Master Thesis International Economics

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Foreign Aid and FDI

How does US aid affect US vertical and horizontal FDI to developing countries?

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Abstract

In this thesis the relationship between foreign aid and Foreign Direct Investment (FDI) is investigated. In the literature there is no consensus about how foreign aid affects FDI. Theoretically, foreign aid can work as a complement when flowing into infrastructure and institutions ór it can work as a substitute when flowing to the private sector. In this thesis we disaggregate FDI into vertical and horizontal fragmentation of production according to the Knowledge Capital model. We estimate a panel data regression using US manufacturing FDI as a proxy for vertical FDI and US services FDI as a proxy for horizontal FDI. From the results we find that there are differences in the relationship between aid and FDI across regions. In an attempt to explain these differences, we stress that (1) US foreign aid is different than aid from other donors as US aid is mostly donated for geostrategic and global security concerns and (2) infrastructural aid only works for FDI up to a certain development level of a developing country. Regarding the first effect, we indeed see a negative effect of US infrastructural aid on both manufacturing and services FDI for countries with a less durable regime. Infrastructural aid in those countries act as a warning sign for the investment decisions by US multinationals. The results for the effect of the development level of a developing country are not significant for both types of FDI. However, we can infer from the signs of the coefficients that there is a certain level of development in which infrastructural aid turns negative for manufacturing FDI. This is not observed with services FDI.

Introduction

The impact of FDI on developing countries has been discussed extensively in the literature. The general consensus about the effect of FDI on economic growth seems to be positive (Balasubramanyam et. al.; 1996, Borensztein; 1998 and Aitken and Harrison; 1999). This has led to a surge in studies about the determinants of FDI. For instance, macro-economic factors or policies like exchange rate effects, taxes and openness to trade seem to have a pulling effect on the investment of multinationals in certain developing economies (Blönigen; 2005). In addition, an efficient legal system and strong rule of law have a positive effect on FDI flows, whereas corruption and political instability affect FDI negatively (Asiedu; 2006).

However, one aspect has been largely overlooked in the literature about the determinants and effects of FDI on developing countries and that has been the fact that most of these countries receive foreign aid. In this thesis we investigate how foreign aid affects FDI inflows to developing countries. As there are many different types of foreign aid, the impact of foreign aid on FDI flows is ambiguous. It seems that aid can act as a complement for investments by providing a proper infrastructure, better institutions and secure property rights. On the other hand, aid directed mostly towards physical capital in the private sector seems to work as a substitute as it crowds out private investments. Therefore, we disentangle foreign aid into two broad categories. First, we define infrastructural aid as directed to mostly infrastructural projects and public sector institution. Second, we define production sector aid which is aid mostly directed towards the private sectors mining, construction and industrial sectors.

Furthermore, we follow the Knowledge-Capital model and stress that it is necessary to disaggregate the FDI flows because of differences in the fragmentation of production of multinationals. If knowledge-based activities can be separated from production facilities geographically, multinationals can fragment their production in low-skilled labour-intensive production facilities and high-skilled knowledge-intensive headquarter services and R&D. We call this vertical FDI and in our empirical model we use as the proxy US manufacturing FDI. This is because US manufacturing multinationals outsource a lot of labour-intensive low-skill production to developing countries and keep knowledge-intensive departments as marketing and finance in the US. On the other hand, it is possible that knowledge-based

activities can not be separated from production but they can be shared simultaneously by multiple production facilities. This gives rise to horizontal FDI and in our empirical model this is proxied by services FDI. This is because services can, in general, not be separated geographically but knowledge can be shared among foreign affiliates and headquarters of multinationals.

Thus, in this thesis we want to investigate how foreign aid from the United States (US) affects US vertical and horizontal FDI to developing countries. This distinction is a novelty in the literature about the relationship between foreign aid and FDI. However, we think it is important because US vertically and horizontally fragmented multinationals react differently towards policy measures as their production activities differ. In addition, US vertical FDI is motivated to cut production costs while US horizontal FDI is motivated to serve new markets. This has implications for the investment decisions by multinationals.

Our analysis focuses on foreign aid by the US government and FDI flows by US multinationals for the following three reasons. First, the US is the largest donor in absolute terms ($31 billion in 2013, OECD 2013). Second, it allows us to analyze how foreign aid decisions by the US government influences the investment decisions by US multinationals. Third, because of limitations in the availability of the data it was possible for the US only and not for other countries to categorize FDI outflows per sector making it possible to distinguish between vertical and horizontal FDI.

In our empirical analysis we control for country- and time- specific effects and by using lagged foreign aid and lagged explanatory variables we reduce the endogeneity problem. Our main findings show that, in general, neither US infrastructural aid nor US production sector aid does significantly influence US manufacturing and services FDI. However, we do find that the results differ across regions. We observe that in the Middle East and South Asia there exists a significantly positive effect of infrastructural aid affecting manufacturing FDI. For the effect of production sector aid on manufacturing FDI our empirical results show a small negative effect for East and Southeast Asia and Sub Saharan Africa indicative for a crowding-out effect on manufacturing FDI. For services FDI we only observe for South Asia a positive affect of infrastructural aid on this type of FDI but no significant effects for other regions are observed.

We provide two factors that may explain this regional heterogeneity of the foreign aid-FDI relationship. First, US infrastructural aid works as a warning sign for the investment

decisions of multinationals. That is, US infrastructural aid that flows to less durable regimes is seen as a warning for both vertical and horizontal US multinationals not to invest. From our empirical results we, indeed, see that infrastructural aid turns positive and significant when durability of a regime increases. Second, there may exist a certain threshold level of human development in a developing country in which US infrastructural aid negatively affects US manufacturing FDI inflows. Thus, infrastructural aid to a developing country with human development above this threshold is viewed as inefficient by US manufacturing multinationals deterring them from investment. We do not find such an effect regarding services FDI. However, our empirical results are not statistically significant regarding the level of human development.

This thesis is structured as follows. In the following section we begin the literature review with a short overview of the Knowledge-Capital model and than explore the relationship between foreign aid and FDI in the literature. Then, we proceed in explaining our empirical model and the data and dataset that we use for our research. The following section then presents the results of our empirical research. The last section concludes and gives an overview of our main findings.

Literature review

Foreign direct investment (FDI) flows by an enterprise are investments that flow to foreign affiliates that belong to the enterprise which are located outside the home country. These cross-border investments of enterprises to foreign affiliates in host countries define these enterprises as multinationals in the literature (Markusen; 2002). In order to investigate the relationship between foreign aid and FDI we first have to understand the investment decisions of multinationals. This decision revolves around the locational choice and the way how the production of the multinational is organized. Theoretically, this is explained by the Knowledge-Capital model in the literature which will be discussed in the next section.

The Knowledge-Capital model

The Knowledge-Capital model of the multinational enterprise includes three principal assumptions. First, knowledge-based activities (R&D) can be separated from production facilities in a geographical sense. Second, knowledge-based activities are skilled-labor-intensive relative to production. Third, knowledge-based services can be utilized simultaneously by multiple production facilities. These first two assumption give incentives for vertical fragmentation of production while the last assumption gives rise to horizontal fragmentation (Carr et. al.; 2001).

The Knowledge-Capital model predicts through these assumptions that a larger host market size (i.e. larger economy) increases horizontal fragmentation and, thus, horizontal FDI. In contrast, the size of the home country's economy positively affects vertical fragmentation as foreign affiliates have a larger export market. In addition, the Knowledge-Capital model states that a higher divergence of skilled-labor abundance between the home and the host country increases the incentive for multinationals to fragment their production in relatively skilled activities (i.e. headquarter services and R&D) and relatively unskilled activities (i.e. production facilities). The increase in fragmentation in relatively skilled and unskilled activities leads to increases in vertical FDI by multinationals (Markusen; 2002). Carr et. al. (2001) test the Knowledge-Capital model empirically and their results show that FDI from the source to the host country increases in the sum of their economic sizes and their similarity in size. Second, FDI increases in the relative skilled labor abundance of the source country

and the difference between relative endowments. In other words, a relatively large skill difference between the source and host country increases FDI. However, Carr et. al. (2001) state that they use horizontal and vertical fragmentation of production simultaneously in their empirical model as they only focus on total sales by foreign affiliates of multinationals.

Research done by Hanson et. al. (2001) gives us clear evidence that vertical FDI next to horizontal FDI is much more common than previous research has so far suggested. Vertically fragmented multinationals have different stages in their production process and these stages can be done in different foreign affiliates. This outsourcing of the production process may mask the presence of vertical FDI when using total sales or an aggregation over the activities of foreign affiliates. Indeed, Hanson et. al. (2001) find empirically that, when holding constant the overall level of multinational sales in a country and industry, outsourcing to foreign affiliates is higher in countries where labor productivity and average incomes are relatively low. In addition, it has been argued by Hanson et. al. (2001) that foreign affiliates of vertically fragmented multinationals respond differently to host-country policies because of different production activities than horizontally fragmented multinationals.

Furthermore, Namini and Penning (2009) analyze empirically the link between domestic and foreign investments by distinguishing between horizontal and vertical FDI following the evidence by Hanson et. al. (2001). Namini and Penning (2009) state that such a disaggregation is crucial for understanding the dynamics of multinationals and their locational choices. It is stressed that horizontal multinationals invest abroad so that they can serve new markets but, in contrast, vertical multinationals invest abroad in order to reduce their production costs. This presents us with another reason for using the procedure of distinguishing between horizontal and vertical FDI in order to investigate the relationship between foreign aid and FDI. In their empirical analysis about US foreign investment of US multinationals, Namini and Penning (2009) use manufacturing and services FDI as proxies for vertical and horizontal FDI, respectively.

