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„The Impact of Foreign Direct Investment on Economic Growth”

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Abstract:

In this paper I test the effect of Foreign Direct Investment (FDI) on economic growth using a cross-country OLS regression framework, utilizing data on about 130 countries over the last four decades. The results suggest that FDI has a positive impact on GDP growth, especially in the developing world. The impact is higher when a sufficient amount of human capital in the host country is available, and is found to decrease as we move along the conditional growth distribution.

Declaration of Authorship

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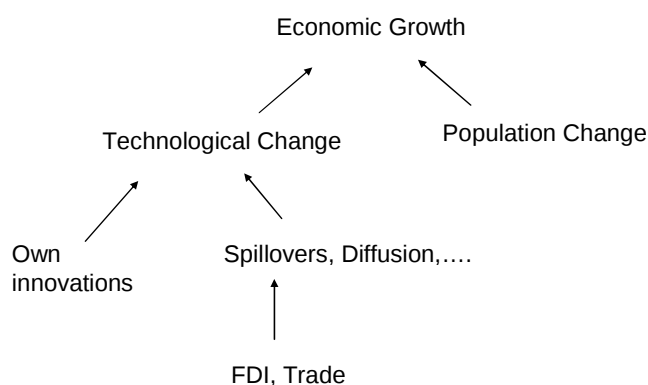
1. Introduction

Foreign direct investment has gained importance over the last 20 years. In 2008 total FDI inflows were at an all time high of 2500 billion USD, whereas this number was just 500 billion USD in 1998. Since 2008 FDI inflows have started to decline in the OECD area, but they are still increasing in other parts of the world and in particular in HIP (heavily indebted poor) countries. The main providers of FDI are the USA, France and the UK. On the other hand the main recipients of FDI are also the USA, Belgium and the UK. The biggest recipient of FDI in non-OECD countries is China.

Early studies, for example Solow (1956), show that there is a direct effect of investment on economic growth via capital accumulation. Newer growth theory focuses more on technological progress, arguing that innovation and invention are the main engines of growth. Besides this direct effect there is also an indirect effect of investment on economic growth. Foreign direct investment is considered to produce externalities in the form of technology transfer and spillovers. Many articles, Romer (1993) for example, argue that foreign direct investment can simplify the transfer of technology between rich and poor countries, therefore increasing productivity, not only of firms receiving the investment, but of the whole economy. The following figure gives a brief overview of this:

Table 1: Theoretical overview

Theoretical Overview:



As mentioned above technological change is considered a catalyst for economic growth. This technological change can happen by a country's own innovations, by foreign direct

investment from multinational firms to lesser developed markets or by international trade. The latter two channels can encourage the transfer of technology, diffusing it within and across industries, and can ease the transfer of business know-how to poorer countries.

However, empirical studies give mixed results about the impact of foreign direct investment on economic growth. Görg and Greenaway (2003) list 42 studies, 19 of them indicating a positive relationship between FDI and economic growth. Haddad and Aitken (1993) however find that FDI does not accelerate economic growth. Borenzstein, De Gregorio and Lee (1998) argue in their article that there has to be a well-educated workforce in order to gain benefits from FDI. In this thesis I test econometrically the relationship between FDI and economic growth, controlling for important economic growth determinants, including inflation, population growth, exports, and so on, and using data on 138 countries over the years from 1970 – 2010. My results indicate a statistically significant and positive impact of FDI on economic growth.

My thesis is structured as following: In section 2 I discuss some general facts about FDI, its development, forms and types, advantages and disadvantages and determinants. In section 3 I link FDI to growth and in section 4 I talk about the role of policy. Afterwards I describe my model, the econometric methods and the data I use before drawing conclusions.

2. Overview about Foreign Direct Investment (FDI)

a.) Definition of FDI

Considering statistics on global FDI inflows and outflows, the role of FDI has been increasing in the global economy over the last decades. This increase in foreign direct investments is a manifestation of the globalization process.

There are a number of related definitions of FDI. A common dictionary definition is that FDI involves “*investing directly in production in another country, either by buying a company there or establishing new operations of an existing business*” (Economist 13 Online Dictionary).

According to Energy Information Administration (EIA) in the USA, “*foreign direct investment in the United States is defined as the ownership or control, directly or indirectly, by one foreign investor of 10 percent or more of the voting securities of an incorporated U.S. business enterprise or the equivalent interest in an unincorporated U.S. business enterprise (or asset). Ownership or control of less than 10 percent of the voting securities of a business is not considered to be direct investment*” (Energy Information Administration, 2005).

UNCTAD characterizes; *“FDI refers to an investment made to acquire lasting interest in enterprises operating outside of the economy of the investor”* (BMP5, 1993)

OECD defines FDI as *“a direct investment enterprise is an incorporated or unincorporated enterprise in which a single foreign investor either owns 10 per cent or more of the ordinary shares or voting power of an enterprise (unless it can be proven that the 10 per cent ownership does not allow the investor an effective voice in the management) or owns less than 10 per cent of the ordinary shares or voting power of an enterprise, yet still maintains an effective voice in management”*. (BD3, 1996)

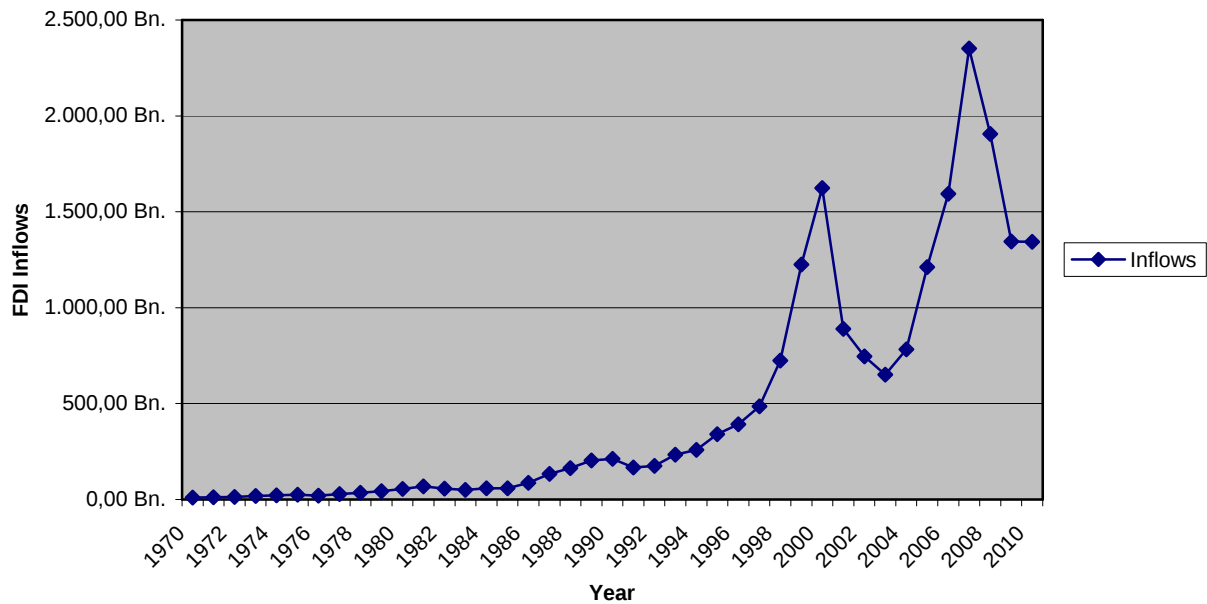
According to the “European Union foreign direct investment yearbook 2008” the definition of FDI is *“Foreign direct investment is the category of international investment in which an enterprise resident in one country (the direct investor) acquires an interest of at least 10 % in an enterprise resident in another country (the direct investment enterprise). Subsequent transactions between affiliated enterprises are also direct investment transactions”* (EU FDI Yearbook, 2008).

Summarizing those definitions, FDI is and investment from one firm to acquire some percentage of ownership from another firm in order to establish lasting interest outside of the economy of the investor.

b.) Importance of and developments in FDI

In order to determine the importance of FDI, I consider total FDI inflows in the world. There has been a huge increase starting in the mid-1990s, reaching its peak in 2001 at around 1.600,00 billion USD. It fell in the next three years to a low of around 600 billion USD, and again increased rapidly over the next 5 years with its peak in 2008 at an all time high of nearly 2.500 billion USD.

Table 2: FDI Inflows World



FDI in OECD countries:

FDI in OECD countries continued to fall in 2003 mostly due to overall sluggish macroeconomic performance of many of the larger countries. Several sectors that saw rampant cross-border investment in the late 1990s and 2000 are in a phase of consolidation and are still integrating old acquisitions into corporate strategies. Some companies heaved off non-core activities to domestic investors and this disinvestment weighs down overall inward FDI figures

Further declines in most OECD countries`FDI

FDI into the OECD area dropped from 535 billion US dollars (USD) in 2002 to USD 384 billion, representing a decline of around 28%. FDI outflows on the other hand remained nearly unchanged. Net FDI flows to non-members climbed to an impressive USD 192 billion from 32 billion USD in 2002, which indicates the traditional role as net providers of direct investment to the rest of the world.

The most affected country of the decline in FDI inflows was the USA. It suffered a decline of about 45% compared to 2002. Consequently, 2003 became the first year that China surpassed the US as the major recipient of FDI. FDI inflows to European countries were 23% lower than in 2002 (see table 2).

