ K - 2C_p > D - C_p \\ K - 2C_p > (K + B) - M \end{cases}$$

which is equivalent to the following set of conditions

$$\begin{cases} B > 0 \\ K > D + C_p \\ M \leq K + B \\ M > B + 2C_p \end{cases}$$

that produces two cases found in the proposition 2.5.

APPENDIX 2

SUMMARY OF THE DATA SET

Sales revenue

Percentiles		Smallest		
1%	800	800		
5%	3969	2283		
10%	5609	3969	Obs	59
25%	16158	4256	Sum of Wgt.	59
50%	87809		Mean	537448.7
		Largest	Std. Dev.	1113956
75%	481659	2197001		
90%	1869182	4008379	Variance	1.24e+12
95%	4008379	4707823	Skewness	2.999409
99%	5414512	5414512	Kurtosis	11.78459

Materials

Percentiles		Smallest		
1%	97	97		
5%	2286	1541		
10%	3736	2286	Obs	59
25%	8039	2404	Sum of Wgt.	59
50%	34702		Mean	308860.8
		Largest	Std. Dev.	660433.3
75%	219130	1605198		
90%	1232985	2347360	Variance	4.36e+11
95%	2347360	2774975	Skewness	2.729494
99%	2913553	2913553	Kurtosis	9.790163

Labor

Percentiles		Smallest		
1%	101	101		
5%	370	277		
10%	634	370	Obs	59
25%	1332	392	Sum of Wgt.	59
50%	5782		Mean	34473.39
		Largest	Std. Dev.	59421.39
75%	57554	123251		
90%	115922	135241	Variance	3.53e+09
95%	135241	196958	Skewness	3.040627
99%	345676	345676	Kurtosis	14.6291

Capital

	Percentiles	Smallest		
1%	1231	1231		
5%	4427	3461.5		
10%	8165.5	4427	Obs	59
25%	15842	5129	Sum of Wgt.	59
50%	39246.5		Mean	139406.3
		Largest	Std. Dev.	231027.5
75%	156857.5	593411.5		
90%	439612.5	641642.5	Variance	5.34e+10
95%	641642.5	1052613	Skewness	2.656091
99%	1082650	1082650	Kurtosis	10.10688

APPENDIX 3

INDIVIDUAL EFFICIENCY SCORES. CONFIDENCE INTERVALS AND BIAS CORRECTED EFFICIENCY SCORES FOR CRS CASE

Individual Efficiency Scores.

