The relationship between aid and FDI and its effect on economic growth

What is the relationship between aid and FDI and is there an enhanced combined effect of both on economic growth?

Abstract

This paper empirically assesses the contribution of FDI and aid to economic growth in a panel of 139 developing countries over 23 years (1990-2012). This study makes a distinction between foreign aid and foreign infrastructure aid. The latter is foreign aid, which is purely targeted at infrastructural developments of a country. The relationship between aid and FDI is also tested in this paper. Furthermore, this study tries to find whether there is an enhanced combined effect of FDI and aid on growth. This study finds some result to support a significant positive relationship between foreign aid and FDI. A second result is that the positive effect of aid seems to be stronger when using the infrastructure aid variable. We could not verify that more aid combined with more FDI lead to a higher growth. The above findings are important, particularly in light of the role of aid on a developing country's economic growth while recognizing its effect on the FDI inflows.

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1. Introduction

Aid effectiveness has been subject of many studies, though every study does not conclude the same regarding aid's effectiveness on growth. This ambiguity leads to uncertainty about the extent it is efficient to provide assistance in the form of aid to developing countries. Dalgaard et al. (2004) did a survey of empirical analyses done in the last thirty years. These empirical studies were all based on cross-country regressions and assessed aid effectiveness. Three consistent patterns that can be drawn from this analysis are that (1) aid increases investments, (2) aid increases aggregate savings, and (3) aid enhances growth when growth is driven by capital accumulation. However, not much research has been done on the individual relationship of foreign aid and foreign direct investments (FDI) on economic growth and development.

This paper will build more on the relationship of aid and FDI. I first raise the hypothesis that (1) aid, which is targeted at economic and social infrastructure, helps developing countries to attract higher inflows of FDI through improved infrastructure varying from better roads to better education systems. I also hypothesise that (2) this consequently leads to a higher economic growth as FDI is proved to have a positive effect on economic growth. Furthermore this paper will study whether (3) there is a combined effect of FDI and aid on growth. The research question therefore is:

What is the relationship between aid and FDI and is there an enhanced combined effect of both on economic growth?

Foreign capital inflows come most usually in two forms: FDI and foreign aid. The reason why I would like to test the effect of foreign aid on foreign direct investments in developing countries is to see whether foreign aid, which is meant to enhance and improve the infrastructure of a country, also leads to more foreign investments. As FDI has been proved to be a major factor for economic growth in various developing countries, this research will test whether foreign aid stimulates the FDI inflow. As many believe that FDI fosters growth, verifying a positive relationship between foreign aid and FDI could indicate that foreign aid helps to attract FDI and in this way enhance growth.

As developing countries receive both FDI and foreign aid, I will further test whether the combined effect of both these inflows enhances growth. I will look at the interaction term of FDI and aid to test this relationship.

As infrastructure is the main channel through which aid affects FDI and growth, special attention will be given to the *infrastructure aid* variable. Hereby, it is important to acknowledge the importance of education and institutions known as social infrastructure, which is also part of the *infrastructure aid* variable.

Some important remarks need to be made regarding the difference between economic growth and development. Economic growth is an important part of economic development (Kosack and Tobin, 2006), but cannot be regarded as being the same. In this paper economic growth is indicated as an increasing GDP per capita, which is important for the development of an economy. We should take into account that a higher growth does not mean that a country is less impoverished or more educated. These factors of development are better indicated by human development, which includes education and health among many more development factors. In this paper I will concentrate on the economic growth and not the economic development of the country.

A significant positive effect of foreign aid on FDI could imply that policymakers should spend the received aid allowances on more specific infrastructural factors that enhances FDI.

This paper is structured as follows: Chapter 2 discusses the theoretical framework in which the growth models are reviewed. In Chapter 3 the focus is on recent literature that examined the relation between growth, aid and FDI. The background, data and results of this empirical study will be discussed in Chapter 4. At last I will conclude by summing up the findings of this research in Chapter 5.

2. Theoretical Framework

In this chapter I discuss the theoretical framework of this paper. This mainly concerns economic growth theories. The neoclassical growth model is a model that explains economic growth by factors such as capital, labour and exogenous technological change. The most prominent neoclassical growth model is the Solow growth model. Further research on economic growth shows that technological progress is actually endogenous and depends on various factors like education, innovation and technological access.

Where neoclassical growth models treat technological progress as an exogenously given rate, the endogenous growth model explains underlying elements that affect technological progress and economic growth. In this section I discuss both the neoclassical Solow growth model and the endogenous growth model. At last I explain the deeper determinants of growth, which are commonly used as a framework in research papers.

2.1. Solow growth model

The Solow growth model (Solow, 1956) is a neoclassical growth model that focuses on factors that accelerate production and analyses to what extent an increase in production is caused by higher inputs, more productivity or both. The three sources for growth in this model are savings, population growth and technological progress. Savings are a source of growth as they are assumed to be invested and these investments lead to more production, thus more growth. Population can be seen as a growth source if we assume that more employees are beneficial for production and therefore also for growth. Technological progress leads to increased productivity of humans and machines, which results in higher production, but this progress is exogenous in this model.

This dynamic model mainly focuses on four variables, namely output (*Y*), physical capital (*K*), level of technology (*A*) and labor (*L*). The combination of capital, knowledge and labour produces output. The aggregate production function of the Solow model is as follows:

(3.1)
$$Y(t) = F(K(t), A(t)L(t)),$$

where *t* denotes time and at any point of time the economy has amounts of capital, labour and technology. Important to note is that technology is free and is publicly available as a non-rival and non-excludable good. This neoclassical production function has the following properties. Technological change is exogenous, which is the main assumption of this model. There is no international trade as it is a closed economy and countries produce and consume only one good. Furthermore, there is perfect competition in all markets. Capital and labour are both important for production; therefore it is assumed that they are complements.

If we use a Cobb-Douglas function for the Solow model we will get the following production function:

(3.2)
$$Y(t) = K(t)^{\alpha} (A(t) L(t))^{(1-\alpha)}$$
 $0 < \alpha < 1$,

where *K* stands for capital, *A* for the level of technology, *L* for labor and *t* denotes time. Furthermore, α denotes the production elasticity. Labor and the level of technology grow exogenously with the growth rate *n* and *g*, respectively.

(3.3)
$$L(t) = L(0)e^{nt}$$

(3.4) $A(t) = A(0)e^{gt}$

The aggregate production function can be written in the intensive form:

(3.5)
$$y = f(k),$$

where y = Y/AL and k = K/AL. These ratios show output and capital relative to effective labour. Income (Y) can only be used for consumption or savings. As we have no government and a closed economy in this model the budget surplus (T-G) and the current account (Z-X) have no surpluses or deficits. We can therefore conclude that investments (I) are financed either by private savings (S) by firms or households.

$$(3.6)$$
 $I = S.$

If we consider that a fraction *s* of GDP is used to finance investments (I = sY), we can rewrite this equation in the intensive form:

(3.7)
$$I/AL = s(Y/AL) = sy = sf(k).$$

Depreciation of old capital is indicated by the depreciation rate (δ), which is constant over time. Both parameters of savings- and depreciation rates are considered to be exogenous.





Figure 1 shows the production function f(k), which is concave because of the diminishing marginal returns of capital. The first derivative of the function is positive,

f'>0, which means that an increase in capital per effective labour increases output. Every extra unit of capital per effective labour leads to a smaller marginal product of capital, f''<0. The marginal product of capital is very high when the capital stock is small $(lim_{k>0}=f'(k) = \infty)$ and very low when the capital stock is sufficiently high $(lim_{-\infty}f'(k)=0)$. These are known as the Inada conditions. If we keep the amount of labour unchanged an increase in capital will only lead to more output until a certain point. The capital-labour ratio (k) stops increasing when investments are equal to depreciation. This occurs when savings sf(k) intersects the depreciation line (δk) and where the economy reaches the steady state:

$$(3.8) \qquad \Delta k = sf(k) - \delta k = 0.$$

An economy with population growth and technological progress changes the capital accumulation line to $(\delta + a + n)k$, where *a* is the rate of technological progress and *n* stands for the rate of population growth. An increase in the rate of population growth or technological progress steepens the capital widening line. This means that higher rates of technological progress or population growth reduce ratios of capital and output to labour to effective labour. Consequently, this leads to a lower steady state level. In case of the population growth this seems acceptable, as investments grow at a constant savings rate and more investments are needed to keep up to more workers per year. A higher rate of technological progress leads to a higher output and capital per capita. In the steady state *k**, output (*Y*) and capital (*K*) increase at rate *a* + *n*, whereas the GDP per capita (*Y*/*L*) increases at rate *a*. Output and capital measured per effective labour unit (*Y*/*AL* and *K*/*AL*) remain constant and have a growth rate of zero in the steady state.

The main lesson of the neoclassical model is that economic growth in per capita GDP in the long-run is driven by technological change. An economy can grow by accumulating capital accumulation, but diminishing marginal returns of capital will end this growth. Therefore, growth can be only be sustained by technological change where the economy converges to a steady state. In a steady state the rate of economic growth in GDP per capita is considered to be equal to the rate of technological progress. The main limitation of the Solow growth model is that it provides no explanation of the rate of technological progress. It is treated as an exogenous factor, which means that the rate of technological progress is independent from economic forces. The endogenous growth model explains this technological change with different factors that we discuss in the next section.

2.2. Endogenous Growth Model

Expanding the neoclassical model with human capital, health, education, experience and government policies is found to be useful. Many endogenous models have been developed over the past decennia. The most important endogenous growth theories are the AK model by Rebelo (1991), the learning-by-doing/knowledge spillovers model by

Romer (1986, 1990) and the human capital externality model by Lucas (1988). All these models verify that the discovery of new ideas and innovating new methods of technologies are important for explaining long term growth. In this section I shortly discuss the endogenous growth model of Romer that emphasizes the importance of knowledge as the main factor of long-term growth.