This section has allowed us to obtain a theoretical foundation on the investment decisions of multinationals in host countries concerning their fragmentation of production. Distinguishing between vertical and horizontal FDI seems necessary according to the literature. In the next section we focus on the relationship between foreign aid and FDI and summarize the main findings from the literature. Later on we will incorporate foreign aid into the Knowledge-Capital model.

Foreign Aid-FDI relationship

Harms and Lutz (2006) analyze how Official Development Assistance (ODA) influences private foreign investments. Theoretically, they stress that on the on hand foreign aid may raise the productivity of private capital by financing public infrastructural investments. On the other hand, foreign aid may also have an adverse effect by creating incentives for unproductive rent-seeking. They hypothesize that the negative rent-seeking effect is stronger in countries that have insecure property rights and a repressive political and economic regime. From the empirical estimations of their panel data regressions, they conclude that higher aid has no significant effect on private foreign investment. At odds with their initial hypothesis, Harms and Lutz (2006) observe from their empirical analysis that in countries with a high regulatory burden foreign aid seems to act as a catalyst for FDI. This does not imply that a bad regulatory environment is good for foreign investors. It could be, however, that the private sector may not be able to supply a proper infrastructure on its own due to the regulatory burden and, therefore, foreign aid can facilitate such an infrastructure having a positive effect on private foreign investments.

Karakaplan et. al. (2005) argue that the relationship between foreign aid and FDI is positive only if there exists a good investment environment in a developing country. They define a good investment environment as good governance and financial market development. It is argued that good governance decreases the rent-seeking effect in a developing country which would increase FDI flows. Furthermore, financial market development and reform can increase private capital flows next to foreign aid because of less capital controls and more efficiency. In their empirical analysis, Karakaplan et. al. (2005) conclude that foreign aid alone is not a condition for FDI to flow to aid receiving countries and that, indeed, only a good investment environment will have a positive effect on FDI flows.

In contrast, Asiedu et. al. (2009) argue that aid mitigates the adverse effect of risk on FDI. Risk, in this case, is defined as expropriation risk and can be seen as the risk of investing in a certain country. Asiedu et. al (2009) conclude in the same fashion as Harms and Lutz (2006) that higher aid to high risk countries –generally countries with a high regulatory burden- will increase FDI flows. This is because aid is seen by multinationals as positive external assistance increasing their willingness to invest in high risk countries. However, it is argued that the amount of aid that is necessary to completely eliminate the negative effect of risk on FDI seems to be implausibly high. Therefore, one should be careful in using aid as a tool to

mitigate the effect of country risk as foreign aid may mask the actual negative effect of investment risk and might reduce incentives by governments to lower it.

In addition to the findings that foreign aid mitigates the effect of country risk, Garriga and Philips (2013) argue that foreign aid flows exhibit an important signaling effect for multinationals to invest in post-conflict developing countries. This is because information about these countries is costly to collect and often not transparent or incomplete. Therefore, multinationals trust foreign aid donors that they have correct information available and the multinationals will base their investment decisions for an important part on aid flows by donor countries. More importantly for our analysis, Garriga and Philips (2013) state that US foreign aid flows are however different. They assume that US aid is more motivated by global security concerns than foreign aid by other donors. Several studies point out that US aid during the cold war was based more on geopolitics than development (Meernik et. al.; 1998 and Boschini and Olofsgard; 2007). Also after the end of the cold war in the 90s and, more recently the 'War on Terrorism' in the beginning of the 21st century, US foreign aid policy was shaped mainly by geopolitical reasons and security concerns. This makes US aid less likely in line with the interests of multinationals than economically motivated foreign aid by other donor countries. US bilateral aid could act as a warning sign for multinationals because the US gives aid to countries not because of their economic potential but instead for global security concerns and geopolitical motivations. This is because an increase in US interest together with US aid to a specific country or region might even increase their volatility and instability (Garriga and Philips; 2013). Recent examples are for instance Iraq and Afghanistan. In other words, US foreign aid has a negative impact on FDI in post-conflict developing countries.

Other studies argue that no relationship exists between foreign aid and FDI and disregard the idea that aid might increase or decrease FDI. Kosack and Tobin (2006) state that aid and FDI are unrelated because aid is generally orientated towards supporting the government budget and financing investments in human development (i.e. education and health). In contrast, FDI is by definition coming from the private sector and much more connected to physical capital. This is because multinationals generally invest in new production facilities, machinery or sales affiliates. Kosack and Tobin (2006) argue that only middle income developing countries with a relatively high level of human capital benefit from local knowledge spillovers that FDI may create because of skilled job creation. Lower income developing countries with relatively low human capital do, in general, not benefit from knowledge spillovers created by

FDI as the investments are mostly aimed towards low-skill labour intensive production. Kosack and Tobin (2006) stress that foreign aid and FDI in these countries are, therefore, neither compatible as substitutes nor complements regarding human capital development. Empirically, it is shown by Jansky (2012) that there is no direct relationship between aid and FDI. Furthermore, he argues that aid and FDI are neither substitutes nor complements. Jansky (2012) states that his findings suggest that donor countries do not substitute aid for insufficient FDI and, therefore, they do not correct for a potential market failure. Thus, no crowing-out or crowding-in processes are found between aid and FDI.

In summary, the findings above in the literature about the general relationship between foreign aid and FDI remain ambiguous. On the one hand, foreign aid seems to mitigate the effect of a regulatory burden and investment risk as it is seen by multinationals as positive external assistance that may supply the proper infrastructure for FDI (Harms and Lutz; 2006, Asiedu et. al.; 2009). However, foreign aid cannot completely offset the negative effect of a regulatory burden and investment risk on FDI. On the other hand, aid may facilitate FDI flows in the case of good governance and financial market development (Karakaplan et. al.; 2005). Finally, it is even argued that there is no direct relationship between aid and FDI (Kosack and Tobin; 2006 and Jansky; 2012). The conflicting results found above might be explained by the use of aggregated aid variables in these studies (e.g. total ODA or bilateral aid). As there are many different projects and sectors that can be financed through aid ranging from humanitarian aid to aid flowing to the production sector, a high level of aggregation might not capture these effects properly. It has been suggested by a few studies to break down foreign aid in order to be able to distinguish its different effects. This will be the topic of the next section.

Disaggregating aid

Disaggregating foreign aid when analyzing the relationship between aid and FDI seems to be a worthwhile exercise as certain types of aid (i.e. infrastructure) seem to be more suitable for the promotion of FDI than others. Selaya and Sunesen (2012) implement a theoretical model which uses a Solow setup for a small open economy. Output per capita in the model grows with the accumulation of physical capital per capita and improvements in total factor productivity. Formally, we have;

$y = A * k$ (where, y = output per capita, A = improvements in total factor productivity and k = physical capital per capita)

If the assumption of unrestricted international mobility of capital holds, the marginal product of capital or, in other words, the return to investments in physical capital should not differ across countries. An inflow of foreign capital will tend to reduce the marginal product of capital and in turn will crowd out other capital because of our assumption that the marginal product of capital should be equal across countries. However, aid directed towards improvements in total factor productivity will increase the marginal product of capital and this will attract additional FDI. In addition, this also increases aggregate output and because we use a Solow setup we observe an increase in domestic savings and investments. This is because in a Solow setup the domestic savings are determined by the country's level of output. Higher domestic investments decrease the marginal product of capital and reduce the amount of FDI inflows. The countries' level of output or, in other words, development level indicates the level of domestic investments. The complementary effect of aid directed towards improvements in total factor productivity on FDI will decrease with higher domestic investment and, therefore, the development level of a country also matters. In summary, the effect of aid into improvements in total factor productivity on FDI is ambiguous in theory.

Examples of improvements in total factor productivity are better institutions and new technologies. Foreign aid that increases physical capital per capita are generally investments that could be made by the private sector. Therefore, this type of foreign aid will tend to crowd out FDI as it acts as a substitute. On the other hand, foreign aid directed to improvements in total factor productivity might increase FDI and, thus, acts as a complement. However, as we have seen above this complementary effect is theoretically ambiguous. This may, theoretically, explain the positive relationship between foreign aid and FDI in developing countries with a high regulatory burden and high risk profile found by Harms and Lutz (2006) and Asiedu et. al. (2009). If foreign aid in these countries is directed towards the forming of better institutions, secure property rights and a proper infrastructure, aid will act as a complement for FDI and, therefore, a positive relationship emerges.

To estimate the theoretical model of foreign aid described above, Selaya and Sunesen (2012) use a fixed effects model as not all countries start with the same initial conditions. In other words, improvements in total factor productivity are different across countries. In order to allow for these differences, time-specific and country-specific effects should be included in

the estimations. However, improvements in total factor productivity may evolve unequally over time and across countries and, therefore, Selaya and Sunesen (2012) include a lagged dependent variable (lag of FDI) to capture time-moving country-specific factors. The latter procedure makes the specification dynamic and results into Generalized Method of Moments (GMM) estimators. The results obtained from the GMM estimations show that indeed according to theory foreign aid invested directly in physical capital has a crowding out effect. More importantly, foreign aid invested in inputs that improve total factor productivity attracts FDI flows. Selaya and Sunesen (2012) use foreign aid directed towards infrastructure and foreign aid directed towards the production sector as proxies for improvements in total factor productivity and accumulation of physical capital, respectively.