Table 2: Direct investment flows to and from OECD countries: 2000-2003
(USD Billion)

	Outflows				Inflows			
	2000	2001	2002p	2003e	2000	2001	2002p	2003e
Australia	0.7	12.2	7.6	14.3	13.2	4.7	16.5	7.8
Austria	5.7	3.1	5.3	7.1	8.8	5.9	1.0	6.9
Belgium/Luxembourg	218.4	100.6	..	..	221.0	84.7	..	..
Belgium	..	..	11.0	39.0	..	..	13.1	31.3
Luxembourg	..	..	126.2	81.8	..	..	117.1	73.2
Canada	44.7	36.1	26.4	21.6	66.8	27.5	21.0	6.6
Czech Republic	0.0	0.2	0.2	0.2	5.0	5.6	8.5	2.6
Denmark	26.5	13.4	5.7	1.2	33.8	11.5	6.6	2.6
Finland	24.0	8.4	7.6	-7.4	8.8	3.7	7.9	2.8
France	177.5	86.8	49.5	57.3	43.3	50.5	48.9	47.0
Germany	56.6	36.9	8.6	2.6	198.3	21.1	36.0	12.9
Greece	2.1	0.6	0.7	0.0	1.1	1.6	0.1	0.7
Hungary	0.6	0.4	0.3	1.6	2.8	3.9	2.8	2.5
Iceland	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.1
Ireland	4.6	4.1	3.1	1.9	25.8	9.7	24.4	25.5
Italy	12.3	21.5	17.1	9.1	13.4	14.9	14.6	17.0
Japan	31.5	38.4	32.3	28.8	8.3	6.2	9.2	6.3
Korea	5.0	2.4	2.6	3.4	9.3	3.5	2.4	3.2
Mexico	..	4.4	1.0	..	16.4	26.6	14.4	10.7
Netherlands	75.6	48.0	34.6	36.1	63.9	51.9	25.6	19.7
New Zealand	0.6	0.9	-1.0	-0.1	1.3	4.2	-0.6	0.8
Norway	7.6	-1.3	4.2	2.6	6.9	2.0	0.7	2.2
Poland	0.0	-0.1	0.2	0.4	9.3	5.7	4.1	4.2
Portugal	7.5	7.6	3.3	0.1	6.8	5.9	1.8	1.0
Slovak Republic	0.0	0.1	0.0	0.0	2.4	1.6	4.1	0.6
Spain	54.7	33.1	31.5	23.4	37.5	28.0	35.9	25.6
Sweden	40.7	6.4	10.7	10.6	23.2	11.9	11.6	3.4
Switzerland	44.7	18.2	7.6	10.9	19.3	8.9	5.7	12.2
Turkey	0.9	0.5	0.2	0.5	1.0	3.3	1.0	0.6
United Kingdom	233.5	58.9	35.2	55.3	118.8	52.7	27.8	14.6
United States	159.2	120.0	134.8	173.8	321.3	167.0	72.4	39.9
Total OECD	1 235.8	661.9	566.7	576.3	1 288.0	624.9	535.0	384.4

Notes: data are converted to US dollars using average exchange rates. p. preliminary; e. estimate.

Source: OECD International Direct Investment Database.

The largest suppliers of FDI to other countries were, in order of importance, the United States, France, United Kingdom, Belgium, Netherlands and Japan.

Over the last decade, the role of OECD countries as the world's foremost provider of direct investment funds has been firmly established. Net outflows reached USD 879 billion over the last decade (1994 to 2003). The main net exporters of FDI have been the United Kingdom, France, Japan, Switzerland and the Netherlands. Contrary, the United States are nearly even in inflows and outflows, and have actually been a net recipient over the last ten years. (see table 3)

Table 3: Cumulative FDI flows in OECD countries: 1994-2003
(USD billion)

Inflows		Outflows		Net outflows	
United States	1 349.6	United States	1 331.0	United Kingdom	415.6
Belgium/Luxembourg	762.7	United Kingdom	878.6	France	301.0
United Kingdom	463.1	Belgium/Luxembourg	767.0	Japan	217.6
Germany	387.0	France	652.7	Switzerland	108.5
France	351.6	Germany	452.7	Netherlands	96.3
Netherlands	286.5	Netherlands	382.8	Germany	65.6
Canada	208.1	Japan	268.0	Spain	46.7
Spain	183.5	Canada	237.3	Canada	29.2
Sweden	168.2	Spain	230.1	Finland	26.7
Mexico	138.2	Switzerland	190.4	Italy	25.9
Ireland	120.0	Sweden	150.2	Belgium/Luxembourg	4.3
Denmark	91.7	Italy	112.4	Portugal	3.4
Italy	86.5	Denmark	82.0	Norway	2.2
Australia	82.2	Finland	72.6	Iceland	0.5
Switzerland	81.9	Australia	57.3	Korea	-3.4
Poland	52.0	Norway	37.7	Greece	-5.0
Japan	50.5	Korea	37.5	Turkey	-7.0
Finland	45.9	Austria	33.6	Austria	-7.6
Austria	41.2	Portugal	29.2	Denmark	-9.7
Korea	40.9	Ireland	26.7	Slovak Republic	-10.9
Czech Republic	37.9	Mexico ¹	5.4	New Zealand	-17.0
Norway	35.5	Hungary	3.9	Sweden	-18.0
Hungary	32.4	Greece	3.7	United States	-18.7
Portugal	25.7	Turkey	3.6	Australia	-24.8
New Zealand	19.9	New Zealand	2.9	Hungary	-28.4
Slovak Republic	11.0	Iceland	1.5	Czech Republic	-36.7
Turkey	10.6	Czech Republic	1.2	Poland	-50.9
Greece	8.7	Poland	1.1	Ireland	-93.3
Iceland	1.0	Slovak Republic	0.1	Mexico ¹	-132.9
TOTAL OECD	5 174.0	TOTAL OECD	6 053.1	TOTAL OECD	879.2

1. Based on outflow data for 2001 and 2002 only.

Source: OECD International Direct Investment Database.

Non-OECD members:

In general, FDI inflows to non-OECD countries have held up better in recent years than those in the OECD area. This is hardly surprising as multinational enterprises (MNEs) not only invest in developing countries to gain access to resources or to integrate low-wage locations into their value chains anymore, but also to service local clients and to acquire a strategic position in markets that could become prosperous in the future.

China is the leading recipient of FDI inflows with around 53 billion USD.

How has FDI changed over the past decade?

The overwhelming majority of foreign direct investment has always been made in the form of fixtures, machinery, equipment and buildings. This is mostly achieved via mergers and acquisitions. However, within the past decade there has been a dramatic increase in the number of technology startups. This and the advent of the internet, has changed the pattern of FDI. Many of those small technology startups have grown out of R&D projects sponsored by universities or governments. They do not require huge manufacturing plants or storage. Companies whose product is intellectual property such as a software program or a software-based process are another aspect to the change in FDI patterns. They can be housed anywhere and do not need large investments in fixtures, machinery or plants.

Since those IPRPs (Intellectual Property Rights Products) tend to have longer incubation periods, and the product itself is constantly developing over time, even before it hits the market, the investment decision is heavily affected and makes it more complicated.

The recent spate of “dot.com” failures is quite illustrative of this point.

Therefore, the playing field of FDI has changed. Companies are still motivated to make foreign investment, but they need new vehicles to accomplish their goals, as we will see in the next chapter.

FDI in non-OECD countries: a source of development finance

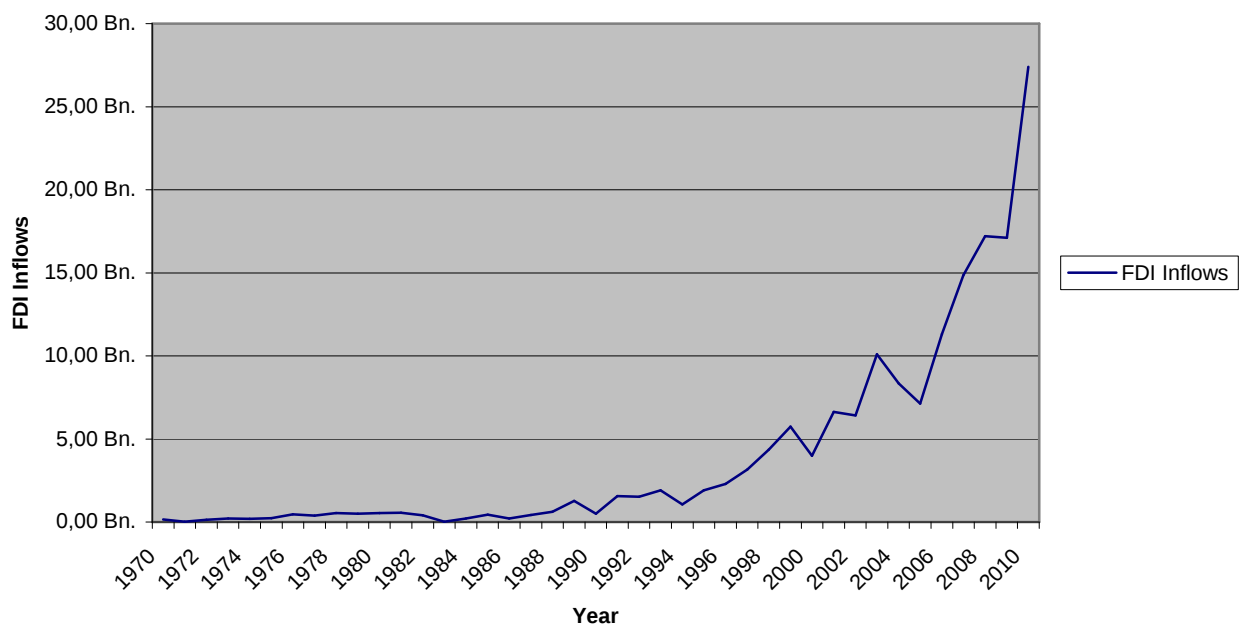
The financing of the United Nations` Millenium Development Goals (MDGs) will rely first and foremost on mobilizing domestic resources, supplement by external financing, such as official development aid (ODA) and FDI. The Monterrey Consensus highlights the need of policies in order to mobilize domestic resources and to attract private investment and for utilizing aid effectively. In turn, the international community agreed to scale up and intensify their efforts to help developing countries, by improving synergies between ODA and FDI. FDI has become of more and more importance because ODA is widely perceived as an insufficient source of external finance. In recent years FDI flows into developing countries have been more than twice the level of aid-flows. Even the FDI flows amongst developing countries have increased, which likely have positive developmental impacts, even if it is not a sign of resource transfer to the developing world as a whole.

