PATTERNS OF FOREIGN DIRECT INVESTMENT

AN INVESTIGATION OF FDI IN POLAND

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DEDICATION

I dedicate this work to my husband, Andrzej Kochut who always encouraged me to do more and taught me never to give up; my children, Natalia and Alexander, who give me a great joy and hope; and my parents, Wanda and Mieczyslaw Mika who are always there to support me.

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ABSTRACT

Globalization emerged as a very important trend reshaping the economic landscape. One of the major drivers of this process is free capital flow between geographical regions. In this new competitive environment, it is crucial for both firms and policymakers to gain a good understanding of Foreign Direct Investment (FDI) processes. In particular, what features of a region are important in attracting and retaining FDI and what are the temporal patterns in FDI development? This dissertation is a discovery of the inter-industry and temporal dependencies in FDI and analyzes several industry segments separately. The results give new insights into the location choice patterns used by different types of firms. In addition, to the best of my knowledge, this is the first empirical study of the evolution of the FDI over time, especially how certain kinds of prior investments influence later ones. The research is conducted at the *powiat* level of territorial division in Poland.

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CHAPTER 1

INTRODUCTION

In recent decades an overwhelming new trend reshaping the economy is globalization. It can be defined as a process of homogenizing prices, products, wages, rates of interest and profits (Steger, 2004). Major drivers of globalization are: free flow of capital, human migration, integration of financial markets and international trade. The globalization process is very natural; companies choose to locate their economic activity in multiple countries for several reasons. Among them is the pursuit of resources, as well as new markets, or the desire to increase productivity and efficiency. The decision of where to expand the company's production is multidimensional. First, the firm must determine what region of the world is the most desired market for a company's products or services, then what country is the best host for potential investment, and lastly where inside the host country is the best place to locate their economic activity.

In this new reality of constant competition, not only among companies but also among regions and countries trying to attract economic activity, it becomes especially important to understand factors that make a region attractive. These are the same factors that companies consider when deciding where to locate their manufacturing or service centers. The decision is based not only on the demand for a company's products or services but also on many other factors such as the host country's environment, market and labor potential, stability and political situation, taxation, and regional incentives. Thus, a good understanding of these location choice determinants is crucial to the economic success or failure of a country, region, or a company.

This dissertation broadens the understanding of the FDI decision process by studying inter-dependencies between investing industries. In particular, the research answers three broad

questions: (1) what are the temporal patterns of FDI development? (2) what are the dependencies between location choices and existing foreign investment in the host area (disaggregated by industry)?, and (3) what are the differences between several industries in the rate of approach to the equilibrium FDI stock level?

I accomplish the above objectives with the use of a dynamic econometric model that allows examination of inter-temporal linkages (of FDI stock and regional characteristics as well as estimated FDI stock and the equilibrium stock) and regional distribution of FDI. I find the partial stock adjustment model (PSAA) created by Chow (1967), to be the most appropriate for this study. The study is performed at the industry-level, which allows me to capture the differences in FDI location determinants and in correlations between investments from multiple industries in a region. As regions, I choose the *powiat*[1] level of territorial division in Poland. I find this level of territorial division appropriate since the local governments have power and means to promote FDI and compete with other regions. In addition, to the best of my knowledge, it is the first empirical study of FDI performed at the *powiat* level in Poland. Therefore, it gives insight into what strategy should the local governments consider to overcome multiple barriers in attracting FDI and compete successfully for inward FDI.

Poland was chosen as a country of interest since the goal of this study was to analyze the FDI stock development path and Poland is perceived as a successful formal transitional economy. During the transition to the market economy, the country effectively reduced trade barriers, liberalized the economy, privatized government-owned companies, and created a financial sector to enable capital movements and macroeconomic stabilization. The results

[1] *Powiat* is the second-level unit of local government and administration division in Poland. It is comparable to a county, district or prefecture (NUTS-4 or LAU-1) in other countries.

obtained allowed us to formulate better policy recommendations to both the national government and the local authorities.

To summarize, this dissertation is a contribution to the existing literature on FDI by:

- discovering and explaining temporal patterns of FDI that reveal the interdependencies between types and timing of FDI stock,
- identification of vertical and horizontal dependencies among foreign investments in a host country's region,
- characterization of inter-industry differences in the rate of approach to the equilibrium FDI level,
- and an examination at the middle territorial level (*powiat*), which has not been previously studied, providing insight and recommendations to regional policymakers.

CHAPTER 2

THEORETICAL MODELS OF MULTINATIONAL ENTERPRISES AND FOREIGN DIRECT INVESTMENT

One of the reasons multinational enterprises (MNEs) expand production of goods and services is to search for new ways to increase revenues and profits. This exploration of new markets is possible because of advances in technologies, decreases in transportation costs, and differences in production costs between countries. MNEs engage in transfer of technology and resources (natural and labor), and take control over local companies through mergers and acquisitions, as well as through green-field investments. The subsidiary entities do not simply have a financial obligation to the parent company; they are part of the same organizational structure (Krugman and Obstfeld, 2003). Between 1981 and 2010, trade from MNEs in the US grew much more rapidly than the GDP. Similar effects are observed in transition economies where the annual change in FDI exceeds the growth of GDP. The recent studies by Feinberg and Keane (2006) and Dunning (2003), offer three major reasons for this rapid FDI growth: reduction in trade barriers, technical change affecting intra-firm trade growth, and global competitive pressures. According to the Feinberg and Keane, 2006) study of MNE-based trade between the United States and Canada over the 1984-1995 period, tariff reductions led to a one-third increase in the volume of arms-length MNE-based trade. At the same time intra-firm trade nearly doubled because of "technical change."

There are multiple general economic theories explaining which locations are best for economic activity. However, the theories about optimal timing and patterns of FDI are very limited. The remainder of this chapter reviews selected general theories, thoroughly examines timing and pattern-related theories, and builds a theoretical rationale for the empirical study.

General Theories of MNE and FDI

There is a significant body of work focusing on explaining the decision process related to location choice of economic activities. In general, the location theories address the "what/where/why" questions: what economic activities locate in a given location, where the best location for investment is, and why they do so. These theories give us insight into what factors companies take into consideration when deciding to invest not only in their home country but in foreign countries as well. The MNEs' motives for entering new foreign markets are usually diverse. The core literature distinguishes MNEs four major motives for investment decisions. These are: search for efficiency; search for resources, search for markets; and search for assets. I follow these motives to present the literature findings that are most relevant to this work.

Efficiency-seeking investors hope to explore economies of scale and scope as well as economies of common ownership. Taube and Ögütçü (2002) conclude that MNEs aim to diversify risk exposure and take advantage of the different comparative cost advantages of various economies for the MNEs' production process. The main reason for *resource-seeking FDI* is the possibility of exploiting foreign production factors (such as labor or natural resources) at prices lower than in the home country. Both of these investment motivations focus on multiple factors to determine location: cost differentials (including production costs such as costs of intermediate goods, competitive wage rates for both skilled and unskilled labor, transportation costs, and many other variable and fixed costs); access to human capital; access to natural resources; and access to local and world markets.

Theories developed based on companies' profit maximization are excellent examples of efficiency-seeking and resource-seeking FDI. One of them is von Thünen's (1826) theory of marginal productivity, which is based on optimal land use. Von Thünen develops a simple rent

function that combines the market price of goods, production costs, and costs of transportation. The function is expressed as follows: $R = Y(p - c) - Yfm$, where R denotes land rent; Y denotes yield per unit of land; c is production expenses per unit of commodity; p is market price per unit of commodity; f denotes freight rate; and m denotes distance to market. Von Thünen concludes that the best location for agriculture production is where the transportation costs are minimized.

Least cost theory by Weber (1929) is based on analysis with use of material index, spatial isocost lines, isodapane surfaces, and critical isodapane. Weber claims that optimal industry location can be chosen by the minimization of transportation costs of raw materials and final goods, as well as labor costs. Both of these theories present solutions that are in terms of partial equilibrium theory that is subject to Lösch's (1954) critique. Lösch argues that Weber did not take into account geographic differences in market demand in his model. Weber does not distinguish that transportation costs are proportional to weight and distance and that intermediate locations between input materials and markets require added terminal charges (extra handling). In addition, according to his model, firms face a tradeoff between transportation costs and labor costs, and choose location with the least combined cost. The fact that labor is often mobile via migration opens the model to further critique. Finally, the model does not take into account the possibility that firms may use multiple intermediate goods to produce a great number of products for multiple diverse markets.

Location theories should not only concentrate on the supply side of the spatial distribution of production processes and services. Demand-oriented theories suggest that distribution of markets and the location of competitors influence firms' location decisions, leaving production costs as being independent of location. Using a full general equilibrium system describing the interrelationship of all locations with a pattern of points and hexagons,

Lösch (1954) concludes that the optimal location is the one where the net profit (defined as the difference between sales revenue and production costs) is the greatest. Therefore, it is very difficult to choose an optimal location since companies are able to substitute some production inputs (technologies employed in the production), and can increase transportation costs while reducing land rent. The changes in all of these factors may influence the net profits, and as a result, the best location.

Another group of efficiency seeking and resource seeking motives are agglomeration effects. Agglomeration is defined as "a concentration of economic activities in related sectors in a geographical area, brought about by, among others, external economies, such as a pool of skilled labor; increasing returns on scale, cumulative causation, planning by local authorities, and fortuitous events" ("A Dictionary of Geography", Oxford University Press, 2004). Economists use the term in several contexts: urban agglomeration as related to cities; human concentration; and most relevant to this work, industrial agglomeration. There are multiple factors that influence companies' geographical concentration. Research by Blonigen et al. (2005) shows that the presence of Japanese firms in a region increases the probability of further investment by Japanese manufacturing companies. The presence of other Japanese companies makes it easier for new companies in a region to enter because of the exchange of information that takes place among them. The literature very often lists agglomeration economies as one of the reasons why firms choose to locate in the same region. Agglomeration economies include *intra-industrial* or localization economies that arise from the specific industrial specialization of the region where foreign firms locate, and *inter-industrial* or urbanization economies that result from the concentration of diversified industries in the same region.

The benefits MNEs gain from intra-industrial agglomerations are based on reduction in production and research and development (R&D) costs, as well as a specialized, very well trained labor force. New location theory underlines the pecuniary benefits of demand and supply linkages. These externalities might be of multiple kinds such as creating joint networks of suppliers and distributors (Krugman, 1991a; Krugman, 1991b; Venables, 1993; Markusen and Venables, 1998). Krugman (1991) develops a two-region model with two kinds of production: agriculture, which is a constant-returns sector tied to land, and manufactures, and an increasing-returns sector that can be located in either region. He finds that manufacturing firms, while minimizing costs, choose to locate where the demand for their products is the largest. However, according to the model, the location of demand itself depends on the distribution of manufacturing. New location theory also finds that knowledge spillovers among foreign companies within and between industries create intra-industrial economies and lead to further increases in economies of scale (Griliches, 1979; Romer, 1986; Gong, 1995; Braunerhejelm and Svensson, 1996). Griliches (1979) uses the production function approach to analyze returns due to R&D. He claims that a company's or industry's productivity level depends not only on its own research but also on the general knowledge available within this industry or among firms. The knowledge-enhancing activities, such as research and development, can be only partially applied by companies. This stems from the fact that an externality is generated from such activities that can be used by other companies. This results in decreases in competitors' production costs. Therefore, the importance of agglomeration factors is seen if the knowledge spillovers, specialized labor, intermediate inputs, and other pecuniary externalities upsurge firms' competitiveness. Lastly, the new location theory, together with more recent literature, addresses some informal advantages of agglomeration on the location of FDI. Agglomeration

makes it easier to find producers of intermediate goods, which decreases production costs (Radner, 1992; Casson, 1992).

Inter-industrial economies arise from the exchange of ideas and information among industries (knowledge spillovers), the availability of natural resources in the area, the quality of infrastructure, easy access of inputs that results from lower cost intermediate goods, a fast vertical communication flow, a large and highly specialized labor force, and finally, a high local demand that decreases transportation costs (Glaeseret et al., 1992). Because of the multi-industry agglomeration, a positive market feedback effect is observed. In particular, companies invest in places where there is a relatively large market. This increases wages and encourages labor migration, which as a result, increases market size. An excellent example of such a feedback effect is shown in an inter-city competition study in China (Head and Ries, 1996). The authors offer a model of self-reinforcing FDI in which "localization economies, positive externalities tied to proximity to similar firms, lead to concentrations of foreign ventures in particular locations." They find that the arrival of FDI in a city will stimulate entry by local specialized suppliers. Growth of this upstream sector in turn makes a city more attractive to subsequent foreign investors.

The objective of *market-seeking* FDI is either to access and explore new markets or to maintain existing ones. One of them is explored by Markusen and Venables (1998), who develop a model in which multinational (multi-plant) firms locate in a host country because of competition with national (single-plant) firms. The conclusion of this research is that MNEs most likely invest in regions where firm-level economies and tariffs, together with transportation costs, outweigh plant-level scale economies. Another very important factor that market-seeking investors take into consideration is the size and the possible expansion of the market. Studies of

this type often use the market and output size hypothesis in analyses of market demand. It takes into account a measure of output size (or country's GNP/GDP used as a proxy for potential sales). Jorgenson (1963) formulates the theory of investment behavior that is based on the neoclassical theory of optimal accumulation of capital. He argues that the short-run determination of investment behavior relates to the time of lagged response to changes in the demand for capital. Summarizing, the main idea of market and output theory is that a sufficiently large market that allows exploitation of economies of scale is an excellent background for FDI inflows (Jorgenson, 1963; Balassa, 1966). Other possible parameters used to determine the size of the market are population size, GDP, and per capita income, or the degree of urbanization.

Another factor used to determine an economy's attractiveness to foreign investors is UNCTAD's inward FDI potential index. Faini (2004) uses it to find that trade barriers are a significant factor discouraging inward FDI. This work is one of the very few in the literature actually using this index. The author investigates the relationship between the ratio of FDI to GDP and this index. Since the index captures a majority of features of a region in a single compact variable, no single regional characteristic is used explicitly.

Another important factor that can influence market-seeking investors is the political environment and stability. High taxes are usually one of the factors that deter investment in a region (Bartik, 1985; Coughlin et al., 1991). The two most commonly used tax measures are local taxes per capita and local taxes as a percentage of personal income. Djankov et al. (2010) find that corporate taxes have a large and significant negative effect on corporate investment and entrepreneurship. In addition, higher effective corporate income taxes are associated with lower investment in manufacturing (but not in services), a larger unofficial economy, and greater

reliance on debt as opposed to equity finance. However, Luger and Shetty (1985) claim that the influence of taxes varies among industries. They analyze four different industries and find that in the United States, companies with FDI from motor vehicles and the motor vehicle equipment industry are insensitive to industrial promotion made by states.

Although, it is very helpful to use taxes as a predictor of regional FDI, there is a problem with measuring regional tax burdens. In particular, amounts reflected by taxes often do not take into consideration tax incentives; it is barely possible to identify tax incidence; and lastly, it is likely that the taxes finance the supply of goods and services valued by business (Kieschnick, 1983). Greenfields or Special Economic Zones (SEZ),[2] together with easy market access, are two political factors that encourage FDI in a region or country. Deichmann and Karidis (2005) find evidence that Poland's SEZs are an effective policy instrument for attracting foreign firms to targeted regions. In addition, in transition economies, privatization can influence FDI. Attinasi et al. (2006) find that voucher privatization and direct sales attract foreign investors, while management and employee buyouts are negatively correlated with FDIs.

Finally, *strategic asset/capability seeking FDI* is based on a strategic plan to gain or sustain the long-term competitiveness of the corporation. These assets can be of multiple kinds, such as natural resources (a company might want to acquire them to prevent their easy access to competitors), technology, marketing, or R&D. The studies of this kind of investment are business-oriented. They assume that investors expand their production to other countries not only based on three previously described motives but also on a desire to learn or attain access to

[2] Following Polish Information and Foreign Investment Agency, SEZ is defined as a designated area in which manufacturing or distribution activities can be conducted on preferential terms (i.e. with income tax exemption).

essential strategic assets existing in the host country (Makino et al., 2002; Dunning, 1995; Frost, 2001).

The most comprehensive FDI location studies, and therefore needing closer attention, is Dunning's eclectic paradigm (Dunning, 1977, 1979, 1988, 1995, 2000, 2006). The superiority of the paradigm lies in the integration of three theories of FDI: the industrial organization, the internalization, and the location theories. Moreover, Dunning's paradigm overlaps with all four previously described FDI motives. Dunning identified three inter-related (*OLI*) advantages that are necessary for MNEs to undertake FDI: 1) Ownership (O) that is explored by strategic asset-seeking and resource-seeking investors, 2) Location (L) on which investors seeking markets and/or looking for a more efficient way of production and transportation focus their attention, and finally 3) Internalization (I) that results from the need to explore other markets (market seeking), to protect knowledge-based assets (asset seeking), as well as to increase efficiency. In particular, the paradigm asserts that, at any given moment, international production is determined by the configuration of three forces:

"(1) The (net) competitive advantages which firms of one nationality possess over those of another nationality in supplying any particular market or group of markets. These advantages may arise either from the firm's access to or privileged ownership (O) of, a set of income-generating assets, or from their ability to coordinate these assets with other assets across national boundaries in a way that benefits them relative to their competitors, or potential competitors.

(2) The extent to which firms choose to locate (L) these value-adding activities outside their national boundaries.

(3) The extent to which firms perceive it to be in their best interests to internalize (I) the markets for the generation and/or the use of these assets; and by so adding value to them" (Dunning, 2001).

According to Dunning, firms looking for a new facility location take into consideration several advantages. Neuhaus (2006) divides the advantages into four groups: market and market related factors (e.g., the size and growth of the market, barriers to enter the market, the distance between the donor and host country, and input costs), economic and political factors (e.g., macroeconomic, institutional, and political stability), factors related to openness and integration (e.g., direct consequences of a liberal trade regime and a membership in a supra-national trade agreement for the location of an FDI,), and other factors (e.g., quality of infrastructure, availability of subsidies to foreign firms, and agglomeration economies).

The paradigm went through transition over time; however, the main idea remains unchanged. The eclectic paradigm theory conveys that all forms of international trade, and in particular FDI, can be explained by the three conditions listed above. However, the importance of each of these advantages and the configuration between them is likely to be context specific. Specifically, the significance of OLI advantages may vary across industries (or types of value-added activities), regions or countries (the geographical dimension) and among enterprises. This is the hypothesis this study is intended to confirm. The application of the OLI paradigm to sub-national FDI studies is possible only if O and I advantages are kept as constant and observe what specific changes in L advantages affect MNE location choice decisions. Another assumption required to ensure the significance of regional location choice determinants is that the decision of what region is the best for investment is made after the country of interest has been selected.

Theories of FDI Patterns

There is no doubt that Dunning's eclectic paradigm is a significant part of location choice theory but, together with most of the general literature on FDI and multinational enterprises, it only answers the questions of "why," "where" and "who" about FDI. These questions concentrate only on FDI spacing decisions and do not offer the answer to the question of "when" (FDI timing). The order (whether to enter first, early, or late) and correlation with the entry of companies from other industries have widespread consequences for performance and survival in a new environment. Companies must decide whether it is best for them to export goods, license, or invest abroad. The theoretical literature focuses on several factors explaining FDI timing and patterns such as cost minimization, cost-benefit analysis, risk and uncertainties issues, and strategic decisions.

Aliber (1970) and Buckley and Casson (1976) develop a neo-classical model of cost minimization. Fixed costs, costs associated with technology transfer, other costs/benefits that result from the differences in production environments, and market growth, indicate whether a firm should produce in the home country and export its goods, license, or move its production to a foreign country to maximize its profit. This model ranks exporting, licensing, and FDI in ascending order of fixed costs and in descending order of variable costs. Therefore, changing from export or license mode to FDI mode occurs at time *t* only if it lowers recurrent variable costs or non-recoverable set-up costs. The described model together with other cost-driven approaches is deterministic and uncertainty plays no role.

Building upon Dunning's eclectic paradigm and upon the extant state of FDI timing literature, Rivoli and Salorio (1996) extend the literature by investigating "when" companies engage in FDI. They claim that when environmental uncertainty is high, or information and

uncertainty are exogenous (e.g., in transition economies) and information is received, the timing of FDI does not depend on cost minimization or profit maximization. If FDI is partially irreversible, or can be delayed in the presence of uncertainty, it can be more profitable for a company to exercise the "wait and see" option. Specifically, to delay FDI until the crucial information arrives.

Another model that deals with investment uncertainty is based on Levins' (1962, 1968) theory of niche width, and is called population ecology of organizations (Hannan and Freeman, 1977). Their explanation for investment timing rests in the difference in companies' investment strategies. They claim that some companies develop a generalist structure that is not optimally adapted to any single environment configuration. Therefore, when a new, unstable, and uncertain product market emerges (like in case of transition economies) that can be characterized by radical change; these generalist organizations will be the first to enter this market. Other companies – "specialized organizations" – will invest only in stable and certain environments. The companies that invest in earlier periods of market development or in beginning stages of product development take a higher risk, but they also have the first mover advantage and the best chance of success. Companies that expand their production at later stages invest in markets with reduced uncertainty, but have to deal with existing rivalry, and therefore look for new sources of efficiency.

The literature on FDI trends is not very extensive. Most of the articles follow the path of changes in FDI magnitude (Cheng and Stough, 2007) and location (Chao, 2003; Sethi, et al., 2003) over time. These trends are very often connected to changes in economic or political environment and thus to changes in FDI determinants (discussed in preceding subchapters) that affect investor decisions. However, none of these studies explore the correlations among

different investments in a region that might influence investor decisions and therefore do not explain the FDI development path in the meaning used in this study. Some attempts to clarify the process of FDI development were made by Johanson and Vahlne (1977) and by Sethi et al. (2003). Johanson and Vahlne's study is based on the empirical observations of Swedish firms. They noticed that firms tend to extend their operations to foreign countries in small incremental steps. The first step is to explore a market via an agent, then open a sales subsidiary, and finally begin production.

In addition, the production process often evolves over time. It begins with the least complex manufacturing activities and later gradually adds more complicated ones. Sethi et al. studied trends in US FDI inflow into Western Europe and Asia between 1981 and 2000. The authors try to identify and validate the factors that cause changes in FDI trends. Some of their results seem to confirm the hypothesis that this study explores. In particular, they claim that regions with the best combination of the traditional FDI determinants have the largest advantage in the initial FDI flow. However, the mix of FDI determinants varies between low-wage countries and developed economies. In addition, accumulation of the "intense competitive pressures in the original host region" forces MNEs to seek cost reductions through investment in low-wage regions. In addition, Sethi et al. underline investor-friendly liberalization polices, as well as a stable political and economic environment, as important determinants of FDI.

What is missing in those studies and is explored in this research is the investigation of FDI location choice trends at a sub-national level and the disaggregation by industries, or at least sectors (e.g. primary, manufacturing, services). Disaggregation by industrial sectors or by individual industries alters the importance of location choice determinants. Expanding the research on FDI trends by incorporating these two factors can give a better understanding of the

patterns of FDI. Another innovative aspect of this study is the analysis of the timing of investments in a particular industry relative to prior investments in other industries in the same region.

Full understanding of FDI trends, in particular the agglomeration processes, is possible only by analyzing space and time aspects of FDI. Researchers single out the main FDI location choice determinants in multi-national and sub-national studies. One of the important factors that affect investor decisions is the presence of other companies in a region. It can have multiple consequences for the agglomeration patterns of FDI. Certainly, a large amount of competition could deter investment in a region, but it can also encourage investment by showing that profit in a region is possible and that the risk of investment manageable. These all depend not only on region determinants but also on the characteristics of the companies in the region. This is where this study advances the literature. I ask how the presence of different industries in a region (together with region characteristics) influences foreign investors' decision. The study is possible only if I disaggregate the market and analyze each industry separately taking into account temporal patterns of FDI.

CHAPTER 3

EMPIRICAL STUDIES OF FDI

The existing empirical studies (listed in Table 3.1) on regional FDI location take into account four main groups of determinants of location choice. These are: 1) production costs, including labor market conditions such as costs, quality, and availability of labor, input costs, and other costs associated with production of goods and services, 2) demand for the foreign company products in each region; 3) agglomeration effects; and 4) the public policy environment for foreign investment. The detailed discussion of the current state of empirical literature on FDI determinants is presented in the remainder of this chapter.

Production Costs

One of the reasons for foreign market exploration is to seek cost reduction. As discussed in the preceding chapter, cost reduction motivation for firms can be found in location theory as well as in Dunning's eclectic paradigm. Among the many variables used in empirical studies of location choice, the most important are wages and other labor costs (Weber, 1909; Head and Mayer, 2004). Variables such as unemployment rate, wages, availability of highly educated workers, and quality of labor serve as a proxy for the region's labor expensiveness and attractiveness.