Infrastructural aid in a broad sense seems to have a crowding-in effect on FDI to developing countries. More specifically, Donaubauer et. al. (2012) test this hypothesis for the effect of aid for education as a measure for infrastructural aid on FDI in Latin America. They find a statistically significant positive effect of aid for education on FDI. However, Tanaka and Tsubota (2013) do not find a statistically significant effect on FDI when they consider foreign aid for roads as a measure for infrastructural aid in Cambodia. In this case, it could be that the aid directed towards roads increases domestic investments decreasing the marginal productivity of capital for FDI inflows offsetting the complementary effect of infrastructural aid. Thus, we observe that the effect of infrastructural aid on FDI is ambiguous when different measures of infrastructural aid or regions are considered.

Kimura and Todo (2009) propose that next to the infrastructure effect described in the previous paragraph and the rent-seeking effect described in the previous section by Harms and Lutz (2006) there is a positive vanguard effect in which foreign aid increases FDI. The vanguard effect can be formulated as foreign bilateral aid from one donor country that promotes FDI from the same donor country. For example, foreign aid from the US directed towards infrastructural projects in Egypt promotes FDI from US multinationals without affecting FDI inflows from other countries. Kimura and Todo (2009) provide several reasons for the existence of such a vanguard effect. First, foreign aid may provide information about the local business environment and the investment risk of the receiving country that is exclusively transmitted to the multinationals of the donor country. Second, foreign aid may bring specific business and legal practices, institutions and rules of the donor country into the receiving country. This benefits donor' investors and multinationals as they have more

experience in dealing with these business practices, rules and institutions than multinationals from other countries.

Kimura and Todo (2009) isolated the vanguard effect empirically by using a country-pair dataset between the donor and the host country. In our empirical analysis, we only focus on US FDI and US foreign aid, thus, capturing the vanguard effect. In addition, Kimura and Todo (2009) disaggregate the aid data by distinguishing between aid for infrastructure and aid for other purposes. Theoretically, Kimura and Todo (2009) ground their analysis on the Knowledge-Capital model which we described in the first section of the literature review. From the results, Kimura and Todo (2009) conclude that foreign aid in general does not have a significant effect on FDI. However, they find evidence that in the case of Japan infrastructural aid works as a catalyst for Japanese FDI. This indicates that there is a vanguard effect for the case of Japan.

The result that Japanese foreign aid enhances Japanese FDI flows to the same region is supported by Blaise (2005). She presents a conditional logit model based on microeconomic foundations by using detailed provincial data on the activity of affiliates of Japanese multinationals in China. From the econometric analysis, she concludes that Japanese ODA or aid has a positive effect on the locational choice of Japanese multinationals. Furthermore, Japanese ODA in China is mainly focused on infrastructure projects creating a positive investment environment for Japanese FDI (Blaise; 2005).

In summary, it becomes apparent from the literature that, when different types of foreign aid streams are observed, foreign aid can have a substitution or complementary effect on FDI. Both in theory and empirically it has been proven that these hypotheses hold.

Knowledge-Capital model and foreign aid

The previous sections of the literature review now leaves us with two important theoretical frameworks regarding FDI and foreign aid. First, the Knowledge-Capital model, the topic of the first section, explains the locational choices and the investment decisions of multinationals through their different fragmentations of production. Second, the simple Solow setup, in the last section, explains that aid can act as a substitute or complement for FDI. Using an empirical framework closely resembling the model of Carr et. al. (2001), Kimura and Todo (2009) incorporate the Knowledge-Capital model into their estimations of

the relationship between aid and FDI. However, their empirical model lacks two crucial factors that are important to the two theories described in the literature review. First, the method of disaggregation of aid in the empirical model of Kimura and Todo (2009) is not done efficiently. They make a distinction between infrastructural aid and all other aid without any theoretical argument. Thus, production sector aid and humanitarian aid fall in the same group in their model. Therefore, in support of the theoretical Solow setup posed by Selaya and Sunesen (2012), we use infrastructural aid and production sector aid as proxies for complementing or substituting aid flows, respectively. Second, the model of Kimura and Todo (2009) does not make a distinction between vertical and horizontal FDI because it closely resembles the model by Carr et. al. (2001). Both forms of FDI are important as argued by Hanson et. al. (2009) in the first section. In addition, Namini and Penning (2009) stress that in understanding the locational choices or investment decisions of the multinational such a distinction is crucial. This is because horizontal multinationals base their investment decisions on expanding towards new markets while vertical multinationals base their investment decisions on reducing production costs. Therefore, we distinguish between vertical and horizontal FDI in our model. This is a novelty in the literature about the aid-FDI relationship but to us this is a crucial factor in order to align our empirical model with the theoretical Knowledge-Capital model.

In the last section, we will discuss some endogeneity problems of the relationship between foreign aid and FDI found in the literature.

Endogeneity

It has been stressed in the literature that the relationship between foreign aid and FDI can run in both directions. Foreign aid may create the necessary conditions for increasing FDI flows to certain developing countries as has been discussed above. However, foreign aid might also be influenced by a lack of FDI as aid generally flows to poorer countries with less access to international capital markets and low growth rates. Thus, it has been argued that foreign aid runs in the opposite direction of FDI (Harms and Lutz; 2006, Seleya and Sunesen; 2012). Asiedu et. al. (2009) argue that there is a possibility that foreign aid and FDI are determined jointly. The factors that affect FDI might reflect general conditions of the economy's host country and these may possibly also have an effect on the allocation of foreign aid. In a seminal paper, Granger (1988) calls this instantaneous causality and it is more commonly

known as simultaneity. The previous two endogeneity problems create estimations which are biased and inconsistent. Thus, care should be taken to avoid endogeneity between foreign aid and FDI.

A possible solution for the endogeneity problem could be to apply the instrumental variable approach. This strategy has been employed by Harms and Lutz (2006) and Bhavan et. al. (2011) where the former use lags of aid per capita, debt service, the literacy rate, population and fuel exporters and the latter use lags of aid, population growth, trade openness and lags of FDI per capita as instruments. However, both studies do not provide us with information about the correlation of these instruments with foreign aid. Furthermore, Selaya and Sunesen (2012) argue that their instruments fail the tests of validity when country-fixed effects are included in the estimations making the estimations biased and inconsistent. Controlling for country-specific effects is important for our analysis as we want to investigate the effects of foreign aid on FDI keeping country characteristics constant. Thus, we have to include country-fixed effects in our estimations. As discussed by Selaya and Sunesen (2012) that there are no valid instruments available, an instrumental variable approach does not seem to be an option.

Empirical model

This thesis studies the effect of foreign aid on vertical and horizontal FDI. The literature makes clear that foreign aid can take on many forms and that disaggregating aid flows is a worthwhile exercise. As stressed in the literature review, we follow Selaya and Sunesen (2012) in using two types of different foreign aid flows. These aid flows are infrastructural aid and production sector aid which have a complementary and substituting effect on FDI according to Selaya and Sunesen (2012). Furthermore, in our empirical model we incorporate the theoretical framework of the Knowledge-Capital model described above to explain the locational choices of multinationals and make a distinction between vertical and horizontal FDI. This is a departure from the model used by Kimura and Todo (2009). The novelty in our analysis is the separation between vertical and horizontal FDI which has not been done before in other studies investigating the relationship between aid and FDI . We use proxies for these FDI streams based on the evidence presented by Hanson et. al. (2001) and Namini and Penning (2009). This evidence is based on US multinationals. In our analysis, we also focus on US FDI data as it is the most detailed data available and it includes a breakdown by sectors which is a necessary requirement to proxy for vertical and horizontal FDI. In addition, it allows us to use the same proxies as Namini and Penning (2009).

In the following sections we first describe our dataset and the variables we use in our estimations. Then we will present our model specification.

Data and variables

Our dataset contains 153 US foreign aid receiving developing countries according to the OECD Crediting Reporting System (CRS) Aid Activities database from 1995-2012 it is collected on a yearly basis. We only use US foreign aid data because of data limitations for our FDI variable. However, this allows us to analyze how US multinationals are affected in their investment decisions by the US government in order to capture the vanguard effect described by Kimura and Todo (2009) in the literature review. Data about US FDI flows are gathered from the Bureau of Economic Analysis (BEA). The control variables are taken from the world development indicators of the World Bank and the Quality of Government Dataset (2013) (by the University of Gothenburg). We use natural logarithms where possible as we

are interested in the relative change of an independent variable to our dependent variable. All the variables used in our empirical analysis are summarized in Appendix A. We will now turn to the variables we use in our empirical analysis.

Dependent variables: we use total US manufacturing and services FDI as proxies for US vertical and horizontal FDI, respectively. The BEA categorizes US FDI flows along several sectors. We use US direct investment in the manufacturing sector abroad as manufacturing FDI. For services FDI we include the following sectors; wholesale trade, information technology, depository institutions, finance including insurance and professional, scientific and technical services. The BEA does not record all US FDI outflows to all individual countries but aggregates small-receiving countries in the 'other' category per region. We do not use this 'other' category as we cannot use country-specific variables as GDP for these cases. All 29 developing countries included in our sample are summarized in Appendix B. For both dependent variables we take the natural logarithm.