Confidence Intervals and Bias Corrected Efficiency Scores

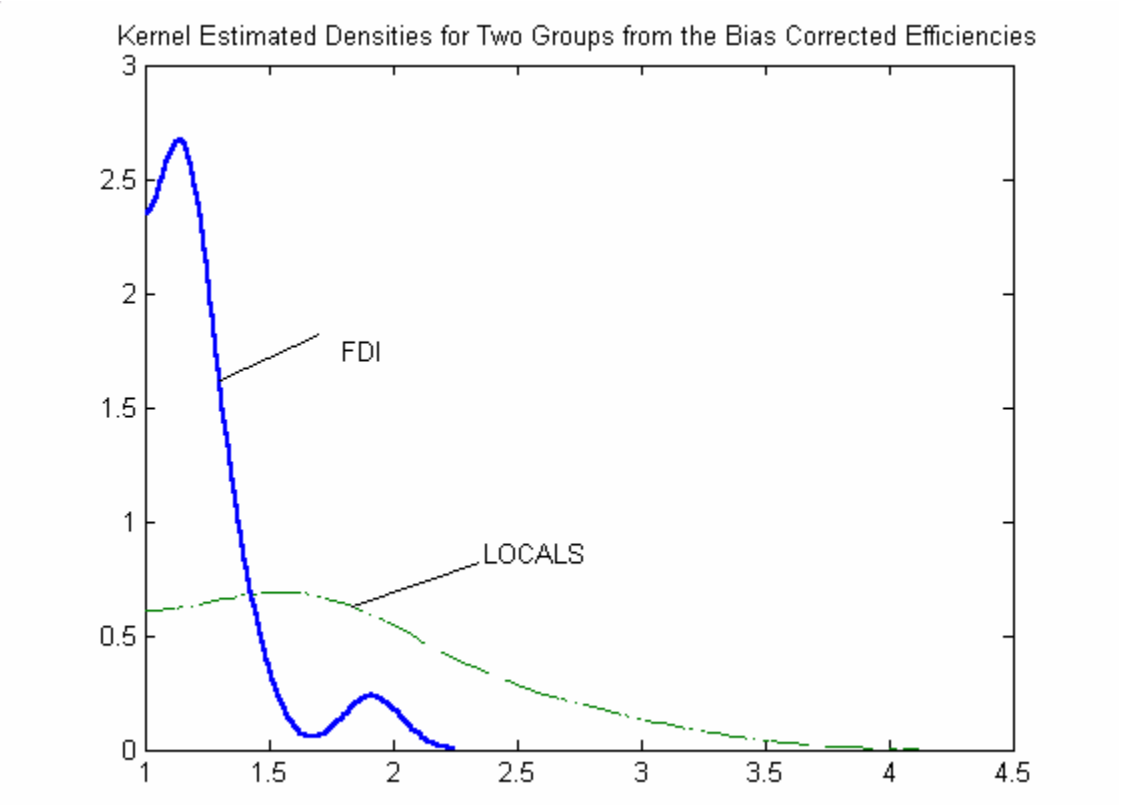
for CRS case

#	Enterprise code	Individual efficiency score	Bias corrected individual efficiency score	Confidence inrterval lower bound	Confidence inrterval upper bound
1	00377029	1.06	1.17	1.10	1.27
2	00382071	1.10	1.20	1.14	1.28
3	00382148	1.85	2.04	1.92	2.16
4	00373882	1.35	1.47	1.40	1.57
5	00381835	1.00	1.18	1.04	1.43
6	30482582	1.00	1.16	1.04	1.33
7	00382088	1.31	1.46	1.36	1.62
8	00382036	1.16	1.30	1.21	1.44
9	00382208	1.23	1.37	1.29	1.48
10	00382220	1.18	1.29	1.23	1.37
11	20426043	1.00	1.18	1.04	1.43
12	30757745	1.00	1.17	1.04	1.40
13	22661110	1.00	1.14	1.04	1.24
14	00382154	1.26	1.39	1.31	1.49
15	25112243	1.00	1.34	1.17	1.46
16	00376194	2.23	2.51	2.35	2.67
17	00382125	2.66	3.05	2.79	3.43
18	00382013	2.25	2.53	2.38	2.72
19	00375881	1.43	1.61	1.51	1.70
20	00382059	2.75	3.13	2.88	3.47
21	00375875	1.57	1.78	1.64	1.91
22	00376165	1.77	1.99	1.86	2.12
23	00382094	1.32	1.45	1.38	1.54
24	00382102	1.64	1.87	1.73	2.02
25	00378431	1.38	1.57	1.47	1.69
26	00378827	1.91	2.15	2.01	2.28
27	21794323	1.58	1.79	1.65	1.93
28	00376418	1.90	2.14	2.00	2.27