The regional unemployment rate is a statistically significant determinant of labor availability in sub-national studies (Coughlin, et al., 1991). The research results are mixed with regard to the sign of unemployment rate variable. Some researchers claim that a high unemployment rate can indicate low local demand for a firm's product or lack of suitable employees (Carlton, 1983; Hogenbirk and Narula, 2004), which in turn can discourage FDI in a

region. On the other hand, high unemployment lessens the costs of production and services in a region and serves as a proxy for labor availability (Woodward, 1992); this situation would be indicated by a positive relationship between unemployment rate and FDI in a region.

In general, there is a significant negative relationship between the level of wages and the number of foreign firms in the region. Higher wages deter FDI (Bartik, 1985; Luger and Shetty, 1985; Coughlin, et al., 1991). However, the agglomeration of companies in a region creates greater employment possibilities, which as a result encourage migration of the labor force (Krugman, 1991). The wage factor is especially important for foreign companies building new plants in a foreign market (as opposed to companies engaged in cross-border acquisitions). Nocke and Yeaple (2004) develop an assignment theory of FDI to explain multinational FDI mode choice. They show that wage levels in the home and host countries are very important for green-field investors, and factor price differences are considered in cross-border acquisitions. A number of studies found the wage rate to be a statistically insignificant factor (Lucas, 1993; Tsai, 1994) and some even show a positive correlation between the wage rate and FDI in a region (Culem, 1988; Shamsuddin, 1994).

Even though the real wages reflect labor costs, they do not seem to be the best proxy. This is because high wages do not reflect high unit labor cost. Actually, in some cases, high wages result from high labor productivity. To control for such cases researchers include an education variable. Attinasi et al. (2006) run a series of regression models that use secondary education of the labor force to measure the skills of the workers in the Czech Republic, Hungary and Poland. They find the effects of the quality of the labor force to be positive and significant. A more recent study that discusses production costs and labor costs in particular, in relation to FDI in Central and Eastern European countries was made by Leibrecht and Scharler (2009).

They find that low unit labor costs encourage foreign investments, even in the presence of employment protection legislations.

Many authors who include production costs in their models look at a region or country's infrastructure. There is no doubt that telecommunication infrastructure is a very important factor in foreign firm's location decisions. However, there are conflicting empirical results about the relationship of regional infrastructure development, investments, and the number of foreign firms in the region. Coughlin et al. (1991) and Glickman and Woodward (1988) find that transportation infrastructure has a significant positive effect on FDI. Martin (1998), who analyzed 104 European regions between 1978 and 1992, noticed that although all infrastructure endowments seem to have a positive effect on convergence between poor and rich regions and when they are put together, only the contribution of telecommunication infrastructure is significant.

Demand Conditions

The demand oriented location theories, together with the market and output size hypothesis and Dunning's eclectic paradigm, can justify the importance of demand conditions being included in the model. One possible method to test the market size hypothesis is to find out whether or not the share of FDI from a given country (or region) going to a group of host countries (regions) is correlated with the individual income level of the host country (region). The empirical country-level studies reveal a positive correlation and confirm this hypothesis. Alternatively, the empirical regional studies seem to have conflicting results. Some studies show that foreign companies tend to locate in regions where the labor force is the cheapest (Carlton, 1983; Coughlin et al., 1991; Woodward, and Rolfe, 1993) and other analyses report a negative correlation between per capita income and the volume of FDI (Békés, 2005; Deichmann and

Karidis, 2005). These theories center the location choice decision in market distribution and size, as well as the location of a firms' competitors. The importance of the relationship between location and demand for a firms' output is significant only in the presence of transportation costs. Economists incorporate demand into location using a "market potential" index approach first introduced by Harris (1954). It is an abstract indicator of the intensity of possible contact with markets. Harris argues that attractiveness of the region as a production site depends on its access to other markets. He defines market potential as a weighted sum of the purchasing power of all regions, with the weights depending inversely on distance. The theoretical as well as empirical background for the use of market potential in studies of the distribution pattern of economic activities was offered by Krugman (1992), Fujita and Krugman (1995), and Fujita et al. (1999). They obtain market potential functions from formal spatial general-equilibrium models, where the market potential of region *i* is defined as the sum of the region *i*'s real gross domestic product (denoted by GDP_i) and real GDPs of all other regions weighted by their distances to the region *i (*denoted by d_{pi} and measured in kilometers) and is calculated according to the formula:

$$MP_i = GDP_i + \sum_{p=1, p \neq i}^{I} \frac{GDP_p}{d_{pi}} \qquad (1)$$

Where $i = 1, ..., i$; i represents the number of regions.

The theory and conducted studies suggest that firms are more likely to locate in regions with greater market potential (Head et al., 2004; Crozet et al., 2004). In a more recent study, Blonigen et al. (2004) use both a traditional and modified version of market potential, called surrounding market potential. In their version of the gravity model with surrounding market potential, they exclude the host region GDP, which is included as a separate predictor variable. Their results suggest that the host GDP and surrounding market potential have contradicting

effects on new FDI in a region. They find a positive correlation among FDI and host region GDP and a negative relation between FDI and market potential (both traditional MP and surrounding).

Many other variables can serve as good determinants for demand conditions. Among them is a country's population, population share, or population density. Population share is defined as the share of the region's population in the total country population. Population density is defined as the number of people per square kilometer for in the region. Regardless of what variable is used in the study, all tend to show a positive correlation with FDI in a region (Boudier-Bensebaa, 2005; Smith and Florida, 1994).

Agglomeration Effects

The theoretical background for agglomeration effects of foreign investment can be found in the new location and endogenous growth theories, discussed in the preceding chapter. Empirical studies appear to confirm the theory and show that the presence of a large number of other competitors in the region will attract foreign investment (Crozet et al., 2004; Békés, 2005). In particular, most industries have a strong tendency to settle where other similar firms have already settled. These positive agglomeration effects exist because of inter-firm technological spillovers, specialized labor, and intermediate inputs (Marshal, 1920; Head et al., 1994).

Two issues here are noteworthy. One is the idea of FDI patterns and another is timing of FDI. Both issues are very complex. Patterns of FDI are a novel idea in location choice studies. Therefore, the literature on this subject, both theoretical and empirical, is very scarce. Timing of FDI is also a very complex subject of location choice study because it involves not only the analysis of costs and benefits s but also an evaluation of risk and uncertainty. In transition economies, such as Poland, investment is associated with some risk. Large investments occur in

countries that offer stable and enforced laws and favorable political environment. Small investments will come first since even failure does not affect a company's existence. For example, before 1989 there were no direct foreign investments in Poland. The first most visible FDI was by fast food restaurants, such as McDonald's; the first was opened in Poland in 1992, KFC (1993) and Burger King (1994). Large investments are more risky and therefore occur later in the FDI cycle. The presence of manufacturing firms again increases interest of companies producing in service industries for two reasons. One is the increased wealth of domestic workers that results in the demand for multiple services. The other is vertical input-output linkages between sectors (Nefussi and Schwellnus, 2007). In addition, Head and Ries (1996) develop the monopolistic-competition model to show that FDI stimulates vertical supply chain investment.

Because of the lack of detailed data, the vast literature on aggregation effects in regional studies does not take into account what kind of investments were previously made in the location. Only the aggregated information on previous FDI or overall industry (such as number of manufacturing/services firms) is considered (Woodward, and Rolfe, 1993; Guimarães, Rolfe, and Woodward, 1996; Coughlin and Segev, 2000; He, 2002; Boudier-Bensebaa, 2005). Yet, it is observed that companies of the same type tend to reside in the same geographical area. To list a few examples: software and high-tech firms are located in Silicon Valley, CA, the movie production industry concentrates its activity in Hollywood, CA, financial services can be found in New York City, NY. This suggests that it is important for a company's success to co-locate with similar companies.

Political Environment

International, national, and regional policies are very often used as determinants of a foreign firms' location choices. The presence of a political factor is supported by location theory

and Dunning's OLI paradigm. Host government decisions and successful implementation of economic reforms in a region indicate a stable macroeconomic environment and decreased risk of the investment. Government can encourage foreign investment in a region or country by setting low barriers to entry, low taxes or creating green-fields. Such policies are very effective, especially when they are linked to other location determinants.

Békés (2004) finds spending money by local government to encourage foreign investments in regions without prior FDI is an inefficient allocation of money because of the existence of agglomeration effects. Békés highlights the importance of the labor and suggests that policies that encourage labor migration should be financed as an alternative option. In addition, an improved relationship between suppliers and multinationals is the key to fostering more investment. Taking into consideration the importance of closeness of similar firms as well as suppliers, Békés claims that investing in transport infrastructure should be beneficial. Very often, the local government's investment expenditure can serve as a good proxy for government commitment in the regional development. Finally, some economists claim that inward foreign investment can be treated as an indicator of an economy's openness, which as a result, leads to economic growth (Baldwin 2003).

Table 2.1 Empirical FDI Literature

Author/Authors	*Year*	*Country*	*Industry*	*Methods used*	*Variables and statistically significant results*
Carlton	1983	USA	Fabricated Plastic products, Communication Transmitting Equipment,	Conditional logit model (CLM)	Wages – Labor availability + or – (depends on industry) Engineers + Natural gas / electricity price –
Coughlin, Terza, and Arromdee	1991	USA	Manufacturing	CLM	State land + State per capita income + Wage – Unemployment rate + Spending to attract FDI + Manufacturing density + Unionization +
Hill and Munday	1991	United Kingdom (Wales region)	No industry specified	OLS	Average Welsh male weekly earnings to the UK equivalent - Annual rate of growth of the production index + Regional financial assistance to direct investors + Infrastructure spending +
Woodward, and Rolfe	1993	Caribbean Basin	Manufacturing	CLM	Per capita GNP + Wage rate – Political stability + Tax holiday length + Profit Repatriation Restrictions – Free Trade Zones + Exchange Rate Devaluation + Inflation Rate – Transport Cost – Manufacturing Concentration +
Felsenstein	1996	Israel	High technology	Utility maximizing logit model	Size of firm + Technological level R&D Employment intensive – High technological intensity of product – High technological intensity of process + Life cycle characteristics –
Guimarães, Rolfe, and Woodward	1996	Puerto Rico	Manufacturing	Maximum Likelihood	Distance – Population density – Manufacturing agglomeration +

Cheng and Kwan	1999, 2000	China	No industry specified	A partial stock adjustment model and Generalized Method of Moments	Labor cost + Agglomeration economies + Roads infrastructure + Policies +
Cantwell and Iammarino	2000	United Kingdom	Innovative activities by large industrial multinational corporations	OLS and Revealed technological Advantage Index	Hierarchy of regional centers
Guimaraes, Figueiredo and Woodward	2000	Portugal	Manufacturing	CLM	Total manufacturing agglomeration + Industry specific agglomeration + Service Agglomeration + Labor costs + Education + Distance +
Coughlin and Segev	2000	USA	Manufacturing	Negative binomial model	Education + State and local taxes as a % of gross state product – Counties with interstate highway + Population + Labor cost – Agglomeration economies +
Mano and Otsuka	2000	Japan	Manufacturing	OLS	Base-period employment – Ratio of large establishments + Urban congestion – Congestion on employment growth –
Basile	2001	Italy	Manufacturing	NEGBIN2 / Poisson regression model	Market + Public Infrastructure + Manufacturing Agglomeration + Stock of Foreign-owned manufacturing plants + Education +
He	2002	China		GLS	Agglomeration economies + Urban population density + Number of telephones per 100 people +
Togo and Arikawa	2002	Malaysia	Electronics	CLM	Agglomeration economies + Industry agglomeration + Industrial estate +
Deichmann, Karidis and Sayek	2003	Turkey	Manufacturing and services	CLM	Paved roads as a percentage of province total + GDP per capita + Student to teacher ratio – Bank credit/GDP + Agricultural value /GDP – Agglomeration (previous FDI) +

Fazekas	2003	Hungary	No industry specified	OLS	Education + ratio of employees in industry + distance of the region's center from the Austrian border –
Hogenbirk and Narula	2004	The Netherlands	No industry specified	CLM	Local agglomeration - Foreign agglomeration + Market size + Unemployment + Land area – Holding companies +
Crozet, Mayer and Mucchielli	2004	France	No industry specified	CLM	proximity of same home country firms / other foreign firms / French firms + Market potential + Distance to home country –
Békés	2005	Hungary	Manufacturing	CLM	Per capita income + Region size + Own industry's output + Local supplier access + Non-local market access + Local raw material access + local business services access + Local industry wage + Distance from borders +
Boudier-Bensebaa	2005	Hungary	No industry specified	Linear regression model	Labor availability + Demand conditions + Agglomeration effects +
DePropris, Driffield and	2005	Italy	High / Medium high / Medium low / Low technology industries	CLM and Poisson model with fixed effects	Local industrial systems+ Marshallian industrial district +
Deichmann and Karidis	2005	Poland	Manufacturing and services	CLM	Special Economic Zone + GDP per capita + Unemployment – Number of crimes per capita – Access to the EU by road or sea – University enrollment + Salary + Financial intermediation +
Barrios, Gorg, and Strobl	2006	Ireland	Manufacturing and High-tech vs. Low-tech.	CLM	Localization + Urbanization – Transportation infrastructure – Foreign Share + Nationality +

CHAPTER 4

MODEL

FDI location choice models in the literature often do not reflect the dynamic character of the FDI adjustment process. They assume that the economies, and therefore the foreign investment stocks, are in equilibrium. Yet, this may not be true. According to economic theory, firms maximize profits or minimize costs. A company will invest until the profit is equal or greater than zero. The presence of foreign investors in a country or a region increases costs of production by increasing wages, decreasing the available labor force or creating a more competitive market, and therefore slows down the adjustment process. This is a dynamic process that in the end results in equilibrium. For example, in India, the FDI in the IT sector was very dynamic over the last few decades; however, it began to slow down because of a rise in labor costs.

The model chosen in the analysis of dynamic FDI location is the partial stock adjustment approach (PSAA). The PSAA was first used in economic analysis by Chow (1967), and was later adapted to FDI studies (Cheng and Kwan, 2000; Kinoshita and Campos, 2004; Bobonis and Shatz, 2007). The approach suits this study since it lets me analyze regional characteristics, FDI regional distribution, and inter-temporal changes in FDI. By analyzing the model, I am able to confirm that the development of FDI in a region follows a Gompertz curve. Named after Benjamin Gompertz, a Gompertz curve is a mathematical, sigmoid function, which shows the process of restricted growth. The most distinguished property of this function is that growth is slowest at the beginning and end of the considered period. This research uses a Gompertz curve to present how FDI stock adjustments to the equilibrium level for each of the considered industries reflects a natural growth. Natural growth is defined as long-run growth of potential

FDI stock. The remainder of this chapter is organized as follows. The first section presents the PSAA model. The second describes a Gompertz curve.

Partial Stock Adjustment Model

The partial stock adjustment model follows Chow (1967) who first used this approach in his study on the growth in use of computers in the United States. Later the model was adapted by Cheng and Kwan to analyze FDI in China (1999, 2000). Their study was duplicated and extended by other researchers (Kinoshita and Campos, 2004; Bobonis and Shatz, 2007).

I extend the model by adding division by industry sectors and by exploring the importance of country macro characteristics. The following model description omits industry indexes for brevity. Note that the same model is used multiple times for multiple industries with one industry estimated FDI stock being the dependent variable and the remaining industries' data included as exogenous variables.

Economic theory states that in the short run, companies invest in a region as long as profit is greater than or equal to zero. In a given industry, the more companies enter the market the lower the profit share is. The process takes place until the number of companies present in a region is so large that the profit is equal to zero. This is long run equilibrium. Following the economic theory, for each industry, the FDI inflow leads the existing FDI stock, Y, to the equilibrium value of Y^*. Therefore, Y represents the industrial share of capital FDI stock in the total capital FDI stock in Poland, in a given year. The stock is disaggregated into regions and is measured in Polish Zloty (PLN).

Following Chow (1967) and Cheng and Kwan (1999, 2000), I define the process of equilibrium approaching by equation:

$$\frac{dlnY}{dt} = \alpha(lnY^* - lnY), 0 < \alpha < 1 \quad (2)$$

Equation (2) states that the percentage change in the FDI stock is equal to the weighted value of the difference between the equilibrium and existing values of FDI stock. Moreover, since$d\ lnY = \frac{dY}{Y}$, equation (2) can be rewritten as:

$$\frac{dY}{dt} = \alpha Y(lnY^* - lnY), \qquad 0 < \alpha < 1 \quad (3)$$

Therefore, the rate of change in the FDI stock depends on the existing stock of FDI and the gap between the equilibrium value and the current one. The presence of *Y* on the right side of equation (3) corresponds with the self-reinforcing effect or "positive feedback effects" and often conforms to agglomeration effects. The equilibrium adjustment process is assumed to be gradual because of convex adjustment costs and can be determined by the decline of the "positive feedback" effect of *Y* as the actual FDI stock approaches the desired FDI stock. Several authors confirm that such effects take place. To list a few, Cheng and Kwan (1999, 2000), He (2002), Chung and Kalinnis (2001), and Hogenbirk and Narula (2004) find a positive correlation between the presence of foreign companies in a region and new foreign investment in this region. For further analysis of equations (2) and (3), see Cheng and Kwan (2000).

Equation (2) can be solved as a differential equation that results in the Gompertz growth curve. This S-shaped curve represents natural growth of the FDI stock, assuming there are no changes in the factors that influence the equilibrium stock.

Note that the data used in the study are discrete points. They depict the state of the FDI stock (disaggregated into industries and regions), regional characteristics, and macro indicators at the end of each year. In the model of FDI in Poland, the regional equilibrium stock depends on multiple region features, as well as on some macro-level variables that are incorporated into

the model. Therefore, the determinants that define the equilibrium level change over time also must change over time. This process of changing equilibria is described further and presented graphically in Chapter 4.

The equilibrium level of FDI stock is not observed here, only the current value. However, empirical literature (Cheng, et al., 1998, 2000) suggests that we can estimate the unobserved equilibrium level of FDI stock. Therefore, first the econometric model of the estimated FDI stock equilibrium level is formulated. In this empirical model, all region characteristics, including the lagged estimated FDI capital stock are used as explanatory variables. Thereafter, the equilibrium share of the FDI stock in equation (3) is specified as equation (4):

$$lnY^{*}_{r,t} = \lambda + \delta' x_{r,t} + \omega' P_t + C_r + T_t + u_{r,t} \qquad (4)$$

where $\ln Y^{*}_{r,t}$ represents the natural logarithm of the estimated FDI capital stock equilibrium level in Poland in a region *r* (*r = 1, 2, 3…, R)* at time *t* (*t=2, 3, …, T*). The set of right hand side variables consists of a vector of time-dependent variables characterizing each region ($x_{r,t}$); and a vector of variables that are common for all regions and are time-dependent (P_t). The vectors of coefficients δ, ω and the vector of intercepts λ are to be estimated. The model also includes unobserved region-specific effects (C_r), time-specific effects (T_t) and the error term ($u_{r,t}$). Unobserved region specific effects could include geographical location, culture, infrastructure determinants, and other factors characterizing a region. Time specific unobserved effects include national FDI regulations, economic cycles, or any other idiosyncratic historical events that affect regions at a given point in time.

In the empirical application of the partial stock adjustment model, equation (2) is replaced by its discrete version:

$$lnY_{r.t} - lnY_{r,t-1} = \alpha(lnY_r^* - lnY_{r,t-1})$$

$$lnY_{r.t} = \big(1-\alpha\big)(lnY_{r,t-1}\big) + \alpha lnY_r^* \qquad (5)$$

Then equation (4) is incorporated into equation (5) to formulate the model used in the empirical study. Since Y_r^* is not constant, it is approximated with $\ln Y_{r,t}^*$.

$$lnY_{r.t} = (1-\alpha)lnY_{r,t-1} + \alpha\lambda + \mu' x_{r,t-1} + \rho P_t + e_{r,t}$$

$$e_{r,t} = \kappa_r + \phi_t + \eta_{r,t}; \quad r = 1,2,3,\dots,R; \qquad t = 2,3,\dots,T \qquad (6)$$

where $\mu = \alpha\delta, \quad \rho = \alpha\omega, \quad \kappa_r = \alpha C_r, \quad \phi_t = \alpha T_t, \quad \eta_{r,t} = \alpha u_{r,t}$

This dynamic panel regression model shows that the current stock of FDI depends on its past value and on the region and macro characteristics. Note that region variables include the FDI stock of companies from other (than the endogenous) industry sectors. Equation (6) is an extended version of the model used by Cheng (2000). It is extended by adding a variable that is time specific, but common for all regions (P_t).

Gompertz Curve

An important part of this study is the analysis of the FDI adjustment path towards equilibrium for multiple industries and the similarities and differences among them. A Gompertz curve has been used in multiple econometric studies showing convergence or divergence from some steady state or equilibrium. Mankiw et al. (1992) used a Gompertz curve to study the convergence of income per effective worker of a country to its steady-state level. Chang and

Kwan (1999, 2000), as well as Merlevede and Schoors (2005), use the Gompertz curve to study FDI's growth and convergence to the equilibrium level. Following, those empirical studies, I use a Gompertz curve to study FDI's stock in Poland.

If it is assumed the level of the equilibrium stock of FDI, $Y_t^* = Y^*$ for all values of *t*, it is possible to demonstrate that equation (2) can be solved as differential equation to express the Gompertz growth curve.

$$Y_t = e^{lnY_t^* - e^{-\alpha t}} \tag{7}$$

with *e* representing Euler's constant.

The Gompertz curve was first introduced in year 1825 (Gompertz, 1825). It is believed that a Gompertz curve better estimates the natural growth of FDI than a logistic growth model (that can be deduced from equation (3)) since the latter has a symmetric property (Winsor, 1932). The relationship has been shown to fit well a multiplicity of natural growth processes (which have a maximum growth constraint) including FDI. Therefore, since the twentieth century, the Gompertz curve became a tool used in medical modeling, technology adoption and economic growth modeling. According to economic theory, continuous investment in the region is possible only if the FDI in a given location is in disequilibrium. In the time-invariant case, the current FDI flow (or FDI stock) approaches the equilibrium with a rate representing natural growth in a form of Gompertz curve (Chang and Kwan, 2000). I assume that there are no changes in FDI location determinants. Figure 4.1 shows a hypothetical rate of growth according to Gompertz. The distinctive feature of the Gompertz curve is that after the slow initial growth, the FDI flow (or stock) increases rapidly and slows down at the final stage of adjustment to the equilibrium. The period depends on the case considered and can vary from minutes (in case of bacteria growth) to years (in case of population growth).

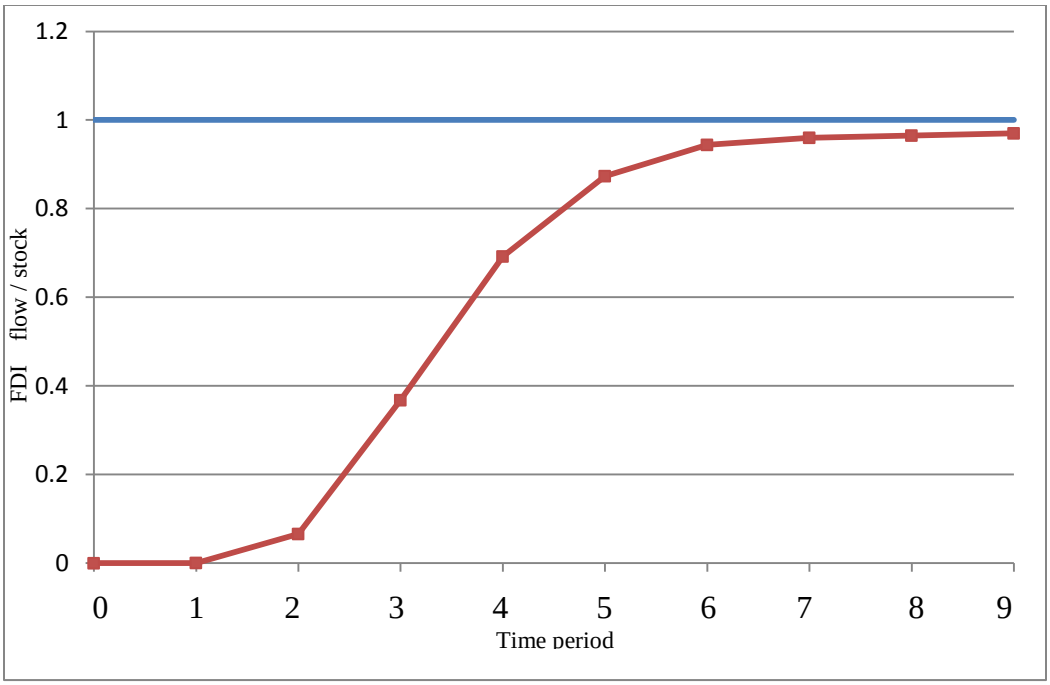

Figure 4.1 Hypothetical Adjustment Path towards the Time Invariant Equilibrium

The time-dependent case is presented in Figure 4.2. The blue sinusoidal line represents the theoretical equilibrium. The equilibrium can be defined as the state where the marginal profits are equal to zero. Moreover, it is dynamic in a way that in this steady state, any possible FDI inflows are equal to FDI outflows (the rate of FDI inflow equals the rate of FDI outflow). Investment flow is assumed to adjust to the equilibrium based on the current stock/inflow of FDI and the current state of the regional environment. Although the theoretical equilibrium is a continuous function (i.e., it changes constantly due to changes in the current value of the FDI flow/stock and region characteristics), it is possible to capture the changes in discrete points (once a year in the data set used in this study). This makes it possible to use the Gompertz curve to model the FDI adjustment path towards equilibrium.