Aid variables: US aid flows are taken from the OECD's CRS and we include total social and economic infrastructure aid (coded 100 and 200, respectively) as infrastructural aid. Furthermore, we include total aid to production sectors (coded 300) as production sector aid. Both US aid flows are in constant dollars. It is important to stress that infrastructural (100 and 200) and production sector (300) do not add up to total US aid flows. We exclude other US aid flows like humanitarian or food security aid as they lack causality with the private sector. We take natural logarithms of both aid flows.

Control variables: To incorporate the Knowledge-Capital model we control for the market size and the skill level. The market size is measured by total GDP in constant 2005 dollars. Skill level is measured by GDP per capita in constant 2005 dollar. A higher GDP per capita can be seen as a generally higher skill level in a developing country. This is a rather rough measure for skill level but it is the most complete one available. We also include a quadratic term of GDP per capita to capture the diminishing effect of GDP per capita on FDI. Both GDP and GDP per capita are taken from the development indicators of the World Bank. Furthermore, we control for country-specific effects by applying country fixed effects. As distance is also an important factor in the Knowledge-Capital model and varies per country we can keep this constant by applying fixed effects estimations.

We also include two other variables in our empirical model. These are durability of regime in a developing country measured in years and health expenses per capita and let them interact

with both US infrastructural and production sector aid. The former is a proxy for instability and taken from the Quality of Government Dataset (2013). The latter is a proxy for the level of human development in a developing country of which we take the natural logarithm. This measure is provided by the world development indicators of the World Bank.

Model Specification

Our baseline regressions estimate the effect of infrastructural and production sector aid on manufacturing and services FDI. As already argued in the literature review, we suspect that the relationship between aid and FDI may be suffering from endogeneity making the coefficients biased and inconsistent. As finding strong instruments proofs to be very difficult and possible instruments may be correlated with the error term (Selaya and Sunesen; 2012), applying an instrumental variable approach is not the best strategy. Instead, we use lagged variables of our aid measures to control for endogeneity. In addition, our control variables total GDP and GDP per capita may suffer from a case of reverse causality. This is because FDI also influences the level of output. By also using the lag of both GDP and GDP per capita we can control for reverse causality. We can now specify our basic regression equation as follows:

$$\ln(FDI)_{it} = \beta_0 + \beta_1 \ln(Aid)_{it-1} + \beta_2 \ln(GDP)_{it-1} + \beta_3 \ln(GDPCapita)_{it-1} + \beta_3 \ln(GDPCapita)^2{}_{it-1} + \alpha_i + \delta_t + \varepsilon_{it} \quad (\mathbf{1})$$

Where;

$\ln(FDI)_{it}$ is the dependent variable, the natural logarithm of US manufacturing FDI or US services FDI;

$\ln(Aid)_{it-1}$ is the natural logarithm of lagged infrastructural aid or production sector aid;

$\ln(GDP)_{it-1}$ is the natural logarithm of lagged total GDP;

$\ln(GDPCapita)_{it-1}$ is the natural logarithm of lagged GDP per capita,

$\ln(GDPCapita)^2{}_{it-1}$ is the quadratic term of the natural logarithm of lagged GDP per capita,;

α_i and δ_t are country- and time-specific effects and ε_{it} is the error term.

Results

To keep our results section clear and structured, we first focus on manufacturing FDI, our proxy for vertical FDI, as the dependent variable in our regressions. Later on we will repeat the same exercises but then use services FDI as our dependent variable.

In our baseline specifications we estimate infrastructural and production sector aid on manufacturing FDI. We control for market size (total GDP), skill level (GDP per capita) and country-specific effects as formalized in the Knowledge-Capital model (Carr et.al; 2001 and Kimura and Todo; 2009). Furthermore, we add time dummies to our estimations to control for time-specific effects. The baseline results are summarized in table 1 below; regression (1)-(3).

Baseline regressions

The first two regressions estimate the effect of infrastructural aid and product sector aid on manufacturing FDI separately. The coefficients for infrastructural aid and production sector aid in regression (1) and (2) are highly insignificant which might confirm the results of

Table 1. Regressions with country- and time-specific effects

	Dependent variable (Regression):		
	FDI_{manu}	FDI_{manu}	FDI_{manu}
Independent Variable:	(1)	(2)	(3)
$\ln(Aid_{infra})^{(t-1)}$	-0.007		-0.011
	(0.068)		(0.072)
$\ln(Aid_{prod})^{(t-1)}$		0.009	0.006
		(0.016)	(0.014)
$\ln(GDP)^{(t-1)}$	-4.377*	-2.439	-4.957*
	(2.282)	(2.565)	(2.458)
$\ln(\text{GDP per Capita})^{(t-1)}$	8.717*	5.166	9.202*
	(4.822)	(5.346)	(4.950)
$\ln[(\text{GDP per Capita})^{(t-1)}]^2$	-0.222	-0.065	-0.218
	(0.207)	(0.254)	(0.218)
Fixed effects (Intercept)	77.070**	45.934	88.373**
	(34.495)	(40.633)	(38.451)
R-Squared	0.528	0.487	0.556
Observations	268	242	214

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Kosack and Tobin (2006) and Jansky (2012) that no relationship between foreign aid and FDI exists. The coefficients of the control variables are significant for market size (total GDP) and skill difference (GDP per capita) at the 10% level in regression (1). The sign of total GDP is negative indicating that manufacturing multinationals increase their investments in countries with a smaller host market size. It could be that the production costs for manufacturing US multinationals are lower in smaller host markets as vertically fragmented multinationals make investment decisions based on reducing production costs (Namini and Penning; 2009). Furthermore, the positive sign of GDP per capita indicates that higher levels of GDP per capita increase FDI by manufacturing multinationals. This is a counterintuitive result for vertical FDI according to the Knowledge-Capital model. The model predicts that lower skill levels (proxied by lower GDP per capita) increase labour-intensive low-skilled production of vertical multinationals increasing vertical FDI.

In regression (2) next to production sector aid all control variables also turn insignificant. We suspect that our sample suffers from selection bias as only the largest US FDI receivers are observed in the BEA dataset. In addition, our sample of only including those developing countries that are receiving aid might give different results regarding the Knowledge-Capital model. If we only regress GDP together with infrastructural aid on FDI we do obtain coefficients for this control variable with the expected signs. However, omitting GDP per capita gives biased and inconsistent estimators and, thus, adding GDP per capita and its square is necessary for our estimations.

Moving on to regression (3) which includes both infrastructural and production sector aid, we can infer that for both types of aid the estimated coefficients are statistically insignificant. The number of observations also drops for these regressions compared to regressions (1) and (2). Some inspection of the data shows that many developing countries that receive production sector aid appear to have gaps of one or two years in which they did not receive this type of aid. Thus, the US gives production sector aid to developing countries on a much less consistent basis than infrastructural aid. This might also explain the statistically insignificant coefficients we observe in regression (2). This might have implications for our empirical estimations as these gaps leave out important information within our regressions. Failing to pick up this information, our estimated coefficients might therefore not capture the effects of our control variables that we saw in our previous regressions (1).

Regional Heterogeneity

As already stated, the results of our baseline regressions may imply that the relationship between US infrastructural aid or production sector aid and US manufacturing FDI is non-existent. However, Asiedu (2002; 2006) argues that Africa might be different considering the determinants of FDI inflows. In addition, Donaubrauer (2012) finds a positive effect of aid to education on FDI but, in contrast, Tanaka and Tubota (2013) find a negative effect of aid to infrastructure on FDI in Cambodia. Thus, these ambiguous results in the literature lead us to suspect that the relationship between US foreign aid and FDI might differ across regions. To control for regional heterogeneity, we include region dummies and let them interact with infrastructural and production sector aid, respectively. The results of this exercise are summarized in table 2 on the next page; regression (4)-(6). Our previous baseline regressions now include interaction terms which control for 6 regions, however, we only include five regions to avoid the dummy variable trap. We include the following regions; Latin America (no dummy included – works as our basic result or reference), East and Southeast Asia (ESEA dummy), Sub-Saharan Africa (SSA dummy), Middle East, South Asia and the rest.

From the results of regression (4) we can infer that our basic result for the effect of infrastructural aid on manufacturing FDI is negative and insignificant. This implies that for our reference region Latin America the effect of infrastructural aid on manufacturing FDI is not statistically different from zero. The coefficients of the control variables have the same signs as in the baseline regressions and are significant except for squared GDP per capita.

Turning our attention to the region interactions for regression (4), we see that the coefficients of the interaction term of East and Southeast Asia and Sub-Saharan Africa are not statistically different from zero. However, Infrastructural aid for the Middle East and South Asia seems to be positive and significant. The coefficients imply that a 1% increase in US infrastructural aid increases US manufacturing FDI for the Middle East by 0.79% and for South Asia 0.53%. It seems that infrastructural aid acts as a complement for FDI in these regions. This is in line with the theory using the Solow setup model in which infrastructural aid increases and improves total factor productivity in a country (Selaya and Sunesen; 2012). In addition, it could be that US infrastructural aid provides information about the investment risk and brings in common business practices for US multinationals which positively affects their investment decisions in these regions. Thus, a positive vanguard effect exists regarding infrastructural aid in these regions (Kimura and Todo; 2009).