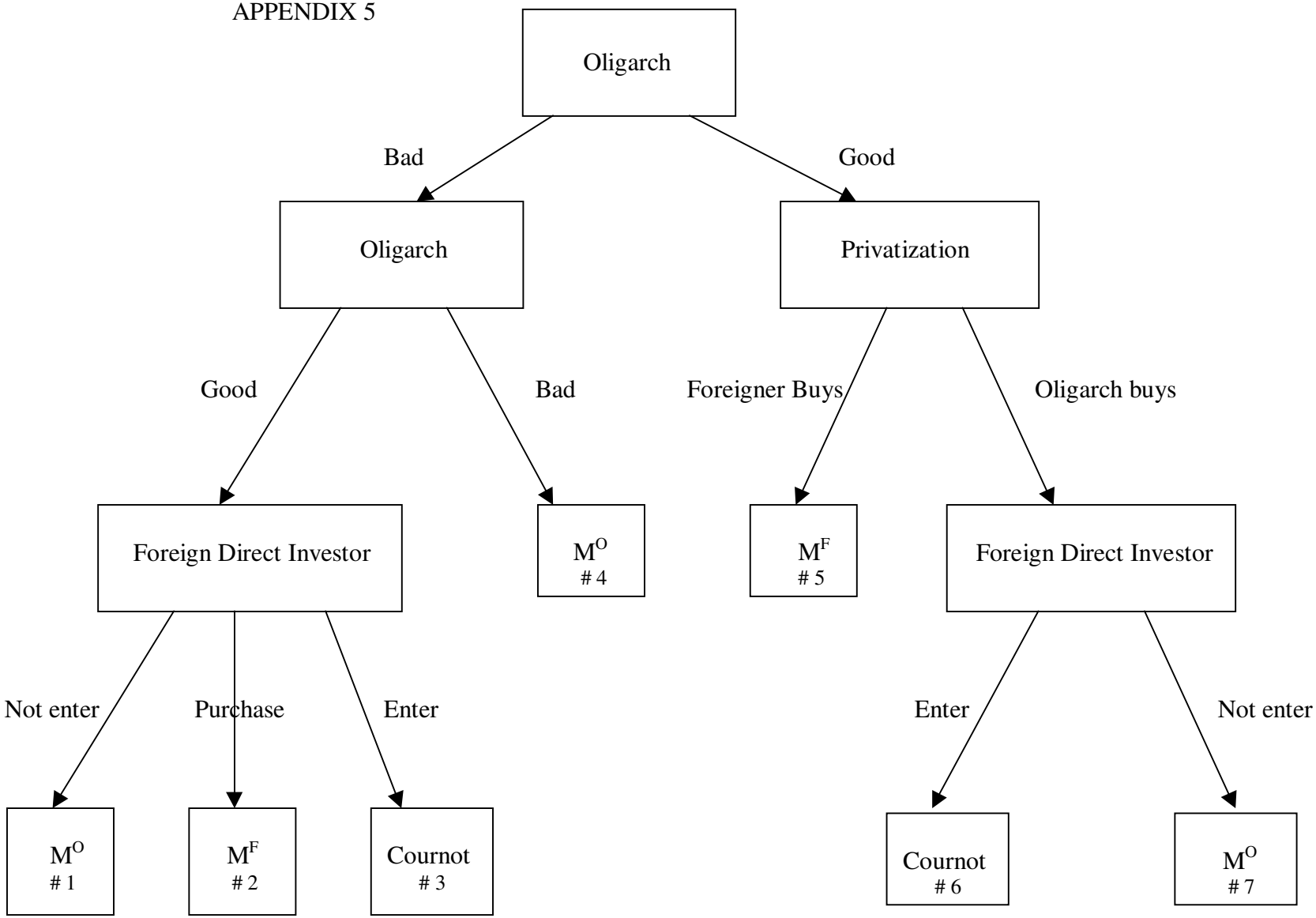
29	05467731	1.37	1.57	1.46	1.70
30	00377147	1.50	1.66	1.58	1.76
31	00382191	2.25	2.52	2.36	2.72
32	00382214	1.51	1.70	1.59	1.87
33	00379519	1.47	1.62	1.54	1.71
34	00379672	1.41	1.60	1.47	1.71
35	00380126	2.57	2.89	2.71	3.05
36	30377900	1.66	1.86	1.73	2.04
37	00382272	1.53	1.70	1.61	1.81
38	00382289	1.36	1.50	1.42	1.62
39	00380741	2.01	2.26	2.12	2.41
40	00380712	1.83	2.06	1.94	2.19
41	00380770	1.85	2.09	1.95	2.22
42	00382303	1.49	1.67	1.58	1.79
43	00382295	1.67	1.86	1.77	1.98
44	05519681	2.88	3.24	3.03	3.43
45	00376219	2.31	2.60	2.44	2.76
46	00378267	2.38	2.67	2.50	2.81
47	00378425	1.93	2.17	2.04	2.31
48	00378483	1.75	1.93	1.83	2.04
49	05583319	1.00	1.40	1.16	1.59
50	05400313	1.74	1.98	1.82	2.13
51	01564236	1.36	1.55	1.42	1.70
52	00382668	1.68	1.85	1.77	1.96
53	00375697	1.50	1.68	1.57	1.79
54	00377265	1.25	1.44	1.33	1.57
55	00381048	1.01	1.10	1.05	1.17
56	00381098	2.08	2.34	2.19	2.47
57	00381108	1.14	1.29	1.19	1.40
58	00381143	1.54	1.76	1.63	1.90
59	21354311	1.70	1.91	1.79	2.02

APPENDIX 4

KERNEL DENSITY ESTIMATES OF PROBABILITY DENSITY FUNCTIONS OF INDIVIDUALS EFFICIENCY SCORES UNDER VRS ASSUMPTION



APPENDIX 5


Oligarch
Bad
Good
Oligarch
Privatization
Good
Bad
Foreigner Buys
Oligarch buys
Foreign Direct Investor
M^O # 4
M^F # 5
Foreign Direct Investor
Not enter
Purchase
Enter
Enter
Not enter
M^O # 1
M^F # 2
Cournot # 3
Cournot # 6
M^O # 7