At time t_0 current FDI stock is at point 1. The inflow will adjust according to a Gompertz curve (red curves) to reach the equilibrium flow level. However, at time t_1 the current stock of FDI (now at point 2), regional characteristics, and macroeconomic indicators have changed, and

therefore the FDI equilibrium level has changed. Therefore, at time t_1 the stock must again adjust to reach the new equilibrium level. This changing equilibrium process continuous and results in the creation of the equilibrium adjustment path that is represented by the dashed green line.

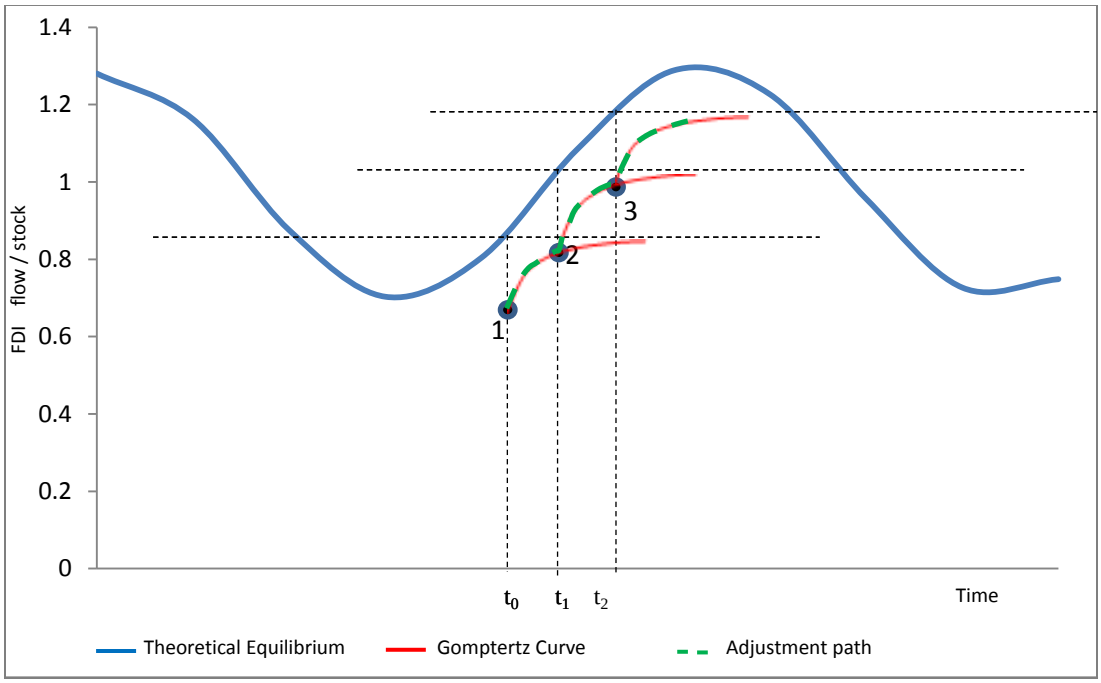

Figure 4.2. Adjustment Path towards Time-Dependent Equilibrium

CHAPTER 5

DATA

Data Description

The data used are drawn from several sources. First, I utilize a dataset that was custom created by the Polish Central Statistical Office (GUS). The dataset covers the period 1995-2005 and includes the number of companies with foreign investment greater than 50% and residing in each *powiat*. The data are part of the REGON[3] system. REGON is the National Official Register of the Nationalized Industries Units. Each company that operates in Poland is required to register in GUS to obtain a REGON identification number. OECD considers 10% of the ordinary shares or voting power of the direct investment enterprise is sufficient to indicate the direct investor's objective of establishing lasting interest in an enterprise. However, some studies (Vernon, 1971; Zhao et al., 1998) suggest that the foreign equity share is correlated positively with the scale of the international joint venture, duration of projects, value of assets brought by foreign investor, and potential exports. Therefore, using the 50% equity share threshold allows us to exclude relatively trivial foreign investments. Also, according to the "OECD Benchmark Definition of Foreign Direct Investment" (2008), a "…direct investment enterprise is either a *subsidiary* (a controlled enterprise if it is more than 50% owned by its immediate direct investor), or an *associate* (an influenced enterprise if it is owned between 10% and 50% by its immediate direct investor) or a *branch* (a quasi-corporation)." The foreign subsidiaries used in the study represent a majority of FDI in Poland. In 2002, 77.1% of companies with FDI had 50% or more of equity share from foreign investment. In 2003, there

[3] http://www.stat.gov.pl/english/bip/rejestry/regon/regon.htm

were 78.3% of such companies, in 2004 – 88.4%, and finally in 2005 – 87.2% of foreign companies were represented by more than 50% foreign investment. Next, I use the inward FDI stock data from UNCTAD's (United Nations Conference on Trade and Development) Foreign Direct Investment database. The data are at the national level and are measured in millions of PLN (Polish Zloty). For associate and subsidiary enterprises, UNCTAD defines FDI stock as "the value of the share of their capital and reserves (including retained profits) attributable to the parent enterprise (this is equal to total assets minus total liabilities), plus the net indebtedness of the associate or subsidiary to the parent firm."[4] I draw data on regional characteristics from GUS's Regional Data Bank, available at their website[5] and in GUS publications. Publications include *Statistical Yearbook of the Regions – Poland* (for years 1995-2005) and *Gminas in Poland in 1996* (1998). The data at the national level are obtained from the World Bank databank[6].

Table 5.1 provides a description of variables used in the study. In recent FDI location studies, multiple measures of FDI are used as dependent variables. Among them are the number of FDI firms in a region, the dollar amount invested by foreign firms, the net FDI inflow,[7] and the dollar amount of outputs produced by foreign companies. For the purpose of this study, an estimated industry FDI stocks in each region (*powiat*) in Poland is used as the endogenous variables. The share is calculated as: the number of foreign subsidiaries in a region and industry divided by the total number of companies with FDI in Poland. It is multiplied by the inward FDI stock in Poland and referred to as "estimated FDI stock" from now on. The FDI stock is given in

[4]http://www.unctad.org/Templates/Page.asp?intItemID=3169&lang=1

[5]http://www.stat.gov.pl/bdren_n/app/strona.indeks

[6]http://data.worldbank.org/

[7]Defined as inward minus outward FDI.

FY 2000 PLN. Because inward FDI stock in Poland shows exponential growth as illustrated in Figure 5.1, all of the independent variables also exhibit exponential growth.

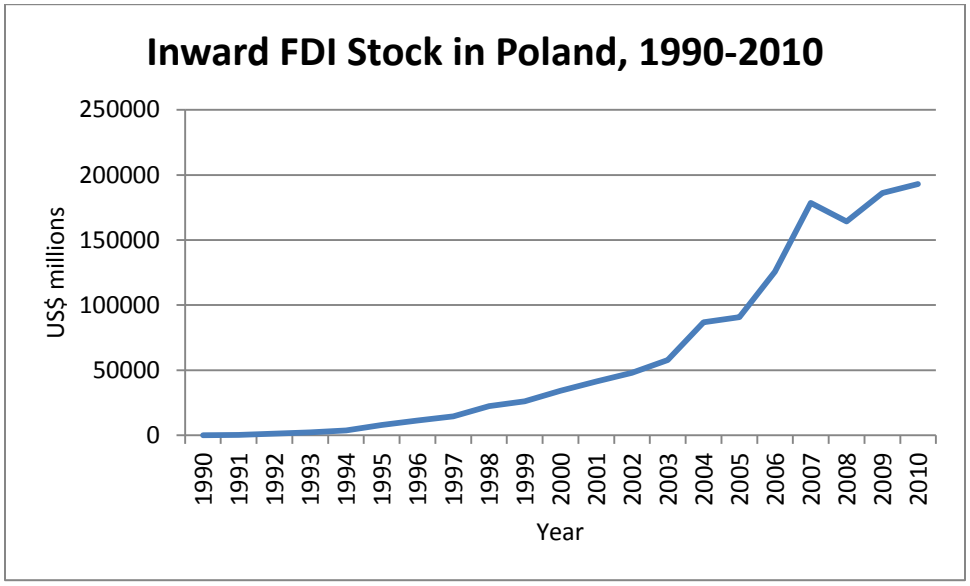

Figure 5.1 Inward FDI in Poland, 1990-2010

Because all dependent variables show exponential growth, they are expressed in natural logarithms. The exponential shape of the growth can be explained by two factors. First, the more companies with FDI are present in the region, the more the region is conceived as an attractive and safe investment place, attracting further investment. Second, there exists a positive influence of the difference between the equilibrium FDI stock level and the existing one. The more companies with FDI enter the market, the more familiar their products and services are. In addition, the market becomes saturated with the products and services, leaving less prospective buyers.

The data describing investment amounts, disaggregated into regions and industries, are gathered and maintained by the Polish Statistical Office; however, it does not provide this information because of privacy concerns. One shortcoming of my approach is that all projects/firms are treated as homogenous in a sense of size as well as economic effect.

Exogenous variables relate to the determinants of location choice. All the independent variables are lagged one and two periods and are divided into five groups representing: production costs, demand conditions, agglomeration effects, political environment climate, and macro indicators.

Production costs consist of labor market conditions and infrastructure quality. The labor market conditions include labor availability, cost, and quality. The unemployment rate (*unemp*) represents labor availability in each region. Labor costs (*wage*) are measured as the log of real average monthly wages in FY 2000 PLN in each region. An education variable (*stud*) is included to control for cases where high wages are due to high labor productivity, which is the log of number of secondary students per 10 thousands of each *powiat's* population. Infrastructure quality (*roads_perkm2*) is proxied by the log of total lengths of roads per square kilometer of the region.

Demand conditions are characterized by population density (*pop_dens*) and market potential (*mp_10k*). The Population density is the log of total population per square kilometer of area. The market potential variable, defined in Chapter 3, is the log of market size (in millions of FY 2000 PLN) of a region together with distance weighted-market sizes of its neighbors. Market size is represented by a region's GDP. For the purpose of this study, the market potential variable is normalized by the region's population size (10 thousands).

The agglomeration effects are introduced by the log of the FDI subsidiaries in a region throughout prior years, disaggregated by industries/sectors. These are the dependent variables discussed previously.

Political climate variables reflect country/local authorities' engagement in creating a welcoming environment for new FDI in a region. In this research, it is going to be expressed by

two variables. The first variable indicates the presence of special economic zones in each region (*sez*). There are 14 SEZs in Poland, located mostly in the northern and southern parts of the country (Figure 5.2). They are created to encourage regional economic development through decreases in unemployment, technological advancement, greater competiveness in the market and productive use of post-industrial property and infrastructure.[8] The variable equals 1 if SEZ is present in a region and 0 otherwise. The second variable representing political climate is the council age index. The index represents the age of people elected to municipal councils (*council_age*). The index, created based on GUS data, is the percentage of municipal council members who are 40 years old and younger, under the assumption that young people provide a better political environment for foreign investment.

Figure 5.2. Location of Special Economic Zones in Poland

Source: Polish Information and Foreign Investment Agency

The fifth group of independent variables represents Poland's attractiveness and potential as a place to invest. There are five macro variable used in this study. First, to assess labor

[8] http://www.paiz.gov.pl/index/?id=a3f390d88e4c41f2747bfa2f1b5f87db

attractiveness, I use Poland's unemployment rate as percentage of the total labor force (*PL_unempl*) and the number of researchers in research and development per million of population. To test the use of infrastructure, electric power consumption (*PL_electric_use*) is used. It is given as kWh per capita. In addition, the percentage of the population living in an urban environment (% of total) is included as a variable indicating market potential for industries other than agriculture, fishing, or mining (*PL_urban_per*). Finally, the five-year average growth of real GDP (*PLGDP_growth5*) represents the direction of economic changes in the country.

The last variable used in this study is *voiv*, which is a control variable equal 1 if *powiats* are in the same *voivideship* and 0 otherwise. *Voiv* controls for *region*-specific factors and is employed to recognize that governments at the *voivodeship* level (fist level of the territorial division) can actively promote regional economic and cultural development as well as implement policies that encourage foreign direct investment. The action of *voivodeship*'s governments can therefore influence the regional development and promotion of *powiats*.

Table 5.1 Description of Variables used in the Study.

Name	***Proxy for***	***Definition***
mp_10k	market potential	Log of market size normalized by 10 thousands of population
pop_dens	demand conditions	Log of population density (defined as: total population per km2 of *powiat*'s area)
sez	political environment	Indicator variable equal 1 if special economic zone is present in a *powiat* and 0 otherwise
council_age	political environment	Log index representing percentage of people elected to municipal councils age 40 and younger
stud_10k	labor quality	Log of total number of secondary students normalized by 10 thousands of population
unemp	labor availability	Unemployment rate
wage	labor cost	Log of real average monthly wages in FY 2000 PLN
roads_perkm2	infrastructure	Log of roads' density (defined as: roads per km2)
PL_unempl	macro indicator	National unemployment rate
PL_rd_research	macro indicator	Log of researchers in R&D (per million people)
PL_electric_use	macro indicator	Log of electric power consumption (kWh per capita)
PL_urban_per	macro indicator	Urban population (% of total)
PLGDP_growth5	macro indicator	5-year average GDP growth (annual %)
voiv	region-control	equals 1 if a *powiat* is in a *voivodeship* and 0 otherwise

Log denotes natural logarithm

Territorial Division in Poland

The data used are at *powiat* level. This territorial division in Poland has changed during the period analyzed in this study and therefore, in some cases, data needed to be adjusted to reflect those changes. The changes in Polish territorial division were due to the reforms that took place in 1999. Based on these reforms a two-level administrative division (with 49 *voivodeships* and 3157 *gminas*) was replaced with three-level territorial division (with 16 *voivodeships*, 373 *powiat*s, and 2478 *gminas* (as presented in Figure 5.3). *Gmina* (also commune or municipality) is the lowest principal administrative unit in Poland. *Gmina* can be of three types: urban *gmina*,

rural *gmina*, and urban-rural *gmina*. The largest *gmina* (by both population and area) is the capitol, Warsaw. The data covering the period before 1999 has been adjusted to the new territorial division based on the weights representing each *gminas*' population. Most of the *gminas* regions remained unchanged after the territorial division reform of 1999. However, some *gminas* were divided among other *gminas*. In all of those cases, the population was split among the *gminas* to which they were attached. Therefore, the study uses 372 *powiat*s (excluding one *powiat*) and 16 *voivodeships* according to the new division.

In the new territorial division, the *voivodeships* governments are responsible for reducing unemployment, promoting higher education, modernizing rural areas, water management, health protection, and cultural development. In addition, they can collaborate with foreign, local, or regional organizations, especially from bordering countries, in order to promote economic, educational, and cultural development in their regions.

A *powiat* is a middle-level unit of territorial division comparable to a county in the United States. Each *powiat* consists of several *gimnas*. A *powiat* can be one of two types: a land *powiat* or an urban *powiat*. The first type is usually found in rural areas, while the towns and cities are usually the second type. Among many responsibilities, the *powiat* is accountable for counteracting unemployment, construction, and maintenance of inter-community roads, and protection of public order and security.

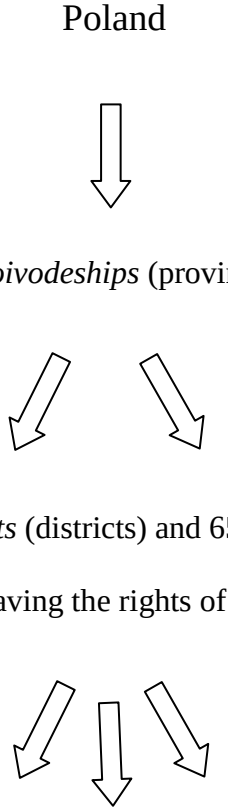

Figure 5.4 Three-Tier Territorial Division of Poland in 1999

Industries in Poland

Disaggregation into industries is done according to the Polish Classification of Activities (PKD-2004).[9] A sector is defined as a PKD-2004 section and an industry is defined as a sub-section. This study includes primary sectors and several industries. A primary sector consists of industries such as agriculture, hunting and forestry, fishing, mining and quarrying. The rest of the industries represent individual industries from the service sector. The *manufacturing*

[9] In 2007 new classification of activities was established (PKD-2007). It was created based on the NACE - the Statistical Classification of Economic Activities in the European Community.

industry includes: manufacture of food products; beverages and tobacco; textiles and textile products; leather and leather products; pulp, paper and paper products; publishing and printing; coke; refined petroleum products and nuclear fuel; chemicals; chemical products and man-made fibers; rubber and plastic products; other non-metallic mineral products; basic metals and fabricated metal products; machinery and equipment; electrical and optical equipment; radio, television and communication equipment and apparatus; transport equipment, motor vehicles, trailers and semi-trailers; and furniture.

The energy industry includes electricity, gas, and water supply. The *wholesale* industry represents wholesale and retail trade; repair of motor vehicles, motorcycles, and personal and household goods. The *hospitality* industry includes the hotels and restaurants. The *transportation* industry includes transport, storage, and communication industry. The *financial* industry is financial intermediation. The *real estate* industry includes real estate, renting, and business activities. The *health* industry includes health and social work. Finally, the *construction* and *education* industries include these respective activities. All values are as of December 31st of each year.

CHAPTER 6

ESTIMATION METHODS

Equation (6) presents the dynamic panel model used in the study. With dynamic models, the Ordinary Least Squares estimator is often inconsistent and biased (Baltagi, 2001; Hsiao, 2002). There are several reasons for that. The first is possible autocorrelation. One of the assumptions for time-series analysis is that there is no serial correlation. Following Wooldridge (2003), the assumption states as follows: "conditional on *X*, the errors in two different time periods are uncorrelated: $Corr(u_t, u_s|X) = 0,$ for all $t \neq s$." If the assumption does not hold, and errors are correlated across time, a serial correlation or autocorrelation exists. In the case of this study autocorrelation exists because of the presence of lagged dependent variables among the regressors. Since $Y_{r,t}$ is a function of C_r, therefore $Y_{r,t-1}$ is also a function of the region specific part of the error term. As a result, the dependent lagged variable present on the right side of equation (6) is correlated with the error term. The autocorrelation of the data used y was confirmed by Wooldridge's test for autocorrelation (Wooldridge, 2002).

Using the within estimator can transform the equation to eliminate C_r, but doing so creates correlation between the transformed lagged dependent variable and the transformed error term. The problem of the presence of individual effects as a part of error term might be solved by a first difference transformation that removes the C_r (region specific effects) part of the error term.

In addition, a detailed analysis of the error term was conducted. The Breusch-Pagan and Cook-Weisberg test for heteroskedasticity, the Pagan and Hall's test of heteroskedasticity, the White's general test for heteroskedasticity, as well as residual-versus-fitted plots revealed that the data used in the study exhibit heteroskedasticity. Heteroskedasticity exists if the variances of

random variables are not the same. Since another classical assumption regarding the error term does not hold, the regression results can produce biased standard errors and therefore, biased inference.

I also need to deal with an endogeneity problem. The Durbin–Wu–Hausman test for endogeneity confirmed the existence of an endogeneity problem in the study. An endogeneity problem is defined as a correlation between an explanatory variable and the regression error term. Analysis of the data shows that the endogeneity problem is a result of the dynamic model used in the study (presence of lagged dependent variable on the right hand side of the regression equation) and due to the simultaneity of some of the variables. Specifically, two-way causality may exist between the market potential variable and the variable measuring the estimated FDI stock in sub-national areas.

Another problem with the data used in the study is that Shapiro-Wilk and Shapiro-Francia tests show that some of the variables are not normally distributed, and I have no knowledge about data distribution. The panel dataset has a short time-dimension (T=11) and a larger regional dimension (R=372 in case of *powiats*).

Under such circumstances, there are two econometric methods that can help to account for the problems listed above: Generalized Method of Moments and Generalized Maximum Entropy. Both methods are used with the same functional form as alternative estimation methods.

Generalized Method of Moments

The first method suitable to problems faced with the data used in this study is Generalized Method of Moments (GMM), which was first introduced by Hansen (1982). The GMM estimator has been applied to studies with econometric problems like the ones above by

Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). In addition, the method was previously used by multiple authors in FDI studies (e.g. Cheng and Kwan, 1998, 2000; Merlevede and Schoors, 2005).

The use of GMM is justified for multiple reasons. First, the GMM estimator works well with nonlinear dynamic methods when there is no complete knowledge about the probability distribution of the data (Hall, 2003). Second, the existence of region-specific effects (fixed effects, C_r in equation (4)), which are part of the error term in equation (6), can be corrected by the use of the Arellano–Bond difference GMM estimator (Arellano and Bond, 1991). The estimator uses first-differences to transform equation (6). For simplicity $ln\ Y_{r,t} = y_{r,t}$ is used.

$$\Delta y_{r,t} = (1-\alpha)\Delta y_{r,t-1} + \Delta x_{r,t-1}\mu + \Delta P_t\rho + \Delta e_{r,t}$$

$$\text{for } r = 1,2,3,\dots,N \text{and } t = 3,\dots,T \qquad (8)$$

where Δ denotes the difference operator (i.e., $\Delta y_{r,t} = y_{r,t} - y_{r,t-1}$, and so on). The above operation eliminates unknown region-specific effects and leaves the time effect. The same procedure can eliminate the autocorrelation problem that exists due to the presence of the lagged dependent variable. The presence of the lagged dependent variable is also one of the causes of the endogeneity problem. To account for these problems, GMM uses a past level instrumental variable approach, for which the moment conditions are specified in Arellano and Bond (1991) and Blundell and Bond (1998, 2000).

The GMM estimation can be performed in one or two steps. The one-step estimator is asymptotically efficient only under homoscedasticity of the $\eta_{r,t}$ disturbances (Equation (6)). The two step estimator is asymptotically efficient and robust even in case of heteroskedasticity. Because the data exhibit heteroskedasticity, the two-step GMM estimator is used.

The overall validity of the moment conditions is checked by the Sargan test of over-identifying restrictions. The results of the study confirmed that the models and over-identifying conditions are correctly specified. In addition, the assumption that there is no serial correlation in the $\eta_{r,t}$ disturbances is tested using Arellano-Bond serial correlation tests. The tests for each regression showed that there is no serial correlation in the first-differenced disturbances. The results of the tests are included in the regressions results table (Appendix B).

Finally, the Arellano–Bond GMM estimator was designed for short time-dimension and larger region (panel) dimension, which is the case with the data used in this study. In a presence of a larger time dimension, the Arellano–Bond GMM may not be appropriate since the fixed effects mentioned above, and the correlation of the lagged dependent variable with the error term decreases over time.

Generalized Maximum Entropy (GME)

The second method used to analyze the dynamic econometric models is Generalized Maximum Entropy. GME was developed based on information theory (entropy) and first used in econometric studies in the early 1990's by Golan, Judge, and Miller.

The estimation method suits the study since it is more robust than the other estimation methods for data with collinearity and endogeneity problems. This study employs the GME specification by Golan et al. (1996) as an alternate to GMM. "The GME minimizes the joint entropy distance between the data and the state of complete uncertainty (the uniform distribution). It is a dual-loss function that assigns equal weights to prediction and precision" (Golan, 2008). In the GME method, all parameters and error terms of the model are reformulated as a set of proper probabilities defined on some support spaces. These support spaces represent the researcher's prior knowledge about parameters. In case the researcher does

not have information about the unknown parameters, the support space for each parameter should be specified as uniformly symmetric around zero, with end points of large magnitude. To provide the support for the error terms, the three-sigma rule of the dependent variable is used (Golan, et al., 1996). The GME parameter estimates are obtained using the Lagrange multiplier method.