Table 2. Regressions with region interactions and country- and time-specific effects

	Dependent variable (Regression):		
	FDI_{manu}	FDI_{manu}	FDI_{manu}
Independent Variable:	(4)	(5)	(6)
$\ln(Aid_{infra})^{(t-1)}$	-0.101		-0.91
	(0.066)		(0.104)
$\ln(Aid_{prod})^{(t-1)}$		0.024	0.033
		(0.019)	(0.022)
$\ln(GDP)^{(t-1)}$	-4.689*	-2.187	-4.409
	(2.314)	(2.436)	(3.011)
$\ln(\text{GDP per Capita})^{(t-1)}$	8.432*	5.986	8.007
	(4.224)	(5.049)	(5.314)
$\ln[(\text{GDP per Capita})^{(t-1)}]^2$	-0.202	-0.147	-0.197
	(0.159)	(0.243)	(0.208)
$ESEA*\ln(Aid_{infra})^{(t-1)}$	0.022		0.001
	(0.090)		(0.159)
$SSA*\ln(Aid_{infra})^{(t-1)}$	0.160		0.119
	(0.107)		(0.173)
$MiddleEast*\ln(Aid_{infra})^{(t-1)}$	0.793***		0.694***
	(0.117)		(0.223)
$SouthAsia*\ln(Aid_{infra})^{(t-1)}$	0.531***		0.725**
	(0.187)		(0.336)
$Rest*\ln(Aid_{infra})^{(t-1)}$	0.192		0.204
	(0.124)		(0.172)
$ESEA*\ln(Aid_{prod})^{(t-1)}$		-0.082*	-0.089*
		(0.039)	(0.051)
$SSA*\ln(Aid_{prod})^{(t-1)}$		-0.075**	-0.082**
		(0.035)	(0.031)
$MiddleEast*\ln(Aid_{prod})^{(t-1)}$		0.308***	0.247**
		(0.052)	(0.094)
$SouthAsia*\ln(Aid_{prod})^{(t-1)}$		-0.029	0.019
		(0.034)	(0039)
$Rest*\ln(Aid_{prod})^{(t-1)}$		0.028	-0.019
		(0.052)	(0.020)
Fixed effects (Intercept)	85.543**	39.072	81.407
	(35.599)	(39.427)	(47.803)
R-Squared	0.595	0.516	0.641
Observations	268	242	214

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Regression (5) presents the results for the effect of production sector aid on manufacturing FDI. The basic result shows that the coefficient of production sector aid is not statistically different from zero. In addition, all the control variables are also not statistically significant.

We observe statistically significant coefficients for the aid interactions with the regions East and South East Asia, Sub Saharan Africa and the Middle East. The first two regions show small negative effects of production sector aid on manufacturing FDI; a 0,08% decrease in US manufacturing investments if production sector aid increases with 1%. It seems that for East and South East Asia and Sub Saharan Africa production sector aid substitutes manufacturing FDI as we observe a small crowing out effect. For the Middle East we see a positive effect of 0.3% in manufacturing FDI for a 1% increase in production sector aid.

In regression (6) we estimate the effects of infrastructural aid and production sector aid on manufacturing FDI simultaneously. We observe the same results as in regression (4) and (5) but with slightly different coefficients.

In summary, adding aid interactions with region dummies to our baseline regressions shows us that there is regional heterogeneity for the relationship of both type of aid and manufacturing FDI. In the Middle East both types of aid seems to have a positive effect on manufacturing FDI. We have to stress that more than half of the observations in our dataset for the Middle East are from Egypt. Extrapolating these results to the whole Middle East is not reasonable as the US and Egypt are generally regarded in the geopolitical spectrum as allies (at least for the period observed). Other countries from the Middle East have a far more hostile relationship with the US, like for instance Iran or Iraq. For other regions the results are less pronounced and significant. Regionally, US multinationals seem to react differently towards US aid. From the literature review we observed that US aid is different than aid from other countries as it is motivated by global security concerns and geostrategic reasons (Garriga and Phillips; 2013). The effect of this so-called warning sign effect of US aid will be explored in the next section.

The warning sign effect of US foreign aid

Our main task now becomes to explain this regional heterogeneity for both infrastructural aid and productions sector aid on manufacturing FDI. As already stressed in the literature, US foreign aid differs from other aid donors as US aid works as a warning sign for US multinationals to invest in post-conflict developing countries (Garriga and Phillips; 2013). In other words, US aid to unstable countries has a detrimental effect on US FDI - this might explain the different outcomes of our results when compared to the empirical research found

in the literature which use aid and FDI streams of many donor countries (Kimura and Todo; 2009, Selaya and Sunesen; 2012). Therefore, we need to find a proxy for instability to analyze if a warning-sign effect exists for US manufacturing FDI and US infrastructural and production sector aid. We use regime durability as a proxy for instability which is measured in years. If a regime falls in a certain developing country, the measure drops to zero. If we look at the summary statistics per region for those countries receiving infrastructural aid and manufacturing FDI in Appendix C, regime durability for the Middle East and South Asia are particularly high and might explain why US infrastructural aid has a positive effect on manufacturing FDI for these regions. As the countries in these regions seem to be stable implied by their relatively long regime durability, US infrastructural aid does not act as a warning sign for the investment decisions of multinationals in these regions. In other words, US infrastructural aid is in these cases less motivated by security or strategic concerns but more motivated by economic reasons. Thus, US infrastructural aid acts as a complement for manufacturing FDI in these regions.

We estimate the effect of US infrastructural and production sector aid and regime durability on manufacturing FDI and let the two interact with each other to see if aid acts as a warning sign for multinationals. The results of this exercise are found in table 3, regressions (7)-(9) on the next page. In regression (7), we observe that the coefficient of infrastructural aid now turns negative and significant and all control variables except squared GDP turn significant with the same signs as before. The coefficient of regime durability turns negative in regression (7) indicating that longer lasting regimes have a damping effect on manufacturing FDI. US multinationals might fear rent-seeking activities and empire building by the longer sitting government. However, this decrease is a marginally small 0.1% per extra year a regime stays in power. The coefficient of the interaction between regime durability and infrastructural aid turns positive and significant. This indicates that the longer a regime stays in power the effect of infrastructural aid turns less negative in total and can eventually even turn positive. The threshold for infrastructural aid to turn positive is 0.149/0.006 = 24.8 years of a regime staying in power. This is above the average regime durability for Latin America and East and Southeast Asia which also have negative but insignificant values for infrastructural aid in our regional regression (4) found in table 2. As stressed above, Middle East and South Asia have high regime durability averages and, therefore, we see a positive effect for these regions in the regionals regressions as the warning sign effect fades away. For

Table 3. Regressions with regime durability and health expenses interacted with aid and country- and time-specific effects

	Dependent variable (Regression):					
	FDI_{manu}	FDI_{manu}	FDI_{manu}	FDI_{manu}	FDI_{manu}	FDI_{manu}
Independent Variable:	(7)	(8)	(9)	(10)	(11)	(12)
$\ln(Aid_{infra})^{(t-1)}$	-0.149**		-0.196**	0.435		0.591
	(0.059)		(0.078)	(0.492)		(0.486)
$\ln(Aid_{prod})^{(t-1)}$		0.009	0.022		-0.169	-0.159
		(0.024)	(0.029)		(0.137)	(0.124)
$\ln(GDP)^{(t-1)}$	-4.459**	-4.204*	-4.692**	-4.488*	-2.520	-5.203**
	(2.034)	(2.370)	(2.261)	(2.223)	(2.509)	(2.462)
$\ln(\text{GDP per Capita})^{(t-1)}$	7.856**	8.527*	7.611*	8.994*	5.261	9.790*
	(3.447)	(4.477)	(4.113)	(4.555)	(5.377)	(5.118)
$\ln[(\text{GDP per Capita})^{(t-1)}]^2$	-0.186	-0.205	-0.173	-0.250	-0.076	-0.261
	(0.136)	(0.216)	(0.192)	(0.201)	(0.261)	(0.251)
Durability	-0.107***	0.016	-0.139***			
	(0.020)	(0.012)	(0.043)			
Durability*$\ln(Aid_{infra})^{(t-1)}$	0.006***		0.009***			
	(0.001)		(0.002)			
Durability* $\ln(Aid_{prod})^{(t-1)}$		-0.0004	-0.001			
		(0.0006)	(0.001)			
ln(Health per Capita)				1.336	-0.239	1.327
				(1.366)	(0.605)	(1.516)
ln(Health per Capita)* $\ln(Aid_{infra})^{(t-1)}$				-0.073		-0.099
				(0.074)		(0.075)
ln(Health per Capita)* $\ln(Aid_{prod})^{(t-1)}$					0.030	0.028
					(0.024)	(0.021)
Fixed effects (Intercept)	85.898**	73.173*	94.149**	71.341*	49.509	84.582**
	(33.224)	(38.863)	(37.707)	(36.055)	(39.907)	(40.394)
R-Squared	0.579	0.541	0.607	0.538	0.495	0.572
Observations	258	230	204	268	242	214

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Sub-Saharan Africa and developing countries categorized as the rest the averages for regime durability are even lower than in Latin America and East and Southeast Asia, but developing countries belonging to Sub-Saharan Africa or the 'rest' category also show a marginally but insignificant positive effect of infrastructural aid on manufacturing FDI as the results in table 2 regression (4) shows. However, the positive effects are much larger for the Middle East and South Asia which leads us to conclude that regime durability works as an important vehicle for infrastructural aid to have a positive impact on manufacturing FDI. In other words, the warning sign effect of US infrastructural aid fades away the longer the regime stays in power. US infrastructural aid in these countries is not seen as a destabilizing factor anymore by US multinationals.