A direct comparison of the impact of FDI and ODA are not straightforward, since ODA often goes to the poorest countries while almost all of the FDI goes to middle-income countries, that possess natural resources or are somehow attractive to investors.

Even if FDI has considerable potential as an external source of finance, it should be kept in mind that the main source of sustainable growth in developing countries will be domestic capital accumulation.

If we look at the figures of FDI inflows into the developing world (Table 5), here defined as the HICP (heavily indebted poor countries), we can say that there has been a rapid increase starting from 2000 with around 5 billion USD to nearly 27 billion USD only 10 years later.

Table 5: FDI Inflows to HIPC



c.) Forms and types of FDI

In its classic definition, FDI is a physical investment of a firm into building a factory in another country. But given the recent trends in international investment, as well as the change in trade and investment policies and the regulatory environment, this definition has been broadened and FDI can now have very different forms.

Basically there are two different types of FDI, vertical and horizontal FDI.

i) Types

1. Horizontal and vertical investment

Horizontal FDI means that firms implement the same activities or procedures in different countries. This is in contrast to vertical FDI, where firms locate their production chain to different countries, hoping to have overall lower production cost by outsourcing to the

cheapest location. The bulk of FDI is of horizontal nature. This suggests that market access is more important than the reduction of production costs.

These two types of FDI can now be undertaken by various different forms:

ii.) Forms

1. Mergers and Acquisitions

This is basically an investment form that transfers already existing assets from local firms to foreign firms. Acquisitions operate more independently and do not suffer from high levels of control towards them. They also experience higher acceptance in the local economy, showed by better marketing and higher levels of production and Research and Development (R&D). (Hanzing, 2002)

There is a slight distinction between the two terms, although often used with the same meaning. An Acquisition is when a company takes over another and clearly defines itself as the new owner. A merger on the other hand happens when two firms of about the same size agree to move on as one single firm.

Mergers and Acquisitions have become the most important form of FDI in recent years, accounting for nearly 80% of total world wide FDI. (Post, 2006)

2. Greenfield Investment

Involves parent companies starting a new venture by constructing facilities from the ground up and the companies usually also create new jobs by hiring local workers. The host countries offer tax-breaks, subsidies and other forms of incentives in order to attract Greenfield investment. Governments see those losses in tax revenues as a price to pay for the creation of new jobs, and the improvement in the countries' human capital.

3. Brown field Investment

In this case, a company purchases or leases already existing production facilities to set up its own, new production activity. The foreign company usually uses its own resources, replacing the ones from the acquired firm. Brownfield investment is often used to utilize inactive land and old infrastructure.

4. Licensing and technology transfer

A licence agreement basically is a contract between the licensor and the purchaser of a product or process. License agreements help to turn raw technologies that are developed at universities into finished products. More and more college researchers are becoming entrepreneurs. These alliances have serious impacts in several high tech industries such as computer software engineering, telecommunications, digital media productions, medical and agricultural biotechnology, and so on. Firms can take full advantage of new technologies while limiting the risks to royalty payments until the technology is fully developed and ready for the market.

5. Joint venture and other hybrid strategic alliances

The traditional joint venture is bilateral involving two partners within the same industry who are partnering for some strategic advantage. Those advantages can be access to new technology, expensive human capital or channels of distributions in key regions of the world. Pure joint ventures have a very high rate of failure mostly explained by the fact that it is very difficult to integrate different corporate cultures.

Joint ventures involving more than two partners are often called syndicates, and are mostly formed for specific projects like a huge construction or public projects that need a lot of different resources and expertise. Syndicates seem to be easier to manage as close collaboration is not a prerequisite for success, and therefore there is no need to integrate the different corporate cultures.

6. Portfolio investment

Investments are not considered direct investment if the amount of stock or capital is not enough to gain significant voting interest amongst shareholders. But two or more firms with mutual interest and with “soft” investment in another firm can use their shareholder power to effectively control management. Those alliances are called “shadow alliances” and in this context it is a form of direct investment.

d.) Advantages and Disadvantages

FDI has become an important determinant of the developing global economy, and its importance has increased steadily over the last decades. There are several reasons for this.

i.)Home country effect of outward FDI

1.Outward FDI and exports

Lipsey and Weiss (1981) and (1984) found in their studies of exports by industry to individual destinations and secondly of total exports by individual US firms that exports and production abroad were complementary.

Later studies by Blomström, Lipsey and Kulchycky (1988) found mixed results, mostly no relation, though more often positive than negative.

Swedenborg (2001) concluded in her study of home country effects of FDI that “...*the enormous growth of foreign production by Swedish firms in the thirty-year period, 1965-94 has not, in itself, had a negative effect on parent-company exports*” (p.121)

A possible interpretation of these studies is that foreign production has little influence on a firm's exports and trade is determined by other factors, such as a change in comparative advantage in production. FDI is more about the ownership of production and not necessarily its location. What moves from country to country when a direct investment is made is intellectual capital or techniques of production rather than physical capital or production capacity.

ii.)Host country effect of inward FDI

1.Host country wages

Most studies find that foreign-owned firms pay higher wages than privately-owned local firms, not only in developing countries but in most industries and most countries. There are several reasons for this phenomenon. One is that there might be some regulations or home-country pressures. Another reason is that local workers must be compensated to leave their preferred local firm. A third reason is that foreign firms have brought intellectual property and have to pay premiums in order to reduce worker turnovers. And lastly firms intend to attract better workers to get better knowledge of the local market by paying higher wages. There is overwhelming evidence in the literature that foreign firms, in all kinds of economies, pay higher wages than domestic firms. Much of the differential can be explained by the size of foreign operations. Higher productivity, accomplished by higher capital intensity and higher inputs of intermediate products, is also important. Whenever foreign firms pay higher wages this might have an effect on the level of wages in domestically-owned plants. Those effects are referred to as spillover effects, which I explain in a later section.

2. Host country productivity

The benefits in productivity stem mostly from the superior efficiency of foreign-owned firms. Blomström (1983), using Mexican manufacturing census data for 1970, found that value added per worker was 40 per cent higher in foreign- than in locally-owned plants. Most of the differential can be explained by differences in capital intensity, labor quality, the scale of production and concentration. Again, of importance is the question of whether or not this benefit spills over to locally-owned firms.

Kokko (1994) used the same census data as Blomström (1983) and confirmed the existence of productivity spillovers from foreign to locally-owned firms.

Görg and Greenaway (2001) summarize the results of their study of productivity spillovers by saying that "...only limited evidence in support of positive spillovers has been reported. Most work fails to find positive spillovers, with some even reporting negative spillovers, at the aggregate level" (p. 23).

iii.) Effect on investing firm

Advantages for the investing firm can be summarized as such:

- Avoiding foreign government pressure for local production
- Circumventing trade barriers, hidden or otherwise
- Making the move from domestic export sales to a locally-based national sales office
- Capability to increase total production capacity
- Opportunities for co-production, joint ventures with local partners, licensing, etc...

e.) Determinants of FDI

Before making the investment decision firms need to decide which country or market is most favourable for the corporate strategy. The OLI paradigm of Dunning (1997,1993) explains the activity of multinationals in terms of ownership (O), localization (L) and Internalization (I).

- The ownership advantage says that a firm must have a product or a production process that gives the firm some market power or an advantage in the foreign market (superior technique, reputation, brand names, trademarks,...)
- The localization advantage says that a firm must have an advantage in locating its investment abroad, i.e. differences in factor endowments, such as infrastructure, legal, social, political framework, or proximity between markets.

- The internalization advantage says that a firm must have a reason to exploit its ownership advantage internally and not by licensing it to some other foreign firms.

There are several factors one should consider when analyzing the inflows of FDI into a country. These are factors a firm considers when making the investment decision:

- Market size: usually proxied by real GDP or by population and it is a localization advantage. Most firms invest in search of new market opportunities, which can be related to market size.
- GDP growth rate: A higher rate of growth of GDP is expected to attract more FDI.
- Openness: Liberalization of trade can be closely related to FDI, because it could make the country more attractive for foreign investors. The relation between FDI and the degree of openness of a country proxies the liberalization of the trade regime in the host country and in part it indicates the propensity to export for multinational firms.
- The investment decision is also driven by linguistic and cultural differences. Firms always have to pay attention to the cultural differences before making the investment. It is recommended to enter a market with huge cultural distance by partnering with a domestic firm.
- Another risk in the investment decision is political stability and corruption. A key factor for a successful investment is a stable political environment. A study of Habib and Zurawicki (2002) suggests that corruption is a serious obstacle for investment. Investors may shun corruption because it is just morally wrong, and also try to avoid it because it can be difficult to manage, risky and costly. It is suggested that firms, as a whole, do not support corruption. Foreign investors should take an aggressive stand and combat corruption for their own long-term interest.
- Other variables that measure the macroeconomic framework such as the inflation rate and the terms of trade. The ability of a government to control inflation is expected to reduce investment risks and therefore will enhance FDI. The terms of trade provide information on relative import and export prices. An improvement in the terms of trade is associated with an increase in this ratio, and represents an improvement in a country's welfare.
- Variables that measure institutional stability and the quality of institutions and/or government from a country.

3. FDI and Economic Growth

a.) Direct Impact of Investment on Economic Growth – a neoclassical approach

Early studies in the economic growth literature used an aggregate production function approach, describing the relationship between the output of an economy and some inputs, mostly capital and labor. The basis for this analysis is the Solow model from 1956.