This semi-parametrical estimation method has numerous advantages over classical methods such as OLS, Empirical Likelihood, or GMM. GME uses minimal assumptions about the data generating process, does not require assumptions or information about the data distribution, can incorporate the optimal conditions resulting from economic (or behavioral) theory, and can incorporate prior information about the parameters or the residuals (Golan, 2008). Using GME, the correction of autocorrelation and heteroskedasticity in the data can be done by incorporating additional sets of restrictions in the model. Lastly, when influential observations or outliers exist in a data panel, GME estimates have been shown to be less sensitive than classical models (Golan, 2008).

CHAPTER 7

SIMPLE STATISTICS OF DATA

Table 7.1 presents descriptive statistics of the dependent variables and regressors at the *powiat* level. Since the dataset used is cross-sectional time-series, for each variable I report means, standard deviations, and minimums and maximums that are decomposed to overall, between and within. The overall variations are calculated for all observations (across time and sections). The between variations relate to cross sectional statistics and indicate differences among *powiats*. Finally, the within variation relates to variation over time for a given section. It is also referred to as within-panel variability. In the case of this study, the within statistics show variation from each *powiat*'s average.

Looking at the mathematical definitions, overall variance is defined as $s_O^2 = \frac{1}{NT-1}\sum_r \sum_t (x_{rt} - \overline{x})^2$, where $\overline{x}$ represents the total variation around the grand mean $\overline{x} = \frac{1}{NT}\sum_r \sum_t x_{rt}$. Overall variance can be decomposed into between variance, $s_B^2 = \frac{1}{NT-1}\sum_r (\overline{x_r} - \overline{x})^2$, and within variance, $s_W^2 = \frac{1}{NT-1}\sum_r \sum_t (x_{rt} - \overline{x_r} + \overline{x})^2$. In the case of within variance, to make outcomes comparable with other results, the total mean $\overline{x}$ must be added. Adding the total mean makes it possible to have negative within minimum values of variations.

The overall and within statistics are calculated over 4092 *powiat*-years (*N*). The between statistics are reported for 372 (*n*) p*owiat*s. Eleven years (*T*) of data is used in the analysis.

Table 7.1 Panel Data Statistics.

Variable	*Units*		*Mean*	*Std. Dev.*	*Min*	*Max*	*Observations*	
Primary	Millions of PLN	overall	7.61	19.71	0.00	315.86	N =	4092
		between		16.71	0.00	144.15	n =	372
		within		10.49	-90.38	179.32	T =	11
Manuf	Millions of PLN	overall	86.98	336.53	0.00	9841.56	N =	4092
		between		302.08	0.00	5368.54	n =	372
		within		149.09	-3635.73	4560.01	T =	11
Energy	Millions of PLN	overall	1.29	9.55	0.00	265.99	N =	4092
		between		6.80	0.00	107.85	n =	372
		within		6.71	-106.56	159.42	T =	11
Construction	Millions of PLN	overall	23.52	149.77	0.00	4538.42	N =	4092
		between		130.77	0.00	2349.27	n =	372
		within		73.29	-1858.21	2212.67	T =	11
Wholesale	Millions of PLN	overall	161.73	1276.36	0.00	40928.93	N =	4092
		between		1117.33	0.00	20906.76	n =	372
		within		619.45	-15815.08	20183.90	T =	11
Hospitality	Millions of PLN	overall	11.16	71.70	0.00	2294.15	N =	4092
		between		60.14	0.00	1073.97	n =	372
		within		39.14	-885.60	1231.33	T =	11
Transportation	Millions of PLN	overall	19.30	131.45	0.00	4172.69	N =	4092
		between		113.29	0.00	2066.39	n =	372
		within		66.91	-1607.82	2125.60	T =	11
Financial	Millions of PLN	overall	5.21	81.67	0.00	2743.00	N =	4092
		between		69.59	0.00	1336.62	n =	372
		within		42.89	-1108.95	1411.60	T =	11
Realestate	Millions of PLN	overall	58.71	707.38	0.00	23764.38	N =	4092
		between		595.30	0.00	11318.17	n =	372
		within		383.24	-9344.04	12504.92	T =	11
Education	Millions of PLN	overall	2.01	21.01	0.00	731.47	N =	4092
		between		17.23	0.00	320.76	n =	372
		within		12.05	-265.95	412.73	T =	11
Health	Millions of PLN	overall	2.21	15.98	0.00	515.35	N =	4092
		between		13.52	0.00	241.54	n =	372
		within		8.54	-197.85	276.02	T =	11
unemp	Percent of unemployed	overall	2.76	0.46	0.00	3.75	N =	4092
		between		0.35	1.48	3.45	n =	372
		within		0.29	1.23	3.66	T =	11
wage	Real PLN	overall	1526.35	552.60	519.05	4407.02	N =	4092
		between		202.63	1153.80	2607.97	n =	372
		within		514.20	-265.40	3325.40	T =	11
stud_10K	Nb of secondary students per 10K of population	overall	177.48	94.14	1.08	651.44	N =	4092
		between		89.69	3.70	535.18	n =	372
		within		28.94	-26.72	583.79	T =	11

pop_dens	Population	overall	4.95	1.26	2.97	8.43	N =	4092
	per square	between		1.26	3.14	8.39	n =	372
	km of area	within		0.04	4.49	5.64	T =	11
mp_10k	Millions of FY	overall	0.74	0.32	0.04	2.32	N =	4092
	2000 PLN per	between		0.32	0.05	2.19	n =	372
	10K of population	within		0.06	0.23	1.59	T =	11
SEZ	Indicator variable -	overall	0.19	0.39	0.00	1.00	N =	4092
	equal 1 if region is	between		0.35	0.00	0.82	n =	372
	SEZ	within		0.19	-0.63	0.37	T =	11
council_age	Percent of	overall	0.21	0.07	0.00	0.83	N =	4092
	municipal council	between		0.05	0.06	0.35	n =	372
	pop below 40 y old	within		0.06	0.04	0.76	T =	11
roads_perkm2	Roads per sq. km	overall	0.51	0.42	0.02	6.23	N =	4092
	of region	between		0.35	0.21	3.31	n =	372
		within		0.22	-1.33	3.43	T =	11
PL_unempl	Unemployment	overall	15.51	3.38	10.70	19.90	N =	4092
	total	between		0.00	15.51	15.51	n =	372
	(% of labor force)	within		3.38	10.70	19.90	T =	11
PL_RD_research	Researchers	overall	1485.44	74.81	1359.29	1627.35	N =	4092
	in R&D(per	between		0.00	1485.44	1485.44	n =	372
	million people)	within		74.81	1359.29	1627.35	T =	11
PL_electric_use	Electric power	overall	3244.69	105.97	3061.48	3437.32	N =	4092
	consumption	between		0.00	3244.69	3244.69	n =	372
	(kWh per capita)	within		105.97	3061.48	3437.32	T =	11
PL_urban_per	Urban	overall	61.59	0.06	61.50	61.70	N =	4092
	population	between		0.00	61.59	61.59	n =	372
	(% of total)	within		0.06	61.50	61.70	T =	11
PLGDP_growth5	RGP growth	overall	4.23	1.21	2.30	5.85	N =	4092
	Average of	between		0.00	4.23	4.23	n =	372
	5 years	within		1.21	2.30	5.85	T =	11

The summary statistics show that all independent variables, except for macro (*PL_unempl, PL_RD_research, PL_electric_use, PL_urban_per, PLGDP_growth5*), *wage*, and *council_age* variables, display greater variation between *powiat*s than over time.

The highest overall standard deviation from mean is observed for the wholesale and real estate industries. It is equal to PLN 1276.36 million in the wholesale industry and PLN 707.38 million in the real estate industry.

For the dependent variables used in the study, the between *powiat*s variations range from PLN 6.80 million in the energy industry to PLN 1,117.33 million in the wholesale industry. Within variations are equal to PLN 6.71 million and PLN 619.45 million, respectively.

Among the regional characteristics, the *wage* variable has the largest overall variation (equal to PLN 552.60). The macro variable with the smallest overall variation is the urban population as a percentage of total population (PL_urban_per) and is equal 0.06. Since macro variables are equal in value for all *powiat*s in any given year, they do not show variations between regions.

In addition, the summary statistics show that the industries with the largest capital stock of FDI are manufacturing and wholesale. The industries with the lowest FDI are energy, education, and health.

Figures 6.2, 6.3, and 6.4 present box-and-whisker diagrams of the estimated capital stocks of FDI for the manufacturing, wholesale, and financial industries, respectively. The graphs display the patterns of growth of FDI, revealing diversity between *powiats* and industries.

The energy, financial, education, and health industries display a very low capital stock of FDI. As Figure 7.4 shows, the median are equal zero and multiple greater than zero outliers are present.

The primary sector and hospitality industry show growth in the stock of FDI over time (Figure 7.1). Only a few outliers, representing significantly higher investments in each year are observed, but they were removed from the graph for clarity. The analysis of outliers reveals that the FDI stock was present at much greater levels in big towns than in other regions. For the remaining regions, the median is close to zero, the upper 75 percentile is positive, ranging from PLN 1.89 million in 1995 to PLN 16.62 million in 2004. The remaining industries

(manufacturing, wholesale, transportation, and real estate) received more foreign investment (Figures 6.2 and 7.3). However, the general trend of stable growth in investment over the years is clearly noticeable.

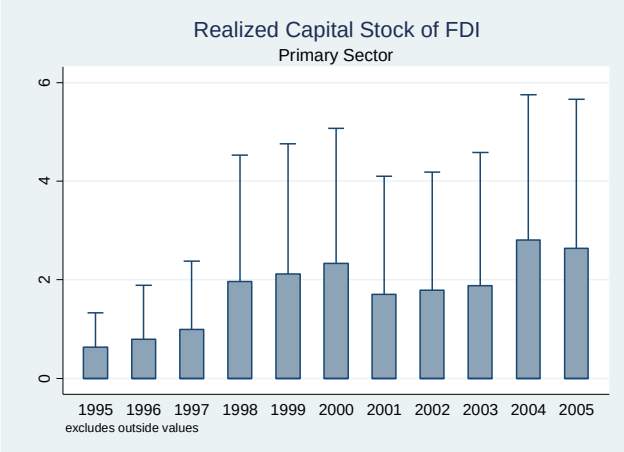

Figure 7.1 Estimated FDI Stock, Primary Sector

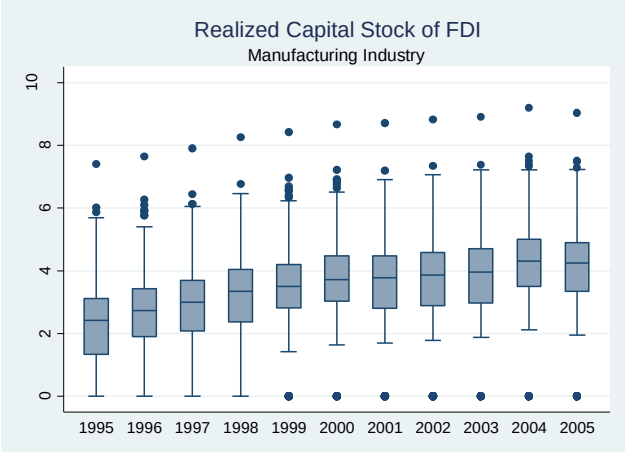

Figure 7.2 Estimated FDI Stock, Manufacturing Industry

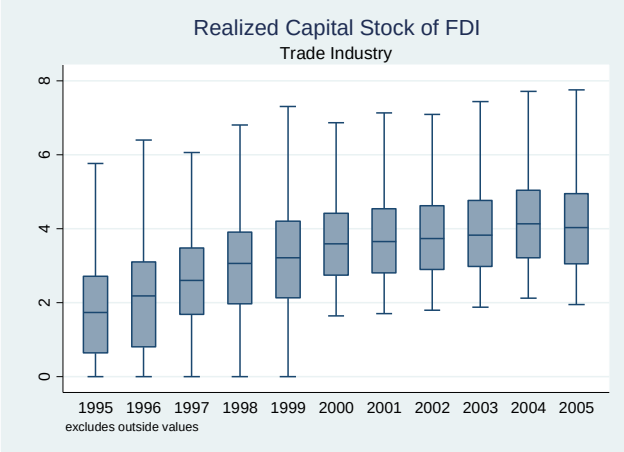

Figure 7.3 Estimated FDI Stock, Wholesale Industry

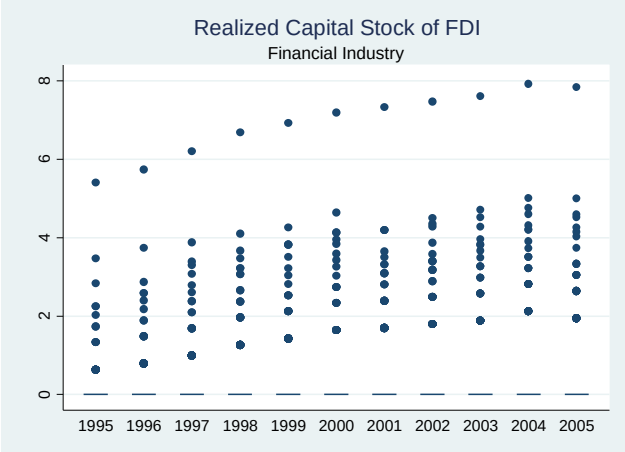

Figure 7.4 Estimated FDI Stock, Financial Industry

Since this *powiat* level study is based on multiple regressions, each with a different endogenous variable, the correlations between all of the dependent, and independent variables used in the study should be analyzed. Correlation coefficient matrices are presented in Tables A.1 and A.2. Table A.1 shows the correlation matrix for the dependent variables, all of which are statistically significant at the 5% level or better. Table A.2 displays the correlation matrix for the independent variables. Since only some of the correlations are statistically significant, I include a star to indicate the correlation coefficients that are significant at the 5% level or better.

The correlations between the variables representing estimated FDI stock disaggregated into industries is positive and statistically significant in each case. The highest correlation is observed between estimated industrial FDI stock and its lagged levels. All of the correlation coefficients are greater than 0.8, except for primary industry. The correlation of primary industry with other industries is 0.4.

Analysis of the correlation matrix for the independent variables (Table A.2) reveals that in case of *powiats*, the correlation coefficients range between -0.75 (for national unemployment, lagged to periods, and 5-year average RGDP, lagged one period) and above 0.8 (for lagged number of researchers in R&D per million of population and macro variable electric use).

The presence of highly correlated variables in the model affects the results. The coefficient estimates may change randomly in response to even small changes in the model or the data and give incorrect results. There are multiple possible solutions to this multicollinearity problem: the model can be left as is; one or more of the highly correlated variables can be removed; some additional data can be used; the predictor variables can be mean–center; the independent variable can be standardized; or the data can be transformed by using ratios or first differences. Each of these solutions has advantages and disadvantages.

The data used in the study show signs of multicollinearity. The regression models were tested for multicollinearity using a variance inflation factor (VIF), and the squared root of VIF. Hair et al. (2006, page 201) defines the variance inflation factor as the inverse of tolerance value (the amount of variability of the selected independent variables not explained by the other independent variables). The square root of VIF is the degree to which the standard error has been increased due to multicollinearity. The results show that regressions with multiple exogenous variables representing estimated FDI stock exhibit multicollinearity (VIF is greater than 10). However, the objective in this study is to show the correlations and aggregation affects among industries, thus even though the data show signs of multicollinearity, in some cases, highly correlated variables have to be used. Transforming the variables and using mean-centered or standardized predictor variables did not solve the problem of high correlation of variables. Therefore, the solution to the multicollinearity problem in this study is the use of proper econometric models, such as GME and GMM.

CHAPTER 8

REGRESSION RESULTS

The goal in this study is to determine how previous presence of FDI's stock disaggregated into industries and region characteristics influence foreign investors decision about location. The study is conducted at middle level of Polish's territorial division called *powiat*. There are two kinds of *powiat*s in Poland: proper *powiat*s (also known as land counties) and cities with *powiat* status (city counties). Among many others, *powiat*s are responsible for maintaining good infrastructure, high school education, public transport, healthcare, and issuing work permits for foreign employees. They can therefore influence regional characteristics. If this is the case, a *powiat*s-level study should reveal strategies that local governments can undertake to increase a region's attractiveness for foreign investors. To evaluate agglomeration effects and the determinants of FDI at the *powiat* level, a partial stock adjustment model, discussed in CHAPTER 4, is used. To estimate the Equation (6), GMM and GME estimation methods are used. The GMM and GME are chosen to deal with multiple econometric problems that were encountered with the data and model I intend to use. The closer discussion on this subject can be found in CHAPTER 6.

The implementation of the GME procedure requires the use of prior knowledge about the unknown parameters β, in terms of specification of the possible parameter space. This knowledge should be based on economic theory or prior information a researcher might have. It is incorporated into the GME procedure to specify the support spaces, as discussed in CHAPTER 6. When it comes to the size of the support spaces, Golan et al. (1996, page 138) claim: "As the parameter supports are widened, the GME risk functions modestly shift upward reflecting the reduced constraints on the parameter space. Hence, wide bounds may be used without extreme

risk consequences if researcher's knowledge is minimal and we want to ensure that Z contains β. Intuitively, increasing the bounds increases the impact of the data and decreases the impact of the support."

For each regression in this study, all parameters and errors have five support points that are symmetrically distributed around zero. With respect to the choice of support vectors for the parameters, a sensitivity analysis was conducted. In particular, new regressions were run with changed support vectors for the parameters and unchanged support vectors for the errors. Initial parameters support vectors were chosen with values exceeding expected parameter values and then appropriately reduced in subsequent regression runs. Error support vectors were chosen using three-sigma rule and kept constant for all regression runs. The regressions yielded unchanged coefficients, suggesting that the support points were chosen correctly.

Golan et al. (1996) suggest that selection of the support bounds of the error terms should be made according to the 3σ rule. This indicates that the error bounds, described in chapter 6, should be equal -3σ and 3σ, where σ represents empirical standard deviation of dependent variable. I used the 3σ rule to select the errors' support vector ranges in each regression.

Table B.1 and Table B.2 present the regression results. Table B.1 shows the results of regressions done using Generalized Method of Moments and Table B.2 shows the results of regressions done using Generalized Maximum Entropy.

The exogenous variables in the regressions are chosen based on the economic theory and the understanding of the economic model being studied. Variables for each model are chosen from among the variables representing estimated FDI stocks disaggregated into industries, variables representing regional characteristics, and macroeconomic indicators.

Since local governments at the first level of territorial division (*voivodeship*) can implement policies that promote a regions' attractiveness for future foreign investments, I also include a dummy variables (*voiv*) that controls for those regions in each regression. *Voiv* variables are not reported in the regression tables.

In the case of GMM, the instruments' validity was tested using the Sargan test of over-identifying restrictions. The test was accepted for all of the regressions. In addition, Arellano-Bond serial correlation tests were performed, which showed that there is no serial correlation in the first-differenced disturbances.

I only discuss the results from the GME estimation method. Both methods give comparable results. However, the GME estimation method results have smaller standard errors. The estimation results are later compared with the results from the GMM regressions.

Effects of Lagged Dependent Variable

One period lagged dependent variables in all the models show very strong, positive, and statistically significant agglomeration effects. The presence of previous investments in the same industry is the main factor that companies consider when choosing the location for investments. In each case, the coefficients on the one period lagged dependent variable are statistically significant at the 1% level. The coefficients range from 0.501 in case of the education industry to 0.886 for the wholesale industry (Table B.2).

Two period lagged dependent variables have a negative effect on future investment in the region for all industries, except manufacturing and construction. For the manufacturing industry, the two periods lagged dependent variable is positive but smaller than one period dependent variable coefficient and is statistically significant at the 1% level. The results show that a 1% increase in FDI stock in the manufacturing industry is associated with a 0.174% increase 2 years

from later and a 0.868% increase one period later. Similarly the for construction industry, the coefficient on the two-period lagged value has a smaller effect (both statistically and in value) on the dependent variable.

Although the coefficients of two period lagged dependent variables are negative for the remaining industries, they are of very small values, and in case of the financial and real estate industries, are almost equal to zero.

Effects of Macro-Level Variable

Macro indicators were found to be a very important factor taken into account by companies that consider investments abroad. The two-period lagged national unemployment rate indicates has positive effects on FDI, when included in the model. The biggest effect is for the manufacturing industry (coefficient is equal to 1.167), followed by the construction and primary industries (coefficients equal to 0.762 and 0.414, respectively). The number of R&D researchers per million of population has varying results, depending on the industry. It has a statistically significant, negative effect on the construction industry for both periods. The one-period lagged *PL_rd_research* shows a positive effect on FDI in the primary sector and the wholesale, transportation, real estate, and education industries. In addition, the two-period lagged *PL_rd_research* has a negative effect on almost all industries (excluding education) when included in the model.

PL_electric_use has a negative effect on all industries (when included) except for the energy industry. Higher use of energy in a region results in new possibilities for companies in the energy sector, and therefore higher FDI. The effect of *PL_electric_use* on the wholesale and hospitality industries is surprising. This suggests that foreign companies in the wholesale and hospitality industries invest in less populated areas. This fact is confirmed by another macro

indicator; the percentage of population that is urban (*PL_urban_per*) has a statistically significant ($p<0.001$) negative effect on the hospitality industry.

Effects of FDI from Other Industries

The previous presence of industries other than the one represented by the dependent variable has a significantly smaller effect on future FDI than the prior presence of the industry used as dependent variable. In fact, the presence of FDI in the financial industry is not influenced by any investments from the remaining industries. However, the prior foreign investments made in the financial industry will have statistically significant positive effect on FDI in the manufacturing and energy industries, and a negative effect on FDI in the real estate and heath industries. Moreover, the prior investments in the construction, hospitality, and real estate industries do not influence future investments in any other industries.

The previous presence of investments in the primary sector negatively affects the hospitality and real estate industries. Prior investments made in the manufacturing industry had a statistically significant ($p<0.01$) effect on investments in the wholesale and transportation industries. However, the effect was not meaningful. The two-period lagged investments in the manufacturing industry (*L2.manuf*) was more statistically significant than the one-period lagged value (*L.manuf*).

Prior investments in the energy industry are a positive factor on FDI in the hospitality, education, and health industries. One-period lagged investments made in the wholesale industry will have a statistically significant, negative effect on investments made in the manufacturing industry ($\hat{\beta} = -0.064,\ p < 0.001$). However, the two-period lagged investments in the wholesale industry will have a stronger, positive effect on investments made in the

manufacturing industry ($\hat{\beta} = 0.131,\ p < 0.001$). Finally, previous FDI in the health industry constitutes a negative factor for future investments in the hospitality and real estate industries.

Effects of Variables Representing Regional Characteristics

Regional characteristics have different effects, depending on the industry considered. A higher unemployment rate (*L.unemp*, *L2.unemp*) attracts investments in the manufacturing and energy industries. However, it is a deterrent for the education industry. This is logical since companies from these sectors should locate in regions where the demand for their products and services is the highest. If included in the model, the regional unemployment rate is statistically significant at 1% level variable. Other interesting findings include the effects of labor characteristics and the cost of the labor force available in a region. When included in the model, the wage variable (*L.wage*) displays a positive effect on FDI in the energy and wholesale industries. Closer investigation of the quality of labor the force (*L.stud_10K*, *L.stud_10K*) shows that foreign companies in the financial industry are attracted by high quality workers. However, a larger educated labor force discourages investments made by the energy, real estate and construction industries.

Larger population density in a region (*L.pop_dens*, *L2.pop_dens*) has a negative effect on foreign investments, if included in the model. This might suggest that the highest investments are made in rural areas as opposed to urban ones. One period lagged market potential (*L.mp_10K*) has a positive sign for each case when present in the model. The highest and statistically significant effects are noticed for the transportation industry, followed by the wholesale industry. For these industries, the coefficients are equal to 0.88 and 0.532, respectively.

Two-period lagged market potential (*L2.mp_10K*), is negative and statistically significant at the 1% level on FDI in the transportation and wholesale industries, but is positive in the real estate industry.

SEZ (*L.sez*) displays a positive effect on the amount invested by foreign companies in the manufacturing ($\hat{\beta} = 0.25,\ p < 0.001$), transportation ($\hat{\beta} = 1.725,\ p < 0.001$), and education ($\hat{\beta} = 2.004,\ p < 0.001$) industries, but a negative effect in the primary sector ($\hat{\beta} = -1.498,\ p < 0.001$), and the wholesale industry ($\hat{\beta} = -3.431,\ p < 0.001$).