Regression (8) shows us the results of US production sector aid and the interaction between regime durability and this type of aid. We have already observed in table 2 that there is a crowding out effect for some regions but now we want to test if production sector aid is affected by regime durability. In both regressions this is not the case as the coefficients of production sector aid and the interaction terms with regime durability are insignificant. Thus, we do not observe a warning sign effect regarding US production sector aid. This seems plausible as this type of aid flows mostly to the private sector of the developing country, thus, it is much less motivated by global security concerns or strategic reasons. Regression (9) includes both types of aid and their interactions between regime durability. The results closely resemble the coefficients of the regression (7) and (8).

In summary, we are now able to explain regional heterogeneity for the relationship of infrastructural aid and manufacturing FDI by introducing an instability measure. In addition, we have showed that for production sector aid such a warning sign effect does not exist. However, a stable government alone is not the only factor for infrastructural aid to have a positive effect on manufacturing FDI. In the next section, we present another factor that may influence the investment decisions of multinationals active in the manufacturing sector.

The impact of a developing countries' development level

There might be another effect that we have so far omitted that influences infrastructural aid from reaching its full potential for some developing countries. This is because, following the Solow setup introduced in the literature review, developing countries with a higher income level have a higher rate of savings and investment. Infrastructural aid in these developing countries will be less effective in raising domestic *and* foreign investments. It may be argued that several developing countries have already reached a certain development level in which infrastructural aid does not increase welfare and might be inefficient in the eyes of multinationals. This is especially the case for middle-income countries which are mainly situated in Latin America and East and Southeast Asia in our sample. Many of these countries can already borrow at international financial markets to cover their government expenses and foreign aid might not be deemed necessary at all. To measure the level of development and its effect on manufacturing and services FDI in combination with infrastructural aid we, therefore, need to find a good proxy.

Strauss and Thomas (1998) stress that there exists a causal impact of health on wages and productivity in low income economies. Proper nutrition and basic health are especially important fundamentals for jobs requiring more strength, which we typically find in the manufacturing sector. Bhargava et. al. (2001) find in their empirical analysis that adult survival rates have significant positive effects on economic growth rates for low income countries. For highly developed countries they find the reverse effect as a negative effect is found.

As we focus mainly on FDI flows and not on economic growth it is important that health, as a proxy for the level of development, has a causal relationship with FDI. According to the empirical evidence provided by Alsan, Bloom and Canning (2006), there exists a positive and statistically relationship between health and gross FDI inflows to low and middle income developing countries. In their analysis Alsan, Bloom and Canning (2006) use life expectancy as a proxy for the overall health level in a developing country. As we are interested in the general development level of a developing country, we use health expenses per capita as a proxy for human development as described above in the same vain as Strauss and Thomas (1998).

From regression (10) in table 3 we can infer that infrastructural aid now turns positive but insignificant. In addition, our health proxy turns positive but statistically insignificant indicating

that more expenses to the health sector leads to more incoming manufacturing FDI. In other words, a higher level of health services increases health among workers and thus increases investments from abroad. However, our coefficients for our variables of interest are not statistically significant but we can still analyze their effects on manufacturing FDI. The interpretation of these effect should be taken with caution of course. As the coefficient of infrastructural aid is positive and the interaction term with health per capita turns negative, we can infer that there is a certain threshold level of the amount of health expenses per capita for the effect of infrastructural aid to turn negative if exceeded. Please note that we have to keep infrastructural aid constant. Thus, we indeed find that there is a certain level of development (measured in health expenses) in which infrastructural aid has a negative effect on manufacturing FDI. This threshold level is 0.435/0.073 = 5.959 which is the natural logarithm or $387.22 health expenses per capita per year. We can see from the summary statistics that Latin America and countries not assigned to a region are above this threshold level. East and South East Asia is below the threshold but, nonetheless, infrastructural aid has a non-significant effect on manufacturing FDI in this region as we observe in table 2. Health expenses per capita might be an incomplete proxy, as we suspect that education is also an important component of human development. However, education measures are fairly incomplete for developing countries (World Bank data) and we, therefore, choose to use health expenses per capita only.

The results of including production sector aid instead of infrastructural aid in regression (11) shows a negative but statistically insignificant effect of productions sector aid on manufacturing FDI. Health per capita turns negative but insignificant and the interaction term turns positive but insignificant. Thus, it seems that there is a positive threshold level of health per capita in which the effect of production sector aid turns positive for manufacturing FDI. In contrast with infrastructural aid, production sector aid could be more efficient in a country with a higher development level. This is because production sector aid it mostly directed towards the private sector and a more developed private sector might be better in allocating these aid flows towards the most profitable projects. However, we should stress that the coefficients are statistically insignificant and not much weight should be put on their interpretation. Regression (12) shows us the results for infrastructural and production sector aid simultaneously. The coefficients have the same signs as in regression (10) and (11) but most are statistically insignificant. It seems that

health per capita is not a significant factor that influences investment decisions by US manufacturing multinationals as its coefficient turns insignificant in all three regressions.

We will repeat the analysis and regressions but now for services FDI in the next section. This allows us to investigate the effect of infrastructural and production sector aid on horizontally fragmented multinationals.

Results for services FDI

The results of the baseline regressions for services FDI can be found in table 4 below. The effect of both infrastructural aid and production sector aid on services FDI in regressions (1) and (2) is statistically insignificant and about the same as for manufacturing FDI. However, the model fit or r-squared is much lower than in the regression for manufacturing FDI. The control variables in regression (1) in table 4 do however have a much larger magnitude than for the same regression with manufacturing FDI in table 1, regression (1). For total GDP, the proxy for market size, the larger negative coefficient is counterintuitive as the Knowledge-Capital model states that a larger host market size should increase horizontal (Services) FDI. The larger coefficient for GDP per

Table 4. Regressions with country- and time-specific effects

	Dependent variable (Regression):		
	$FDI_{services}$	$FDI_{services}$	$FDI_{services}$
Independent Variable:	(1)	(2)	(3)
$\ln(Aid_{infra})^{(t-1)}$	0.0009		-0.030
	(0.084)		(0.113)
$\ln(Aid_{prod})^{(t-1)}$		0.036	0.055**
		(0.025)	(0.024)
$\ln(GDP)^{(t-1)}$	-10.753*	-5.968	-8.704
	(6.065)	(5.707)	(6.214)
$\ln(\text{GDP per Capita})^{(t-1)}$	20.237*	9.217	13.536
	(11.329)	(10.127)	(10.610)
$\ln[(\text{GDP per Capita})^{(t-1)}]^2$	-0.669	0.178	-0.314
	(0.556)	(0.523)	(0.529)
Fixed effects (Intercept)	175.862	109.626	154.868
	(108.158)	(107.691)	(116.763)
R-Squared	0.215	0.226	0.252
Observations	278	251	223

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

capita our proxy for skill level is however in line with the Knowledge-Capital model. Horizontal FDI is relatively more skill-intensive than vertical FDI as the horizontal FDI does not allow to fragment its production in low skill or high skill intensities. We again suspect that selection bias might give the counterintuitive result for market size.

Finally, regression (3) shows us that production sector aid has a positive but small and statistically significant effect on services FDI. This may be because production sector aid is mostly directed to the mining, industry and construction sectors of the economy. Thus, the services sector in a developing country is not affected much by production sector aid and US multinationals from the services sector are not influenced by this type of aid in their investment decisions. The increase in physical capital for the production sector because of external aid may increase the demand by firms active in the production sector of services firms and, thus, investments in the services sector may rise to meet this demand. Thus, we may observe a positive indirect effect on the investment decisions by multinationals active in the services sector.

Table 5 on the previous page shows the regional effects of both types of aid on services FDI. From regression (4) with infrastructural aid as our main variable of interest, we can infer that only for the region South Asia there exists a statistically significant large positive effect of infrastructural aid on services FDI. A possible explanation of why South Asia is different might be that US multinationals active in the services sector in South Asia behave more as a vertically fragmented multinational than a horizontally fragmented one. It is well known that many US multinationals active in IT but also in the insurances and finance sectors have outsourced over the past two decades some of their activities to mainly India. These activities included for a large part customer services and simple business administration purposes. Several countries in South Asia (including India, Pakistan and Bangladesh) have the advantage that they are well educated in speaking the English language. Other regions do not have this advantage. However, this only explains why South Asia might be different but not why infrastructural aid should increase services FDI to South Asia. It could be that US infrastructural aid to South Asia supports institutions and brings in business and legal practices common to US multinationals. This could positively benefit the investment decisions of US multinationals in South Asia. Moving on to regression (5) which estimates the effect of production sector aid, we see that not any interaction

term is statistically significant and their coefficients are fairly close to zero. Again we see that services FDI may not be influenced by production sector aid as it is directed towards other sectors. Regression (6) shows again the large and statistically significant coefficient of the interaction between infrastructural aid and South Asia. The effect of production sector aid on

Table 5. Regressions with region interactions and country- and time-specific effects