The role of investment in my framework can be summarized as the following:

The first equation is an aggregate production function,

$$Y = A * f(K, L) \quad [1]$$

where Y is output, K capital input, L labour input and A “Hicks-neutral” technology.

The second equation, commonly known as the capital accumulation equation, explores the relationship between investment in tangible assets (I), and the capital stock (K):

$$\Delta K_t = I_t - \alpha K_{t-1} \quad [2]$$

Where Δ represents a discrete change, α is a depreciation rate, and I_t is the gross investment.

The gross investment term can either be some fixed amount of the output, or endogenously determined by profit maximizing firms. Further, the neoclassical model assumes competitive factor markets and constant returns to scale where all inputs are paid their marginal outputs.

The decomposition of the production function relates output growth as a weighted function of change in primary inputs (i.e. K and L) and multi factor, or the famous cited “Solow residuals”: (or $\Delta \ln A$)

$$\Delta \ln Y = \beta_K \Delta \ln K + \beta_L \Delta \ln L + \Delta \ln A \quad [3]$$

Where β_K is capital’s share of output, β_L is labour’s share of output and the neoclassical assumption implies $\beta_L + \beta_K = 1$. The technology term A is assumed to be exogenous and described by the following equation:

$$A = A_0 e^g \quad [4]$$

Equation [2] and [3] describe the link between investment in tangible assets and economic growth. In particular, in this model capital accumulation contributes to economic growth in proportion to capital’s share of national output.

As appealing as the model may be, there are some troubling results. Since capital accumulation depends on diminishing returns, steady growth can not be achieved without exogenous technical progress, which is not explained at all in this model. However, Solow attributed about 90% of U.S. per capita output growth to exogenous technical progress.

Another limitation to this model is the definition of the term capital accumulation itself. Solow considers investment to be only in tangible assets. Mankiw (1995) however stated: *“there is an increasing consensus that the role of capital in economic growth should be broadly interpreted”* (p.308). Additionally Jorgenson (1996) contended: *“Investment is the commitment of current resources in the expectation of future returns and can take a multiplicity of forms...”* (p.57)

b.) The new growth theory

The new or endogenous growth literature focuses on the determinants of and impacts of technological progress on long-run growth. The literature emphasises that incentives drive innovation, invention and creation, and that these are a main engine of growth.

The following discussion is adapted from Romer (1994) who simplified the evolution of the endogenous growth models.

The models from Romer (1986, 1990), Lucas (1988) and Grossman and Helpman (1991) generally assumed constant returns to scale to inputs (i.e. K and L) and the level of technology depends on a set of inputs.

The model can be written in a simple form as:

$$Y_i = A(K) * f(K_i, L_i) \quad Y_i = A(K) * f(K_i, L_i) \quad [5]$$

Where: i – refers to firms and represents firm specific variables capital (K_i) and labour (L_i)

K – refers to the aggregate capital stock

A(K) – is the technology function.

Romer (1986) for instance specified the technology function A(.) as a function of the stock of research and development. He assumed that investment in R&D has positive external effects since the creation of new knowledge can not be perfectly patented or kept a secret. Therefore other firms will imitate and adopt, upgrading their production levels.

Lucas (1988) considered A(.) as a function of the human capital stock. He analysed the contribution of the average level of skill or human capital to productivity of all factors.

Coe and Helpman (1995) modelled A(.) as being dependent on the R&D stock of international trading partners. They stated that *“when a country has free access to all inputs available in the world economy, its productivity depends on the world’s R&D experience”* (p. 862)

The big difference between the neoclassical approach and those from the new growth theory is the technology function. The neoclassical model considers technological progress as

exogenous, whereas the latter one explains it as a form of investment spillovers of different sources, for example, human capital or research and development (R&D).

Both models, however, define capital accumulation (or formation in the latter one) as a very important engine for economic growth. This means that if FDI contributes to growth (via the direct effect) and to domestic investment (via indirect effects), then its overall impact can be substantial, and therefore FDI can be a source of sustainable growth and development, depending on the size of the indirect effects, which are explained in the next section.

c.) Indirect impact

The main reason to examine the role of FDI to economic growth is to understand the contribution of inward investment to the economic growth of the host country. Literature suggests that this contribution is mainly in the form of spillovers from MNEs to indigenous firms.

i) Channels of spillovers

There is a very well developed literature on why multinational enterprises (MNEs) set up overseas rather than just export directly. A persuasive explanation is that firms have some technological advantage and want to protect it, thus internalising certain transactions. But the question is then, how can any advantage spill over to the local economy via firms in the same industry?

Saggi (2002) finds three potential channels through which spillovers might occur:

- **Demonstration effects:** The exposure to superior technology leads local firms to update their production methods. Geographical proximity is a crucial point in this argument. FDI may expand the set of available technologies for local firms, but a mere exposure to it, doesn't mean faster adoption. Wang and Blomström (1992) find that technology transfer through FDI is positively related to the local firm's investment in learning. It is important to note that the demonstration effect strongly depends on the legal system, regulations, patents and human capital.
- **Labor Turnover:** Workers that are trained or previously employed by multinationals may transfer important information to local firms by switching employers or may contribute to technology diffusion by starting their own firms. The ability of local firms to absorb new technologies from multinationals is a key determinant of whether any labor turnover that takes place impacts upon the domestically-owned firms. Also

the local investment climate may be such that workers find it unprofitable to leave the multinational and start their own company. Since superior technology is one of the keys for multinationals to successfully compete with local firms, they have to pay higher wages than local firms, in order to prevent technology diffusion. This need not be socially efficient, and therefore technology diffusion is not necessarily optimal for the host economy. Policies designed to encourage diffusion do not always increase welfare of the recipient country.

Labor competition policy, trade secrets laws may also affect labor turnover.

- **Vertical linkages:** Multinationals may transfer technology to firms that are potential suppliers of intermediate goods or buyers of their own product.

Mexico's experience with FDI in the automobile industry is a perfect example:

Foreign producers transferred industry best practices, zero defect procedures, and production audits to domestic suppliers, thereby improving their productivity and the quality of their products. As a result of increased competition and efficiency, Mexican exports boomed. Thus, although direct competitors of multinationals may not realize technological benefits, suppliers of intermediate goods are likely to benefit substantially.

Görg and Greenaway (2003) identify four channels through which the host might benefit, as set out in the following table.

Table 6: Spillover Channels

Driver	Sources of Productivity Gain
Imitation	• Adoption of new production methods. • Adoption of new management practices.
Competition	• Reduction in X-inefficiency. • Faster adoption of new technology.
Human Capital	• Increased productivity of complementary labour. • Tacit knowledge
Exports	• Scale economies. • Exposure to technology frontier.

Imitation is a classic transmission mechanism for new products and processes. The scope always depends on the complexity of the process. Consequently, the more complex the process, the more difficult the imitation. But imitation need not be limited to processes or products, with managerial or organisational innovations also being imitated. As seen in the table above, local firms can upgrade their production methods and practices by imitating, therefore increasing their productivity level.

Another channel which is often emphasised in the literature is **competition**. Even if local firms are not able to imitate the new technology used by the MNE, they still produce in competition and thus need to use their existing technology more efficient. Competition also leads to an increase in the speed of the adoption of the new technology or the imitation of it. However, competition can also work in a reverse way, as domestic firms, especially in developing countries are simply unable to compete with the multinationals.

New technology can also be adopted by the **acquisition of human capital**, which is the third channel of spillovers. Since MNEs need to find workers that are able to use the new technology, they have to invest in training. Those workers often move back to local firms or start up their own firm, thus diffusing their newly gained knowledge. This generates productivity improvements. Haaker (1999) and a survey by Görg and Strobl (2002) argue that this is the most important channel for spillovers. One counter argument to the positive human capital effect is that MNEs skim the market of well-trained workers and free-ride on previous training provided by domestic firms.

Another channel might be via **exports**. Exporting generally includes costs, such as establishing distribution networks, transport infrastructure, regulatory arrangements and so on. MNEs are most likely already endowed with all this information and local firms can learn how to penetrate export markets. There is a growing literature about exporting and productivity gain.

Regional Dimensions

Human capital acquisition and imitation can be considered as the more important channels for spillovers and since Audretsch (1998) argues that geographical proximity is necessary to facilitate knowledge spillovers, domestic firms that are located near to multinationals may be more likely to benefit than other firms. Therefore transmission costs are assumed to increase with distance

This has been investigated several times with mixed results. Sjöholm (1999) fails to find evidence for a regional component, when he calculated proxies for foreign presence at the regional level using cross-sectional data for Indonesia. Aitken and Harrison (1999) used firm level panel data for Venezuela to find positive spillovers from multinationals in one region to domestic firms in the same region, but failed to do so. They rather found negative spillovers.

ii) Spillover effects

Now that the different channels through which spillovers might occur have been discussed, let's examine the different spillover effects.

1. Research & Development spillovers

In a world with international trade in goods and services, FDI, and the international exchange of information and knowledge, a country's productivity depends on its own Research and Development (R&D) as well as on R&D efforts of its trading partners. A country's own R&D allows it to use its resources more effectively thereby increasing its productivity.

Additionally, own R&D enhances a country's benefits from technological advance in the rest of the world, and again thereby raising the productivity level.

Benefits from foreign R&D can either be direct or indirect. Direct benefits are the learning of new technologies and materials, production processes and organizational methods. Indirect benefits come from imports of goods and services developed by trade partners. In either case foreign R&D affects a country's productivity level.

Foreign R&D capital stocks have stronger effects on domestic productivity the larger the share of domestic imports in GDP. The more open an economy is to trade, the more benefits it extracts. In smaller countries the foreign R&D capital stock is as important as the domestic, while in larger (G7) countries the domestic R&D capital stock is more important.