Quality of infrastructure, represented by *L.roads_perkm2* and *L.roads_perkm2*, has a positive effect on future investment in the real estate industry. Finally, the age of people elected to municipal councils (*L.council_age*) has a positive effect on future FDI investments.

Dummy variables representing *voivodeship* level, region specific effects -*voiv*- show the importance of the location and significance of the higher level, local government policies. *Voiv* variables are statistically significant at 1% level and display higher, positive coefficients for *voivodeships* located in the west and central Poland.

GME vs. GMM

GMM is used as an alternative estimation method. The results of regressions estimated with GMM are presented in Table B.1. Both of the methods are used with exactly the same functional form in the equations. To make the results comparable, the equations used for the GME estimation are first differenced and all variables that are not strictly exogenous are instrumented for with all of their available lags in levels. The instruments used in estimation with GME are identical to the once used in GMM estimation.

The results obtained using GMM are very similar to the ones obtained with GME. However, GMM produces smaller standard errors.

Both estimation methods confirm the presence of very strong agglomeration effects. The coefficients on the one-period lagged dependent variables are positive and statistically significant at the 1% level. The coefficients on the two-period lagged dependent variables are similar in magnitude and signs as the ones I obtained with GME. However, the significance level differs. GMM shows higher statistical significance for the two-period lagged dependent variables than GME.

In addition, the GMM estimator finds comparable effects of prior investments from other industries, regional characteristics, as well as macroeconomic indicators to those estimated with GME.

Conclusions

This chapter has examined the location choice of foreign investments in *powiat*s in Poland over the period 1995-2005. The analysis shows the importance of recognizing that companies from each industry take into account different regional, demographic, political, and economic characteristics when deciding the location for their investments. The results of the regressions confirm the presence of strong, positive, and statistically significant agglomeration effects. The prior presence of foreign investments from industries other than the one used as the dependent variable also were found to be an important decision factor. The presence of other industries can have a positive or negative effect. This shows the superiority of an analysis at a disaggregated, industrial level, as compared to studies at an aggregated level. Also, since the results were at the sub-national level (second level in three-level territorial division), they can be used by local governments to attract future FDI to specific areas.

CHAPTER 9

GROWTH ANALYSIS

An important part of this study is the analysis of the adjustment path to the equilibrium level of FDI for multiple industries and a comparison of the similarities and differences among industries. If some level of the equilibrium stock of FDI, $Y_{r,t}^{*} = Y_{r}^{*}$ for all values of t is assumed, it is possible to demonstrate the path towards an equilibrium stock using a Gompertz growth curve. The Gompertz curve was discussed in detail in CHAPTER 4 and is represented by Equation (7). Since I have chosen GME as a leading estimation method, I analyze the industry growth paths using the coefficients calculated with this method. GMM and GME estimators produced comparable regression results; however, the GME method resulted in smaller standard errors.

The starting value of the path is assumed to be zero. This assumption is made because the starting data used in this study represent a time when there was almost no foreign investment in Poland or the level of foreign investment was very low. Using the estimated coefficients and Equation (5), it is possible to recover the equilibrium stock of FDI in each region ($Y_{r,t}^{*}$). Given the equilibrium FDI stock, the growth rate and the assumption of a zero value of FDI as a starting point, I can estimate how long it takes each industry to achieve equilibrium. In addition, by comparing the equilibrium and realized growth paths, I am able to determine each industry's potential in absorbing further FDI. In addition, as noticed by Cheng et al. (1998), "the movements of the equilibrium stock reflect the comparative static effect of changes in policy and other exogenous variables, without the interference of the self-reinforcing effect and adjustment cost effect."

FDI Adjustment Path to Equilibrium Level

Analyzing FDI patterns and growth paths at the *powiat* level will help formulate policies and strategy recommendations for local governments. The speed of adjustment (growth rate) is equal to α used in equation (5). The rate is estimated based on the GME's one-period lagged dependent variable coefficient estimation. It depicts the average annual growth of estimated FDI stock for each industry.

Table 8.1 presents recovered equilibrium level (logarithmic value), estimated growth rates, and time in years needed to reach the equilibrium level for each industry studied in each *powiat*? Since the equilibrium level in each region is changing with the change in value of investments disaggregated into industries, regional characteristics, and macroeconomic indicators, the equilibrium level for each industry was chosen as an average value for the study period (1995-2005). It is expressed as the logarithmic value of millions PLN. The growth rate represents the average annual change of FDI capital stock (estimated value) between 1995 and 2005.

Table 9.1 Time needed to achieve FDI stock equilibrium

Industry	*Equilibrium*	*Growth Rate*	*Time period (in years) needed to achieve*				
			25% of the equilibrium	*50% of the equilibrium*	*75% of the equilibrium*	*90% of the equilibrium*	*100% of the equilibrium*
Manufacturing	4.60	0.13	12	17	24	31	60
Primary Sector	1.27	0.27	6	8	11	15	32
Energy	0.29	0.36	3	5	7	10	31
Construction	2.77	0.11	13	19	27	32	50
Hospitality	1.39	0.19	7	115	15	21	35
Wholesale	4.47	0.16	9	14	19	25	48
Transportation	1.63	0.35	4	6	8	11	31
Financial	0.33	0.27	6	9	12	16	32
Real Estate	2.31	0.19	8	12	16	22	40
Education	0.27	0.50	2	3	5	7	10
Health	0.39	0.41	3	4	6	9	14

The time needed to reach the equilibrium level of FDI stock is uneven among industries at the *powiat* level. The time depends on the pace of growth, as well as on the level of equilibrium FDI stock. The industries with the fastest growth in the FDI stock in the *powiat*s are education and health. The growth rate for those industries is estimated to be 0.5 and 0.41, respectively. However, these industries have low equilibrium levels, such that low levels of investments will be sufficient to reach equilibrium levels. The remaining industries have growth rates that range between 0.11 and 0.36. The lowest is observed for the construction industry. In the case of the manufacturing industry, which receives the largest share of FDI in Poland, the growth rate is equal to 0.16.

Even though Poland is considered a country with a good quality government and rule of law,[10] it is also considered a costly country when it comes to starting a business and enforcing contracts. The time to reach the equilibrium stock of FDI is long for *powiat*s because the FDI stock among *powiat*s is distributed unevenly. Foreign companies from selected industries such

[10] Based on the Worldwide Governance Indicators

as energy, financial, education, and health invest only in a small number of *powiat*s. In particular, foreign companies from these industries are present in only 15% of *powiat*s or less. Other foreign companies from industries such as construction, hospitality, transportation, real estate, and the primary sector invest in around 50% of *powiat*s. Only FDI from the manufacturing and wholesale industries is present in over 90% of *powiat*s.

All figures presented in this chapter can be found in Appendix C. Figures C.1, C.2, and C.3 show the theoretical adjustment paths towards equilibrium FDI stocks for the manufacturing industry, primary sector and the wholesale industry, respectively. The same period of time (25 years) is covered to show how different industries develop over the period. For all industries, the volume of foreign investments is very high at the beginning of the adjustment path and when closes to equilibrium. Almost all industries reach 90% of the equilibrium FDI stock in around half of the time needed to achieve equilibrium. Reaching the remaining 10% of FDI stock takes a long time due to competition and increased production costs. Industries with higher FDI stock growth rates in *powiat*s (such as education, health, energy, transportation, financial industries, or the primary sector) exhibit steeper adjustment paths (Figure C.2 and Figure C.3). Industries with a slower pace of growth (such as manufacturing, construction, hospitality, wholesale, or real estate) display a more smooth increase in the FDI stock.

To analyze the patterns of FDI in *powiats* more closely, the differences between the equilibrium FDI stock and the actually estimated FDI stock, disaggregated into several industries, is explored. The equilibrium fitted values (trend) of equilibrium FDI capital stock is presented to show the relationship between the equilibrium and the estimated FDI capital stock. Figures C.4, C.5, and C.6 present the median equilibrium, equilibrium trend and estimated median capital stock of FDI for the manufacturing, transportation, and energy industries. For

each industry, the equilibrium FDI stocks are more volatile than estimated FDI stocks. Equilibrium FDI is more sensitive to economic, social, political, and financial shocks. In addition, these three graphs illustrate three different patterns of relationships between equilibrium and estimated stocks of FDI. Figures C.4 shows that for the manufacturing industry, the equilibrium and estimated FDI stock converge over a period. The same result is observed for the primary sector, and the wholesale, financial, construction, and hospitality industries. Figure C.5, which presents the transportation industry, displays parallel paths of equilibrium and estimated FDI stock. A similar pattern is noticed for the education, real estate, and health industries. Finally, divergent paths of equilibrium and estimated FDI stock are presented in Figure C.6. This trend is present in the energy industry.

Similar trends can be found when growth rates of the equilibrium and estimated annual FDI stocks are studied. Figures C.7 and C.8 present growth rates for the wholesale industry and primary sector, respectively. The primary sector, together with the construction industry, show that the trend of equilibrium and realized annual growth rates are almost equal. For the energy industry, the FDI stock growth displays a convergence trend. Lastly, in the wholesale, as well as the remaining industries, the annual growth rates of equilibrium trend and estimated FDI stock converge at the beginning of the analyzed period, but starting in year 2000 to 2001, and then begin to diverge.

To analyze *powiat*s' potential in absorbing additional FDI, deviations of estimated capital FDI stock from equilibrium stock are calculated and presented in Figures C.9, C.10, C.11 and C.12. Figures C.9and C.10 show deviations in the manufacturing industry and Figures C.11 and C.12 show the wholesale industry. Two industries are chosen to present the trend of deviations. Each industry is presented with and without outliers. However, the graphs are also good a

representation of the deviations of estimated and equilibrium FDI stock for other industries. In all of those cases, the median is around zero. Multiple outliers confirm an uneven distribution of FDI among *powiat*s. In addition, a negative median suggests that the estimated FDI stock value is lower than equilibrium. This signals possibilities for further investments in the regions. In addition, with time, the dispersion between the estimated and equilibrium FDI stock is decreasing.

Conclusions

This chapter has analyzed foreign investment development paths. The study revealed that each industry reaches its equilibrium FDI capital stock at different pace. Some industries (such as education, health, energy, transportation, financial or primary sector) reach the equilibrium stock of FDI faster than other industries (like manufacturing, construction, hospitality or real estate).

The analyses of median capital stock of FDIs and median annual growth rates of FDI stocks show that equilibrium levels of FDI stocks are much more volatile. The equilibrium levels respond more to economic, financial, demographic, and political changes. In the case of this *powiat* level study, the shifts in the equilibrium level were so big that a trend line was introduced to make it comparable with the estimated FDI stock. Three patterns of relationships between estimated and equilibrium FDI stocks were identified: patterns of convergence, parallel paths, and divergence.

Finally, the study of the regions' potential in absorbing additional FDI was conducted. Annual deviations of estimated capital FDI stock from equilibrium stock were calculated and presented. The deviations fluctuate around a zero value, showing small differences between estimated and equilibrium levels of FDI stocks.

CHAPTER 10

DISCUSSION AND CONCLUSIONS

The main objective of the study presented in this dissertation was to find regional characteristics that attract foreign investment in Poland and to investigate whether agglomeration effects are present. In addition, I wanted to discover temporal patterns of foreign investments, as well as connections among industries. This chapter summarizes and discusses the findings of this dissertation, gives policy recommendations for local governments, and suggests areas of future research.

Agglomeration Effects

This dissertation adds to current literature on FDI by analyzing the influence of different industries present in a region on foreign companies' investment location choice decisions. Most of the articles analyzing location decisions at subnational levels focus on regional characteristics. Low production costs that are the result of a cheap, efficient, and highly educated labor force, good infrastructure, such as a high road density, water, and telecommunications, and a good political environment or favorable market conditions, lead to increased foreign investments in a region. More recent articles on FDI emphasize the importance of agglomeration effects, mainly the effect of prior FDI on future foreign investment in a region. However, most of the literature is focused on aggregated cases rather than on specific industries. There are many examples of studies where only one industry or aggregated FDI level is analyzed. Some examples include: Woodward and Rolfe (1993), who analyze the manufacturing industry in the Caribbean Basin; Menghinello, Propris, and Driffield (2010), who study the manufacturing industry in Italy; and

Yu and Sun (2011) and Boudier-Bensebaa (2005), who conduct aggregated studies of FDI in China and Hungary, respectively.

Agglomeration effects are present due to three main factors: increasing returns to scale, network effects, and technological spillovers. In particular, companies that cluster together are able to lower costs of production through decreased transportation costs, competing suppliers that are attracted by large number of companies from the same industry, better access to information, as well as specialization and division of labor. As a group, companies have a better chance to influence local governments and service or product providers. Economic theory states that a company's goal is profit maximization. Minimizing costs (including research and development, production and transportation costs) is one to do this. Network externalities will arise as a through a higher value of the offered services or products, resulting from a larger number of customers using it. Lastly, clustering of industries often leads to quicker diffusion and implementation of new ideas. Moreover, clustered companies may split the risks and costs of their actions or new inventions.

In addition to positive agglomeration effects, companies need to consider the weaknesses of clustering. Among them is decreased pricing power resulting from competition among companies supplying similar or identical products or services. Another disadvantage that might exist with a large number of companies clustered in the same region is a shortage of qualified labor. In addition, some economists list congestion and pollution as negative factors resulting from agglomeration.

The results obtained in this dissertation confirm other existing studies. The study by Yu and Sun (2011) shows that agglomeration is a preferred strategy for foreign firms in China. In addition, Menghinello et al. (2010) confirmed positive agglomeration effects of FDI in Italy. In

addition the authors claim that if foreign companies are clustered in Marshallian industrial districts, the advantages of agglomeration effects outweigh the disadvantages of investment clustering. The main benefit is in a form of greater productivity growth.

Yehoue (2009) used game theory to examine how the combination of setting up a cluster and implementing policy reforms can attract FDI. One of the findings presented in his article suggests that the existence of clusters of foreign and host country companies can be a strong factor that encourages FDI, even in the event of political reforms that are not implemented.

The positive coefficients on the lagged dependent variables indicate that in Poland, the benefits of agglomeration surpass the costs. This pattern of strong positive agglomeration effects implies that local authorities should focus on selected industries, create a propitious business environment, and encourage other foreign companies from these industries to locate in their region.

In addition, this research shows that although previous foreign investments in a region are a very significant factor in the investment location decision, it is important to distinguish what kinds of industries those investments were representing. The study reveals that with the exception of the financial industry, prior investments by foreign companies from industries other than that represented by the dependent variable is a crucial element of location decision. At the *powiat* level, foreign companies seek regions with a higher concentration of foreign investments, as it indicates a higher market potential for products and services in the area.

In addition, reliance among industries is noticeable. The results show that foreign investments in the manufacturing industry are present where previous investments in the financial industry were made. Also, that the wholesale industry will locate in regions where previous investments in the manufacturing industry were made. This result confirms the

monopolistic-competition model developed in Head and Ries (1996), which was based on a study of inter-city competition in China. The authors find that the arrival of FDI in a city will stimulate entry by local specialized suppliers. Growth of this upstream sector in turn makes a city more attractive to subsequent foreign investors. In the case of Poland, FDI stimulates vertical supply chain investment. In particular, for some industries, the later FDI is complementary to the initial investment. With respect to horizontal investments,[11] the research did not show a negative influence of previous investments. One of the hypotheses explored was that companies from the same industries, especially those that provide services as opposed to those providing goods, should not cluster because of competition issues and lower expected profits. However, it was observed that regardless of the industry studied, previous presence of companies from the same industry positively influence further foreign investments. This result confirms previous studies in this subject (Crozet et al., 2004; Békés, 2005, Marshal, 1920; Head et al., 1994).

Market potential displays a positive effect at the *powiat* level, meaning that foreign companies carefully consider local markets. They invest in locations with higher GDP. Special Economic Zones were found to be a very important positive factor at both study levels. Even though the general effect of labor force costs and characteristics is visible, for some models, the effect changes when considered at different geographic levels.

Macro-level variables were included in the regressions to test the importance of country characteristics. They were found to have very strong effects on foreign investment decisions. Real GDP growth and the number of R&D researchers per million of population have positive effects on future investments. Electric use and percentage of urban population have negative

[11]In the meaning of investments made by the companies from the same industry.

effects on future FDI. Most of the empirical studies of FDI use GDP per capita to capture macro conditions. These studies show positive effects of macro-level conditions on FDI. This study uses average GDP growth to characterize the national-level economic environment. The effect of GDP growth was consistent with previous studies, demonstrating that higher GDP growth leads to higher market potential and improves the economic and business environment for foreign investment. The literature showing the effect of FDI on economic growth and the effect of economic growth on FDI is extensive. In general, studies show that the effect of FDI on economic growth depends on the industry considered (A. Khaliq, I. Noy, 2007; L. Alfaro, 2003). However, some empirical studies suggest that the effect of economic growth on FDI is bigger than that mentioned previously (T. Xiaowen, 2004; Wang, and Swain, 1997). Those studies demonstrate diverse results. Some suggest that economic growth on FDI yields no change in FDI; the latter suggest that economic growth is the main determinant of inward FDI.

In regards to regional characteristics, the effects on the FDI stock depended on the considered industry and level of territorial division. In the case of the unemployment rate, the obtained results in part confirm previous studies. Literature in this subject shows that a higher unemployment rate can have various effects on FDI, depending on the sector (Carlton, 1983). In addition, depending on the country, results can be different. Studies of FDI in the manufacturing industry show that a higher unemployment rate encourages FDI in the USA (Coughlin, et al., 1991) and discourages FDI in Poland (Deichmann, et al., 2005).

Another variable, which was part of the labor force characteristics, was wage level. In most of the models I observed a positive effect of the wage on future FDI in a region. Even though most studies find a negative effect of higher wages on FDI (Coughlin, et al., 1991;

Carlton, 1983), there are studies that show positive effects of labor costs on FDI (Cheng and Kwan, 1999, 2000). Therefore, the results obtained in this study are consistent.

Moreover, the research confirmed the importance of incentives offered by governments. One of them is the creation of Special Economic Zones. According to economic literature, Special Economic Zones (SEZ) have a positive and statistically significant effect on the location of FDI. Wang (2010) study SEZ in China between 1978 and 2007. Wang finds that SEZ increase per capita FDI by 58%. However, the foreign investment is made mainly in regions with previous foreign investments in export-oriented companies. Also, the study of SEZ in the Philippines by Makabenta (2002) shows that the number of SEZ in a region has a positive and statistically significant effect on the new manufacturing FDI in a region. Finally, the study of FDI in Poland (Deichmann et al., 2005) revealed that Special Economic Zones foster an environment conducive for FDI and have a positive, statistically significant effect.

Growth Study

The second part of the dissertation focused on the temporal patterns of FDI. Continuous investment in the region is possible only if the FDI in a given location is in disequilibrium. Companies invest only if positive profit is possible. Therefore, another interesting aspect of the dissertation emerged: how fast industries meet the equilibrium stock. I discovered that industries need different amounts of time to achieve equilibrium levels of FDI in a region. At the *powiat* level, the equilibrium level is reached in a timely process. This is likely due to multiple reasons. One is that foreign investors first chose a general part of Poland (*voivodeship* in example) to invest but later shift between smaller regions such as *powiat*s. Second is the fact that investments at the *powiat* level are unequally distributed. Thus, for *powiat*s, it takes

considerately more time to reach equilibrium levels. Finally, some kinds of industries prefer locations in urban, rather than rural areas.

As it comes to the equilibrium FDI stock at *powiat* level, the timeliest evolving industries are manufacturing, construction, and real estate; the fastest growing industries are energy, health and financial.

The study of equilibrium and estimated FDI stock shows that equilibrium FDI stock is more sensitive to economic and political shocks, while estimated FDI stock is more stable. Depending on the industry, the time development paths of estimated and equilibrium FDI stocks can be parallel, convergent, or divergent. The study of deviations of estimated FDI stocks from equilibrium showed that at the beginning of the analyzed period, possible absorption of additional FDI was possible. This is visible by a negative difference between estimated and equilibrium FDI stocks. The possibility was realized by foreign companies, as there were positive deviations at the end of the time considered.

Policy Recommendations

The study of patterns of foreign investments gives us better insight into how foreign companies make their decision on where to invest in Poland. Local authorities very often face barriers in attracting FDI. The barriers range from a lack of financing to a lack of promotional ideas. Dorożyński and Urbaniak (2011) find that among many problems that local governments face is a lack of knowledge of how to attract foreign companies. Another is a lack of ideas of how to promote the region. The final barrier is a lack of promotional materials in foreign languages. On the other hand, the authors suggest that local governments can influence inward FDI investment in multiple ways. They can use discounts in local taxes, fees, as well as subsidies to encourage foreign investments. In addition, they notice that at the *powiat* level, the

exchange of information and closer relationships between local governments and investors is possible. Foreign companies can receive legal and financial advice, along with assistance with company startup or purchases of land or equipment.

Based on the patterns of FDI, detailed policy recommendations can be formed. The recommendations implemented by local governments can lead to development and greater prosperity of the regions. Local governments should develop different strategies depending on the level of territorial division to attract foreign investments. First, at the national level, government can positively influence foreign investment by maintaining positive economic growth, assuring well-protected and enforced property rights, little to no corruption, as well as economic openness.

At lower levels of territorial division, local governments can develop and implement policy reforms that will increase a region's attractiveness. They can create special economic zones, introduce tax incentives, improve infrastructure, increase labor attractiveness (for example by additional training), as well as foster linkages between foreign and domestic companies. A comprehensive analysis of policies and factors affecting inward FDI was presented by D. Velde (2001). The author has divided policies and factors into three parts: those that affect potential investors; policies and factors affecting existing ones; and factors affecting the response of domestic companies. Among the factors affecting potential FDI in regions are: financial and fiscal incentives and bargaining; efficient administrative procedures and rules on ownership; promotion, targeting and image building; developing key sectors (agglomeration and clustering); developing export platforms (EPZS); availability of infrastructure and a skilled workforce and good labor relations; sound macroeconomic performance and prospects; privatization opportunities; development of financial market and debt position; a lack of impediments to

wholesale of goods and services; global economic integration and transportation; international, regional and bilateral treaties, including BITS and WTO; insurance (ICSID, MIGA, ECGD, OPIC) and political risk ratings; having a location near large and wealthy markets; availability of natural resources; historical ties and language-use; absence of corruption; and financial conditions in home countries.

In addition, some researchers claim that implementing FDI-favoring policies or reform is not enough for successful FDI promotion. What works is a combination of the country's FDI policies as well as economic conditions, stage of development, location, resources, regional agreements and international competition (Bartels, 2009). However, sometimes such policies and reforms might be costly, especially for small regions. As Yehoue (2009, page?) noticed, "the locational factors combined with the policy reforms necessary to attract foreign investment can be costly for many developing countries. This leads governments in these countries to wholesale off the benefits of attracting foreign investment against the costs of creating business-friendly conditions in their countries."

This study has confirmed recent findings in the FDI literature. Depending on the development stage of FDI in a region, local governments can take additional steps to encourage new, and to maintain the existence FDI. Alternative or additional policy reforms should focus on existing foreign investments in a region and attracting foreign companies from the same industry. Many *powiat*s have very small amounts of foreign investments. The presence of manufacturing and wholesale industries is noticed in *powiats,* but other industries are underrepresented by foreign companies. Those *powiat*s, with none or a small number of foreign firms, should asses where their comparative advantage is and aim to improve labor, demographic, economic, and infrastructure characteristics of the region to attract foreign investments. The best strategy is to

focus on one industry, because the presence of foreign investments will attract other foreign investments from the same industry. *Powiat*s with large number of foreign investments should focus on investments made by existing industries and try to attract other companies from the same and complementary industries.

Areas of Future Research

Discovering and explaining the temporal patterns in FDI development within a region requires the analysis of a large number of possible combinations and orderings of investments within several industries. My hypothesis is that the foreign investment in some industries occurs earlier than in other industries. In particular, companies offering services such as restaurants, education services, recreational, cultural, and sporting activities, or post and telecommunications will invest in foreign countries earlier than companies that have large initial fixed costs. Therefore, one expects to see increased investment of such companies to occur with one, two, or more lags after the firms from the service sector enter the market. In developing countries, such as Poland used to be,[12] it is also connected with some risk issues. Large investments occur in countries that offer stable and enforced laws and a favorable political situation. Small investments will come first since even failure does not affect a company's existence. For example, before 1989 there were no direct foreign investments in Poland. The first most visible FDI was in fast food restaurants, such as McDonald's (first was opened in Poland in 1992), KFC (1993) or Burger King (1994). However, large investments are more risky, and often in countries such as Poland, are connected with the economic transition that took place over the years. Privatization was one such economic change that encouraged FDI. Very often foreign

[12] Countries that have joined European Union are considered as those that completed transition process. Poland had become part of EU on May 1, 2004.

firms acquired a share in privatized firms to enter a Polish market first. Privatization is a very complicated process and requires time. Therefore, it did not occur shortly after transition to a market economy. For example, Polish firms such as PLZ "Warszawa-Okęcie" S.A., Electrociepłownia "Kraków" S.A., or Firma Oponiarska Dębica S.A. were privatized in 1994-1997 and their shares sold to foreign firms after that. This dissertation looked at disaggregated industries. To study the development paths of FDI more closely, greater analyzes are needed. One of the ways it can be done is by disaggregating industries into smaller groups. However, obtaining data on FDI stocks at such a low level can be extremely difficult.