	Dependent variable (Regression):		
	$FDI_{services}$	$FDI_{services}$	$FDI_{services}$
Independent Variable:	(4)	(5)	(6)
$\ln(Aid_{infra})^{(t-1)}$	-0.077		-0.003
	(0.107)		(0.167)
$\ln(Aid_{prod})^{(t-1)}$		0.024	0.064
		(0.047)	(0.048)
$\ln(GDP)^{(t-1)}$	-8.037*	-5.763	-3.479
	(4.219)	(5.584)	(3.575)
$\ln(\text{GDP per Capita})^{(t-1)}$	12.318	8.960	2.071
	(10.327)	(10.251)	(10.228)
$\ln[(\text{GDP per Capita})^{(t-1)}]^2$	-0.374	-0.175	0.068
	(0.539)	(0.540)	(0.547)
$ESEA*\ln(Aid_{infra})^{(t-1)}$	0.126		0.158
	(0.196)		(0.289)
$SSA*\ln(Aid_{infra})^{(t-1)}$	-0.157		-0.467
	(0.420)		(0.474)
$MiddleEast*\ln(Aid_{infra})^{(t-1)}$	0.379		0.086
	(0.237)		(0.210)
$SouthAsia*\ln(Aid_{infra})^{(t-1)}$	1.612***		1.75**
	(0.533)		(0.673)
$Rest*\ln(Aid_{infra})^{(t-1)}$	0.356		-0.029
	(0.312)		(0.169)
$ESEA*\ln(Aid_{prod})^{(t-1)}$		0.086	0.024
		(0.063)	(0.059)
$SSA*\ln(Aid_{prod})^{(t-1)}$		-0.077	-0.115**
		(0.071)	(0.050)
$MiddleEast*\ln(Aid_{prod})^{(t-1)}$		0.155	0.151
		(0.102)	(0.101)
$SouthAsia*\ln(Aid_{prod})^{(t-1)}$		0.028	0.116
		(0.096)	(0.123)
$Rest*\ln(Aid_{prod})^{(t-1)}$		-0.004	-0.040
		(0.051)	(0.051)
Fixed effect (Intercept)	148.877**	108.765	94.004
	(71.588)	(107.805)	(64.993)
R-Squared	0.265	0.240	0.321
Observations	278	251	223

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

services FDI turns negative and statistically significant in Sub Saharan Africa. A probable factor explaining this negative effect may be that in Sub Saharan Africa aid to the production sector is seen as a destabilizing force by US multinationals in the services sector. This is because several countries in Sub Saharan Africa are in a post-conflict situation, thus, it works as a warning sign for US multinationals active in services. In addition, the rent-seeking activities might be more pronounced because of relatively large resource extraction industries in many Sub Saharan African countries.

We now repeat the same exercise as we performed in table 3 regression (7) but now we use services FDI as our dependent variable in table 6 on the next page. It would be interesting to see how the relationship of infrastructural aid and FDI to the services sector is influenced by regime durability. All coefficients for all variables have the same sign as in table 3 with manufacturing FDI in table 3, regression (7). For services FDI, we now find a threshold value for infrastructural aid to have a positive effect on services FDI of 0.383/0.015 = 25.53 years of regime durability. Infrastructural aid seems to work in the same way for manufacturing FDI and services FDI with respect to instability. However, regional heterogeneity seems to matter more for manufacturing FDI than services FDI. This could be because manufacturing FDI, as a proxy for vertical FDI, fragments its production processes regionally and is much more able to outsource operations (Marchant and Kumar; 2005). For instance, a manufacturing multinational chooses a location for its production facility in one country and from there it can serve the whole region (or even the whole world) via sales subsidiaries in other countries (Carr et. al.; 2001, Markusen; 2002). In contrast, services FDI, our proxy for horizontal FDI, cannot fragment its production by definition. Investment decisions by multinationals in the services sector are more focused on a country basis as it is much harder to export services to other countries without opening local headquarters with skilled workers. Of course, we do see outsourcing of less-skilled services from the US to certain developing countries, India in particular as our results also make clear, but to a much lesser extent than is the case for the manufacturing sector (Marchant and Kumar; 2005). Therefore, the effect of infrastructural aid on services FDI also differs much more *within* regions. In other words, horizontal FDI is more country-specific while vertical FDI is more region-specific regarding their production. In regression (8) we do not observe any effect of production sector aid on services FDI when we include regime durability. Regression (9) in table 6 again

Table 6. Regressions with regime durability and health expenses interacted with aid and country- and time-specific effects

	Dependent variable (Regression):					
Independent Variable:	$FDI_{services}$ (7)	$FDI_{services}$ (8)	$FDI_{services}$ (9)	$FDI_{services}$ (10)	$FDI_{services}$ (11)	$FDI_{services}$ (12)
$\ln(Aid_{infra})^{(t-1)}$	-0.383**		-0.479**	-0.160		-0.379
	(0.139)		(0.212)	(0.639)		(0.657)
$\ln(Aid_{prod})^{(t-1)}$		0.040	0.054		0.192	0.109
		(0.053)	(0.049)		(0.166)	(0.131)
$\ln(GDP)^{(t-1)}$	-12.272	-7.517	-8.793	-10.720*	-6.206	-8.683
	(8.066)	(9.293)	(8.848)	(6.057)	(5.692)	(6.088)
$\ln(\text{GDP per Capita})^{(t-1)}$	18.074*	9.714	9.022	20.005	9.952	13.504
	(10.260)	(12.004)	(12.328)	(11.923)	(9.988)	(10.730)
$\ln[(\text{GDP per Capita})^{(t-1)}]^2$	-0.505	-0.131	-0.102	-0.662	-0.231	-0.322
	(0.507)	(0.608)	(0.612)	(0.588)	(0.517)	(0.543)
Durability	-0.270***	0.015	-0.302**			
	(0.070)	(0.031)	(0.121)			
Durability*$\ln(Aid_{infra})^{(t-1)}$	0.015***		0.017***			
	(0.004)		(0.006)			
Durability* $\ln(Aid_{prod})^{(t-1)}$		-0.0003	-0.0006			
		(0.002)	(0.002)			
ln(Health per Capita)				-0.199	0.899	-0.436
				(1.733)	(0.797)	(1.941)
ln(Health per Capita)* $\ln(Aid_{infra})^{(t-1)}$				0.026		0.058
				(0.100)		(0.105)
ln(Health per Capita)* $\ln(Aid_{prod})^{(t-1)}$					-0.027	-0.009
					(0.029)	(0.024)
Fixed effects (Intercept)	227.536	142.171	186.990	177.805	108.213	158.116
	(154.61)	(178.123)	(172.526)	(108.919)	(109.628)	(120.903)
R-Squared	0.305	0.249	0.337	0.216	0.232	0.254
Observations	268	239	213	278	251	223

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

shows the same results as in regression (7) for infrastructural aid and again we do not observe any statistically significant effect for production sector aid.

The results in regression (10) show the effects of health per capita, the proxy for a country's development level and infrastructural aid on services FDI. The coefficient of infrastructural aid turns negative and is statistically insignificant. Health per capita turns negative and the interaction term positive, however, both are statistically insignificant. The coefficients of our variables of interest are all statistically insignificant. Again we have to stress that leaving out education in our human development proxy has important implications for our results. The services sector, in particular, is knowledge-intensive and an educated population is a key decision maker for multinationals active in the services sector to invest in a developing country. In regression (11) with production sector aid and regression (12) with both types of aid, all coefficients turn statistically insignificant.

Conclusion

From the findings in the literature we found that the relationship between foreign aid and FDI is ambiguous. On the one hand, foreign aid seems to mitigate the effects of risk and a regulatory burden by increasing FDI flows according to Asiedu et. al. (2009) and Harms and Lutz (2006). On the other hand, only a positive effect of foreign aid on FDI exists in such developing countries which exhibit good governance and sound financial markets (Karakaplan et. al.; 2005). By disaggregating aid, it becomes apparent that foreign aid might have a complementary (infrastructural aid) or a substitution (aid to the production sector) effect (Kimura and Todo; 2009, Selaya and Sunesen; 2012). In addition, the Knowledge-Capital model allows us to make a distinction between horizontal and vertical FDI which is a novelty exercise in the literature about the relationship between foreign aid and FDI.

The available data permits us to focus on the United States (US) only as no sectorial data about FDI is available for other developed countries. In our empirical research we use manufacturing and services FDI as proxies for vertical and horizontal FDI, respectively. The main findings of our base regressions show that no significant effect is found for infrastructural and production sector aid on both manufacturing and services FDI.

The literature shows that there are conflicting results of the relationship between foreign aid and FDI when different regions are considered. We also suspect that our dataset suffers from regional heterogeneity and, therefore, the results of our baseline regressions remain insignificant. By adding interactions with region dummies, we find that infrastructural aid has a positive effect on manufacturing FDI only in the regions Middle East and South Asia. For the case of production sector aid, there seems to be a crowding out effect on manufacturing FDI for the regions East and South East Asia and Sub-Saharan Africa but a crowding-in effect for the Middle East. For other regions such a crowding out effect does not seem to exist. Estimations including the effect of both types of aid on services FDI, our proxy for horizontal FDI, show that regional heterogeneity is less strong as only for South Asia we observe a significantly positive effect for infrastructural aid on services FDI. We suspect that the heterogeneity for horizontal FDI is country-specific and not region-specific. Multinationals in the services industry cannot easily fragment their production in contrast with multinationals active in the manufacturing industry.

The results show two factors that explain regional heterogeneity for the relationship between infrastructural aid and manufacturing FDI. First, from the literature we found that US foreign aid to a certain developing country can act as a warning sign for multinationals to invest in such a country. This is because the US government uses development aid for geostrategic reasons and invests more in unstable countries. From the results with the interaction of infrastructural aid with our proxy for instability, regime durability, we can infer that indeed such a warning sign effect persists for manufacturing FDI. The Middle East and South Asia have significantly higher regime durability than Latin America and East and Southeast Asia. In addition, we find the same effect for regime durability on the relationship between infrastructural aid and services FDI.