Coe and Helpman (1995) find that *"the rate of return on R&D capital is very high, both in terms of domestic output and in terms of international spillovers"*. In their calculations they find that *"the average own rate of return from investment in R&D in 1990 was 123% in the G7 countries and 85% in the remaining 15 countries."* The average worldwide rate of return from investment in R&D in the G7 countries was 155%. The difference in the own and worldwide rate of return is about 30%, which implies a large international R&D spillover.

2. Export spillovers

There are three main factors for domestic firms concerning spillovers from exports.

Firstly, local firms get more knowledge of foreign markets through the presence of MNEs. Multinational enterprises usually already have large distribution networks and better knowledge of the markets. Local firms can learn how to penetrate those markets.

Secondly, there are also demonstration effects of the MNEs' superior production and management techniques and thirdly the competition with MNEs on both the local and the foreign market can induce domestic firms to improve their export performance.

Greenaway, Sousa and Wakelin (2004) find that MNEs exports have a positive effect on domestic firm's probability to export but not on their export ratio. R&D spillovers and the presence of MNEs in the sector have a positive effect on both the decision to export and the choice of export ratio.

Barrios, Görg and Strobl (2003) show that domestic firms learn from MNEs to increase their export to other developed countries which are generally markets with superior technological capability.

Exporting is associated with higher productivity. Therefore the presence of MNEs can have an indirect impact of domestic firm's productivity by increasing the propensity to export.

3. *Wage spillovers*

If labour productivity increases via spillovers, local firms will pay higher wages in competitive labour markets, to attract workers. Lipsey and Sjöholm (2001) find that higher foreign presence in a sector leads to higher wages in domestic firms in the same sector.

Girma, Greenaway and Wakelin (2001) use firm level panel data and find no effect of MNEs in a sector of the wage level in domestic firms but some negative effect on wage growth.

Lipsey and Sjöholm (2001) made a variety of calculations of spillovers from foreign presence to wages in domestically- owned establishments in Indonesia, calculating foreign presence at various levels of industry and geographical detail. In every variant, there were significant spillovers to domestically- owned establishments. The coefficients on foreign shares were larger than the wage differentials themselves, suggesting some impact through increases in the demand for labor.

Some of the literature on wage spillovers from foreign-owned to domestically- owned firms has recently been reviewed by Görg and Greenaway (2001). They summarize the results of panel data studies as showing mostly negative spillovers and cross-section studies as showing positive spillovers. There is no overlap in the countries studied, but the authors are sceptical about all findings from cross-section studies. There are enough indications of positive wage spillovers to preclude any general conclusion that they are typically negative. What is needed

is more consideration of the different circumstances and policies of countries and industries that promote or obstruct spillovers.

4. Vertical linkages

Multinationals may provide technical assistance to enable suppliers to raise the quality of their intermediate products, or provide high quality standards for local inputs, which create incentives for local firms to upgrade their technology. Harris and Robinson (2003) distinguish in their productivity study between horizontal and vertical spillovers, and find that none of the spillovers is always positive, however and there is evidence of negative spillovers in many of the sectors.

5. Negative spillovers

The so-called dependency scholars claim in their studies that most of the benefits from spillovers are transferred to the multinational enterprise's home country, and that FDI from developed to developing country harms the long-run growth (see Singer, 1950; and Prebisch, 1968). Bos et al (1974) identified some other negative factors such as price distortions due to protectionism, market monopolization and depletion of natural resources. UNCTAD (1999) supports this view arguing that MNEs are often involved in exploiting natural resources. However, most of the empirical reviews do not support the views of the dependency scholars.

iii) Characteristics of host country

This is not about determinants of FDI, which are emphasised in chapter 2.5., but whether there are some characteristics of the host country that might affect the adoption of new technologies or spillovers from FDI in general.

Relative backwardness

Findlay (1978) stressed the importance of relative backwardness, which refers to the distance between two economies in terms of development. His model suggests *“that the greater this distance, the greater the backlog of available opportunities to exploit in the less advanced economy, the greater the pressure for change and therefore the more rapidly new technology is imitated/adopted.* (Görg and Greenaway, 2003)

Contagion

The speed of adoption is also a function of contagion, meaning the faster MNEs establish upstream and downstream networks, the faster local firms are exposed to the new technology, promoting its diffusion and therefore the faster is the transfer of technology.

Absorptive Capacity

The term absorptive capacity describes the ability of a country to adopt new technologies. The bigger the gap in terms of technological standards between two countries, the less likely is the lower developed country to have the human capital, physical infrastructure and distribution networks to be able to absorb new technology. Therefore MNEs will transfer only lower quality technology and as a result the potential for spillovers is lower. (Glass and Saggi, 1998) Borenzstein et.al (1998) claim in their paper *“that the effect of FDI on economic growth is dependent on the level of human capital available in the host economy”*.

4. The role of policy

Since FDI is generally seen as a contributor to economic growth via an improvement in productivity through both direct and indirect channels, it has become a policy priority for many governments. This leads to 3 questions:

- Can active policy influence the level of inward investment?
- Can policies maximize the impact of FDI?
- Do policies yield net benefits?

The influence of policies regarding the composition and the level of FDI has been reviewed extensively. Although most of the work considers developing countries, there is also research related to industrialized countries. The key points from the literature are:

- Trade policy is relevant: economies with open trade regimes, do better at attracting FDI and benefiting more from it (see Balasubramanyam, Salisu and Sapsford, 1996).
- Investment incentives can affect the choice of location of MNEs. The effect appears to be small though. Competition between host governments may render incentives ineffective as they offset each other (see Head, Ries and Swenson, 1999).
- Trade related investment measures (TRIMs) are often introduced to recapture some of the rents which accrue to MNEs. They can have positive welfare effects on the host country, but the evidence does not point to major effects on inward investment.

- The quality of local infrastructure is very important, in particular communication and transportation infrastructure.
- The availability of skilled labour is an important magnet: The larger the supply of skilled labour workers, the higher the benefit from spillovers.
- Providing a supportive economic environment seems to be essential, i.e. education, and training policies aiming at upgrading skills, technology policies aiming at developing clusters and public investment policies aiming at efficient and reliable transportation and communication networks.

5. Empirical findings in the literature

In this section I am going to review and summarize what is done so far in the existing literature. There are a lot of papers that have been investigating the effect of FDI on economic growth.

In general a positive relationship between FDI and growth is not always found at the aggregate level and this relationship is often found to be contingent on a certain threshold level of human capital. At the firm and industry level, on the other hand, a positive effect of foreign presence on domestic firm's productivity is also not always found. In fact, even negative effects are often found.

Romer (1993) finds that there can be a positive effect of growth in developing countries by helping them bridge the idea gap with respect to industrial countries

Borenstein and others (1998) utilize data on FDI flows from industrial countries to 69 developing countries to test the effect of FDI on growth in a cross-country regression framework. They find that FDI contributes more to domestic growth than domestic investment, suggesting indeed that FDI is a vehicle of technology transfer. These results are somewhat nuanced however, with FDI only enhancing growth in countries with a minimum threshold stock of human capital

Balasubramanyam and others (1996) run a similar regression, and they found that the growth-enhancing effects of FDI are stronger in countries that pursue a policy of export promotion rather than import substitution. They further find that in countries with export-promoting trade regimes, FDI has a stronger effect on growth than domestic investment.

Keller (1996) finds that the mere access to foreign technologies may not increase the growth rates of developing countries. A switch to an outward orientation does not lead to a higher growth rate, if the absorptive capacity is unchanged. The stock of human capital constrains the ability of a country to benefit from foreign technologies.

Glass and Saggi (1998) found that investment in imitation by firms of the host country generates the necessary knowledge (skill) foundation for FDI, and thus factors that promote imitation, also promote a higher-quality mix of FDI.

The above studies all consider the impact of FDI on growth at the aggregate level. An alternative set of studies considers the impact of foreign presence on firm-level productivity, addressing whether foreign presence has spillover effects on the productivity of domestic firms. Görg and Greenaway (2003) summarize 42 studies on horizontal productivity spillovers:

Table 7: Intra-industry productivity spillovers

	Author(s)	Country	Year	Data	Aggregation	Result
	Developing Countries					
1	Blomström & Persson (1983)	Mexico	1970	cs	micro	+
2	Blomström (1986)	Mexico	1970/1975	cs	micro	+
3	Blomström & Wolff (1994)	Mexico	1970/1975	cs	micro	+
4	Kokko (1994)	Mexico	1970	cs	micro	+
5	Kokko (1996)	Mexico	1970	cs	micro	+
6	Haddad & Harrison (1993)	Morocco	1985-1989	panel	micro & ind.	?
7	Kokko et al. (1996)	Uruguay	1990	cs	micro	?
8	Blomström & Sjöholm (1999)	Indonesia	1991	cs	micro	+
9	Sjöholm (1999a)	Indonesia	1980-1991	cs	micro	+
10	Sjöholm (1999b)	Indonesia	1980-1991	cs	micro	+
11	Chuang & Lin (1999)	Taiwan	1991	cs	micro	+
12	Aitken & Harrison (1999)	Venezuela	1976-1989	panel	micro	-
13	Kathuria (2000)	India	1976-1989	panel	micro	?
14	Kokko et al. (2001)	Uruguay	1988	cs	micro	?
15	Kugler (2001)	Colombia	1974-1998	panel	industry	?
16	López-Córdova (2002)	Mexico	1993-1999	panel	micro	-/?
17	Görg & Strobl (2002c)	Ghana	1991-1997	panel	micro	+
	Developed Countries					
18	Caves (1974)	Australia	1966	cs	industry	+
19	Globerman (1979)	Canada	1972	cs	industry	+
20	Liu et al. (2000)	UK	1991-1995	panel	industry	+
21	Driffield (2001)	UK	1989-1992	cs	industry	+
22	Girma et al. (2001)	UK	1991-1996	cs	micro	?
23	Girma & Wakelin (2001)	UK	1980-1992	panel	micro	?
24	Harris & Robinson (2001)	UK	1974-1995	panel	micro	?
25	Girma & Wakelin (2002)	UK	1988-1996	panel	micro	?
26	Haskel et al. (2002)	UK	1973-1992	panel	micro	+/?
27	Girma (2002)	UK	1989-1999	panel	micro	?
28	Girma & Görg (2002)	UK	1980-1992	panel	micro	?
29	Ruane & Ugur (2002)	Ireland	1991-1998	panel	micro	+
30	Barrios & Strobl (2002)	Spain	1990-1994	panel	micro	?
31	Dimelis & Louri (2002)	Greece	1997	cs	micro	+
32	Castellani & Zanfei (2002)	France, Italy, Spain	1992-1997	panel	micro	+ for Italy