APPENDIX A

CORRELATION MATRICES

Table A.1 Matrix of Endogenous Variables Correlation Coefficients

	primary	*L.primary*	*L2.primary*	*manuf*	*L.manuf*	*L2.manuf*	*energy*	*L.energy*	*L2.energy*	*construction*	*L.construction*	*L2.construction*
primary	1											
L.primary	0.95	1										
L2.primary	0.93	0.96	1									
manuf	0.56	0.54	0.52	1								
L.manuf	0.56	0.55	0.52	0.99	1							
L2.manuf	0.56	0.54	0.52	0.99	0.99	1						
energy	0.57	0.55	0.52	0.83	0.84	0.85	1					
L.energy	0.55	0.55	0.51	0.8	0.83	0.83	0.96	1				
L2.energy	0.53	0.53	0.49	0.79	0.82	0.81	0.92	0.97	1			
construction	0.54	0.51	0.49	0.98	0.97	0.98	0.85	0.82	0.82	1		
L.construction	0.53	0.52	0.49	0.96	0.98	0.98	0.86	0.85	0.84	0.98	1	
L2.construction	0.53	0.51	0.49	0.96	0.97	0.98	0.87	0.86	0.84	0.99	0.99	1
wholesale	0.5	0.47	0.45	0.97	0.96	0.97	0.82	0.8	0.8	0.98	0.96	0.97
L.wholesale	0.49	0.48	0.45	0.96	0.97	0.97	0.82	0.83	0.83	0.97	0.98	0.97
L2.wholesale	0.49	0.48	0.45	0.96	0.97	0.98	0.84	0.84	0.83	0.97	0.98	0.98
hospitality	0.53	0.51	0.49	0.97	0.96	0.97	0.85	0.83	0.83	0.98	0.97	0.98
L.hospitality	0.52	0.52	0.49	0.94	0.96	0.96	0.85	0.85	0.85	0.96	0.98	0.97
L2.hospitality	0.53	0.52	0.49	0.94	0.96	0.96	0.85	0.86	0.86	0.96	0.97	0.98
transportation	0.53	0.51	0.48	0.97	0.96	0.97	0.88	0.86	0.86	0.97	0.96	0.97
L.transportation	0.53	0.52	0.49	0.95	0.97	0.96	0.87	0.88	0.87	0.96	0.97	0.97
L2.transportation	0.53	0.51	0.49	0.96	0.97	0.97	0.89	0.88	0.87	0.96	0.97	0.97
financial	0.45	0.43	0.4	0.93	0.93	0.93	0.79	0.79	0.8	0.95	0.94	0.95
L.financial	0.45	0.44	0.41	0.91	0.93	0.93	0.79	0.81	0.82	0.93	0.95	0.95
L2.financial	0.45	0.43	0.41	0.91	0.93	0.93	0.81	0.81	0.82	0.94	0.95	0.95
realestate	0.48	0.46	0.44	0.95	0.95	0.96	0.83	0.82	0.83	0.97	0.97	0.97
L.realestate	0.48	0.47	0.44	0.93	0.95	0.95	0.82	0.84	0.84	0.95	0.97	0.97
L2.realestate	0.48	0.46	0.44	0.93	0.95	0.95	0.84	0.84	0.85	0.96	0.97	0.97
education	0.49	0.46	0.44	0.95	0.95	0.95	0.83	0.83	0.84	0.97	0.97	0.97
L.education	0.48	0.47	0.44	0.92	0.95	0.94	0.82	0.84	0.85	0.95	0.97	0.97
L2.education	0.48	0.47	0.44	0.93	0.95	0.95	0.84	0.85	0.86	0.96	0.97	0.98
health	0.5	0.47	0.45	0.96	0.95	0.96	0.82	0.8	0.81	0.97	0.96	0.96
L.health	0.49	0.48	0.45	0.93	0.95	0.95	0.81	0.82	0.82	0.95	0.97	0.96
L2.health	0.49	0.48	0.45	0.93	0.95	0.95	0.82	0.82	0.82	0.95	0.96	0.97

	wholesale	*L.wholesale*	*L2.wholesale*	*hospitality*	*L.hospitality*	*L2.hospitality*	*transportation*	*L.transportatio*	*L2.transportat*	*financial*	*L.financial*	*L2.financial*
wholesale	1											
L.wholesale	0.99	1										
L2.wholesale	0.99	1	1									
hospitality	0.97	0.96	0.97	1								
L.hospitality	0.95	0.97	0.97	0.98	1							
L2.hospitality	0.95	0.96	0.97	0.99	0.99	1						
transportation	0.98	0.97	0.98	0.97	0.95	0.95	1					
L.transportation	0.96	0.98	0.98	0.95	0.96	0.95	0.99	1				
L2.transportation	0.97	0.98	0.98	0.96	0.96	0.96	0.99	0.99	1			
financial	0.98	0.97	0.98	0.95	0.93	0.93	0.96	0.95	0.95	1		
L.financial	0.96	0.98	0.98	0.94	0.95	0.94	0.95	0.96	0.96	0.99	1	
L2.financial	0.97	0.98	0.98	0.94	0.94	0.94	0.95	0.96	0.96	0.99	1	1
realestate	0.99	0.98	0.99	0.97	0.96	0.96	0.98	0.97	0.97	0.99	0.98	0.99
L.realestate	0.97	0.99	0.99	0.95	0.97	0.96	0.96	0.97	0.97	0.98	0.99	0.99
L2.realestate	0.98	0.99	0.99	0.96	0.96	0.96	0.97	0.97	0.97	0.98	0.99	0.99
education	0.98	0.97	0.98	0.98	0.96	0.97	0.97	0.96	0.96	0.98	0.97	0.97
L.education	0.95	0.98	0.97	0.96	0.98	0.97	0.95	0.97	0.96	0.96	0.98	0.97
L2.education	0.96	0.97	0.98	0.97	0.97	0.98	0.96	0.96	0.96	0.96	0.97	0.97
health	0.97	0.96	0.96	0.98	0.96	0.96	0.96	0.94	0.95	0.95	0.93	0.94
L.health	0.94	0.96	0.96	0.96	0.97	0.97	0.94	0.95	0.95	0.93	0.94	0.94
L2.health	0.95	0.96	0.96	0.96	0.97	0.97	0.94	0.94	0.95	0.93	0.93	0.94

	realestate	*L.realestate*	*L2.realestate*	*education*	*L.education*	*L2.education*	*health*	*L.health*	*L2.health*			
realestate	1											
L.realestate	0.99	1										
L2.realestate	0.99	1	1									
education	0.99	0.98	0.98	1								
L.education	0.97	0.99	0.98	0.98	1							
L2.education	0.98	0.98	0.99	0.99	0.99	1						
health	0.96	0.95	0.95	0.97	0.95	0.96	1					
L.health	0.95	0.96	0.96	0.95	0.97	0.96	0.98	1				
L2.health	0.95	0.95	0.95	0.96	0.96	0.96	0.98	0.99	1			

Table A.2 Matrix of Exogenous Variables Correlation Coefficients

	L.primary	*L2.primary*	*L.manuf*	*L2.manuf*	*L.energy*	*L2.energy*	*L.construction*	*L2.construction*	*L.wholesale*	*L2.wholesale*	*L.hospitality*	*L2.hospitality*
L.primary	1											
L2.primary	0.96*	1										
L.manuf	0.55*	0.52*	1									
L2.manuf	0.54*	0.52*	0.99*	1								
L.energy	0.55*	0.51*	0.83*	0.83*	1							
L2.energy	0.53*	0.49*	0.82*	0.81*	0.97*	1						
L.construction	0.52*	0.49*	0.98*	0.98*	0.85*	0.84*	1					
L2.construction	0.51*	0.49*	0.97*	0.98*	0.86*	0.84*	0.99*	1				
L.wholesale	0.48*	0.45*	0.97*	0.97*	0.83*	0.83*	0.98*	0.97*	1			
L2.wholesale	0.48*	0.45*	0.97*	0.98*	0.84*	0.83*	0.98*	0.98*	0.99*	1		
L.hospitality	0.52*	0.49*	0.96*	0.96*	0.85*	0.85*	0.98*	0.97*	0.97*	0.97*	1	
L2.hospitality	0.52*	0.49*	0.96*	0.96*	0.86*	0.86*	0.97*	0.98*	0.96*	0.97*	0.99*	1
L.transportation	0.52*	0.49*	0.97*	0.96*	0.88*	0.87*	0.97*	0.97*	0.98*	0.98*	0.96*	0.95*
L2.transportation	0.51*	0.49*	0.97*	0.97*	0.88*	0.87*	0.97*	0.97*	0.98*	0.98*	0.96*	0.96*
L.financial	0.44*	0.41*	0.93*	0.93*	0.81*	0.82*	0.95*	0.95*	0.98*	0.98*	0.95*	0.94*
L2.financial	0.43*	0.41*	0.93*	0.93*	0.81*	0.82*	0.95*	0.95*	0.98*	0.98*	0.94*	0.94*
L.realestate	0.47*	0.44*	0.95*	0.95*	0.84*	0.84*	0.97*	0.97*	0.99*	0.99*	0.97*	0.96*
L2.realestate	0.46*	0.44*	0.95*	0.95*	0.84*	0.85*	0.97*	0.97*	0.99*	0.99*	0.96*	0.96*
L.education	0.47*	0.44*	0.95*	0.94*	0.84*	0.85*	0.97*	0.97*	0.98*	0.97*	0.98*	0.97*
L2.education	0.47*	0.44*	0.95*	0.95*	0.85*	0.86*	0.97*	0.98*	0.97*	0.98*	0.97*	0.98*
L.health	0.48*	0.45*	0.95*	0.95*	0.82*	0.82*	0.97*	0.96*	0.96*	0.96*	0.97*	0.97*
L2.health	0.48*	0.45*	0.95*	0.95*	0.82*	0.82*	0.96*	0.97*	0.96*	0.96*	0.97*	0.97*
L.unemp	0.1*	0.12*	-0.15*	-0.15*	-0.08*	-0.08*	-0.15*	-0.15*	-0.15*	-0.14*	-0.12*	-0.12*
L2.unemp	0.08*	0.09*	-0.17*	-0.17*	-0.09*	-0.08*	-0.17*	-0.16*	-0.16*	-0.15*	-0.14*	-0.13*
L.wage	0.21*	0.2*	0.23*	0.24*	0.21*	0.21*	0.19*	0.21*	0.18*	0.19*	0.19*	0.20*
L2.wage	0.18*	0.19*	0.22*	0.22*	0.20*	0.20*	0.18*	0.18*	0.17*	0.17*	0.17*	0.18*
L.stud_10K	0.03*	0.02	0.13*	0.12*	0.1*	0.09*	0.13*	0.13*	0.11*	0.11*	0.12*	0.12*
L2.stud_10K	0.03	0.04*	0.13*	0.14*	0.11*	0.10*	0.14*	0.14*	0.12*	0.12*	0.13*	0.13*
L.pop_dens	0.02	0.01	0.26*	0.26*	0.19*	0.19*	0.24*	0.25*	0.21*	0.21*	0.22*	0.22*
L2.pop_dens	0.01	0.01	0.26*	0.26*	0.20*	0.19*	0.25*	0.25*	0.21*	0.21*	0.22*	0.22*
L.mp_10K	-0.12*	-0.13*	-0.25*	-0.25*	-0.17*	-0.16*	-0.21*	-0.21*	-0.18*	-0.18*	-0.18*	-0.19*
L2.mp_10K	-0.13*	-0.13*	-0.25*	-0.25*	-0.18*	-0.16*	-0.21*	-0.21*	-0.18*	-0.18*	-0.19*	-0.19*
L.sez	0.06*	0.06*	0.03	0.02	0.01	0.01	0.02	0.03	-0.04	-0.02	0.03	0.02
L2.sez	0.06*	0.07*	0.03	0.03	0.02	0.01	0.02	0.01	-0.09	-0.02	0.03	0.03
L.roads_perkm2	-0.05*	-0.05*	0.06*	0.07*	0.06*	0.07*	0.06*	0.07*	0.05*	0.06*	0.06*	0.07*
L2.roads_perkm2	-0.06*	-0.06*	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*	0.05*
L.council_age	-0.02	-0.01	-0.01	0.01	0.02	0.04*	0.02	0.04*	0.02	0.04*	0.03	0.04*
L2.council_age	-0.01	-0.02	-0.02	-0.02	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.03

L.PL_unempl	0.14*	0.14*	0.1*	0.1*	0.11*	0.1*	0.07*	0.07*	0.06*	0.06*	0.08*	0.08*
L2.PL_unempl	0.11*	0.12*	0.09*	0.09*	0.11*	0.11*	0.06*	0.07*	0.05*	0.06*	0.07*	0.08*
L.PL_rd_research	0.15*	0.13*	0.1*	0.09*	0.11*	0.11*	0.07*	0.06*	0.06*	0.06*	0.07*	0.07*
L2.PL_rd_research	0.14*	0.11*	0.09*	0.08*	0.09*	0.09*	0.06*	0.05*	0.05*	0.05*	0.06*	0.06*
L.PL_electric_use	0.17*	0.13*	0.11*	0.09*	0.11*	0.11*	0.08*	0.06*	0.06*	0.05*	0.08*	0.07*
L2.PL_electric_use	0.14*	0.14*	0.09*	0.09*	0.1*	0.09*	0.06*	0.06*	0.05*	0.05*	0.07*	0.07*
L.PL_urban_per	0.05*	0.03*	0.03	0.09	-0.01	-0.04*	0.03	0.03	0.01	0.04	0.03	0.06
L2.PL_urban_per	0.07*	0.12*	0.05*	0.07*	0.04*	0.03	0.04*	0.05*	0.04	0.04*	0.04*	0.05*
L.PLGDP_growth5	0.02	-0.03	0.00	-0.04*	-0.03	-0.07*	0.06	-0.03	0.06	-0.04	0.04	-0.03*
L2.PLGDP_growth5	0.03	0.06*	0.02	0.03	-0.01	-0.01	0.02	0.03	0.01	0.02	0.02	0.02

	L.transportatio	*L2.transportat*	*L.financial*	*L2.financial*	*L.realestate*	*L2.realestate*	*L.education*	*L2.education*	*L.health*	*L2.health*	L.unempl	L2.unempl
L.transportation	1											
L2.transportation	0.99*	1										
L.financial	0.96*	0.96*	1									
L2.financial	0.96*	0.96*	0.99*	1								
L.realestate	0.97*	0.97*	0.99*	0.99*	1							
L2.realestate	0.97*	0.97*	0.99*	0.99*	0.99*	1						
L.education	0.97*	0.96*	0.98*	0.97*	0.99*	0.98*	1					
L2.education	0.96*	0.96*	0.97*	0.97*	0.98*	0.99*	0.99*	1				
L.health	0.95*	0.95*	0.94*	0.94*	0.96*	0.96*	0.97*	0.96*	1			
L2.health	0.94*	0.95*	0.93*	0.94*	0.95*	0.95*	0.96*	0.96*	0.99*	1		
L.unemp	-0.16*	-0.15*	-0.11*	-0.11*	-0.12*	-0.12*	-0.13*	-0.13*	-0.15*	-0.15*	1	
L2.unemp	-0.17*	-0.17*	-0.12*	-0.12*	-0.13*	-0.13*	-0.14*	-0.14*	-0.16*	-0.16*	0.89*	1
L.wage	0.19*	0.2*	0.13*	0.14*	0.15*	0.16*	0.15*	0.17*	0.19*	0.2*	0.19*	0.06*
L2.wage	0.18*	0.18*	0.12*	0.12*	0.14*	0.14*	0.14*	0.15*	0.17*	0.18*	0.30*	0.15*
L.stud_10K	0.11*	0.11*	0.08*	0.08*	0.09*	0.09*	0.11*	0.11*	0.13*	0.13*	-0.07*	-0.08*
L2.stud_10K	0.12*	0.13*	0.09*	0.09*	0.1*	0.1*	0.12*	0.12*	0.14*	0.14*	-0.03*	-0.05*
L.pop_dens	0.22*	0.23*	0.14*	0.15*	0.17*	0.17*	0.19*	0.2*	0.22*	0.23*	-0.3*	-0.29*
L2.pop_dens	0.23*	0.23*	0.15*	0.15*	0.17*	0.17*	0.19*	0.2*	0.23*	0.23*	-0.29*	-0.29*
L.mp_10K	-0.19*	-0.2*	-0.12*	-0.13*	-0.14*	-0.14*	-0.16*	-0.17*	-0.18*	-0.19*	0.24*	0.23*
L2.mp_10K	-0.2*	-0.2*	-0.13*	-0.13*	-0.15*	-0.14*	-0.16*	-0.17*	-0.19*	-0.19*	0.24*	0.23*
L.sez	-0.02	-0.02	-0.02	-0.03	-0.01	-0.03	0.01	0.02	0.03	0.02	0.21*	0.20*
L2.sez	-0.01	-0.02	-0.02	-0.02	-0.01	-0.02	0.01	0.07	0.03	0.02	0.25*	0.20*
L.roads_perkm2	0.06*	0.07*	0.04*	0.04*	0.04*	0.05*	0.05*	0.06*	0.06*	0.07*	-0.20*	-0.19*
L2.roads_perkm2	0.05*	0.05*	0.04	0.04	0.04*	0.03*	0.04*	0.05*	0.05*	0.05*	-0.21*	-0.20*
L.council_age	0.03	0.04*	0.03*	0.05*	0.04*	0.05*	0.03	0.05*	0.02	0.04*	-0.09*	-0.09*
L2.council_age	0.01	0.01	0.03	0.04	0.03	0.04	0.02	0.03	0.01	0.02	-0.07*	-0.04*
L.PL_unempl	0.07*	0.07*	0.03*	0.03	0.05*	0.05*	0.05*	0.05*	0.07*	0.07*	0.47*	0.41*
L2.PL_unempl	0.06*	0.06*	0.04	0.03	0.04*	0.04*	0.05*	0.05*	0.06*	0.07*	0.43*	0.45*
L.PL_rd_research	0.07*	0.06*	0.04	0.04	0.04*	0.04*	0.05*	0.05*	0.07*	0.07*	0.3*	0.22*
L2.PL_rd_research	0.06*	0.05*	0.04	0.04	0.04*	0.05	0.04*	0.04*	0.06*	0.06*	0.39*	0.22*

L.PL_electric_use	0.07*	0.06*	0.04*	0.03	0.05*	0.04*	0.05*	0.05*	0.08*	0.07*	0.27*	0.30*
L2.PL_electric_use	0.06*	0.06*	0.04	0.04	0.04*	0.04*	0.05*	0.05*	0.06*	0.07*	0.31*	0.17*
L.PL_urban_per	0.01	0.07	0.02	0.09	0.02	0.02	0.02	0.03	0.03	0.02	0.02	-0.2*
L2.PL_urban_per	0.04	0.04*	0.02	0.03	0.03	0.04	0.03	0.04	0.03*	0.05*	0.3*	0.09*
L.PLGDP_growth5	0.04	-0.04	0.03	-0.01	0.07	-0.02	0.07	-0.03	0.04	-0.03	-0.22*	-0.39*
L2.PLGDP_growth5	0.02	0.02	0.04	0.01	0.06	0.02	0.02	0.01	0.01	0.03	0.07*	-0.18*

	L.wage	*L2.wage*	*L.stud_10K*	*L2.stud_10K*	*L.pop_dens*	*L2.pop_dens*	*L.mp_10K*	*L2.mp_10K*	*L.sez*	*L2.sez*	*m2*	*km2*
L.wage	1											
L2.wage	0.95*	1										
L.stud_10K	0.14*	0.08*	1									
L2.stud_10K	0.17*	0.14*	0.97*	1								
L.pop_dens	0.17*	0.16*	0.58*	0.58*	1							
L2.pop_dens	0.2*	0.16*	0.59*	0.58*	0.99*	1						
L.mp_10K	-0.03	-0.03*	-0.18*	-0.17*	-0.45*	-0.45*	1					
L2.mp_10K	-0.06*	-0.03	-0.18*	-0.18*	-0.45*	-0.45*	0.99*	1				
L.sez	0.15*	0.08*	0.11*	0.11*	0.07*	0.08*	-0.13*	-0.15*	1			
L2.sez	0.17*	0.16*	0.1*	0.11*	0.07*	0.07*	-0.13*	-0.13*	0.92*	1		
L.roads_perkm2	-0.06*	-0.06*	0.39*	0.37*	0.67*	0.67*	-0.08*	-0.09*	-0.04	-0.03	1	
L2.roads_perkm2	-0.04	-0.06*	0.41*	0.38*	0.67*	0.67*	-0.07*	-0.08*	-0.03	-0.04	0.93*	1
L.council_age	-0.35*	-0.28*	-0.22*	-0.22*	-0.33*	-0.31*	0.15*	0.16*	-0.13*	-0.09*	-0.21*	-0.20*
L2.council_age	-0.3*	-0.32*	-0.22*	-0.24*	-0.37*	-0.37*	0.17*	0.17*	-0.11*	-0.13*	-0.25*	-0.24*
L.PL_unempl	0.73*	0.84*	0.01	0.07*	-0.02	-0.02	0.09*	0.09*	0.08*	0.14*	-0.13*	-0.15*
L2.PL_unempl	0.60*	0.71*	-0.06*	0.02	0.09	-0.02	0.07*	0.08*	0.04	0.08*	-0.08*	-0.12*
L.PL_rd_research	0.68*	0.69*	0.03	0.04*	0.04	0.04	0.07*	0.07*	0.12*	0.15*	-0.09*	-0.09*
L2.PL_rd_research	0.67*	0.68*	0.04*	0.03	0.04	0.02	0.06*	0.06*	0.01	0.15*	-0.11*	-0.09*
L.PL_electric_use	0.71*	0.67*	0.05*	0.05*	0.01	0.07	0.08*	0.07*	0.15*	0.11*	-0.09*	-0.1*
L2.PL_electric_use	0.71*	0.71*	0.03	0.07*	0.05	0.04	0.07*	0.07*	0.13*	0.18*	-0.1*	-0.09*
L.PL_urban_per	0.45*	0.17*	0.13*	0.13*	0.05	0.09	0.04*	0.01	0.16*	0.13*	-0.09*	-0.03
L2.PL_urban_per	0.66*	0.65*	0.06*	0.15*	-0.01	0.06	0.07*	0.06*	0.11*	0.2*	-0.13*	-0.11*
L.PLGDP_growth5	0.19*	-0.23*	0.13*	0.07*	0.08	0.07	0.02	-0.04*	0.17*	0.05*	-0.04	0.05*
L2.PLGDP_growth5	0.39*	0.31*	0.1*	0.14*	0.02	0.04	0.04	0.03	0.11*	0.19*	-0.09*	-0.04*

	L.council_age	*L2.council_age*	*L.PL_unempl*	*L2.PL_unempl*	*L.PL_rd_research*	*L2.PL_rd_research*	*L.electric~e*	*L.PL_electric_use*	*L.urban_per*	*L2.PL_electric_use*	*L.PL_urban_per*	*L2.PL_urban_per*
L.council_age	1											
L2.council_age	0.72*	1										
L.PL_unempl	-0.29*	-0.29*	1									
L2.PL_unempl	-0.24*	-0.25*	0.9*	1								
L.PL_rd_research	-0.23*	-0.26*	0.62*	0.69*	1							

L2.PL_rd_research	-0.11*	-0.15*	0.63*	0.57*	0.76*	1						
L.PL_electric_use	-0.39*	-0.21*	0.63*	0.76*	0.88*	0.68*	1					
L2.PL_electric_use	-0.22*	-0.36*	0.62*	0.58*	0.89*	0.73*	0.70*	1				
L.PL_urban_per	-0.18*	-0.08*	0.11*	-0.41*	-0.19*	-0.17*	0.13*	0.070*	1			
L2.PL_urban_per	-0.2*	-0.28*	0.61*	0.26*	0.29*	0.25*	0.18*	0.53*	0.76*	1		
L.PLGDP_growth5	-0.1*	0.02	-0.32*	-0.75*	-0.20*	-0.55*	0.07*	-0.02	0.83*	0.28*	1	
L2.PLGDP_growth5	-0.03	-0.17*	0.11*	-0.26*	0.07*	0.09*	-0.12*	0.34*	0.92*	0.81*	0.69*	1