Second, we argue that some developing countries (the emerging economies in Latin America and East and South East Asia in particular) have already reached a certain development level in which foreign aid might be inefficient in the eyes of multinationals. Using health expenses per capita as a proxy for the development level of a country, we can infer from our results that there is a certain threshold level of health expenses per capita in which the effect of infrastructural aid on manufacturing FDI turns negative. In other words, infrastructural aid becomes less and less efficient for manufacturing FDI with higher health expenses per capita in a developing country. However, we should stress that our coefficients were insignificant so we should not put much weight on their interpretation.

Creating a distinction between vertical (manufacturing) and horizontal (services) FDI allowed us to show that they are affected differently with regard to foreign aid. However, this novelty in our analysis caused data limitations as we could only focus on the United States. Therefore, we should take care in generalizing our findings for all donor countries in their allocation of foreign aid. As already stressed in the literature, foreign aid from the United States is different for geostrategic reasons. Further research may increase our understanding of the relationship between infrastructural and production sector aid on vertical and horizontal FDI by using other donor countries and longer time periods. This research could shape aid policies by donor countries in such a way that they are able to allocate foreign aid more efficiently.

Literature

Aitken, B., J. and A. E. Harrison (1999), Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela, *The American Economic Review*, Vol. 89 (3), 605-618

Alsan, M., D. E. Bloom and D. Canning (2006), The effect of Population Health on Foreign Direct Investment Inflows to Low- and Middle-Income Countries, *World Development*, Vol. 34 (4), 613-630

Asiedu, E. (2002), On the Determinants of Foreign Direct Investment to Developing Countries: Is Africa Different?, *World Development*, Vol. 30 (1), 107-119

Asiedu, E. (2006), Foreign Direct Investment in Africa: The Role of Natural Resources, Market Size, Government Policy, Institutions and Political Instability, The World Economy, Vol. 29 (1), 63-77

Asiedu, E., Y. Jin and B. Nandwa (2009), Does Foreign Aid Mitigate the Adverse Effect of Expropriation Risk On Foreign Direct Investment?, *Journal of International Economics*, Vol. 78, 268-275

Balasubramanyam, V. N., M. Salisu and D. Sapsford (1996), Foreign Direct Investment and Growth in EP and IS Countries, *The Economic Journal*, Vol. 106 (1), 92-105

Bhargava, A., D. T. Jamison, L. J. Lau and C. J. L. Murray (2001), Modeling the effects of health on economic growth, *Journal of Health Economics*, Vol. 20 (1), 423-440

Bhavan, T., C. Xu and C. Zhong (2011), The Relationship Between Foreign Aid and FDI in South Asian Economies, *International Journal of Economics and Finance,* Vol. 3 (2), 143-149

Blaise, S. (2005), On the Link Between Japanese ODA and FDI in China: a Microeconomic Evaluation Using Conditional Logit Analysis, *Applied Economics*, Vol. 37 (1), 51-55

Blonigen, B.,A.(2005), A Review of the Empirical Literature on FDI Determinants, *Atlantic Economic Journal,* Vol. 33, 383-403

Borensztein, E., J. De Gregoria and J-W. Lee (1998), How does Foreign Direct Investment Affect Economic Growth, *Journal of International Economics*, Vol. 45 (1), 115-135

Boschini, Anne, and Anders Olofsgard. 2007. ‘‘Foreign Aid: An Instrument for Fighting Poverty or Communism?’’ *Journal of Development Studies*, 43 (4): 622-48

Carr, D. L., J. R. Markusen and K. E. Maskus (2001), Estimating the Knowledge-Capital Model of the Multinational Enterprise, *The American Economic Review*, Vol. 91 (3), 693-708

Donaubrauer. J. (2014), Does Foreign Aid Really Attract Foreign Investors? New Evidence From Panel Cointegration, *Applied Economics Letters*

Donaubrauer, J., D. Herzer and P. Nunnenkamp (2012), Does Aid for Education Attract Foreign Investors? An Empirical Analysis for Latin America, Working Paper, *Kiel Institute for World Economy*, No. 1806

Emami Namini, J. and E. Pennings (2009), Horizontal Multinational Firms, Vertical Multinational Firms and Domestic Investment, Discussion Paper, *Tinbergen Institute*, No. 2009-004/2

Garriga, A. C. and B. J. Phillips (2014), Foreign Aid as a Signal to Investors: Predicting FDI in Post-conflict Countries, *Journal of Conflict Resolution*, Vol. 58 (2), 280-306

Harms, O. and M. Lutz (2006), Aid Governance and Private Foreign Investment: Some Puzzling Findings for the 1990s, *The Economic Journal*, Vol. 116 (3), 773-790

Hanson, G. H., R. J. Mataloni and M. J. Slaughter (2001), Expansion Strategies of U.S. Multinational Firms, Working Paper, *NBER*, No. 8433

Jansky, P. (2012), Aid and Foreign Direct Investment: Substitutes, Complements or Neither?, *Int. J. Trade and Global Markets*, Vol. 5 (2), 119-132

Karakaplan, U., B. Neyapti and S. Sayek (2005), Aid and Foreign Direct Investment: International Evidence, Discussion Paper, *Turkish Economic Association*, No. 2005/12

Kimura, H. and Y. Todo (2009), Is Foreign Aid a Vanguard of Foreign Direct Investmen? A Gravity-Equation Approach, *World Development*, Vol. 38 (4), 482-497

Kosack, S. and J. Tobin (2006), Funding Self-Sustaining Development: The Role of Aid, FDI and Government in Economic Success, *International Organization*, Vol. 60 (1), 205-243

Marchant, M. A. and S. Kumar (2005), An overview of U.S. Foreign Direct Investment and Outsourcing, *Applied Economic Perspectives and Policy*, Vol. 27 (3), 379-386

Markusen, J. R. (2002), *Multinational Firms and the Theory of International Trade.* Cambridge, Massachusetts: The MIT Press

Meernik, James, Eric L. Krueger, and Steven C. Poe. 1998. ‘‘Testing Models of U.S. Foreign Policy: Foreign Aid During and after the Cold War.’’ *Journal of Politics* 60 (1): 63-85

Selaya, P. and E., R. Sunesen (2012), Does Foreign Aid Increase Foreign Direct Investment? *World Development*, Vol. 40 (11), 2155-2176

Strauss, J. and D. Thomas (1998), Health, Nutrition and Economic Development, *Journal of Economic Literature*, Vol. 36 (2), 766-817

Tanaka, K. and K. Tsubota (2013), Does Aid for Roads Attract Foreign or Domestic Firms? Evidence from Cambodia, *The Developing Economies*, Vol. 51 (4), 388-401

Teorell, J., N. Charron, S. Dahlberg, S. Holmberg, B. Rothstein, P. Sundin and R. Svensson. 2013. *The Quality of Government Basic Dataset made from The Quality of Government Dataset*, version 15May13. University of Gothenburg: The Quality of Government Institute, http://www.qog.pol.gu.se.

Appendix

A. Summary Statistics

Variable	# Obs.	Mean	Std. Dev.	Min	Max
$\ln(FDI_{manu})$	460	20.787	1.705	15.202	24.296
$\ln(FDI_{services})$	471	20.420	1.963	13.816	24.278
$\ln(Aid_{infra})^{(t-1)}$	1167	17.275	1.780	9.594	22.828
$\ln(Aid_{prod})^{(t-1)}$	1091	14.402	2.423	3.135	20.805
$\ln(GDP)^{(t-1)}$	2579	22.827	2.092	16.679	29.065
$\ln(\text{GDP per Capita})^{(t-1)}$	2574	7.408	1.252	3.913	10.739
Durability	1903	16.904	18.704	0	97
ln(Health per Capita)	2596	5.244	1.160	2.122	7.843

B. Individual developing countries receiving US FDI recorded by the BEA.

Argentina	Jamaica
Barbados	South Korea
Brazil	Malaysia
Chile	Mexico
China	Nigeria
Colombia	Panama
Costa Rica	Peru
Dominican Republic	Philippines
Ecuador	Saudi Arabia
Egypt	South Africa
Guatemala	Thailand
Honduras	Trinidad & Tobago
India	Turkey
Indonesia	Venezuela
Israel	

C. Summary statistics for regime durability per region (where manufacturing FDI > 0 and infrastructural aid > 0)

Region	# Obs.	Mean	Std. Dev.	Min	Max
Latin America	128	22.477	20.422	0	92
East and South East Asia	55	19.182	19.875	0	62
Sub-Saharan Africa	24	9	4.773	2	18
Middle East	11	37.909	25.489	0	80
South Asia	17	54	5.050	46	62
Rest	27	16.074	9.102	0	29

D. Summary statistics for ln(health expenses per capita) per region (where manufacturing FDI > 0 and infrastructural aid > 0)

Region	**# Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
Latin America	135	6.367	1.890	4.77	7.382
East and South East Asia	57	5.186	0.665	3.840	6.427
Sub-Saharan Africa	25	5.952	0.896	3.972	6.890
Middle East	12	5.448	0.465	4.848	6.676
South Asia	17	4.470	0.356	3.876	5.055
Rest	27	6.194	0.478	5.336	7.042