Romer's model of endogenous technological change

Romer follows the economics of learning by doing by Arrow (1962), where experience and increasing productivity are highly associated. Hence experience must be seen as an investment. The main idea of Romer's model is that technological progress is the driving force behind economic growth and the aim is to explain the rate of growth that results from technological progress and invention. Where technological progress grows exogenously in the Solow model, Romer includes a mechanism of technological progress within his growth model. In this model ideas increase the stock of knowledge A and consequently raise the productivity of both production factors capital and labour. The output production function is his production function is similar to the Solow production function (3.2), but the difference is that A is assumed to be an endogenous factor. The output of an economy is now a function of capital, labour, technological change and human capital:

(3.9)
$$Y = (K, L, A, H).$$

Furthermore, population grows at a constant rate *n*, similar to the Solow model. The economy can only grow if technology grows, which is again the same implication as the Solow model, but the difference lies in the fact that in this model the growth of technology is based on other factors like population growth:

$$(3.10) g_A = \frac{n}{1-\vartheta} ,$$

where g_A stands for the growth of technology and ϑ denotes the productivity of one researcher. This growth rate of technology also indicates the growth rate of the economy as $g_y = g_A$. In this model a higher population growth, means a higher technological progress and therefore a higher long-run economic growth rate, whereas a

larger population in the Solow model led to a lower per capita growth. Endogenous growth models however still fail to explain differences in economic growth across countries by merely accounting for knowledge accumulation.

2.3 Other determinants of growth

Cross-country differences in per capita output are much larger than standard neoclassical models or endogenous models predict. The fundamental problem in explaining cross-country differences with knowledge accumulation is the non-rivalry of knowledge. The non-rivalry aspect of knowledge would imply that poor countries have the same amount of access to knowledge and developed technologies as richer countries, which is certainly not the case. The lack of access to technology and the lacking ability to use new technology are possible arguments. Therefore differences in incomes across countries cannot only be explained by knowledge accumulation, but by including other factors that affect accessibility to technology. Growth models that include factors like infrastructure, social infrastructure and the quality of institutions could explain growth better. Nevertheless, one should acknowledge the endogenous growth models for analysing the channels of knowledge accumulation that affect growth. In this section I will discuss some literature in which growth models include these other determinants of economic growth. In these papers the neoclassical growth model is extended with certain essential features of a growing economy, where the saving rate, the allocation of human capital and technological progress are treated as exogenous factors.

Immediate factors of income are physical and human capital. Years of education, schooling quality and on-the-job training are all sources of human capital. In most studies we therefore see the inclusion of human capital in the growth model. The challenging aspect of including human capital in the model lies in its used measure, because human capital is not measurable in units as it is dependent on various factors. Some use years of education as a measure of human capital (Hall and Jones, 1999), whereas others argue that human capital cannot be captured only by the amount of schooling (Klenow and Rodriguez-Clare, 1997). The reason is that differences in unmeasured skills are not taken into account. Besides these immediate factors of income, geography is believed to have a significant impact on the growth of an economy.

Studies show that geography of a country plays a very important role in the development of a country.

However, accounting for direct determinants of income and geography still does not explain most of the cross-country income differences. Income differences between Europe and Africa cannot be explained by merely accounting for production factors like labour, capital and technology. This brought researchers to think about other determinants of growth. Various studies identified several other determinants of growth that can be regarded as integral parts of an economy. Public policies, religion and education systems are some of these determinants that help to analyse the sources of income differences on a profound level. Hall and Jones (1999) identify these determinants as social infrastructure. In their empirical study they use the index of "government anti-diversion policies" and an index of "openness or market orientation" to represent social infrastructure. The difficulty however is that social infrastructure implies a broad range of facets of a government and economy, which varies from political stability to the security of property rights.

Engerman and Sokoloff (2002) and Acemoglu, Johnson and Robinson (2001) had a different approach to identify these deeper determinants of growth. They tried to find answers to these cross-country income differences by focusing on history, namely the effect of colonization. They study what effect early institutions have had on the economic development today. This study showed that these former institutions did have a significant effect on the present income. In the same way Sachs and Warner (1995), Knack and Keefer (1995) find that social infrastructure in the tropics are much lower. Furthermore, Nunn (2008) finds a significant negative effect of slave trades on economic development. Engerman and Sokoloff (2002) also find that slavery had a large effect on colonization strategies. However, the channels through which colonization strategies led to differences in institutions are not clear. Gennaioli and Rainer (2007) find that state development has a significant effect on economic development and Alesina et al. (2002) find that fractionalization has a negative effect on economic development. Both bad state development and ethnic fractionalization are proved to be results of slave trades. Therefore, these could be seen as channels of causality that led to bad economic development.

In this paper I account for social infrastructure by using the infrastructure aid variable that includes foreign aid, which is also targeted at education, political stability and public health. This would theoretically lead to improved human capital and improved infrastructure, which in return attracts foreign countries to invest in these developing countries.

3. Literature Review

In order to study the relationship between foreign aid and economic growth through the channel of foreign direct investments, it is important to analyse the relationships between each of these factors separately. Therefore, this chapter will include an extensive analysis of studies that focused on the relationship of (1) foreign aid and economic growth, (2) foreign direct investments and economic growth and lastly the relationship between (3) foreign direct investments and foreign aid. There are not many studies that covered the last relationship.

3.1 Foreign Aid

3.1.1. Foreign aid - Economic growth

In the recent past a lot of research is done on the effectiveness of foreign aid on economic growth (Burnside and Dollar, 2000; Easterly et al. 2004; Hansen and Tarp, 2001; Rajan and Subramanian, 2005 among many others).

Burnside and Dollar (2000) find that the aid is more effective when receiving countries have better policies. In countries where fiscal, monetary and trade policies are poor, aid has little effect on economic growth. The researchers therefore argue on the basis of their result that aid would be more effective if it were conditioned systematically on good policies. This result is in line with the social infrastructure theory of Jones (2002). According to Boone (1995, 1996) foreign aid does not affect economic growth in typical poor countries. This is consistent with Burnside and Dollar's result, as aid has zero impact on growth in these typical poor countries with average policies. Furthermore, Burnside and Dollar rightfully point out that the effect of aid on economic growth depends on the way it is spent. Is the received aid invested in a way that domestic output can increase or is it consumed? Only in the first case aid can affect growth.

To test how macroeconomic policies affect growth Burnside and Dollar use a dummy as an indicator of openness, inflation as a measure of monetary policy and to measure fiscal policy they use the budget surplus relative to GDP as an indicator. The dummy for openness was created by Sachs and Warner (1995) and using inflation as a measure of monetary policy is inspired from Fischer (1993). The budget surplus has foreign grants in the revenue and aid-financed projects in expenditures to prevent a relationship between aid and this index. Furthermore, an interaction of aid and policies is added to the growth equation. Ethnic fractionalization (Easterly and Levine, 1997) and institutional quality (Knack and Keefer, 1995) indicate the efficiency of government bureaucracy and security of property rights as long-term characteristics of countries that affect both growth and policies. Lastly, they add regional dummies for sub-Saharan Africa and East Asia. Easterly et al. (2004) however find that the findings of Burnside and Dollar are not robust with updated data and when adding missing information.

Hansen and Tarp (2001) find that aid increases the growth rate, but that it is not conditional on 'good' policy contrasting the finding of Burnside and Dollar (2000). Hansen and Tarp (2001) find no positive effect of aid on when controlling for investments and human capital. However they suggest that aid continues to affect growth via investments. This supports the hypothesis that aid affects growth via capital accumulation. To analyse whether aid has effect on growth via the investment channel, Hansen and Tarp (2001) test firstly that investments have an impact on growth and secondly that aid has an impact on investments. They formulate the growth regression as such that aid is still a regressor and add investments and human capital as additional independent variables. Furthermore, all sources of capital accumulation are added into the regression. These include logarithm of gross domestic investments relative to GDP, foreign direct investments as share of GDP and a measure of human capital, which is the mean of years of education at primary and secondary school (Nehru et al., 1995 database). They however mention that these sources are not exhaustive, but do cover the main sources. Results indicate a positive impact of FDI on growth and identify a socalled "triple role" of FDI, namely: (1) an indicator of good policy and institutions, (2) increasing factor productivity and (3) contributing to capital accumulation. It is remarkable to see that FDI has a considerable positive impact on growth in this model. Adding human capital does not affect FDI's effect on growth but increases the effect of gross domestic investments on growth. Interesting to note is that the impact of aid on growth is negative when adding human capital. This is explained by considering that this might be true for highly aid-dependent countries. However, the effect of aid is positive when regressed on the gross domestic investment as share of GDP as dependent variable.

This approach and result of Hansen and Tarp (2001) is very interesting for this paper as they address the effect of aid on growth via investments, including foreign direct investments.

3.2 Foreign Direct Investments

3.2.1 FDI – Economic growth

In the same way we see that a lot of research is done on the effectiveness of FDI on growth. Alguacil et al. (2010) address the problem of the ambiguous effect of FDI on growth and argue that heterogeneity of host countries is the source of this ambiguity. Hereby, Alguacil et al. concentrate on local conditions of a country that could influence the relation between foreign investments and economic growth. They also state that firm level studies mostly find no effect of FDI on growth, while most of the macroeconomic studies show that FDI does accelerate growth except Herzer et al. (2008) and Carkovic and Levine (2005) who find that FDI has no robust effect on growth. In their research Alguacil et al. address the problem of heterogeneity by looking at the quality of institutions and economic environment, which will be addressed as social infrastructure in this paper. Furthermore, they justly identify two channels through which FDI can affect growth. Firstly, the impact of FDI on capital accumulation, which means that FDI only has effect through domestic investment. Secondly, it could be that FDI affects growth by increasing productivity via technology transfers. This is a good example of the mechanism of economic convergence. The results show that the quality of institutions and internal as well as external macroeconomic stability is important for a FDI effect on growth, especially in upper-middle income countries. Important is therefore not only to concentrate on FDI friendly policies, but also on improving the investment environment i.e., improving the social infrastructure.