						- for Spain ? For France
33	Keller & Yeaple (2003)	US	1987-1996	panel	micro	+
34	Görg & Strobl (2003)	Ireland	1973-1996	panel	micro	+
	Transition Countries					
35	Djankov & Hoekman (2000)	Czech Republic	1993-1996	panel	micro	-
36	Kinoshita (2001)	Czech Republic	1995-1998	panel	micro	?
37	Bosco (2001)	Hungary	1993-1997	panel	micro	?
38	Konings (2001)	Bulgaria	1993-1997	panel	micro	-
		Poland	1994-1997			?
		Romania	1993-1997			-
39	Damijan et al. (2001)	Bulgaria, Czech Republic, Estonia, Hungary, Poland, Romania, Slovakia, Slovenia	1994-1998	panel	micro	? Or -, + only for Romania
40	Li et al. (2001)	China	1995	cs	industry	+
41	Smazynska (2002)	Lithuania	1996-2000	panel	micro	?
42	Zukowska-Gagelmann (2002)	Poland	1993-1997	panel	micro	-

Of these studies, 19 report statistically significant and positive horizontal spillover effects.

However 11 of them use cross sectional data which may lead to biased results as the spillovers may vary from sector to sector and can not be aggregated. Considering this, there are only 7 studies with panel data that find positive effects, none of them for developing countries.

In a number of cases, for example Aitken and Harrison (1999), evidence of negative productivity effects of foreign presence are found. A number of arguments have been proposed to explain these negative effects.

Firstly, there might be lags in the adoption of new technology which are not accounted for in short-run analysis. Secondly, MNEs may be able to guard their technological advantage closely, keeping it a secret and therefore no spillovers occur. Thirdly, spillovers may only affect some firms and aggregate studies underestimate this positive effect.

6. The model

My model is based on endogenous growth theory, in the tradition of Borenstein, Gregorio, and Lee (1995), and Balasubramanyam, Salisu, and Sapsford (1996), where FDI contributes to economic growth directly through new technologies and other inputs as well as indirectly through improving human capital.

The basic formulation looks like this:

$$\text{GROW} = a + b_1 L_FDI + b_2 EXP + b_3 POP_GR + b_4 GOV + b_5 \text{init_gdppc} + b_6 INF + b_7 GCF + b_8 SCH + e$$

Where, as above described, “GROW” is the GDP growth rate, “L_FDI” the logarithm of FDI inflows in % of GDP, “EXP” are the exports of goods and services in % of GDP, “POP_GR” is the population growth, “GOV” is the general government final consumption expenditures, “init_gdppc” is the initial GDP per capita, “GCF” is the gross capital formation in percent of GDP, “INF” is the inflation rate, “SCH” is the years of secondary schooling and “e” the error term.

Most of these specifications are borrowed from the paper of Borenzstein, Gregorio, and Lee (1995). I added the population growth variable because growth in GDP can be achieved simply by the growth of the population, and I added the export variable, because as described in the theory above, there might be potential spillovers from the exports that lead to economic growth.

In my second and third equation I add country and year dummies to control for fixed effects. I am going to describe the econometric techniques in the next section. Then I add the democracy dummy variable to control for political factors.

I then run the same regressions for developed and less developed countries. I defined “developed” countries as the OECD countries as of 2010. All the other countries are considered “less developed”.

Then I add two interaction terms, $L_FDI * SCH$, and $EXP * SCH$, in order to control for the absorptive capacity and diffusion via trade. Again I borrowed this idea from the Borenzstein et al. (1995) paper.

Rather than use simple interaction terms to test for non-linearities I further use threshold regression analysis to examine whether there is a threshold level of human capital above which the effect of FDI on growth differs. This threshold will provide an estimate of the level of absorptive capacity that has to exist for a country to be able to benefit from spillovers. To estimate this model I use the recently developed endogenous threshold model of Hansen (1996, 1999, 2000).

To account for alternative non-linear effects I further report results from quantile regression models. These allow the coefficients on the FDI variable as well as the other explanatory variables to differ along the conditional growth distribution and thus allow me to examine

whether the growth effects of FDI differ for under- and over-achievers, that is, countries that perform worse or better than expected given values for the explanatory variables in the model.

7. Methods

In this section I am going to describe the econometric techniques I used for my regressions.

A.) OLS Regressions

OLS stands for Ordinary Least Squares, the standard linear regression procedure. One estimates a parameter from data by applying the linear model

$$Y = Xb + e$$

where y is the dependent variable or vector, X is a matrix of independent variables, b is a vector of parameters to be estimated, and e is a vector of errors with mean zero that make the equations equal.

B.) OLS Threshold regression

Threshold models are getting more and more popular in order to model parameter heterogeneity and non-linearities. This technique was developed by Hansen in a series of papers (1996, 1999, 2000), and allows the sample data to jointly determine both the regression coefficients and the threshold value for OLS and (non-dynamic) fixed effects panel models.

The threshold model for a single threshold can be written as:

$$\begin{aligned} y_i &= \delta_1 x_i + \varepsilon_i & q_i &\leq \lambda_1 \\ y_i &= \delta_2 x_i + \varepsilon_i & q_i &> \lambda_1 \end{aligned}$$

where q_i is the threshold variable. The observations are divided into two groups depending on whether the threshold variable is greater or smaller than λ_1 . δ_1 and δ_2 distinguish the two different groups by different slopes. It is recommended to estimate λ_1 by least squares.

Once a threshold is found, it is important to test whether or not this threshold is statistically significant, therefore testing the null-hypothesis: $H_0: \delta_1 = \delta_2$. This can be done using a bootstrapping procedure.

We employ the threshold regression model to examine further whether there is a non-linear relationship between FDI and growth due to absorptive capacity (as measured by human capital).

C.) Quantile Regressions

Another non-linear approach that is becoming more and more popular is the use of quantile regression methods. These models aim to model the conditional quantile functions, in which the quantiles of the conditional distribution of the dependent variable are expressed as functions of observed covariates. The main advantage of quantile regressions is that different solutions at various quantiles can be interpreted as different responses of the dependent variable to changes of the regressor along various points in the conditional distribution of the dependent variable.

Quantile regressions were firstly introduced by Koenker and Bassett (1978) and are nowadays applied in a wide range of economic issues.

In my model, quantile regressions allow me to estimate different coefficients on the covariates for under- and over-achievers (i.e. countries in the lower and upper ends of the conditional growth distribution).

8. Data

To estimate the regression model this thesis employs data from three sources. FDI, the GDP growth rate, initial GDP per capita, the inflation rate, the ratio of exports of goods and services in GDP, general government final consumption expenditure and population growth are all obtained from the World Bank's World Development Indicators database.

The data for the average years of secondary schooling is taken from Barro and Lee (2011).

The data for the democracy dummy variable is taken from the Polity IV Project. The "Polity Score" captures this regime authority spectrum on a 21-point scale ranging from -10 (hereditary monarchy) to +10 (consolidated democracy). The Polity scores can also be converted to regime categories: recommend is a three-part categorization of "autocracies" (-10 to -6), "anocracies" (-5 to +5 and the three special values: -66, -77, and -88), and "democracies" (+6 to +10)

a.) Descriptive statistics

Table 8 provides summary statistics on our main variables of interest.

Variable	Observations	Mean	Std. Deviation	Min	Max
GROW	6810	.0369527	.0659836	-.5103086	1.518296
INF	5600	.381684	5.219578	-1	244.1103
EXP	6203	.3724855	.2643783	.0018297	2.343522
POP_GR	8669	.0176244	.0162189	-.1095514	.1959724
GCF	6022	.2319115	.0899904	-.2376259	1.135779
GOV	5959	.1642011	.0707546	.0137519	.8315895
SCH	5863	1.997837	1.350503	0	7.476144
L_FDI	5793	18.51282	3.021848	2.374347	26.49556

where the interesting variables are: “GROW” is the GDP growth rate, “LFDI” the logarithm of FDI inflows in % of GDP, “EXP” are the exports of goods and services in % of GDP, “POP_GR” is the population growth, “GOV” is the general government final consumption expenditures, “INF” is the inflation rate, “GCF” is the gross capital formation, and “SCH” is the years of secondary schooling.

The mean GDP growth rate is 3.69%, ranging from -51% to nearly +52%. The mean inflation rate in the data sample is about 3.8% and the mean share of exports of goods and services of total GDP is around 37%. Population growth is 1.76%. In the analysis below I split the sample, considering separate regressions for OECD member states and non-OECD members. It is interesting to also look at the descriptive statistics for those two different samples therefore.

Here is the table for the OECD members:

Variable	Observations	Mean	Std. Deviation	Min	Max
GROW	1261	.030243	.0336537	-.2116866	.1366084
INF	1174	.1079176	.2715178	-.0962854	5.553812
EXP	1226	.36172	.2333253	.0321972	1.784308
POP_GR	1353	.0074549	.0074758	-.0452576	.0601702
GCF	1238	.2374675	.0481734	.0985421	.4131038
GOV	1231	.1790701	.0516641	.0725755	.4340595
SCH	1353	3.026986	1.221051	.4683071	7.476144
L_FDI	1140	21.33869	2.18986	12.26013	26.49556

The GDP growth rate dropped to 3% and inflation increased to nearly 10.8%. The exports are around the same proportion of total GDP that in the total sample. Population growth is at a rate of 0.7%.