APPENDIX B

REGRESSIONS RESULTS

Table B.1 Generalized Method of Moments Regressions Results

	(1) GMM	(2) GMM	(3) GMM	(4) GMM	(5) GMM	(6) GMM	(7) GMM	(8) GMM	(9) GMM	(10) GMM	(11) GMM
	primary	*manuf*	*energy*	*construction*	*wholesale*	*hospitality*	*transport*	*financial*	*realestate*	*education*	*health*
L.primary	0.685***					-0.046*	0.003		-0.047*		
	(0.037)					(0.020)	(0.020)		(0.022)		
L2.primary	-0.077***					-0.007	-0.015		0.004		
	(0.017)					(0.017)	(0.020)		(0.023)		
L.manuf	-0.050	0.870***	-0.005		-0.078*		0.012**				
	(0.026)	(0.020)	(0.008)		(0.032)		(0.029)				
L2.manuf	0.045*	0.168***	-0.007		0.048		0.002*				
	(0.019)	(0.018)	(0.010)		(0.027)		(0.025)				
L.energy			0.642***			0.031				0.034***	0.086***
			(0.036)			(0.020)				(0.008)	(0.018)
L2.energy			-0.085***			0.035				-0.028**	0.018
			(0.016)			(0.022)				(0.010)	(0.016)
L.construction				0.893***							
				(0.040)							
L2.construction				0.012							
				(0.019)							
L.wholesale		-0.041**			0.809***						
		(0.015)			(0.038)						
L2.wholesale		0.098***			-0.004						
		(0.016)			(0.013)						
L.hospitality						0.671***					
						(0.043)					
L2.hospitality						-0.063***					
						(0.017)					
L.transportation	-0.078***						0.656***				
	(0.018)						(0.046)				
L2.transportatio	0.093***						-0.045**				
	(0.023)						(0.017)				
L.financial		0.019	0.023***					0.739***	-0.087**		0.038**
		(0.013)	(0.034)					(0.019)	(0.030)		(0.014)
L2.financial		0.043**	0.077*					-0.044***	0.057		0.002
		(0.013)	(0.031)					(0.010)	(0.033)		(0.020)

L.realestate									0.808***		
									(0.026)		
L2.realestate									-0.016		
									(0.021)		
L.education				-0.067*						0.496***	
				(0.030)						(0.014)	
L2.education				0.069*						-0.059***	
				(0.035)						(0.008)	
L.health						-0.084**			-0.099**		0.609***
						(0.031)			(0.034)		(0.028)
L2.health						0.040			0.078*		-0.035*
						(0.025)			(0.034)		(0.014)
L.unemp		0.119***	0.028*							-0.018	
		(0.028)	(0.012)							(0.010)	
L2.unemp		-0.130***	0.049**							0.016	
		(0.028)	(0.017)							(0.009)	
L.wage			0.011		0.387***						
			(0.044)		(0.086)						
L2.wage			0.180**		-0.320***						
			(0.061)		(0.080)						
L.stud_10K			-0.019	0.034				0.013	-0.379***		
			(0.051)	(0.078)				(0.012)	(0.096)		
L2.stud_10K			-0.099*	-0.347**				0.019	-0.169*		
			(0.044)	(0.134)				(0.015)	(0.074)		
L.pop_dens					-0.686***			-1.015***		-0.166***	
					(0.200)			(0.240)		(0.034)	
L2.pop_dens					0.102			-1.037***		-0.405***	
					(0.167)			(0.233)		(0.094)	
L.mp_10K					0.511***		0.094		0.053		
					(0.141)		(0.218)		(0.329)		
L2.mp_10K					-0.374*		-1.427**		0.176		
					(0.180)		(0.489)		(0.191)		
L.sez	-1.268*	0.011			-3.433*		1.689*			2.221**	
	(0.503)	(0.038)			(1.423)		(0.680)			(0.721)	
L2.sez	0.111**	0.000			0.078**		0.030			-0.008	
	(0.041)	(0.033)			(0.030)		(0.033)			(0.007)	
L.council_age			0.347**	-0.394	0.083					0.147**	0.058*
			(0.116)	(0.279)	(0.142)					(0.055)	(0.064)
L2.council_age			0.141	0.877***	-0.260*					0.022*	0.017**
			(0.084)	(0.213)	(0.125)					(0.045)	(0.088)
L.roads_perkm2									-0.001		
									(0.050)		
L2.roads_perkm									0.229**		
									(0.076)		
L.PL_unempl	-0.379***	-1.486***		-0.718				-0.039*			
	(0.092)	(0.067)		(0.391)				(0.015)			
L2.PL_unempl	0.432***	1.849***		0.799***				0.084***			
	(0.090)	(0.079)		(0.175)				(0.022)			
L.PL_rd_researc	3.841***			-4.651***	4.220***		8.357***		5.255***	0.795***	
	(0.639)			(1.115)	(0.373)		(1.062)		(0.699)	(0.144)	
L2.PL_rd_resear	-1.078*			1.963***	-2.460***		-4.208***		-0.330	0.036	
	(0.528)			(0.591)	(0.326)		(0.777)		(0.533)	(0.103)	

L.PL_electric_us	-4.713***	-7.442***	1.272***	-5.491***	-3.929***	-1.827***	-3.591***		-4.918***		0.521*
	(0.590)	(0.324)	(0.271)	(1.898)	(0.583)	(0.481)	(0.696)		(0.821)		(0.215)
*L2.PL_electric_*	-5.698***	-7.482***	1.534***	-8.532***	-9.746***	-4.431***	-8.157***		-9.180***		0.284
	(0.751)	(0.330)	(0.276)	(0.756)	(0.407)	(0.698)	(0.742)		(0.886)		(0.321)
L.PL_urban_per						-9.062***					
						(0.870)					
L2.PL_urban_pe						-5.033***					
						(0.473)					
L.PLGDP_growt		0.148***				0.094***	0.093***				
		(0.011)				(0.014)	(0.020)				
L2.PLGDP_gro		0.033***				0.030***	0.121***				
		(0.007)				(0.008)	(0.016)				
N	2976	2976	2976	2976	2976	2976	2976	2976	2976	2976	2976
Arellano-Bond	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arellano-Bond	0.308	0.281	0.281	0.221	0.435	0.977	0.452	0.442	0.468	0.431	0.579

Standard errors are shown in parentheses, * p<0.05 ** p<0.01 *** p<0.001

Table B.2 Generalized Maximum Entropy Regressions Results

	(1) GME	(2) GME	(3) GME	(4) GME	(5) GME	(6) GME	(7) GME	(8) GME	(9) GME	(10) GME	(11) GME
	primary	*manuf*	*energy*	*construction*	*wholesale*	*Hospitality*	*transport*	*financial*	*realestate*	*education*	*health*
L.primary	0.732***					-0.021**	0.002		-0.104***		
	(0.019)					(0.013)	(0.014)		(0.016)		
L2.primary	-0.169***					-0.009	-0.012		0.001**		
	(0.02)					(0.013)	(0.015)		(0.017)		
L.manuf	-0.059	0.869***	-0.003**		0.03***		0.017***				
	(0.031)	(0.019)	(0.009)		(0.018)		(0.023)				
L2.manuf	0.055***	0.174***	-0.012		0.067**		0.023**				
	(0.031)	(0.018)	(0.008)		(0.018)		(0.024)				
L.energy			0.638***			0.031				0.052***	0.104***
			(0.015)			(0.020)				(0.002)	(0.014)
L2.energy			-0.077**			0.084***				-0.031*	0.035*
			(0.015)			(0.021)				(0.014)	(0.016)
L.construction				0.886***							
				(0.016)							
L2.construction				0.016*							
				(0.016)							
L.wholesale		-0.064***			0.836***						
		(0.015)			(0.015)						
L2.wholesale		0.131***			-0.012						
		(0.015)			(0.012)						
L.hospitality						0.811***					
						(0.015)					
L2.hospitality						-0.021					
						(0.010)					
L.transportation	-0.072***						0.651***				
	(0.02)						(0.016)				
L2.transportation	0.085***						-0.033				
	(0.021)						(0.016)				
L.financial		0.019***	0.023**					0.733***	-0.084**		-0.024***
		(0.011)	(0.013)					(0.014)	(0.027)		(0.012)
L2.financial		0.042***	0.069					-0.003***	0.048**		-0.003***
		(0.012)	(0.015)					(0.010)	(0.03)		(0.016)
L.realestate									0.815***		
									(0.016)		
L2.realestate									-0.004		
									(0.016)		
L.education				-0.075**						0.501***	
				(0.028)						(0.011)	
L2.education				0.072***						-0.032**	
				(0.031)						(0.006)	
L.health						-0.074***			-0.076**		0.589***
						(0.020)			(0.025)		(0.015)
L2.health						-0.073**			0.083**		-0.027

						(0.022)			(0.027)		(0.012)
L.unemp		0.165***	0.031***							-0.016***	
		(0.026)	(0.02)							(0.02)	
L2.unemp		0.120***	0.044**							-0.010***	
		(0.026)	(0.02)							(0.002)	
L.wage			0.013		0.367***						
			(0.042)		(0.081)						
L2.wage			0.212**		-0.383**						
			(0.047)		(0.080)						
L.stud_10K			-0.021	0.034				0.014**	-0.309***		
			(0.024)	(0.055)				(0.012)	(0.052)		
L2.stud_10K			-0.097**	-0.359***				0.021***	-0.123**		
			(0.024)	(0.054)				(0.014)	(0.051)		
L.pop_dens					-0.617***			-1.031***		-0.012***	
					(0.192)			(0.140)		(0.026)	
L2.pop_dens					0.083*			-1.059***		-0.275***	
					(0.192)			(0.14)		(0.026)	
L.mp_10K					0.532*		0.88**		0.023**		
					(0.098)		(0.198)		(0.297)		
L2.mp_10K					-0.357**		-1.345***		0.521***		
					(0.064)		(0.389)		(0.094)		
L.sez	-1.498***	0.250***			-3.431**		1.725***			2.004***	
	(0.061)	(0.035)			(1.036)		(0.046)			(0.024)	
L2.sez	0.176***	0.081*			0.086***		0.042***			-0.002	
	(0.045)	(0.023)			(0.031)		(0.029)			(0.005)	
L.council_age			0.319***	-0.354**	0.093*					0.162***	0.046***
			(0.088)	(0.202)	(0.132)					(0.028)	(0.053)
L2.council_age			0.166	0.823***	-0.54**					0.019***	0.077**
			(0.081)	(0.194)	(0.129)					(0.037)	(0.081)
L.roads_perkm2									0.022		
									(0.040)		
L2.roads_perkm2									0.153***		
									(0.039)		
L.PL_unempl	-0.475	-1.382**		-0.793*				-0.053**			
	(0.061)	(0.018)		(0.265)				(0.012)			
L2.PL_unempl	0.414**	1.167***		0.762**				0.087***			
	(0.032)	(0.043)		(0.148)				(0.019)			
L.PL_rd_research	2.334			-4.552***	4.183***		8.454***		4.723***	0.813***	
	(0.307)			(1.101)	(0.205)		(0.906)		(0.516)	(0.115)	
L2.PL_rd_research	-1.082			-1.826***	-1.964***		-3.778***		-0.537	0.034	
	(0.09)			(0.249)	(0.368)		(0.521)		(0.477)	(0.059)	
L.PL_electric_use	-4.267***	-7.523***	1.345***	-4.77***	-3.148**	-1.89***	-3.814***		-4.934***		0.575*
	(0.585)	(0.318)	(0.139)	(0.898)	(0.545)	(0.366)	(5.036)		(0.635)		(0.133)
L2.PL_electric_use	-5.125	-7.446***	1.652***	-7.551***	-8.684***	-4.455	-7.968		-8.180***		0.052*
	(0.216)	(0.263)	(0.161)	(0.39)	(0.311)	(0.499)	(0.661)		(0.761)		(0.267)
L.PL_urban_per						-9.262***					
						(0.670)					
L2.PL_urban_per						-5.433***					
						(0.373)					
L.PLGDP_growth5		0.137***				0.082***	0.111***				

		(0.011)				(0.013)	(0.012)				
L2.PLGDP_gro		0.097***				0.120***	0.17***				
		(0.004)				(0.008)	(0.007)				
N	2976	2976	2976	2976	2976	2976	2976	2976	2976	2976	2976
Root MSE	0.325	0.297	0.243	0.485	0.331	0.398	0.471	0.278	0.463	0.238	0.268
MSE	0.106	0.183	0.059	0.235	0.110	0.158	0.222	0.077	0.214	0.057	0.072
Adj R^2	0.976	0.891	0.885	0.910	0.957	0.920	0.907	0.898	0.930	0.909	0.903

Standard errors are shown in parentheses, * p<0.05 ** p<0.01 *** p<0.001

APPENDIX C

GROWTH ANALYSIS

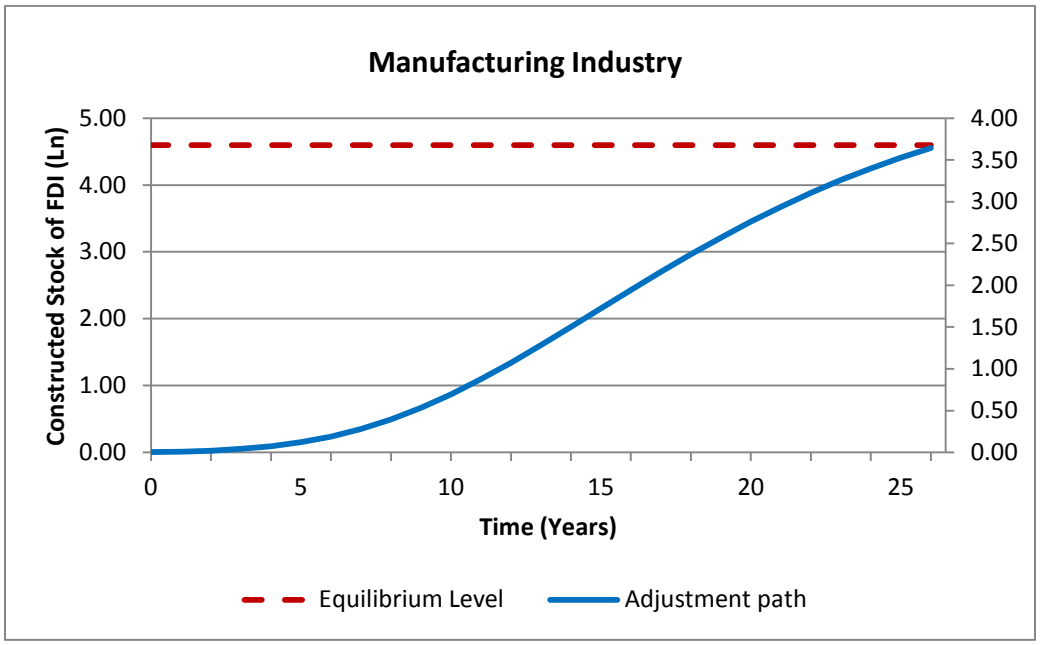

Figure C.1 Adjustment Path to Equilibrium for Manufacturing Industry

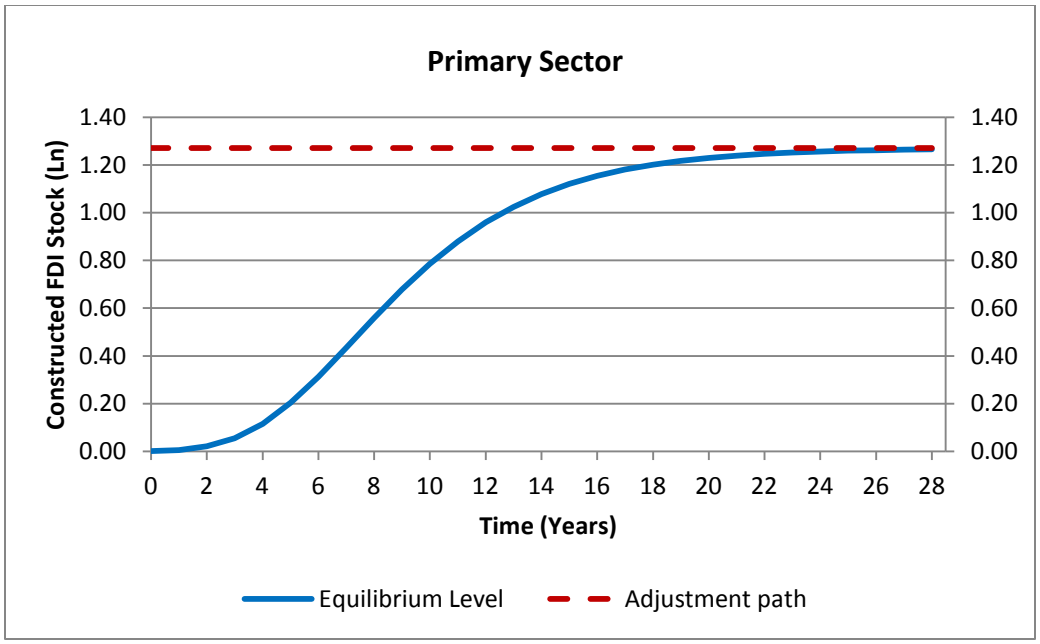

Figure C.2 Adjustment Path to Equilibrium for Primary Sector

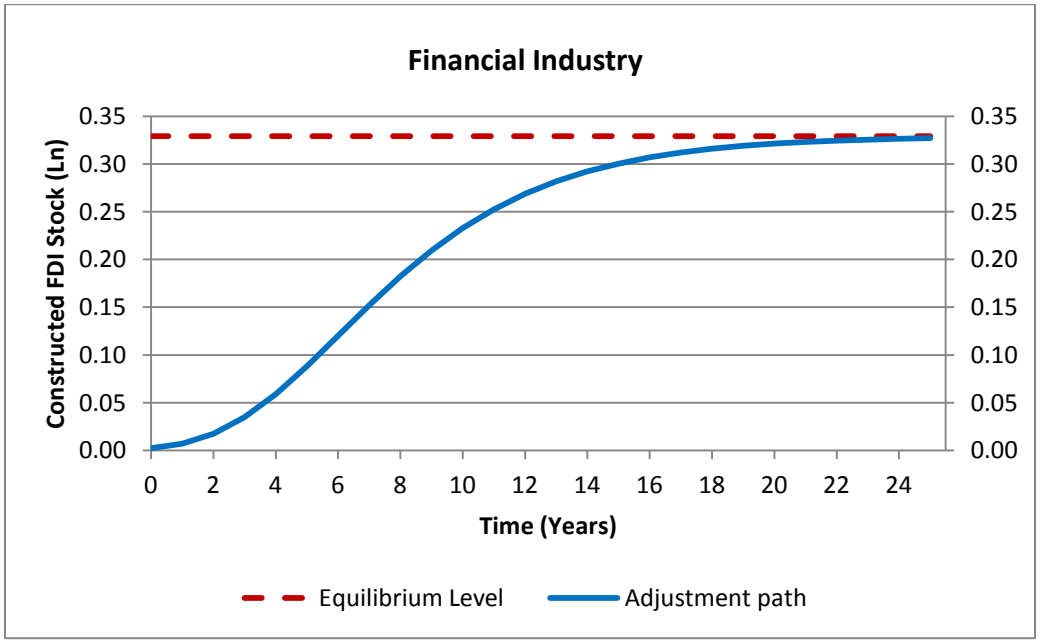

Figure C.3 Adjustment Path to Equilibrium for Financial Industry

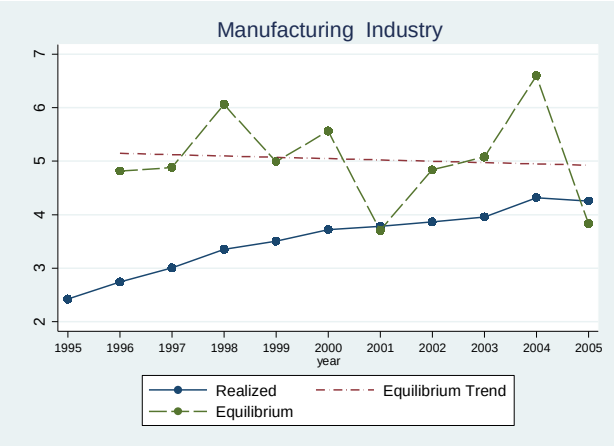

Figure C.4 Equilibrium and Estimated Median FDI Stock for Manufacturing Industry

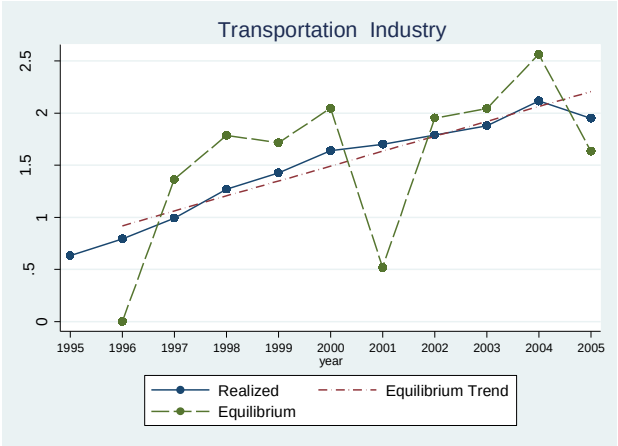

Figure C.5 Equilibrium and Estimated Median FDI Stock for Transportation Industry

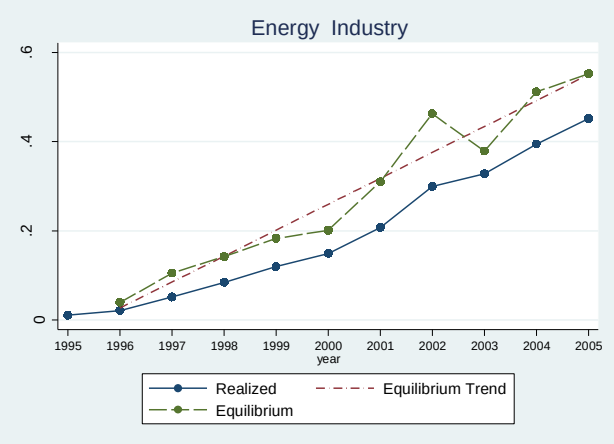

Figure C.6 Equilibrium and Estimated Median Stock of FDI for Energy Industry

Figure C.7 Equilibrium and Estimated Median Annual Growth Rate of FDI Stock for Wholesale Industry

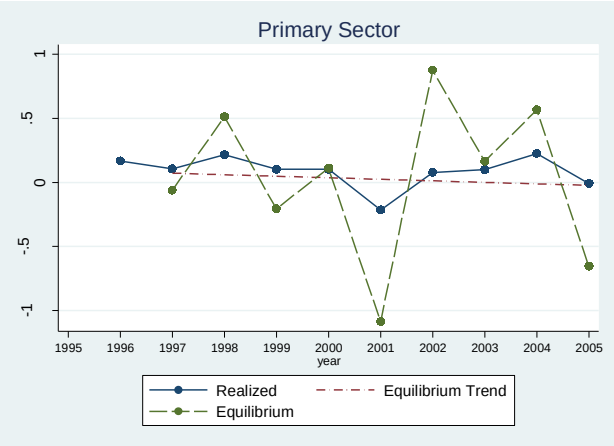

Figure C.8 Equilibrium and Estimated Mean Annual Growth Rate of FDI Stock for Primary Sector

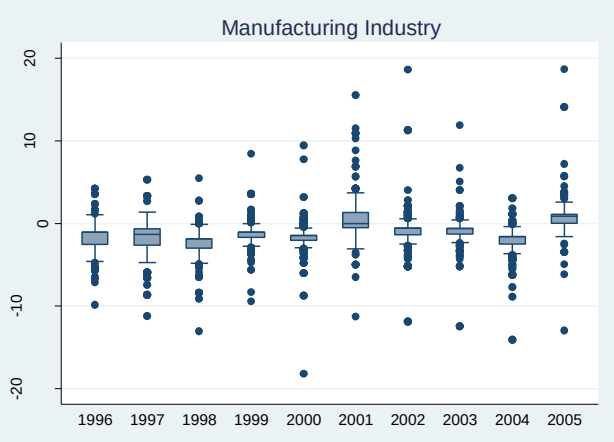

Figure C.9 Deviations of Estimated FDI Stock from Equilibrium Stock - Manufacturing Industry

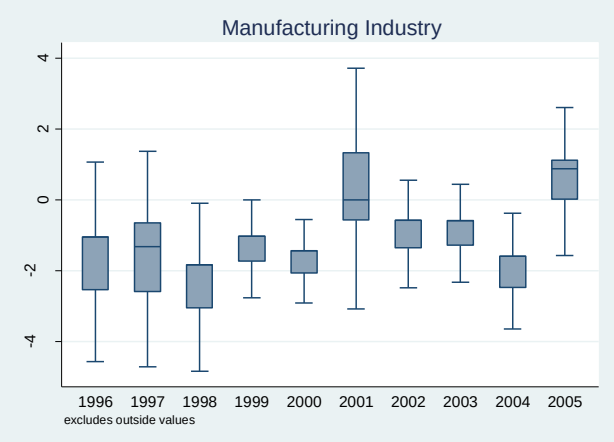

Figure C.10 Deviations of Estimated FDI Stock from Equilibrium Stock - Manufacturing Industry (without Outliers)

Figure C.11 Deviations of Estimated FDI Stock from Equilibrium Stock - Wholesale Industry

Figure C.12 Deviations of Estimated FDI Stock from Equilibrium Stock - Wholesale Industry (without Outliers)

REFERENCES

Alfaro L. (2003). “Foreign Direct Investment and Growth: Does the Sector Matter?” *Business School http://www.people.hbs.edu/lalfaro/fdisectorial.pdf*

Aliber, R. Z. (1970). “A Theory Of Direct Foreign Investment.” In C. P. Kindleberger, *The International Corporation* (pp. 17-34). Cambridge, MA: MIT Press.