Bhandari et al. (2007) find in a study of East European countries, that stock of domestic capital and inward FDI are significant factors for growth. Furthermore, it is successfully argued that FDI stimulates economic development in the local economy (Trevino and Upadhyaya, 2003). FDI also increases economic growth by stimulating the incorporation of foreign technology and new inputs (Borenzstein et al., 1998). De Mello (1999) also shows that FDI enhances the level of knowledge in the host country through skill acquisition and labour training. Borenzstein et al. (1998) have found a positive effect of FDI on economic growth in 69 developing countries over two decades. An

important remark in their study however is that FDI is more effective in countries where the level of education is high. The conclusion of most of the empirical studies is that FDI enhances growth in host countries.

3.2.2 Foreign aid – FDI

Contrary to the effect of FDI and foreign aid on economic growth, less focus has been on the relationship between foreign aid and FDI. Some researchers however have focused this relationship.

Harms and Lutz (2006) find that the effect of foreign aid on FDI is not significant, but also find that the effect is significantly positive for countries in which private agents have to face heavy regulatory burdens. Karakaplan et al. (2005) find that foreign aid does not affect FDI significantly, however they also found that good governance and developed financial markets result in a positive effect of aid on FDI.

The study of Kimura and Todo (2010) extended the research of the previous studies and used less aggregated data on FDI and aid for each recipient country pair during the period of 1990-2002. Hereby they used the gravity equation type estimation, which is mostly used for the determinants of FDI (Egger and Winner, 2006; Mody et al., 2003; Carr et al., 2001). Kimura and Todo (2010) focused on the different channels in which aid affects FDI and the ambiguous effects. On the one hand the positive effect of aid on FDI also called the "financing effect" and the negative effect in the form of the "Dutch-disease effect" (Arellano et al., 2009). The Dutch-disease theory identifies the paradox impact of aid on the recipient country. This Dutch-disease effect arises when aid, which is received in dollars, is spent on importing goods. The recipient country becomes richer through the received aid, but by spending it on importing goods, it compresses the recipient's production of tradable goods. This causes a decline in competitiveness through an appreciation of the real exchange rate and a decrease in exports. Rajan and Subramaniam (2005) also found evidence that foreign aid causes the Dutch-disease effect. They identified that the more aid a country received, the less the growth was in industries that would export the most.

Kimura and Todo find that foreign aid from a donor country has a positive effect on the FDI coming from only this specific donor country and does not stimulate FDI from other countries. This effect is called the vanguard-effect by the authors. The first finding of the study is that the total effect of foreign aid from all donor countries on FDI is positive but insignificant. When checking for aid and its interaction with the quality of governance, they find an insignificant relation between aid and the quality of governance unlike Harms and Lutz (2006) and Karakaplan et al. (2005). Kimura and Todo (2010) also checked for difference in foreign aid like infrastructure and non-infrastructure, which results in no significant effect of aid on FDI. Only a positive significant effect of foreign infrastructure aid from Japan on FDI is found which is also robust. They find robust evidence that infrastructure aid from Japan has a vanguard effect. In other words, Japanese aid promotes FDI from Japan, while having no impact on FDI from other countries. The caveat of this study mentioned by the authors themselves is that the economic and social conditions of the recipient country and the modality and volatility of aid are not included in the model. Whereas these are all factors on which aid-effects might depend.

Selaya and Sunesen (2012) also argue that the relationship between aid and FDI is ambiguous, because aid raises the marginal productivity of capital when used to finance infrastructure and human capital investments. While on the other hand aid might crowd out private investments when invested in physical capital. Therefore they conclude that the composition of aid matters for the efficiency on FDI.

Most of the studies on foreign aid and FDI showed an insignificant effect between the two. We can conclude that the effect of aid on FDI is ambiguous due to various effects like the financing effect and the Dutch-disease effect. The composition of aid is also argued to be important to have an effect on FDI.

After analysing these studies on foreign aid, FDI and growth we can derive the following conclusions. The first conclusion is that aid affects growth and increases domestic output only when it is invested and not when consumed. The next conclusion is that investments and aid have a positive effect on growth even after controlling for human capital (Hansen and Tarp, 2001). The last conclusion we can derive is that FDI specifically has a positive effect on growth on which the majority of researchers are in accordance with. An important note to make is that each study identifies the role of social infrastructure in determining the independent relation ships between, foreign aid, FDI and growth.

4. Empirical Study

In the past couple of decades aid effectiveness has been subject of numerous studies. In the literature review we discussed various research papers that scrutinized the relationships between aid, FDI and growth respectively. There have been micro and macro level studies that explained the effectiveness of aid. In this paper I will concentrate on (1) the relationship between foreign aid and FDI and (2) the combined effect of FDI and foreign aid on economic growth. This study will be carried out at a macro-level using cross-country regressions based on a large panel dataset. In the first part of this section I will describe the background of this research, and then continue explaining the dataset I use for my research. Hereafter, the hypotheses are defined and the methodology for this research is explained. In the last part of this section I discuss the results.

4.1. Background

Foreign aid can be consumed or invested, but aid effectiveness if considered as increased growth, only occurs when the latter happens. This research focuses on aid's effect on FDI and the combined effect of FDI and foreign aid on growth. Foreign capital inflows most commonly come in two forms: FDI and foreign aid. Foreign aid is meant to enhance and improve a country's infrastructure (including social infrastructure). Better infrastructure, educated people and good institutions can improve a country's investment environment. Most of the developing countries receive foreign aid to stimulate all these factors in society. If this were done efficiently, the foreign capital inflow in the form of FDI would get stronger, because of the improved investment climate. One can therefore theoretically assume that foreign aid, which is spent on infrastructural and social investments, enhances the flow of foreign direct investments and thereby also stimulates growth. The latter follows from recent studies that proved that FDI has a positive effect on economic growth in various developing countries and that this effect is highly dependent on various conditions like the level of technology and education (Todo and Miyamoto, 2006; Girma, 2005; Li et al., 2005; Javorick, 2004).

I therefore raise the hypothesis that aid, if targeted at economic and social infrastructure, helps developing countries to attract higher inflows of FDI through improved infrastructure varying from better roads to better education systems. In these FDI regressions aid is the independent regressor and FDI the dependent variable. In the growth regressions we add an interaction term of both FDI and foreign aid to check whether there is a combined effect of FDI and foreign aid on growth. In both the FDI and growth regressions we take into account that aid effectiveness and FDI's effect on growth cannot be seen directly, as investments take time to result into anything concrete. Foreign aid provided in any year will have an effect after investing it in social or economic infrastructure. This is also the case with FDI, as investing in a foreign country shows result only after a certain period of time. As returns of aid as well as foreign direct investments will only be seen after a period of time, I account for this 'delay' by adding lags to the regressions.

4.2. Data

I will be using an unbalanced panel of 139 developing countries from the year 1990 to 2012. Each variable is gathered as yearly data. The three main variables that I will use in this paper are the variable of foreign aid, total inflow of foreign direct investments as percentage of GDP and the dependent variable GDP annual growth per capita.

4.2.1. Main variables

GDP per capita growth

The dependent variable economic growth is stated as the GDP per capita annual growth valued in percentages.

Aid

The foreign aid variable is measured as a percentage relative to the total GDP of a country between the year 1990 and 2012. Foreign aid is measured by the Official Development Assistance (ODA) and official aid, which is derived from the World Development Indicators database of the World Bank.

Infrastructure Aid

Besides this general aid variable that includes both infrastructure and noninfrastructure aid, I will construct a variable that only consists of infrastructure aid. I will use the same construction method that Kimura and Todo (2010) used to construct their aid variable for infrastructure. Data for this variable is derived from the Creditor Reporting System (CRS) database of the OECD. This infrastructure aid variable is defined as the sum of foreign aid for the sectors "economic infrastructure (200)", "social infrastructure (100)", "production activities (300)" and "multi-sector/cross-cutting (400)". The sector economic infrastructure includes aid used for facilitating transport infrastructure varying from road, rail to air infrastructure. Economic infrastructure also includes communications varying from telephone networks to ICT. The social infrastructure sector includes among more education facilities and training, health and basic health infrastructure. It also includes water supply and sanitation, government policy and management. The sector production activities includes industrial and agricultural developments and trade facilities. Environmental policy, urban and rural developments are part of the multi-sector/cross-cutting sector. For a more full and detailed description of each of these sectors I refer to the CRS database website.¹

This constructed infrastructure aid variable is only available for a period of 17 years from the year 1995 till 2012. I therefore use this period of time for all other variables in my model when using this infrastructure aid variable.

Foreign direct investments

The third important variable is FDI, which is measured as the net inflow of foreign direct investments as percentage of total GDP. These data is also derived from the World Development Indicators of the World Data Bank.

4.2.2. Control variables

To control for other effects that could have an influence on a country's growth rate, I will add the controls that Barro (2013) suggested to explain growth. However, I am leaving out variables that were not suitable for my dataset in terms of data availability for

¹<u>http://www.oecd.org/dac/stats/documentupload/2012%20CRS%20purpose%20code</u> <u>s%20EN_2.pdf</u>

developing countries and if the compilation of the variable was not simultaneous with my dataset. By adding country fixed effects I account for time invariant characteristics of a country like the rule of law or the level of democracy. By adding time fixed effects in the OLS fixed effects model I account for possible trends in time like seasons. In the FDI regressions I use control variables like openness to trade and GDP per capita growth.

4.2.2.1. Controls in growth regressions

Population's health

To capture the health aspect of human capital I added the population's health state. This variable is measured by taking the log of life expectancy at birth. The population's health state will be indicated by *log(life expectancy)*. The life expectancy data is derived from the World Data Bank (2013).