Here is the table for the non-OECD members:

Table 10: summary statistics non-OECD					
Variable	Observations	Mean	Std. Deviation	Min	Max
GROW	5549	.0384775	.0712294	-.5103086	1.518296
INF	4426	.4543008	5.867488	-1	244.1103
EXP	4977	.3751374	.2714389	.0018297	2.343522
POP_GR	7316	.0195051	.0166947	-.1095514	.1959724
GCF	4784	.2304737	.0978986	-.2376259	1.135779
GOV	4728	.1603298	.0744501	.0137519	.8315895
SCH	4510	1.689092	1.229195	0	5.792189
L_FDI	4653	17.82047	2.785467	2.374347	25.94406

The most interesting change is the one in the inflation rate to an astonishing 45%. Population growth is a bit higher than in the complete sample with 1.95%.

9. Findings

The purpose of my empirical investigation is to estimate the effects of FDI on per capita GDP growth. I also look for different results in OECD and non-OECD, as well as in democratic and non-democratic countries. Interactions between FDI and human capital, as well as the between exports and human capital are tested for, in order to examine whether the level of absorptive capacity impacts upon the relationship between growth and both FDI and exports.

A.) OLS Regressions

Table 11 presents the results from the different regressions.

Table 11: OLS regression results							
Regression number	1	2	3	4	5	6	7
Independent variable	Main OLS regression	Fixed effects	Democracy Dummy (fixed effects)	OECD (fixed effects)	Non-OECD (fixed effects)	Interaction term L_FDI*SCH (fixed effects)	Interaction term EXP*SCH (fixed effects)
L_FDI	0.0013*** (0.00035)	0.0024*** (0.0006)	0.0032*** (0.0009)	-0.0008*** (0.0009)	0.003*** (0.0007)	0.00178*** (0.00077)	0.0024*** (0.0006)
Init_gdppc	-0.0036*** (0.0009)						
POP_GR	0.5250* (0.06489)	0.4179* (0.0895)	-0.0559 (0.19498)	0.2395 (0.1061)	0.5038 (0.10746)	0.3966* (0.09097)	0.4189* (0.09062)
EXP	0.0095*** (0.00287)	0.00343*** (0.008)	0.04225** (0.0119)	0.1599** (0.0104)	0.00423*** (0.0100)	0.00275*** (0.0080)	0.00414** (0.01318)
INF	-0.0004*** (0.00014)	- (0.00014)	-0.0013*** (0.00021)	-0.0254*** (0.00408)	0.00054*** (0.00015)	-0.00056*** (0.00014)	-0.00057*** (0.00014)
GOV	-0.09147** (0.01391)	-0.1370** (0.0231)	-0.14598** (0.03273)	-0.1477** (0.03890)	-0.12178** (0.02773)	-0.1369** (0.0231)	-0.1372** (0.0232)
GCF	0.1592** (0.01078)	0.1292** (0.01376)	0.1240** (0.0178)	0.2410** (0.025)	0.1113** (0.0164)	0.1302** (0.0138)	0.1291** (0.01387)
SCH	-8.9e-06*** (0.00096)	- (0.0023)	-0.00412*** (0.00267)	- (0.00216)	-0.0038*** (0.0034)	-0.0110*** (0.00659)	-0.00283*** (0.00298)
L_FDI*SCH						0.00036*** (0.00027)	
EXP*SCH							-0.00025*** (0.00368)
Nr. Of Observations	3102	3642	2004	1024	2618	3642	3642
R ²	0.1354	0.2861	0.3491	0.5321	0.2666	0.2865	0.2861

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

NonLin variable: L_FDI

We begin our discussion of the results by considering the results in Column 1, which report simple OLS results with neither time nor country fixed effects included. Regressions two to seven all include time and country fixed effects. We find that the coefficients on the additional explanatory variables are largely as expected with negative coefficients on initial GDP per capita, the inflation rate and government spending and positive coefficients on the ratio of exports to GDP and investment. The coefficient on population growth is positive and significant, which is somewhat unexpected, as is the negative (albeit insignificant) coefficient on schooling. Finally, the coefficient on the FDI variable is positive and significant and suggests that higher levels of inward FDI are associated with higher growth rates.

FDI has a positive, although small, influence with a coefficient of 0,13%. This means that a 1% increase in FDI increases GDP by 0,13%.

Column (2) reports results when country and time fixed effects are included in the regression equation, i.e. the model is a two-way fixed effects regression. Qualitatively the coefficients on the explanatory variables are largely similar, with most coefficients continuing to be significant. The coefficient on population growth decreases, while the negative influence of government expenditures increases, and years of schooling remains negative. Interestingly, the coefficient on FDI nearly doubles implying that a 1 percent increase in FDI is associated with an increase in growth of 0.24 percent.

In Column (3) I include the democracy dummy variable to examine whether a stable political environment influences the regression results. Results are qualitatively similar though the coefficient on FDI again rises, implying that a 1 percent increase in FDI is associated with an increase in growth of 0.32%. There is a large increase in the coefficient on exports when the democracy variable is included, with the coefficient on the human capital variable remaining negative.

Columns (4) and (5) report results for the OECD sample and the non-OECD sample separately respectively. Here we observe interesting differences across the two sub-samples. While the signs (and significance) of the variables is fairly similar for the two different sub-samples, there are important differences in the size of coefficients. The coefficient on population growth is found to be larger for the non-OECD sample, while that for the ratio of exports to GDP is larger (and significant only) for the OECD sample. The inflation rate has a larger negative effect and investment a larger positive effect on the non-OECD sample, with similar effects found for government spending. Most importantly however, we find that while the coefficient on FDI is negative and insignificant for OECD countries it is positive and significant for the non-OECD sample.

In the final two columns I include the interaction terms “ $lfdi*yr_sch_sec$ ” and “ $exp*yr_sch_sec$ ” to account for potential non-linear effects of FDI and openness due to a country’s absorptive capacity – as measured by the average years of schooling. The results do not differ widely from the main regression results, with the interaction terms found to be insignificant in both cases. Overall we can see that FDI has a positive impact on economic growth, but the results thus far provide little evidence suggesting that absorptive capacity is a relevant determinant of the impact of FDI on growth.

B.) OLS Threshold regression

Table X shows the results from the OLS threshold regression where the threshold variable is the average years of secondary schooling in the population over 15 and those for the linear fixed effects regression model:

Table 12: Threshold regression		
VARIABLES	(1) gdp gr	(2) gdpgr
POP_GR	0.418 *** (0.0895)	0.447*** (0.0896)
EXP	0.0034273*** (0.008)	0.00329 (0.00799)
INF	-0.000567** (0.000138)	-0.000561*** (0.000138)
GOV	-0.137*** (0.0231)	-0.136*** (0.0230)
GCF	0.1292*** (0.0138)	0.131*** (0.0137)
SCH	-0.00296*** (0.00235)	-0.00731*** (0.00257)
L_FDI	0.0024*** (0.0006)	
L_FDI_low		0.00217*** (0.000602)
LFDI_high		0.00278*** (0.000605)
Constant	.0354357 (.0231004)	-0.00693 (0.0155)
Observations	3642	3,642
Number of country_no	134	134
R-squared	0.2861	0.161
Threshold		1.935
Percentile		44
P-value		0.000
F-stat		13.79

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1
 NonLin variable: L_FDI

The first column represents the results from the fixed effects regression, the second column those from the OLS threshold regression. The coefficients on the additional variables are largely similar as those to the linear model, so I turn immediately to the coefficients on the FDI variable. The results indicate that there is a threshold at a value of 1.935 (i.e. 1.935 average years of secondary schooling). This threshold corresponds to the 44th percentile of the

distribution and is significant at the 1 percent level. The coefficients in the two regimes indicate that the impact of FDI on growth is significantly stronger for countries above the threshold than for those below the threshold. A 1% increase in FDI is associated with an increase in per capita GDP of 0.278% for countries above the threshold and 0.217% for those below the threshold. Such a result is consistent with those of Borenzstein et al (1995) and is suggestive of the importance of absorptive capacity for the relationship between FDI and growth.