Arellano, M., and O. Bover. (1995). “Another look at the instrumental variables estimation of error components models.” *Journal of Econometrics* 68: 29–51

Arellano, M. and Bond, S. (1991). "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *Review of Economic Studies, 58(2),* 277-97.

Attinasi, M. G., Melloni, N., and Soci, A. (2006). “Institutional Change And FDI In Three Selected Ceecs: The Czech Republic, Hungary And Poland.” *Dipartimento Scienze Economiche, Università di Bologna,* Working Paper Nb. 576.

Balassa, B. (1966). “American Direct Investment in the Common Market.” *Banco Nazionale del Lavoro Quarterly Review, 67,* 121-46.

Baldwin, R. E. (2003). “Openness and Growth: What’s the Empirical Relationship?” *NBER Working Paper No. 9578.*

Baltagi, B. H. (2001). “Econometric Analysis of Panel Data.” *John Wiley & Sons, Ltd,* Chapter 8, 129-158.

Banjanovic. A. (2007). “Improving Poland's transport infrastructure*”, Euromonitor,*http://www.euromonitor.com/Improving_Polands_transport_infrastructure

Barrios, S., Goerg, H., and Strobl, E. (2006). “Multinational Location Choice, Agglomeration Economies, and Public Incentives.” *International Regional Science Review, 29,* 81-107.

Bartels F. L. (2009). “FDI Policy Instruments: Advantages and Disadvantages” *United Nations Industrial Development Organization, Vienna. Working Paper 01/2009*

Bartik, T. J. (1985). “Business Location Decisions in the United States: Estimates of the Effects of Unionization, Taxes, and Other Characteristics of States.” *Journal of Business and Economic Statistics, 3* (1), 14-22.

Basile, R. (2001). “The Locational Determinants Of Foreign-Owned Manufacturing Plants In Italy.” *Working Paper 14, ISAE.*

Békés, G. (2005). “Location Of Manufacturing FDI In Hungary: How Important Are Inter-Company Relationships?” *www.mnb.hu/Resource.aspx?ResourceID=mnbfileandresourcename=bekes050*

Bewley, R., and Fiebig, D. G. (1988). “A Flexible Logistic Growth Model With Applications In Telecommunications.” *International Journal of Forecasting, 4* (2), 177-192.

Blonigen, B. A., Davies, R. B., Wadell, G. R., and Naughton, H. T. (2004). "FDI in Space: Spatial Autoregressive Relationships in Foreign Direct Investment." *NBER Working Paper No. 10939*.

Blundell, R. and Bond, S. (1998). "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models."*Journal of Econometrics*, 87(1), 115-143.

Blundell, R. and Bond, S. (2000). "GMM Estimation with Persistent Panel Data: An Application to Production Functions." *Econometric Reviews*, 19(3), 32 1-340.

Bobonis, G. J., and Shatz, H. J. (2007). "Agglomeration, Adjustment, and State Policies in the Location of Foreign Direct Investment in the United States." *The Review of Economics and Statistics, 89* (1), 30-43.

Boudier-Bensebaa, F. (2005). "Agglomeration Economies And Location Choice. Foreign Direct Investment In Hungary. *Economies of Transition, 13* (4), 605-28.

Braunerhejelm, P., and Svensson, R. (1996). "Host Country Characteristics And Agglomeration In Foreign Direct Investment." *Applied Economics, 28*, 833-840.

Buckley, P. J., and Casson, M. (1976). "The Future of the Multinational Enterprise." London: Macmillan.

Buckley, P. J., and Casson, M. (1981). "The Optimal Timing of a Foreign Direct Investment." *The Economic Journal, 91* (361), 75-87.

Cantwell, J., and Iammarino, S. (2000). "Multinational Corporations and the Location of Technological Innovation in the UK Regions." *Regional Studies, 34* (4), 317-332.

Carlton, D. W. (1983). "The Location and Employment Choices of New Firms: An Econometric Model with Discrete and Continuous Endogenous Variables." *The Review of Economics and Statistics, 65* (3), 440-49.

Casson, M. (1992). "Why are Firms Hierarchical?" *International Journal of the Economics of Business, 1*, 47-76.

Chao, J. W. (2003). "Foreign Direct Investment: Determinants, Trends In Flows And Promotion Policies." *Investment Promotion And Enterprise Development Bulletin For Asia and the Pacific, 1*.

Cheng, L. K., and Kwan, Y. K. (1999). "FDI Stock And Its Determinants." In Y. Wu, *Foreign Direct Investment and Economic Growth in China* (pp. 42–56). Cheltenham: Edward Elgar.

Cheng, L. K., and Kwan, Y. K. (2000). "What Are The Determinants Of The Location Of Foreign Direct Investment? The Chinese Experience." *Journal of International Economics, 51*, 379-400.

Cheng, S., and Stough, R. R. (2007). "The Pattern and Magnitude of China's Outward FDI in Asia." *International Workshop on Intra-Asian FDI Flows: Magnitude, Trends, Prospects and Policy Implications*.

Chow, G. C. (1967). Technological Change and the Demand for Computers. *The American Economic Review, 57*(5), 1117-1130.

Chung, W., and Kalnins, W. (2001). "Agglomeration Effects and Performance: A Test of the Texas Lodging Industry. *Strategic Management Journal, 22* (10), 969-988.

Coughlin, C., and Segev, E. (2000). Location Determinants of New Foreign-Owned Manufacturing Plants." *Journal of Regional Science, 40* (2), 323–351.

Coughlin, C., Terza, J., and Arromdee, V. (1991). "State Characteristics and The Location Of Foreign Direct Investment In The United States." *The Review of Economics and Statistics*, *73* (4), 675–83.

Crozet, M., Mayer, T., and Mucchielli, J. (2004). "How Do Firms Agglomerate? A Study of FDI in France." *Regional Science and Urban Economics, 34*, 27– 5.

Culem, C. G. (1988). "The Locational Determinants of Direct Investments Among Industrialized Countries." *European Economic Review, 32*, 885-904.

Davidson, R., and MacKinnon, J. G. (2003). "Econometric Theory and Methods." Oxford University Press.

Deichmann, J., Karidis, S., and Sayek, S. (2003). "Foreign Direct Investment In Turkey: Regional Determinants." *Applied Economics, 35*, 1767–78.

Deichmann, J. I., and Karidis, S. (2005). "Special Economic Zones and Foreign Direct Investment in Poland"*Applied Economics Quarterly, 51* (1), 83-106.

DePropris, L., Driffield, N., and Menghinello, S. (2005). "Local Industrial Systems and the Location of FDI in Italy." *International Journal of the Economics of Business, 12* (1), 105-121.

Desbordes, R., and Vicard, V. (2005). "Being Nice Makes You Attractive: The FDI – International Political Relationships Nexus." *Ninth Annual Conference on Economics and Security.*http://carecon.org.uk/Conferences/Conf2005/Abstracts/Vicard.pdf.

Dorożyński T., Urbaniak W. (2011), "The role of local government units in supporting investors in the voivodeship of Lodz" in "Foreign Direct Investment. The Case of Lodz Region" *LozdzkieTowarzystwoNaukowe. 116-157*

Dunning, J. H. (1977). "Trade, Location of Economic Activity and the MNE: A Search for Eclectic Approach." In B. Ohlin, P. O. Hesselborn, and W. P.J., *The International Allocation of Economic Activity.* London: MacMillan.

Dunning, J. H. (1979). "Explaining Changing Patterns of International Production." *Oxford Bulletin of Economics and Statistics, 41* (4), 269-95.

Dunning, J. H. (1988). "The Eclectic Paradigm Of International Production, A Restatement And Some Possible Extensions." *Journal of International Business Studies, 19*, 1-31.

Dunning, J. H. (1995) "Reappraising The Eclectic Paradigm In The Age Of Alliance Capitalism." *Journal of International Business Studies, 26* (3).

Dunning, J. H., Jones, G. G., and Nachum, L. (2000). "UK FDI and the Comparative Advantage of the UK."*The World Economy, 23* (5), 701-720.

Dunning, J. H. (2001). "The Eclectic (OLI) Paradigm of International Production: Past, Present and Future." *International Journal of the Economics of Business, 8* (2), 173- 190.

Dunning, J. (2003). "The Key Literature on IB Activities: 1960-2000." In A. M. Rugman, and T. L. Brewer, *The Oxford Handbook of International Business* (pp. 36-68).

Dunning, J. H. (2006). "Towards a New Paradigm Of Development: Implications For The Determinants Of International Business." *Transnational Corporations, 15* (1).

Faini, R.(2004). "Trade Liberalization in a Globalizing World."*IZA, Discussion Paper No. 1406*

Fazekas, K. (2003). "Effects Of Foreign Direct Investment On The Performance Of Local Labor Markets –The Case Of Hungary." *Budapest Working Papers on the Labour Market, No 03/03.*

Feinberg, S. E.; Keane, M. P.;. (2006). "Accounting for the Growth of MNC-Based Trade Using Structural Model of U.S. MNCs." *The American Economic Review, 96* (5).

Felsenstein, D. (1996). "High Technology Firms and Metropolitan Locational Choice in Israel: A Look at Their Determinants." *Geografiska Annaler, 78B,* 43-58.

Frost, T. S. (2001). "The Geographic Sources of Foreign Subsidiaries' Innovations."*Strategic Management Journal,* 22(2), 101-123

Fujita, M., and Krugman, P. R. (1995). "When in the Economy Monocentric? von Thunen and Chamberlin United." *Regional Science and Urban Economics, 25,* 505-28.

Fujita, M., Krugman, P. R., and Venables, A. J. (1999). "The Spatial Economy: Cities, Regions and International Trade." Cambridge: MIT Press.

Glaeser, E., Kallal, H. D., Scheinkman, J. A. and Shleifer, A. (1992). "Growth in Cities." *Journal of Political Economy,* 100(6), 1126–52.

Glickman, N., and Woodward, D. (1988). "The Location Of Foreign Direct Investment In The United States: Patterns and Determinants." *International Regional Science Review, 11*.

Gminas in Poland in 1996 (Gminy w Polsce w 1996 r.).(1998)*GUS*, Warsaw, Poland

Golan, A., Judge, G., and Miller, D. (1996). "Maximum Entropy Econometrics: Robust Estimation with Limited Data." J. Wiley and Sons.

Golan, A. (2002). "Information And Entropy Econometrics – Editor's View." *Journal of Econometrics, 107* (1-2).

Golan, A. (2008). "Information and Entropy Econometrics - a Review and Synthesis" *Foundations and Trends in Econometrics,* 2(1–2), 1-145

Glebocki, B. and Rogacki, H. (2002). Regions of Growth and Stagnation in Poland: Changes in Agriculture, Industry and International Markets." *European Urban and Regional Studies,* 9(1), 53-59

Gompertz, B. (1825) “On the Nature of the Function Expressive of the Law of Human Mortality, and on a New Mode of Determining the Value of Life Contingencies.” *Philosophical Transactions of the Royal Society of London, 115 (1825), 513-583*

Gong, H. (1995). “Spatial Patterns Of Foreign Investment In China’s Cities, 1980–1989.” *Urban Geography, 16* (3), 198–209.

Greene, W. H. (2002). “Econometric Analysis.” Prentice Hall; 5th edition.

Griliches, Z. (1979). “Issues in Assessing the Contribution of Research and Development to Productivity Growth.” *Bell Journal of Economics, 10* (1), 92-116.

Guimarães, P., Rolfe, R. J., and Woodward, D. P. (1996). “Regional Incentives and Industrial Location in Puerto Rico.” *http://ssrn.com/abstract=41215*.

Guimarães, P., Figueiredo, O., and Woodward, D. (2000). “Agglomeration And The Location Of Foreign Direct Investment In Portugal.” *Journal of Urban Economics, 47* (1), 115–35.

Hannan, M. T., and Freeman, J. H. (1977). “The Population Ecology Of Organizations.” *The American Journal of Sociology, 82*, 929 - 964.

Hansen, L. (1982). “Large sample properties of generalized method of moments estimators.” *Econometrica,* 50(3): 1029-1054.

Hall, A. R. (2003). “Generalized Method of Moments” in A Companion to Theoretical Econometrics, Wiley-Blackwell.

Hair, J. F., Anderson R., Tatham R. L., Black W.C.: “Multivariate Data Analysis”. Prentice Hall: Upper Saddle River, N.J. 2006.

Harris, C. D. (1954). “The Market As A Factor In The Localization Of Industry In The United States.” *Annals of the Association of American Geographers, 44*, 315-48.

He, C. (2002). “Information Costs, Agglomeration Economies And The Location Of Foreign Direct Investment in China.” *Regional Studies, 36* (9), 1029–36.

Head, K., Reis, J., and Swenson, D. (1994). “Agglomeration Benefits and Location Choice: Evidence from Japanese Manufacturing Investment in the United States.” *National Bureau of Economic Research, Working Paper 4767*.

Head, K., and Ries, J. (1996). “Inter-City Competition for Foreign Investment: Static and Dynamic Effects of China's Incentive Areas.” *Journal of Urban Economics, 40* (1), 38-60.

Head, K., and Mayer, T. (2004). “Market Potential and the Location of Japanese Investment in the European Union.” *Review of Economics and Statistics, 86* (4), 959-972.

Hill, S., and Munday, M. (1991). “The Determinants Of Inward Investment: A Welsh Analysis.” *Applied Economics, 23,* 1761-1769.

Hogenbirk, A., and Narula, R. (2004). “Location And Agglomeration Of FDI In The Netherlands: Implications For Policy.” *MERIT-Infonomics Research Memorandum series, 6*.

Hsiao, C. (2002). "Analysis of Panel Data."*Cambridge University Press*, Chapter 4, 69-112

Jalilian, H. (1996). "Foreign Investment Location in Less Developed Countries: A Theoretical Framework." *Journal of Economic Studies, 23* (3), 18-30.

Johanson, J., and Vahlne, J. E. (1977). "The Internationalisation Process of the Firm - A Model of Knowledge Development and Increasing Market Commitment." *Journal of International Busienss Studies, 8*, 23-32.

Jorgenson, D. W. (1963). "Capital Theory and Investment Behavior." *American Economic Review, 53* (2), 247-59.

Khaliq A. and Noy I. (2007). "Foreign Direct Investment and Economic Growth: Empirical Evidence from Sectoral Data in Indonesia," Working Papers 200726, University of Hawaii at Manoa, Department of Economics.

Kieschnick, M. (1983). "Taxes and Growth: Business Incentives and Economic Development." In M. Barker *State Taxation Policy*, Durham, NC: Duke Press Policy Studies, 153-282

Kinoshita, Y., and Campos, N. F. (2004). "Estimating the Determinants of Foreign Direct Investment Inflows: How Important are Sampling and Omitted Variable Biases?" *BOFIT Discussion Paper Nr 10*.

Krugman, P. R. (1991a). "Increasing Returns and Economic Geography." *Journal of Political Economy, 99*, 483-99.

Krugman, P.R. (1991b). "Geography and Trade." MIT Press, Cambridge Mass.

Krugman, P. R. (1992). "A Dynamic Spatial Model." *NBER Working Paper 4219*.

Krugman, P. R.; Obstfeld, Maurice;. (2003). "International Economics: Theory and Policy." Addison Wesley.

Leibrecht M. and Scharler J.(2009) "How important is employment protection legislation for Foreign Direct Investment flows in Central and Eastern European countries?" *Economics of Transition, 17(2) 2009, 275–295*

Levins, R. (1968). "Evolution In Changing Environments." *Monographs in Population Biology,v. 2*.

Levins, R. (1962). "Theory Of Fitness In A Heterogenous Environment. I. The Fitness Set And Adaptive Function." *The American Naturalist, 96*, 361-73.

Lösch, A. (1954). "The Economics of Location." New Haven: 2nd edition. Translated from the German by W. H. Woglom with the assistance of W. F. Stolper. Yale University Press (originally published in 1940).

Lucas, R. B. (1993). "On the Determinants of Foreign Direct Investment: Evidence from East and Southeast Asia." *World Development, 21*, 396-406.

Luger, M., and Shetty, S. (1985). "Determinants of Foreign Plant Start-ups in the United States: Lessons for Policy Makers in the Southeast." *Vanderbilt Journal of Transnational Law, 18*, 223- 45.

Makabenta M. P. (2002). "Fdi Location and Special Economic Zones in The Philippines" *RURDS, 14(1)*

Makino, S., Lau, C.-M. and Yeh, R.-S. (2002) "Asset-Exploitation Versus Asset Seeking: Implications For Location Choice of Foreign Direct Investment From Newly Industrialized Economies." *Journal of International Business Studies,* 33(3), 403-421.

Mani, M., Pargal, S., and Huq, M. (1997). "Does Environmental Regulation Matter? Determinants of the Location of New Manufacturing Plants in India in 1994." *Policy Research Working Paper Series: 1718*.

Mano, Y., and Otsuka, K. (2000). "Agglomeration Economies and Geographical Concentration of Industries: A Case Study of Manufacturing Sectors in Postwar Japan." *Journal of the Japanese and International Economies, 14*, 189–203.

Markusen, J. R., and Venables, A. J. (1998). "Multinational Firms and The New Trade Theory." *Journal of International Economics, 46* (2), 183-203.

Marshal, A. (1920). "Principles of Economics." London: MacMillan.

Martin, P. (1998). "Can Regional Policies Affect Growth And Geography In Europe?" *World Economy, 21* (6), 757-74.

Menghinello, S., De Propris, L., and Driffield, N. (2010). "Industrial districts, inward foreign investment and regional development."*Journal of Economic Geography, 10(4), 539-558*

Nefussi, B. and Schwellnus, C. (2007) "Does FDI in Manufacturing Cause FDI in Business Services? Evidence from French Firm-Level Data." *CEPII research center, Working Papers,* 2007-21

Neuhaus, M. (2006). "The Impact of FDI on Economic Growth: An Analysis for the Transition Countries of Central and Eastern Europe." Physica-Verlag Heidelberg; 1 edition.

Nocke, V., and Yeaple, S. (2004). "An Assignment Theory Of Foreign Direct Investment." *Working Paper 11003*. OECD Benchmark Definition of Foreign Direct Investment FOURTH EDITION 2008 http://www.oecd.org/dataoecd/42/56/43985557.pdf

Radner, R. (1992). "Hierarchy: The Economics of Managing." *Journal of Economic Literature, 30* (3), 1382-1415.

Rivoli, P., and Salorio, E. (1996). "Foreign Direct Investment And Investment Under Uncertainty." *Journal of International Business Studies, 27* (2), 335–357.

Romer, P. M. (1986). "Increasing Returns and Long-Run Growth." *The Journal of Political Economy, 94* (5), 1002-1037.

Roodman D. (2006). "How to Do xtabond2: An Introduction to "Difference" and "System" GMM in Stata", *Center for Global Development,* Working Paper Number 103

Sala-i-Martin, X. (1990). "Lecture Notes On Economic Growth." *NBER WP No. 3563 and 3564*.

Sethi, D., Guisinger, S. E., Phelan, S. E., and Berg, D. M. (2003). "Trends in Foreign Direct Investment Flows: A Theoretical and Empirical Analysis." *Journal of International Business Studies, 34* (4), 315-326.

Shamsuddin, A. F. (1994). "Economic Determinants of Foreign Direct Investment in Less Developed Countries." *Pakistan Development Review, 33,* 41-51.

Smith, D. F., and Florida, R. (1994). "Agglomeration And Industrial Location: An Econometric Analysis Of Japanese-Affiliated Manufacturing Establishments In Automotive-Related Industries." *Journal of Urban Economics*, *36* (1), 23–41.

Statistical Yearbook of the Regions – Poland (Rocznikstatystycznywojewództw) 1995, 1996, ... 2005; *GUS*, Warsaw, Poland,

Steger, M. B. (2004). "Globalization: The New Market Ideology." New Delhi: Rawat Publications.

Taube, M., and Ögütçü M. (2002). "Main Issues On Foreign Investment In China's Regional Development: Prospects And Policy Challenges." *Foreign Direct Investment in China: Challenges and Prospects for Regional Development*, OECD, 2002

Tian X, Lin S, and Lo V. (2004). "Foreign Direct Investment and Economic Performance in Transition Economies: Evidence from Chinese Provinces." *Post-Communist Economies*, 2004.

Togo, K., and Arikawa, Y. (2002). "Agglomeration Effects versus Policy Effects: The case of the Electronics Industry in Malaysia." *Asian Economic Journal*, *16* (3).

Tsai, P. (1994). "Determinants of Foreign Direct Investment and Its Impact on Economic Growth." *Journal of Economic Development*, *19*, 137-163.

Wang, Z. Q. and Swain, N. (1997)."Determinants of inflow of foreign direct investment in Hungary and China: time-Series approach" *Journal of International Development, 9, 695- 726.*

Waters, C.D.J. (1999). "Changes to road transport in Poland during a period of economic transition." *International Journal of Physical Distribution and Logistics Management*, 29(2), 122 – 138.

Winsor, C. (1932). "The Gompertz Curve As A Growth Curve." *Proceedings Of The National Academy Of Sciences, 18(1).*

Velde D. W. (2011). "Policies Towards Foreign Direct Investment In Developing Countries: Emerging Best-Practices and Outstanding Issues" Overseas Development Institute, London

Venables, A. (1993). "Equilibrium Locations Of Vertically Linked Industries." *CPER Discussion Paper Nr 82*.

Vernon, R. (1971). "Sovereignty at Bay: The Multinational Spread of U. S. Enterprises." New York: Basic Books

von Thünen, J. (1826). "Isolated State: An English edition of Der isolierte Staat." Trans. by C.Wartenberg and P. Hall, Oxford: Pergamon Press, 1966.

Wang J. (2010). "The Economic Impact of Special Economic Zones: Evidence from Chinese Municipalities"https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=NASM2011&paper_id=239

Weber, A. (1929). "Alfred Weber's Theory of Location of Industries." Chicago, IL: University of Chicago Press.

Weber, A. (1909). “Theory of the Location of Industries.” Chicago: The University of Chicago Press; translated by Carl J. Friedrich.

de Wolff, P. (1938). “The Demand for Passenger Cars in the United States.” *Econometrica*, *6* (2), 113-129.

Woodward, D. P. (1992). “Locational Determinants of Japanese Manufacturing Start-ups in the United States.” *Southern Economic Journal*, *53*, 690-708.

Woodward, D. P., and Rolfe, R. J. (1993). “The Location of Export-Oriented Foreign Direct Investment in the Caribbean Basin.” *Journal of International Business Studies, 24* (1), 121-44.

Wooldridge, J. M. (2002). Econometric Analysis of Cross Section and Panel Data. Cambridge, MA: MIT Press.

Wooldridge, J. M. (2003). “Introductory Econometrics: A Modern Approach”, *South-Western College Pub; 2 edition*

Yehoue, E. (2009). “Clusters as a driving engine for FDI.”*Economic Modeling, 26(5), 934-945.*

Yu, P., and Sun, Y. (2011).“The impacts of agglomeration on MNE's location choice in China.”*Economic Research Journal, 46(1), 71-82.*

Zhao H. and Zhu G. (1998). “Determinants of Ownership Preference of International Joint Ventures: New Evidence from Chinese Manufacturing Industries.”*International Business Review*, 7(6), 569-589