Fertility Rate

The variable fertility rate is added as control, because recent studies show a certain effect on economic growth. Studies show that a drop in population growth leads to a positive effect on the per capita growth rate. In the neo-classical growth model, it is furthermore argued that a higher population growth leads to less capital per worker, which negatively impacts the GDP per capita. The total number of births per woman is measured to capture this fertility rate. The annual data of the fertility rate indicating the total births per woman is taken from the World Data Bank. I will take the log of the fertility rate as Barro (2013) did. This variable will be indicated as *log(fertility)*.

Government consumption ratio

The government consumption ratio is used to measure what part of government expenditure is not enhancing productivity. The variable general government final consumption expenditure as percentage of the GDP is derived from the World Development Indicators (2013). This variable is indicated as *government consumption ratio* (% of GDP).

Terms-of-trade change

Terms of trade are seen as an important factor of growth in developing countries. This variable is measured by taking the ratio of exports to imports prices:

(4.1) Terms of Trade index =
$$\frac{Average \ export \ price \ index}{Average \ import \ price \ index} x \ 100$$

An improvement in the terms of trade raises real domestic income and consumption, assuming that the quantities of exports and imports do not change. However, real GDP does not change accordingly. The World Development Indicators database has a 'net barter terms of trade' index that measures the ratio between export and import prices. We need the change of this index to show the growth rate of the terms of trade. Therefore, we will take the log difference of this variable, which will be indicated as *dlnterms-of-trade*.

Inflation rate

The inflation rate variable is added to account for effects of inflation on growth. Isolating the effect of inflation on growth is difficult because of the endogeneity of inflation. I will use the log difference of the CPI index as Hansen and Tarp (2001) used. The inflation rate will be indicated as *dln_cpi*. The endogeneity problem of most variables will be discussed in the methodology section, where the regression method is introduced.

4.2.2.2.Controls in FDI regressions

The controls I will add in the FDI regressions are the *GDP per capita growth*, a variable that measures the *openness to trade, inflation, life expectancy* and *domestic savings*. The control *GDP per capita growth* is already explained above. The *openness to trade* and *domestic savings* variable will be explained now.

Openness to trade

The variable *openness to trade* will be added in the FDI regressions as a control. This variable accounts for the fact that trade and FDI are complements. The *openness to trade variable* is defined as the sum of a country's exports and imports as a share of GDP. A higher value of this variable indicates that a country has a friendly climate for foreign companies, hence more attractive for FDI. This variable was also used as a control in the FDI regressions in Karakaplan et al. (2005) and Harms and Lutz (2006). Data on *openness of trade* is taken from the World Development Indicators (2013). I expect a positive effect of the openness to trade on FDI. However, the FDI and trade relationship

can be endogenous, where FDI affects trade (Moosa, 2002). As I use this variable as a measure of openness I still expect this variable to be positive.

Infrastructure

Using the quality of trade- and transport-related infrastructure as a regressor would help to confirm the positive effect of infrastructure on FDI. This variable, which can be derived from the World Development Indicators databank, is not available for most of the developing countries and is therefore not included in these regressions. Another index of infrastructure (Donaubauer et al., 2014) could be useful, but this database was not free of cost. Therefore, we cannot add infrastructure as a control and rely on recent literature that infrastructure plays a very important role in attracting higher FDI inflows (Donaubauer et al., 2014).

Domestic savings

According to Selaya and Sunesen (2012) domestic savings can have a negative effect on FDI, if these savings are high. This is explained by fact that the higher the domestic savings the lower the need of FDI (Selaya and Sunesen, 2012). I therefore add the gross domestic savings as percentage of GDP in the FDI regressions and expect this variable to be negatively related to FDI.

The remaining controls that I add in the FDI regressions are *GDP per capita growth*, *log(life expectancy)* and *inflation*. *GDP growth per capita* is added as a measure for the market size. As foreign investors are more drawn to markets with a higher growth, this variable is expected to be positively related to FDI. Karakaplan et al. (2005) also use this control. *Inflation* can be seen as a measure of macroeconomic stability and is also used as a control in Karakaplan et al. (2005) and Harms and Lutz (2006). A higher inflation rate indicates economic instability and I expect this variable to be negatively related to FDI. To control for the health factor of human capital I add *log(life expectancy)*. As human capital is regarded as a determinant of FDI, I expect this health to be positively related to FDI.

4.2.3. Summary statistics and stationarity

Table 1. Summary Statistics										
Variable	Mean	Observ.	S.D.	Min.	Max.					
GDP growth per capita (%)	2.13	2961	5.32	-65.03	102.78					
ODA (%GDP)	9.30	2909	13.73	-2.41	147.17					
Infrastructure aid (%GDP)	3.53	2260	5.71	0.00	78.24					
FDI (%GDP)	3.92	2826	6.78	-82.89	91.01					
Government consumption (%GDP)	15.65	2668	9.34	2.05	156.53					
Life expectancy (years)	63.47	3066	9.50	26.76	83.32					
Fertility (births per woman)	3.90	3058	1.72	1.09	8.67					
Openness to trade (%GDP)	79.39	2862	38.42	0.31	280.36					
Inflation (CPI index)	63.94	2444	31.69	0.00	243.97					
Terms of trade index	107.53	2350	30.70	21.22	280.74					
Gross domestic savings (%GDP)	12.35	2705	18.52	-151.35	85.36					

In Table 1 we see the summary statistics of the variables. The mean of the GDP per capita growth is 2.13% for developing countries in the period from 1990 to 2012. Developing countries receive foreign that is approximately 9.3% of their GDP on average. The FDI inflow to developing countries is considerably lower than the inflow of foreign aid, namely 3.92% of GDP. Governments consume a considerate amount of 15.65% of the GDP in these developing countries. The average life expectancy in a developing country is 63 years, but has a standard deviation of approximately 10 years. Furthermore, women get nearly four children on average, where the highest births per woman is nine in our observations. The CPI index indicates the inflation rate, the index of 63.94 shows that on average there has been deflation of 36.94 percent compared to the base year, which is 2000. The terms of trade index on average is 107.53, which means that more income is coming in from exports on average. The key variable in the terms of trade for developing countries is the price of primary commodities. The last two columns of table show the lowest and the highest value of each variable. GDP growth per capita however varies from -65.03 to 102.78%, which is a large difference. Another extreme outlier is the received aid of 141.71% of the GDP, which means that they receive more aid than their own GDP. These outliers are mainly countries with a population of less than a million. Therefore, I do not include countries with less than a million people in my dataset.

In Table A1 we see that in general the correlations between variables are low. However, I will discuss the few higher correlations we find in the matrix. The somewhat higher correlation between the aid variable and respectively the life expectancy and fertility rate can be explained as follows. For this we have to take into account that foreign aid is only given to developing countries. These countries are mostly poor and have a very large population due to a higher than usual birth rate. This explains some higher correlation factor of (0.496) between aid and the fertility rate. The negative correlation of life expectancy (-0.413) with foreign aid is also according to the expectations, because developing countries have a lower life expectancy due to high poverty and low labour environmental quality and limited access to medical help. Gross domestic savings are negatively correlated with ODA (-0.414) this shows that aid receiving countries have low domestic savings. Domestic savings can be seen as a measure of development, where higher savings indicate higher development of a country. ODA and infrastructure aid are highly correlated due to the fact that infrastructure aid is a part of ODA. These two variables will however never be used in the same regression.

Stationarity

The stationarity of the variables is tested by using the unit root test. I am using the Fisher type unit root test because I have an unbalanced dataset. The null-hypothesis of the Fisher unit root test based on the augmented Dickey Fuller test is that all panels contain unit roots, whereas the alternative hypothesis indicate that at least one panel is stationary. In Table A2 in the appendix we can find the results and the p-values of the Fisher test for all variables. We can reject the null hypothesis that all panels contain unit roots at a one percent significance level. We can therefore conclude that we have stationary variables and they contain no unit root.

4.3. Hypotheses and methodology

This research consists mainly of three main parts. In the first part I will study the individual relationship of foreign aid on FDI, the second part will focus on the growth regressions and in the third part the growth regressions will be performed with the infrastructure aid variable.

This section discusses the hypotheses and methods I will use in STATA to test these hypotheses. At last I address the endogeneity problem in my data. From all previously

discussed papers in the literature review it is clear that recent studies used the neoclassical model to explain growth in their research and expanded their models with control variables. Therefore, I will use the same expanded neoclassical growth model to test my hypotheses.

For this analysis I will use the OLS method extended with fixed effects and controls. To get a representative result, I will use the suggested controls by Barro (2013) as mentioned earlier. These controls have been explained in the data section. Along with the extended OLS method I will also estimate my model using the GMM method in order to deal with endogeneity.

4.3.1. FDI regressions

I first test the individual relationship of aid and FDI. As this study expects aid to have a positive effect on FDI the null hypothesis is that aid affects FDI positively. In order to test this hypothesis we will use the following model:

(4.1)
$$FDI = \alpha + \beta_1 AID + \beta_2 GDP percapgrowth + \beta_3 openness to trade + \beta_4 inflation + \beta_5 savings + \beta_6 log(life expectancy) + \varepsilon$$

After testing the relationship between normal foreign aid on FDI I will also test whether this relationship changes by using infrastructure aid variable instead of the normal foreign aid variable. The null hypothesis is that infrastructure aid does affect FDI positively. In order to test this hypothesis we will use the following model:

(4.2) $FDI = \alpha + \beta_1$ Infrastructure AID + β_2 GDPpercapgrowth + β_3 openness to trade + β_4 inflation + β_5 savings + $\beta_6 \log(\text{life expectancy}) + \varepsilon$

These models will be extended with lagged variables of aid and FDI of one year and more years, as mentioned before.

4.3.2. Growth regressions with foreign aid and FDI as regressors

After having analysed the individual relationships of aid and FDI, we will focus on the combined effect of FDI and aid on growth. In order to answer the research question whether I will test the null hypothesis that a combined effect of FDI and aid lead to higher growth. In order to test this hypothesis I have formulated the following models.