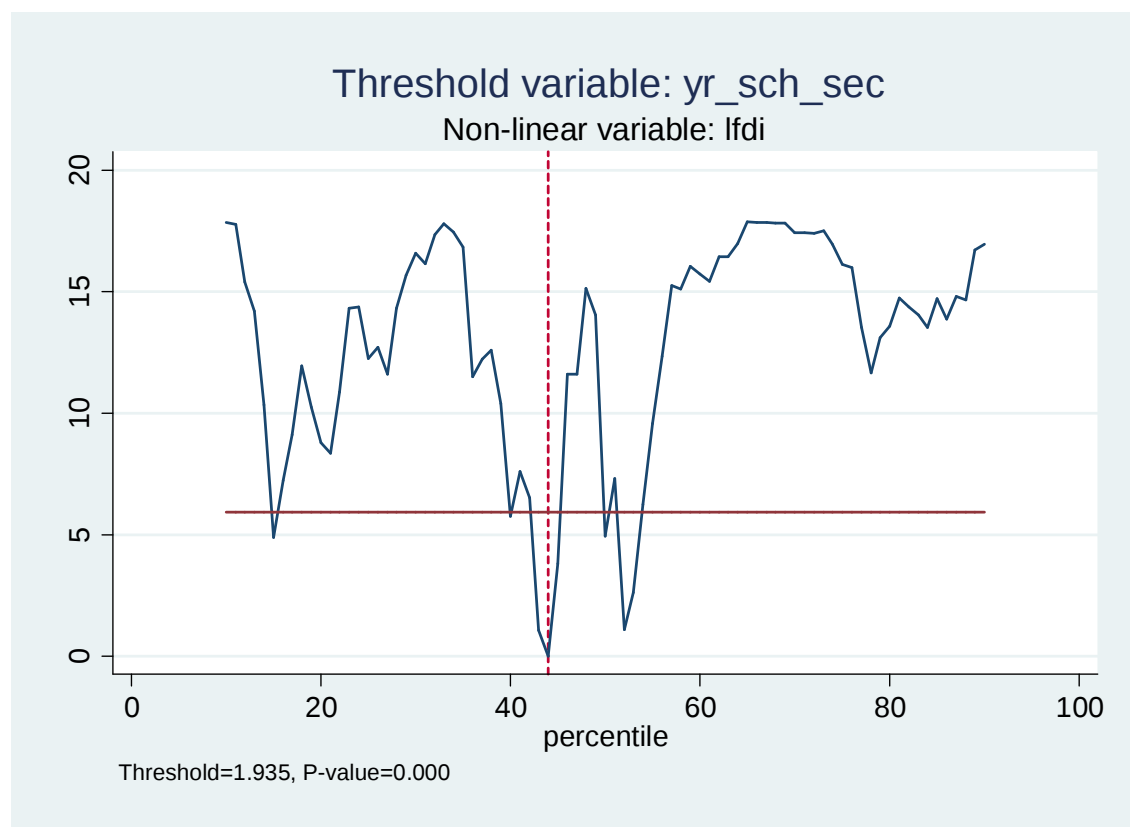


Figure X reports the confidence interval for the estimated threshold. This confidence interval is fairly wide beginning at around the 17th percentile and proceeding to the 55th percentile. The wide confidence interval is suggestive of a second threshold around the 17th percentile.

C.) Quantile Regressions

Table X reports the results when using quantile regression methods at the 10th, 30th, 50th, 70th and 90th percentiles. represents the output of the quantile regressions, where q10 explains the lowest 10% of countries in GDP growth, q30 the lowest 30%, and so on:

Table 13: Quantile regression results					
VARIABLES	(1) q10	(2) q30	(3) q50	(4) q70	(5) q90
init_gdppc	-0.00466** (0.00216)	-0.00454*** (0.00133)	-0.00381*** (0.000666)	-0.00241*** (0.000747)	-0.000828 (0.00137)
L_FDI	0.00392*** (0.000932)	0.00264*** (0.000459)	0.00167*** (0.000411)	0.000766** (0.000365)	-0.000989** (0.000406)
POP_GR	-0.0798 (0.200)	0.335*** (0.118)	0.495*** (0.104)	0.700*** (0.0828)	0.985*** (0.113)
EXP	-0.00456 (0.00847)	0.00813*** (0.00266)	0.0116*** (0.00220)	0.0107*** (0.00216)	0.0236*** (0.00493)
INF	-0.00319 (0.00207)	-0.000949 (0.00122)	-0.000470 (0.000766)	-8.82e-05 (0.000508)	-0.000187 (0.000331)
GOV	-0.159*** (0.0338)	-0.105*** (0.0181)	-0.0792*** (0.0116)	-0.0812*** (0.0117)	-0.109*** (0.0211)
GCF	0.183*** (0.0224)	0.142*** (0.0123)	0.148*** (0.0111)	0.170*** (0.0116)	0.177*** (0.0172)
SCH	0.00230* (0.00118)	0.000699 (0.00111)	-0.00106 (0.000878)	-0.00159 (0.000973)	-0.00356*** (0.000869)
Constant	-0.0732*** (0.0188)	-0.0244*** (0.00938)	0.000130 (0.00760)	0.0158** (0.00686)	0.0627*** (0.0127)
Observations	3,102	3,102	3,102	3,102	3,102

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Coefficients are found to differ a great deal across the conditional growth distribution. In the cases of initial GDP per capita, the inflation rate and government spending we observe that the coefficient decreases (in absolute value) as we move to higher quantiles, implying that the effects of these variables are stronger for under-achievers. For the export to GDP ratio and population growth we find the reverse, with the coefficients being larger and more significant at higher quantiles. In the case of secondary schooling we find a positive and significant impact at the lowest quantiles and a negative and significant coefficient at the highest quantile, while in the case of investment the coefficients are lowest at the middle of the conditional distribution. Finally, we observe for the FDI variable that the coefficient is positive at the lowest quantile and then decreases as we move to higher quantiles, with the coefficient becoming negative and significant at the highest quantile. As such the results suggest a great deal of heterogeneity in the size and sign of the coefficients across the different quantiles. Of most importance for this thesis is the result that the impact of FDI on growth is found to be highest for under-achievers and is actually negative for the highest over-achievers.

10. Conclusions

There has been a huge increase in FDI across the world from the mid-1990s on. Especially in the developing world FDI is seen as a more promising source of development finance than the official development aid (ODA). But not only the amount of FDI also the forms of FDI have changed in the last decade. Most of the investment is still made in machinery and plants, but since the advent of the internet the number of small high-technology start-ups grown out of university research labs has increased. A countries economy can benefit from FDI via so-called spillover effects which can work in different ways. The impact of those spillovers depends on the characteristics of the host country and the absorptive capacity of a country plays a prominent role in this discussion.

The results of this paper emphasize the positive relation between FDI and economic growth. The strongest impact of FDI can be observed in Non-OECD member countries. The quantile regression function shows that the effect decreases the better the countries perform in terms of GDP growth and that the strongest effect can be measured in the lowest 10% of the conditional growth. There is a threshold of years of schooling of 1,395 years corresponding to the 44th percentile of the data sample. Countries above this threshold value experience a stronger impact of FDI on growth than countries below, supporting the argument that the higher the absorptive capacity in a country, the greater the impact of FDI.

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Appendix

Zusammenfassung:

In meiner Diplomarbeit analysiere ich das Zusammenspiel von Foreign Direct Investment (Auslandsdirektinvestitionen) und Wirtschaftswachstum.

Wie bereits in bestehender Literatur gehe ich davon aus, dass Investitionen sowohl einen direkten als auch einen indirekten Effekt auf Wirtschaftswachstum haben.

Der direkte Effekt begründet sich auf die Anhäufung von Kapital, der indirekte hingegen auf sogenannte „spillovers“.

Im theoretischen Teil der Arbeit bringe ich zunächst einige Definitionen von FDI und argumentiere weshalb Auslandsdirektinvestitionen wichtig sind und wie sie sich in den letzten Jahren verändert haben, bevor ich die verschiedenen Formen und Typen analysiere. Ein weiterer wichtiger Punkt sind die Eigenschaften die ein Land aufweisen muss um überhaupt von Auslandsdirektinvestitionen profitieren zu können. Hierzu gehört vor allem die „absorptive capacity“. Dies ist ein Level an Humankapital, welches von Nöten ist um etwaige technologischen Fortschritte, die auf Grund eines Markteintritts eines globalen Unternehmens auftreten, aufnehmen zu können. Weiters erkläre ich die Vor- und Nachteile, die für das

Ursprungs- und Zielland von Investitionen, auftreten können. Hier sind vor allem ein höheres Produktionsniveau und höhere Löhne im Zielland zu nennen. Auf gibt es verschiedene Arten von „spillovers“. So können diese von Exporten, Löhnen oder technologischen Fortschritten stammen. In den letzten beiden Punkten des theoretischen Teils gehe ich noch kurz auf wirtschaftspolitische Maßnahmen ein um Direktinvestitionen anzuziehen oder zu unterbinden, und diskutiere bereits existierende Studien zu diesem Thema.

In meinem empirischen Teil untersuche ich nun mein Datenmaterial ob es nun tatsächlich einen Zusammenhang zwischen Auslandsdirektinvestitionen und Wirtschaftswachstum gibt. Dazu verwende ich eine OLS-Regression, und kontrolliere auf verschiedenen wirtschaftliche Indikatoren wie Inflationen, Exporte, Investitionen der Regierung aber auch Bevölkerungswachstum, und Bildungsniveau. Ich habe Datenmaterial für 138 Länder in der Zeit von 1970 – 2010. Weiters untersuche ich ob der Effekt in OECD Mitgliedsländer und Nicht-Mitgliedsländer unterschiedlich ist und ob der Zustand des politischen Systems eine Rolle spielt. Zuletzt analysiere ich noch mittels einer „Quantile Regression“ wie sich der Zusammenhang bei den „Under- und Overachiever“ im Bezug auf Wirtschaftswachstum entwickelt.

Meine Ergebnisse zeigen einen statistisch signifikanten und positiven Zusammenhang zwischen FDI und Wirtschaftswachstum, welcher in unterentwickelten Ländern größer ist als in OECD-Ländern. Deshalb gilt FDI auch als eine alternative Finanzierungsquelle zu den offiziellen Entwicklungshilfen. Das Bildungsniveau spielt, basierend auf meinen Ergebnissen, keine große Rolle, allerdings finde ich einen Beweis dass ein gewisses Level an Humankapital (ein Threshold) vorhanden sein muss um von „spillovers“ profitieren zu können.

Lebenslauf:

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Abstract (deutsch)

In meiner Diplomarbeit analysiere ich den Effekt von Auslandsdirektinvestitionen (FDI) auf Wirtschaftswachstum. Dazu verwende ich mehrere Regressionsmethoden und Daten von den letzten vier Jahrzehnten von um die 130 Länder. Meine Ergebnisse zeigen einen positiven Zusammenhang von FDI auf das Wirtschaftswachstum, vor allem in Entwicklungsländern. Der Effekt ist größer wenn ein gewisses Level an Humankapital in einem Land vorhanden ist, und geringer je weiter wir uns entlang der bedingten Wachstumsverteilung bewegen.