(5.1) $GDPpercapgrowth = \alpha + \beta_1 AID + \beta_2 FDI + \varepsilon$

In the next model we add controls and the interaction term in order to test what the combined effect of FDI and aid is on growth.

(5.2) GDPpercapgrowth = $\alpha + \beta_1 AID + \beta_2 FDI + \beta_3 Aid^*FDI + \beta_4 \log(life expectancy) + \beta_5 \log(fertility rate) + \beta_6 government consumption ratio + <math>\beta_7$ terms-of-trade change + β_8 inflation + ϵ

4.3.3. Growth regressions with foreign infrastructure aid and FDI as regressors

To test whether the previous results of the growth regressions differ when using infrastructure aid instead of normal foreign aid I repeat these regressions and replace the normal aid variable with the infrastructure aid variable. The infrastructure aid variable is the reduced version of the normal aid variable that is only used for infrastructural developments including roads, better schooling and health. The null hypothesis is that the combined effect of infrastructure aid and FDI results in higher economic growth.

(6.1) GDPpercapgrowth = $\alpha + \beta_1$ Infrastructure AID + β_2 FDI + ε

Again in order to test whether there is a combined effect of FDI and aid I will add an interaction term of FDI and aid. The regression will be extended with controls.

(6.3) GDPpercapgrowth = $\alpha + \beta_1$ Infrastructure AID + β_2 FDI + β_3 Aid*FDI + β_4 log(life expectancy) + β_5 log(fertility rate) + β_6 government consumption ratio + β_7 terms-of-trade change + β_8 inflation + ε

4.3.4. Serial correlation and heteroskedasticity

As our panel consists of data with a time series of 23 years, it is important to test for serial correlation. Serial correlation (also known as autocorrelation) could cause smaller standard errors of coefficients and thereby a higher R-squared. I tested for autocorrelation by using the Wooldridge test for autocorrelation in the OLS regressions. I indeed had to conclude that my panel data was suffering from autocorrelation. Therefore, I correct for autocorrelation by using robust standard errors in the OLS regressions. Adding the lagged dependent variable as regressor solves the problem of autocorrelation in the GMM regressions. The GMM regressions are accompanied with the Cumby-Huizinga test for autocorrelation with the null-hypothesis is of no first-order autocorrelation. To correct for possible heteroskedasticity I use robust standard errors in both the GMM and OLS FE regressions.

4.3.5. Endogeneity

The problem of endogeneity is addressed in various studies. I will shortly discuss how researchers have dealt with the problem of endogeneity, with a particular focus on studies that tested the relationship between foreign aid, FDI and economic growth.

As we know estimated coefficients are only consistent if all explanatory variables are exogenous, addressing the problem of endogeneity is therefore important. Since income growth and FDI flows are likely to be determined simultaneously, it is possible that foreign aid variables are endogenous in FDI regressions. Variables can be endogenous due to several reasons. Endogeneity can be caused by (1) an omitted variable bias, (2) reverse causality or (3) a measurement error. In case of an omitted variable bias other determinants of the dependent variable could be related to the explanatory variable, whereas reverse causality emerges when the dependent variable has a causal effect on the explanatory variable. We speak of a measurement error when the explanatory variable is simply measured with error. Many papers indicate that most of the explanatory variables in recent aid, FDI and growth regressions are probably endogenous (Selaya and Sunesen, 2012; Kimura and Todo, 2010). The most common method that researchers apply to solve the problem of endogeneity is by using the GMM estimator. This estimator that is consistent in the presence of endogenous regressors and country specific effects. It offers a reasonably robust solution to the problems of possible mis-specification. Our growth model estimation has many endogenous variables among which FDI, aid and inflation. Therefore, my data estimation could suffer from potential endogeneity. In order to get an efficient and unbiased estimator I follow the suggested method and use the GMM estimation that allows controlling for potential endogeneity of all explanatory variables considered in growth models. This method is also the most commonly used approach today because of its efficient estimation in the presence of heteroskedasticity (Baum et al., 2003). Instrumental variables are subject to two conditions:

(4.5) $E[X|Z] \neq 0$, instrument Z should be correlated with the variable that is instrumented and

(4.6) $E[\varepsilon|Z]=0$, instrument *Z* should not be correlated with the error term.

I use the first lagged regressors of my endogenous variables as instruments in the GMM estimation in accordance with Selaya and Sunesen (2012) and Kimura and Todo (2010). If there are more instruments than explanatory variables we will have overidentification. The GMM results are therefore all accompanied by a "difference-in-Sargan test" for overidentifying restrictions, which tests whether the instruments satisfy the orthogonality conditions in the context of a overidentified model, condition (4.6) (Baum et al., 2003). To test condition (4.5), whether the instruments are correlated with the endogenous regressors Baum et al. (2003) suggest examining the significance of the excluded instruments in the first-stage regressions. The rule of thumb is that the F-statistic of the joint significance of the instruments (*Z*) should be larger than ten. A F-statistic lower than ten is cause for concern (Staiger and Stock, 1997). The GMM regressions will therefore be accompanied with the Bound et al. (1995) F-statistic of the first-stage regressions.

4.4. Empirical Results

This section discusses the results based on my dataset of 139 developing countries from year 1990 to 2012. The country fixed effects added in the OLS regressions account for the diversity of developing countries in terms of for example their natural endowment and cultural characteristics.

4.4.1. FDI regressions

In this part we test whether foreign aid has a positive effect on FDI. Table 2 reports the results. We perform two types of estimators as introduced in the methodology, namely the OLS with fixed effects and the GMM estimator. As we distinct normal aid from infrastructure aid we report the results when using the latter in Table 3.

In these FDI regressions the main regressor is foreign aid, which is of our principal interest and is indicated as aid. We add GDP per capita growth, openness to trade, inflation, log(life expectancy) and savings as controls. Openness to trade is added as control because it accounts for the fact that FDI and trade are complements of each other, therefore FDI and *openness to trade* are expected to be related positively. *GDP per capita growth* is added as a control because growth in developing countries and their increasing market has mainly been the reason for market-seeking FDI. Market-seeking FDI implies that investments in foreign countries are driven by the possibility to get access to local or regional markets in the host country. As aid's effect on investments is assumed to be realized on a long term, we will account for this 'delayed' effect of aid by using lagged values of aid in the following regressions. We add inflation as a control for economic instability. I expect inflation to have a negative effect on FDI, as high inflation causes economic instability and therefore not attractive for FDI. Savings is expected to have a negative effect on FDI as savings lower the need of FDI (Selaya and Sunesen, 2012). As I use the log of life expectancy as a proxy for health, I expect this to be positively related to FDI.

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			Та	ıble 2. FDI regi	ressions						
Relationship between foreign aid and FDI											
Independent variable: Foreign Direct Investments inflow (as % of GDP) Period: 1990-2012											
Regression Method of estimation:	(2.1) OLS	(2.2) GMM	(2.3) OLS	(2.4) GMM	(2.5) OLS	(2.6) GMM	(2.7) OLS	(2.8) GMM			
FDI(-1)		0.685*** (8.96)		0.687*** (8.87)		0.674*** (8.65)		0.682*** (8.86)			
Aid(-1)	-0.019 (-0.37)	0.059 (1.29)									
Aid(-2)			-0.021 (-0.90)	0.044 (1.20)							
Aid(-3)					0.090 (1.19)	0.139* (1.78)					
Aid(-4)							0.067 (1.28)	0.079 (1.18)			
log(life expectancy)	0.800 (0.22)	1.938 (1.60)	0.846 (0.22)	1.643 (1.48)	0.523 (0.13)	3.767** (1.97)	1.239 (0.25)	2.433 (1.45)			
Inflation	-0.224 (0.56)	-0.312 (-0.83)	-0.280 (0.44)	-0.337 (-0.89)	-0.159 (-0.26)	-0.211 (-0.56)	-0.217 (-0.30)	-0.297 (-0.73)			
Savings	-0.008 (-0.05)	0.003 (0.24)	-0.008 (-0.16)	0.000 (0.02)	-0.002 (-0.04)	0.017 (1.11)	-0.002 (-0.04)	0.006 (0.41)			
GDP p.c. growth	0.029 (0.27)	0.005 (0.06)	0.030 (0.29)	0.006 (0.08)	0.017 (0.15)	0.002 (0.02)	0.025 (0.23)	0.006 (0.08)			
Openness to trade	3.414** (2.01)	5.339*** (3.19)	3.434** (2.11)	5.415*** (3.20)	3.854** (2.14)	5.077*** (2.97)	3.879** (2.26)	5.471*** (3.23)			
Observations	2044	2028	2036	2018	2028	2006	2013	1990			
R ² Fixed effects	0.059 Yes	0.462	0.060 Yes	0.463	0.093 Yes	0.448	0.094 Yes	0.461			
Sargan test		0.682		0.939		0.182		0.587			
Serial correlation ^a F-stat ^b		0.091 174.66		0.073 106.04		0.318 68.99		0.109 73.24			

Notes: The notations ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively. *t*-statistics are reported in brackets. The coefficients and *t*-statistics of the OLS FE as well as GMM regressions are robust to heteroskedasticity. All regressions include a constant term and OLS regressions include country and time fixed effects variables. The Sargan test indicates the p-values for the null hypothesis of valid specification. The Cumby-Huizinga test is used to test autocorrelation in the GMM regressions, the null hypothesis of no autocorrelation.

^aIn the OLS FE regressions we use the robust standard errors to correct for autocorrelation.

^bThe F-stat on excluded instruments in the first-stage regression.

In regression (2.1) we therefore start by taking the first lag of aid. We see that *aid(-1)* has an insignificant negative effect on FDI, which was not expected. This negative effect could be explained by reverse causality of FDI and aid. Most of the controls are not significant, but do have the expected signs. The openness to trade variable has a positive effect on FDI, which is significant at a five percent significance level. This effect was expected as a higher value indicates a more friendly investment environment for foreign companies, which is attractive to foreign investors.

When using the GMM estimator in regression (2.2) we see that aid that is lagged one year has a positive but insignificant effect on FDI, whereas the OLS FE (2.1) had a negative sign. The latter could be caused by reverse causality of aid and FDI in the OLS estimation. All controls have the expected signs except savings that has a positive sign. We expected this coefficient to be negative as a higher level of domestic savings decreases the need of foreign investments as Selaya and Sunesen (2012) argued. However, one can also see this variable of gross domestic savings as an indication of development, where a higher savings could indicate more potential private investments. This does not mean that higher savings necessarily lowers the need of FDI. For example collaborations between foreign companies and domestic companies could be more interesting to foreign investors if domestic companies have a certain amount of capital to invest. We can also see that GDP per capita growth has a positive but insignificant effect on FDI. A significant coefficient could show that higher economic growth in host countries is indeed associated with higher FDI inflows.

We can see that the more lags we take for aid the stronger its effect gets on FDI, however this effect remains insignificant in all the OLS and most of the GMM regressions. However, by taking the fourth lag of aid, its effect on FDI decreases in both the OLS and GMM regression (respectively 2.7 and 2.8) and also looses its significance in the GMM regression. The largest effect of aid on FDI can be seen if we take the third lag of aid. In the GMM regression (2.6), we can see a significantly positive effect of aid on FDI at a 10 percent significance level. Based on only this regression we can carefully say that aid does enhance FDI positively.

The "difference-in-Sargan" p-values in Table 2 indicate that the instruments used in the GMM regressions satisfy the orthogonality conditions in the context of an overidentified model. Furthermore, the F-statistics indicate that the used instruments are correlated with the endogenous regressors. As we identified the problem of autocorrelation in our OLS FE regressions we used robust standard errors to correct for this. After adding the lagged dependent variable *FDI(-1)* in the GMM regressions as explanatory variable, we do not witness the problem of autocorrelation at a significance level of at least 5 percent.

			Table	e 3. FDI regres	sions			
		Relatio	onship betw	veen infrastr	ucture aid a	nd FDI		
	Independ	ent variable: Fo	oreign Direct I	nvestments inf	low (as % of C	GDP) Period: 1	1995-2012	
Regression Method of estimation:	(3.1) OLS	(3.2) GMM	(3.3) OLS	(3.4) GMM	(3.5) OLS	(3.6) GMM	(3.7) OLS	(3.8) GMM
FDI(-1)		0.680***		0.687*** (8.32)		0.660*** (7.58)		0.651*** (7.32)
Infra_Aid(-1)	-0.028 (-0.49)	0.176** (2.04)						
Infra_Aid(-2)			-0.070 (-1.42)	0.093 (1.08)				
Infra_Aid(-3)					0.137* (1.89)	0.240** (2.07)		
Infra_Aid(-4)							0.409* (1.84)	0.347 (1.39)
log(life expectancy)	10.259 (0.90)	1.63 (1.62)	12.625 (1.01)	1.016 (1.02)	-0.573 (-0.06)	2.100 (1.63)	-9.602 (-0.97)	3.033 (1.36)
Inflation rate	1.849 (0.64)	0.440 (0.34)	1.893 (0.66)	0.332 (0.26)	6.419 (1.17)	1.703 (0.76)	6.356 (1.13)	1.971 (0.82)
Savings	-0.005	0.007	-0.008	0.001 (0.07)	-0.006	0.016 (1.08)	-0.002	0.060 (1.23)
GDP p.c. growth	0.004 (0.00)	-0.016 (-0.15)	0.006 (0.04)	-0.009	-0.023 (-0.13)	-0.031 (-0.26)	-0.050	-0.541 (-0.40)
Openness to trade	5.545** (2.37)	8.102*** (3.20)	5.515** (2.42)	8.150*** (3.21)	6.976** (2.32)	9.977*** (3.25)	7.672** (2.40)	11.02*** (3.29)
Observations	1677	1660	1677	1649	1416	1407	1327	1318
R ²	0.022	0.455	0.022	0.459	0.062	0.441	0.056	0.421
Fixed effects	Yes	-	Yes	-	Yes	-	Yes	-
Sargan test		0.082		0.681		0.093		0.254
Serial correlation		0.095		0.3670		0.1704		0.340
F-stat ^b	Ju 1 Ju 1 1 .	61.02		66.36		48.32	1 1 . 771	50.24

Notes: The notations ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively *t*-statistics are reported in brackets. The coefficients and *t*-statistics of the OLS FE as well as GMM regressions are robust to heteroskedasticity. All regressions include a constant term and OLS regressions include country and time fixed effects variables. The Sargan (S) test indicates the p-values for the null hypothesis of valid specification the Cumby-Huizinga test is used to test autocorrelation in the GMM regressions, the null hypothesis of no autocorrelation.

^aIn the OLS FE regressions we used the robust standard errors to correct for autocorrelation.

^b The F-stat (Bound et al., 1995) on excluded instruments in the first-stage regression.

Table 3 reports the results of the FDI regressions when using the infrastructure aid variable. Unlike the *foreign aid* variable the *infrastructure aid* variable shows a significant positive effect at a five percent significance level in GMM regression (3.2), when instrumented with its second lag. In the OLS regression (3.1) infrastructure aid lagged with one year has an insignificant negative effect on FDI. Again the only significant control variable is openness to trade, which has a positive effect on FDI.

However taking the second lag of the infrastructure variable leads to insignificant coefficients in both the GMM and OLS regressions (3.3) and (3.4). Taking the third lag of the infrastructure aid variable leads to positive significant coefficients in both used estimators in regression (3.5) and (3.6). This shows that infrastructure aid does enhance FDI inflow. The coefficient when using the GMM estimator is more significant compared to the coefficient when using the OLS estimator. However, we should realise that taking more lags decreases our number of observations. The R-squared is not

affected by this decrease in observations. The stronger results of the GMM regressions could be explained by the use of the GMM estimator, which accounts for endogeneity.

When taking the fourth lag of infrastructure aid in regression (3.7) and (3.8), we see that OLS regression (3.7) shows a significant positive effect while the GMM estimator (3.8) only shows an insignificant positive coefficient of infrastructure aid. This could be explained by that the fact that the OLS estimator captures the effect of infrastructure aid with a delay, while the GMM estimator is more direct in capturing this effect. The control openness to trade stays consistent and is significantly positive in every OLS FE and GMM regression. This shows the high association that trade and FDI have with each other. Openness of a country in terms of higher international trade is certainly attractive for foreign investors as this shows the capability of a country to import and export extensively and thereby also implicitly indicates a fairly good state of infrastructure in the host country. Moreover, a higher amount of international trade also shows experience of the host country in terms of trade agreements and policies.

In Table 3 the "difference-in-Sargan" p-values indicate that the instruments used in the GMM regressions satisfy the orthogonality conditions in the context of an overidentified model. Furthermore, the F-statistics show that the used instruments are correlated with the endogenous regressors. The problem of autocorrelation in our OLS FE regressions is corrected by using robust standard errors. We corrected for autocorrelation in the GMM regressions by adding the lagged dependent variable *FDI(-1)*. We can conclude that the residuals in the GMM regressions do not contain autocorrelation as the null hypothesis of the Cumby-Huizinga test can be rejected at a significance level of at least five percent.

The conclusion is that the results of the FDI regressions to some extent support our hypothesis that aid whether it is normal or infrastructure aid affects the inflow of FDI positively when accounting for the 'delayed' effect of aid regarding investments. The maximized effect of the aid as well as the infrastructure aid variable can be witnessed when taking the third lag of these variables. Furthermore, we confirm a stronger effect of aid on FDI when this is specifically targeted on infrastructure.

4.4.2. Growth regressions with foreign aid and FDI as regressors

Table A3 in the appendix reports the growth regressions where the main regressors are FDI and the normal aid variable. We again use both the estimation methods of OLS FE and GMM. We start by only regressing the main variables on the dependent variable *GDP per capita growth*. In order to account for the delayed effect aid and FDI have on growth through investment, we directly take the second lag of our main regressors.

First we discuss the results of the OLS FE estimations. In the OLS FE (A3-1) as a well as the GMM regression (A3-2) we see that aid respectively has an insignificant positive and negative effect on growth. FDI however in both these regressions has a significantly positive effect on growth. The "difference-in-Sargan" p-value indicates that the instruments satisfy the orthogonality conditions, which indicate that they are not correlated with the error term. Furthermore, the F-statistics show that the instruments are correlated with the endogenous regressors.

When we add the FDI and aid interaction to our OLS FE regression (A3-3) we see that all our main regressors turn significantly positive. This shows that FDI, aid and the combined effect of these to foreign inflows have a significantly positive effect on growth. Before we conclude anything we will check whether these results are robust when we add controls.

The used controls were introduced in the data section. I will shortly explain the interpretation of these controls. As life expectancy is used as an indicator of the population's health, a higher life expectancy is expected to lead to a higher economic growth as a healthier population can work better. A high fertility rate can lead to higher fertility rate is more likely to imply that the country is poor and developing, which mostly does not affect their growth positively. Moreover, in the framework of the neoclassical Solow model we expect a negative relationship between both the life expectancy and the fertility rate with GDP per capita growth. Since a larger population in the Solow model implies that capital has to be shared with more people. As government consumption is the unproductive part of the GDP, consumed by the government we expect a negative impact on growth. Usually lower government consumption is better for the growth of a country. A high government consumption in some cases can also imply some form of corruption. A higher change in the terms of trade is better for the

economy. This means that more income is coming from exports, therefore we expect a positive effect on growth. The inflation rate is negatively related to growth, as higher prices reduces the level of business investments and the efficiency of the usage of production factors among many other factors.

In regression (A3-5) adding controls to the OLS FE regression leaves only FDI with a significant positive coefficient, while aid and the interaction term both turn insignificant. All the controls have expected sign as discussed in the data section. However, the controls government consumption, inflation and terms of trade change only have a significant impact on growth, while health (*life expectancy*) and the *fertility* variable are not significant. This changes when we take more lags of our main regressors, all controls then turn significant in the OLS FE regressions.

In the GMM regressions (A3-4) and (A3-6) we see that of our main regressors only FDI remained significantly positive at a five percent significance level. FDI's effect on growth remains significantly positive after adding the controls in regression (A3-6). All controls are significant in the GMM regression and have the expected signs.

When we use the third lag of our main regressors, we see that both aid and FDI turn significantly positive in OLS FE estimation (A3-7). The interaction term however remains insignificant, while the controls have their expected signs where inflation and government consumption have significant effects. In the OLS FE regressions however the positive effect of life expectancy is not in accordance with the Solow model. This could be explained by the use of the OLS FE estimator, as GMM takes endogeneity into account.

The GMM estimation shows significantly positive effects of both the aid and the FDI variable. This means that foreign aid and FDI indeed have a positive effect on growth. The interaction term of FDI and aid, which indicates a combined effect on growth, shows a significantly small but negative effect. This implies that a country that receives both aid and FDI lowers its country's growth. However, we cannot give much value to this coefficient as the F-statistic of 10.6 is just on the borderline of the rule of thumb, as the F-statistic should be higher than 10. The F-statistic of 10.6 indicates that the instruments used for the interaction term are not correlated enough with the instrumented interaction term of FDI and aid.

When using the fourth lag of our main regressors we find no significant coefficients of aid, FDI and the interaction term (A3-9 and A3-10). This indicates that we

have to use lags to account for the delayed effects of these FDI and aid investments, but taking more than three lags does not capture the effect of neither FDI nor aid. If we only base our conclusion on regression (A3-7) and (A3-8) we can say that both aid and FDI have a significantly positive effect on growth. However, the effect of the interaction term is still ambiguous and not robust to the different estimators. This can be explained by the problem of weak instruments, as the F-statistic of the interaction term in most of the GMM regressions are lower than ten. Therefore, not correlated enough with the endogenous interaction term of FDI and aid. However, the "difference-in-Sargan" statistic shows that the instruments used in all regressions satisfy the orthogonality conditions. We however still cannot conclude that there is a positive combined effect of FDI and aid on growth. Therefore we cannot support our hypothesis that a country that receives more aid and more FDI does lead to a higher growth, keeping the investment channel in mind.

4.4.3. Growth regressions with infrastructure aid and FDI as regressors

In this section we will discuss the results of the growth regressions where aid is targeted at infrastructure. The results are reported in Table A4 in the appendix. In OLS regression (A4-1) we first regress the second lags of FDI, infrastructure aid and the interaction term on GDP per capita growth. Here we see that infrastructure aid has a significant effect on growth, whereas FDI and the interaction term are of insignificant effect on growth. In the GMM regression only a significant positive effect of FDI is found in (A4-2).

When adding the controls in regressions (A4-3 and A4-4) in the OLS FE estimation besides the infrastructure aid variable, FDI also turns significantly positive at a ten percent level. All the controls are significant and have the expected signs, except for the terms of trade change, which is insignificant in regression (A4-3). The reason why the terms of trade change stays insignificant in many OLS FE regressions can be explained by the following fact. Changes in terms of trade are known to have important influences on developing countries that specialize in exporting primary products. As this change is not mechanical and is based on a change in the ratio of export to import prices, an improvement of this index would only affect the real domestic income and consumption if the physical quantities that are produced domestically remain the same. This would not lead to an improved real GDP. The change in terms of trade should stimulate domestic employment and output then only will it affect the real GDP (Barro, 2013).

In GMM regression (A4-4) all our regressors are significant. FDI and aid are significantly positive, while the interaction term is significantly negative. However, the F-statistic of 10.46 shows that the instruments of the interaction term are weak and not correlated enough with the interaction term. Therefore, we cannot strongly depend on the coefficient of the interaction term. Furthermore, the controls have all the expected signs and have significant effects on growth.

Using the third year lag of our main regressors in regression (A4-5) and (A4-6) turns the infrastructure aid variable insignificant, while FDI remains significantly positive in the OLS FE as well as in the GMM estimation (A4-5). The interaction term in the GMM remains significant and negatively related to growth, while insignificantly positive in the OLS FE estimation. We again identify a problem of weak instruments for the interaction term in the GMM regression, the F-statistic is lower than ten, namely 7.21. Using the fourth lags of the main regressors led to significant coefficients of infrastructure aid and FDI in the GMM regression, while the latter had a negative effect. However, if we again look at the F-statistic of the FDI variable we see a value of 10.09. This means that we again have a problem of weak instruments and the instruments used for FDI are not strongly correlated with FDI. We can conclude the same for the interaction term in regression (A3-8), the instruments of the interaction term are not correlated with the endogenous interaction term with a F-statistic of 6.67.

The "difference-in-Sargan" p-values indicate that all the instruments used in the GMM regressions satisfy the orthogonality conditions at a significance level of at least ten percent. Furthermore, most of the instruments were also correlated with the endogenous regressors except for the interaction term in regressions (A4-4), (A4-6) and (A4-8), and the FDI variable in regression (A4-8).

Performing the regressions with the infrastructure variable did lead to remarkable difference compared to the regressions while using the 'normal' aid variable. In the GMM regressions with controls, a positive significant effect of the infrastructure aid variable was already visible while using the second lagged of the main regressors (see A4-3 and A4-4), while the 'normal' aid variable only turned significantly positive while using the third lags of the main regressors. From this we can conclude

that the infrastructure aid variable captures the growth effect of foreign aid more accurately, as this variable only concentrates on economic and social infrastructural investments of aid and does not include 'non-investment aid' like humanitarian aid.

In the performed growth regressions FDI and infrastructure aid have a significant positive impact on growth when adding the controls, however the interaction term was mostly not significant due to the problem of weak instruments.

We can conclude that our results are highly dependent on the used estimation method (OLS or GMM), as Hansen and Tarp (2003) justly observed when using these two estimators. We can therefore not support our null hypothesis that there is a combined positive effect of FDI and aid on growth.

5. Conclusion

This paper studied the effect of aid on FDI and the combined effect of aid and FDI on growth. These relationships have not been explored that much in growth models as yet. In the literature review we established some of the important relationships between aid, FDI and growth. We could conclude from many studies that aid's impact on growth is ambiguous. Aid can have a positive impact on growth via investments in infrastructure and a negative impact via the rent-seeking behaviour of companies. The positive effect of aid can stimulate foreign direct investments, whereas the rent-seeking effect discourages FDI. The majority in growth papers agrees that FDI has a positive impact on growth. The focus of this paper has been on whether aid affects FDI and whether both these foreign capital inflows could have a combined effect on growth. In order to test this we hypothesise aid receiving countries attract more FDI as they receive aid to improve their state of infrastructure and consequently results in a higher FDI inflow, as FDI is highly dependent on the quality of infrastructure in the host country. I use an interaction term of FDI and aid to test for a possible combined effect of FDI and aid on growth, which might show that a country receiving more aid and FDI can have a higher growth. As aid can be seen as an enhancing factor to attract FDI if received aid is spent on investments in infrastructure, which could lead to a more attractive investing environment for foreign companies.

This study used a panel data of 139 countries over the time period 1990 till 2012. This research conducted regressions with two different estimation methods, namely OLS extended with fixed effects and the GMM method. We can conclude that the effect of our main regressors are highly dependent on the used estimation method.

We have found some result that aid affects FDI positively and that this effect is enhanced when it concerns infrastructure aid. Therefore, we cannot strongly support our hypothesis that aid has a positive effect on FDI. This positive effect of foreign infrastructure aid on FDI shows to some extent that policymakers should target received aid more at infrastructure- and social infrastructure to attract more FDI. The social infrastructure channel, through which aid could positively affect investments, is not explored fully in this study because of the lack of available data for developing countries. Adding controls of human capital, schooling, rule of law, education or infrastructure was not possible due to the limited data that is available for most of the developing countries. Therefore, we could not include this aspect into the FDI regressions, which is proved and expected to be important pull factors of FDI.

An important change in the significance of our main regressors FDI and aid was seen when adding controls to the growth model. When we do not control for other growth factors and only regress aid and FDI on growth, we mostly find no significant result of these variables. These controls can be seen as important determinants of growth and therefore essential to include in growth regressions.

We only found a significant positive effect of the interaction term in the OLS model extended with fixed effects. In this regression I used the second lagged variables of both aid and FDI and also I took the second lagged variable of the interaction term. This shows that it is important to include possible time lags to account for the delayed effect that both aid and FDI have on growth, as aid or FDI investments do not affect growth immediately. Doing this gives a small but significantly positive effect of the interaction term on growth, which shows that more aid combined with more FDI results in higher growth. The GMM method, which accounts for endogeneity and heteroskedasticity, however shows that the interaction term is mostly negative but insignificant to growth. However, we cannot fully rely on the coefficient of the interaction term as we diagnosed a problem of weak instruments.

Our results show that developing countries that receive more aid and FDI do not have a combined enhanced effect on growth. We can therefore not support the hypothesis that there is a combined effect of aid and FDI on growth. To explore the aidinvestment-growth relationship fully, more theoretical explanation about the processes and channels, is needed to empirically derive the possible effect aid has on growth via investments, particularly via foreign direct investments.

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Databases

World Development Indicators (WDI) - The World Bank

Creditor Reporting System (CRS) - OECD

7. Appendix

Table A1. Correlation matrix											
	GDP	ODA	FDI	Gov. Cons.	Life	Fert. rate	Savings	Openness	Inflation	ТоТ	Infra
	growth				expect			to trade		change	aid
GDP per capita growth	1										
Aid (ODA)	-0.060	1									
FDI	0.093	0.094	1								
Gov. consumption	-0.060	0.105	0.079	1							
log(life expectancy)	0.204	-0.413	0.086	-0.043	1						
Log(fertility rate)	-0.285	0.469	-0.124	-0.078	-0.771	1					
Gross domestic savings	0.110	-0.414	-0.064	-0.202	0.217	-0.223	1				
Openness to trade	0.125	-0.063	0.281	0.275	0.253	-0.322	0.006	1			
Inflation (dlncpi)	-0.190	0.023	-0.043	0.029	-0.168	0.133	-0.017	-0.028	1		
Terms of trade change	0.011	-0.029	0.044	-0.019	0.030	-0.019	0.174	0.004	-0.011	1	
Infrastructure aid	0.025	0.793	0.162	0.176	-0.311	0.391	-0.406	0.029	0.046	-0.002	1

Table A2. Fisher-type unit root test of variables									
Variable	z-stat.	p-value	No of panels	Av.no of					
				periods					
GDP growth per capita (%)	-20.08	0.000	137	21.61					
ODA (%GDP)	-11.50	0.000	135	21.55					
Infrastructure aid (%GDP)	-13.67	0.000	131	17.25					
FDI (%GDP)	-7.18	0.000	133	21.25					
Government consumption (%GDP)	-6.70	0.000	129	20.68					
Life expectancy (years)	-22.19	0.000	137	22.38					
Fertility (births per woman)	-4.55	0.000	137	22.32					
Inflation (CPI index)	-17.71	0.000	126	19.40					
Terms of trade index	-27.54	0.000	133	17.67					
Openness to trade (%GDP)	-2.42	0.007	134	21.36					
Gross domestic savings (%GDP)	-4.45	0.000	132	20.49					
H ₀ = All panels contain unit root H _a = At least one panel is stationary									

Table A3 Growth regressions										
	Relationship between foreign aid and FDI on economic growth									
		Independe	ent variable: (Growth of rea	al per capita (GDP Period: 1	1990-2012			
Regression:	(A3-1)	(A3-2)	(A3-3)	(A3-4)	(A3-5)	(A3-6)	(A3-7)	(A3-8)	(A3-9)	(A3-10)
Method of estimation:	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
GDP p. c. growth (-1)		0.183*		0.163*		0.209***		0.197***		0.253***
Aid (2)	0.066	(1.87)	0.040*	(1./1)	0.040	(3.78)		(3.42)		(7.02)
Alu (-2)	(1.47)	(-0.38)	(1.81)	-0.031	(1 19)	0.035				
Aid (-3)	(1.47)	(-0.50)	(1.01)	(-0.00)	(1.17)	(0.90)	0.067*	0.068**		
Ind (5)							(1.96)	(2.16)		
Aid (-4)							(1)0)	(110)	0.047	0.013
									(0.75)	(0.39)
FDI (-2)	0.066**	0.193**	0.063**	0.155*	0.123*	0.167**				
	(2.15)	(2.56)	(2.16)	(1.89)	(1.88)	(2.23)				
FDI (-3)							0.160***	0.299**		
							(2.49)	(2.54)		
FDI (-4)									0.015	-0.001
									(0.10)	(-0.04)
Aid*FDI (-2)			0.001**	0.003	-0.001	-0.001				
			(1.99)	(0.53)	(-0.09)	(-0.37)	0.004	0.004*		
Aid*FDI (-3)							-0.001	-0.004*		
							(0.57)	(-1.85)	0.000	0.001
Ald*FDI (-4)									0.000	0.001
log(life expectancy)					1 109	2 502**	0 770***	2 550**	(0.02) 2 967***	(0.76)
log(life expectancy)					4.490	-2.393	(3.20)	-2.559	-2.00/***	0.093
log(fortility rate)					-1 523	-2.375	-3.56	-2 800***	-2.831***	-4 210*
log(leftillty fate)					(-0.65)	(6.01)	(1 57)	(-5 55)	(-3.88)	(1.86)
Government consumption					-0 197***	-0.085***	-0 191***	-0 100***	-0.057**	-0 134***
ratio					(-3.41)	(-4.46)	(3.89)	(-3.93)	(-2.14)	(-2.98)
Terms of trade change					1.815*	4.102***	1.780	3.933***	4.141***	1.817*
0					(1.79)	(4.02)	(1.65)	(3.58)	(3.65)	(1.86)
Inflation rate					-2.438***	-1.782***	-2.291**	-1.490*	-0.92*	-1.951***
					(-2.67)	(-2.66)	(-2.37)	(-1.93)	(-1.87)	(-3.20)
Observations	2596	2561	2657	2473	1760	1747	1698	1681	1616	1637
R ²	0.039	0.065	0.040	0.027	0.161	0.155	0.151	0.102	0.102	0.094
Fixed effects	Yes	-	Yes	-	Yes	-	Yes	-	Yes	-
Sargan test		0.141		0.273		0.362		0.066		0.663
Serial correlation ^a		0.323		0.213		0.129		0.375		0.243
F-stat ^b :										
FDI		37.50		36.37		23.58		18.94		13.90
UDA EDL ALD		133.22		94.60		166.98		114.76		90.96
FDI_AID		-		6.56		6.47		10.6		5.95

Notes: The notations ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively. *T*-statistics are reported in brackets. The coefficients and *t*-statistics are robust to heteroskedasticity. All regressions include a constant term and OLS regressions include time fixed effects variables. The Sargan test indicates the p-values for the null hypothesis of valid specification. The Cumby-Huizinga test is used to test autocorrelation in the GMM regressions, the null hypothesis of no autocorrelation. A more proper way than the F-stat to test the correlation between the instruments and endogenous regressors, when there are more than one endogenous regressors, is by looking at the Shea's partial r-squared. However, Shea's partial r-squared is only available after using an *ivreg2* command, which is not used for the GMM regressions.

^aIn the OLS FE regressions we use the robust standard errors to correct for autocorrelation.

^bThe F-stat (Bound et al., 1995) on excluded instruments in the first-stage regression

Table A4 Growth regressions										
	R	elationship b	oetween infra	structure aid	l and FDI on e	economic gro	wth			
Independent variable: Growth of real per capita GDP Period: 1995-2012										
Regression: Mothod of estimation	(A4-1)	(A4-2)	(A4-3)	(A4-4)	(A4-5)	(A4-6)	(A4-7)	(A4-8)		
CDB.p.c. growth (1)	0L3	0.117	ULS	0.257***	0L3	0.222***	UL3	0.225***		
GDP p.c. growth (-1)		(0.85)		(3.69)		(2.85)		(6.87)		
Infra Aid (-2)	0.084**	0.361	0.190***	0.233***		(2.00)		(0.07)		
inita_init (2)	(2.49)	(0.70)	(3.31)	(3.81)						
Infra Aid (-3)					0.029	0.115				
					(0.28)	(1.28)				
Infra_Aid (-4)							0.160**	0.334**		
							(2.18)	(2.39)		
FDI (-2)	0.053	0.227**	0.129*	0.201**						
	(1.39)	(1.89)	(1.85)	(2.16)						
FDI (-3)					0.138**	0.346**				
					(2.30)	(2.47)				
FDI (-4)							0.017	-0.070**		
							(0.48)	(-0.25)		
Aid*FDI (-2)	-0.003	-0.004	-0.001	-0.008*						
	(-0.94)	(-0./1)	(0.29)	(-1./1)	0.000	0.010**				
Aid*FDI (-3)					0.002	-0.013**				
					(0.32)	(-2.11)	0.002	0.002		
Ald*FDI (-4)							-0.002	-0.002		
log(life expected av)			0 720***	2 054***	10 100***	2 002**	(-0.00) 12.025**	(-0.23) 2 210***		
log(me expectancy)			(3 30)	-3.050	(2.97)	-2.905	(2.29)	(-2.91)		
log(fertility rate)			-6.03***	-2 808***	-6 724**	-2 042***	-4 518	-2.91)		
log(lef unity fate)			(-2.82)	(5.26)	(-2.49)	(-3.09)	(-1.66)	(-3.15)		
Government consumption			-0.158***	-0.094***	-0.111**	-0.081***	-0.140***	-0.108***		
ratio			(-3.71)	(-4.29)	(-2.36)	(-2.94)	(-2.85)	(-4.09)		
Terms of trade change			0.869	3.492***	0.601	3.132**	0.287	4.107***		
6			(0.87)	(3.17)	(0.57)	(2.49)	(0.30)	(2.74)		
Inflation rate			-4.297***	-2.833***	-5.73***	-3.482***	-5.174***	-1.887**		
			(4.21)	(-2.83)	(-5.94)	(-3.46)	(-4.93)	(-1.37)		
Observations	2142	1903	1534	1420	1361	1354	1299	1290		
R ²	0.033	0.042	0.091	0.131	0.067	0.025	0.068	0.137		
Fixed effects	Yes	-	Yes	-	Yes	-	Yes	-		
Sargan test		0.700		0.093		0.194		0.187		
Serial correlation ^a		0.245		0.555		0.362		0.774		
F-stat ^o		25.00		17.05		12.24		10.00		
ועז Infra aid		25.09		17.05 81.45		12.24		66 91		
FDI AID		20.44		10.46		7 21		6.67		

Notes: The notations ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively. *T*-statistics are reported in brackets. The coefficients and *t*-statistics are robust to heteroskedasticity. All regressions include a constant term and OLS regressions include time fixed effects variables. The Sargan test indicates the p-values for the null hypothesis of valid specification. The Cumby-Huizinga test is used to test autocorrelation in the GMM regressions, the null hypothesis of no autocorrelation. A more proper way than the F-stat to test the correlation between the instruments and endogenous regressors, when there are more than one endogenous regressors, is by looking at the Shea's partial r-squared. However, Shea's partial r-squared is only available after using an ivreg2 command, which is not used for the GMM regressions. a'In the OLS FE regressions we use the robust standard errors to correct for autocorrelation.

^bThe F-stat (Bound et al., 1995) on excluded instruments in the first-stage regression.