Economic Development and the Direction of FDI Flows*

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Abstract

Evidence suggests that advanced economies make and attract relatively more FDI as a share of GDP than developing countries. This paper uses a model with heterogeneous multinational firms to explain this relationship. In the model developed countries make relatively more FDI because the average productivity of firms in these countries is higher, thus there are more firms with sufficiently high productivity levels, that can profitably enter into foreign markets. Furthermore, the model can explain why advanced countries earn higher returns on their international assets. Comparing the composition of international liabilities across countries the paper argues that higher risks and regulatory barriers in developing countries are the primary reasons behind the relatively higher levels of FDI liabilities to GDP in advanced countries. Finally, the model provides some important implications concerning the effect of capital controls on global imbalances.

Keywords: Foreign Direct Investment; International Capital Flows.
JEL code: F21, F41.

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1 Introduction

In standard open economy models capital flows appear in the form of one-period bonds, which are traded in international capital markets. However, several recent studies have emphasized the importance of gross capital flows and the structure of foreign assets and liabilities (see McGrattan and Prescott (2010), Ramondo and Rappoport (2010), Broner et al. (2013)). The exploitation of models that incorporate gross follows and different types of assets may broaden our understanding of international capital flows both at business cycle frequencies and at longer horizons. This paper takes a step in this direction.

Evidence suggests that advanced economies make and attract relatively more FDI as a share of GDP than developing countries. The fact that advanced countries make more FDI seems to be intuitive and different approaches have been proposed to address this issue (see Mendoza et al. (2009) and Antras and Yeaple (2015)). However, there is no clear explanation concerning the relationship between FDI inflows and economic development. This paper uses data on foreign assets and liabilities and their structure to develop some new insights that can improve our understanding of the relationship between FDI and economic development. Furthermore, the paper shows that a calibrated model with heterogeneous firms can explain the patterns observed in the data very well.

Table (2) brakes countries into different groups according to their level of income and provides some information on the size and structure of their international portfolios. Before discussing the levels of FDI assets and liabilities it is useful to look at total assets and liabilities of different countries. The first and second columns of the table represent the ratio of gross assets and liabilities to GDP, which can be interpreted as *de facto* financial openness or the degree of integration into international capital markets. According to this table there is an unambiguous positive correlation between economic development and financial openness. Developed countries in general have lower policy barriers. Using a *de jure* index of capital account openness proposed by Quinn (1997), Reinhardt et al. (2013) show that countries in higher income groups have more open capital accounts. Of course one may argue that developing countries use capital controls to prevent short term speculative inflows, which do not affect activities related to FDI. Indeed, most developing countries encourage FDI inflows into manufacturing sector but there are still substantial barriers in services sector. In many developing countries FDI inflows into the financial services, retail, communications and many other industries are still heavily regulated. This indicates that the role of capital controls and other policy barriers should not be neglected in the analysis of capital flows between countries.

Furthermore, in addition to the level of policy barriers there are many other factors that can affect country's openness to international capital flows, such as language, culture, diaspora, size, distance, country risk, protection of property rights. In this direction developed countries may have some advantages that make them more open. For example, these countries are more likely to have better legal environment and contract enforcement mechanisms, which facilitate international capital flows.

The third column provides data on the ratio of FDI assets to GDP. These results are in line with the analysis in Antras and Yeaple (2015) who show that more developed countries make more FDI. Similar conclusion can be made if one looks at the share of FDI in total assets (Column V). The fourth column shows the ratio of FDI liabilities to

GDP. Again, there is a direct relationship between economic development and the ratio of FDI liabilities to GDP but as Antras and Yeaple (2015) point out the relationship is much weaker compared with FDI assets. However, the data in the sixth column show that the direct relationship between economic development and FDI liabilities does not hold if FDI liabilities are measured as a ratio of total liabilities. High income countries have relatively low ratio of FDI liabilities compared with all other groups. These disparities between the two measures of FDI liabilities can be explained by the heterogeneity in the degree of financial openness and other factors mentioned above. If advanced countries are financially more open there will be more financial inflows into these countries including FDI. Consequently, in order to establish a relationship between economic development and FDI inflows, looking at at the ratio of FDI liabilities to GDP may not be enough. It is more intuitive to look at the share of FDI liabilities in total financial liabilities because the latter controls for financial openness, county risk and property rights to certain extent.

Figure (1) provides further evidence using scatter plots similar to Antras and Yeaple (2015). The bottom panel plots the relationship between GDP per capita and the ratio of FDI liabilities to GDP as in Antras and Yeaple (2015). In the top panel the dependent variable is the ratio of FDI liabilities to total liabilities. In the latter the slope of the line is slightly negative but the $R - squared$ is low. However, as it can be seen from the figure if low income countries are eliminated the slope becomes more negative and results become statistically more significant. It is not surprising that low income counties deviate from the general pattern. One likely explanation for this is that in low income countries institutions are weak and it is harder for foreign private sector companies to enter such markets. Low income countries mainly interact with governments of other countries and International Financial Institutions (IFI) and as it is well known most of these institutions are mainly providing aid and loans and rarely make direct investments[1]. Another factor that should be taken into account is that in low income countries most FDI goes to resource extracting sectors. This may create additional problems because depending on the existence of natural resources otherwise similar countries may have very different levels of FDI liabilities.

This paper uses a model with heterogeneous multinational firms to explain these observations. In the model productivities across countries differ not only because of the levels of human capital and general TFP but also because of the distributions of firm productivities. In other words, the average productivity of firms from an advanced economy is higher than that of firms from a less developed economy not only because they have access to higher skilled workers, better infrastructure and property rights but also because they have better practices and firm-specific technologies. When a firm starts production in a foreign country it uses the same firm-specific technology as at home[2]. In the model developed countries make relatively more FDI because in these countries there are more firms with sufficiently high firm-specific productivity levels (globally competitive firms), that can profitably enter into foreign markets.

Assuming equal entry costs across countries the model predicts that there is no clear relationship between FDI liabilities and economic development as in the data for

[1]The reason figure(1) plots the results for all counties including those with low income is to make the results more comparable with Antras and Yeaple (2015).

[2]Ramondo and Rappoport (2010) and references therein point out that empirical evidence shows that firms, which open foreign affiliates are able to replicate their home productivity.

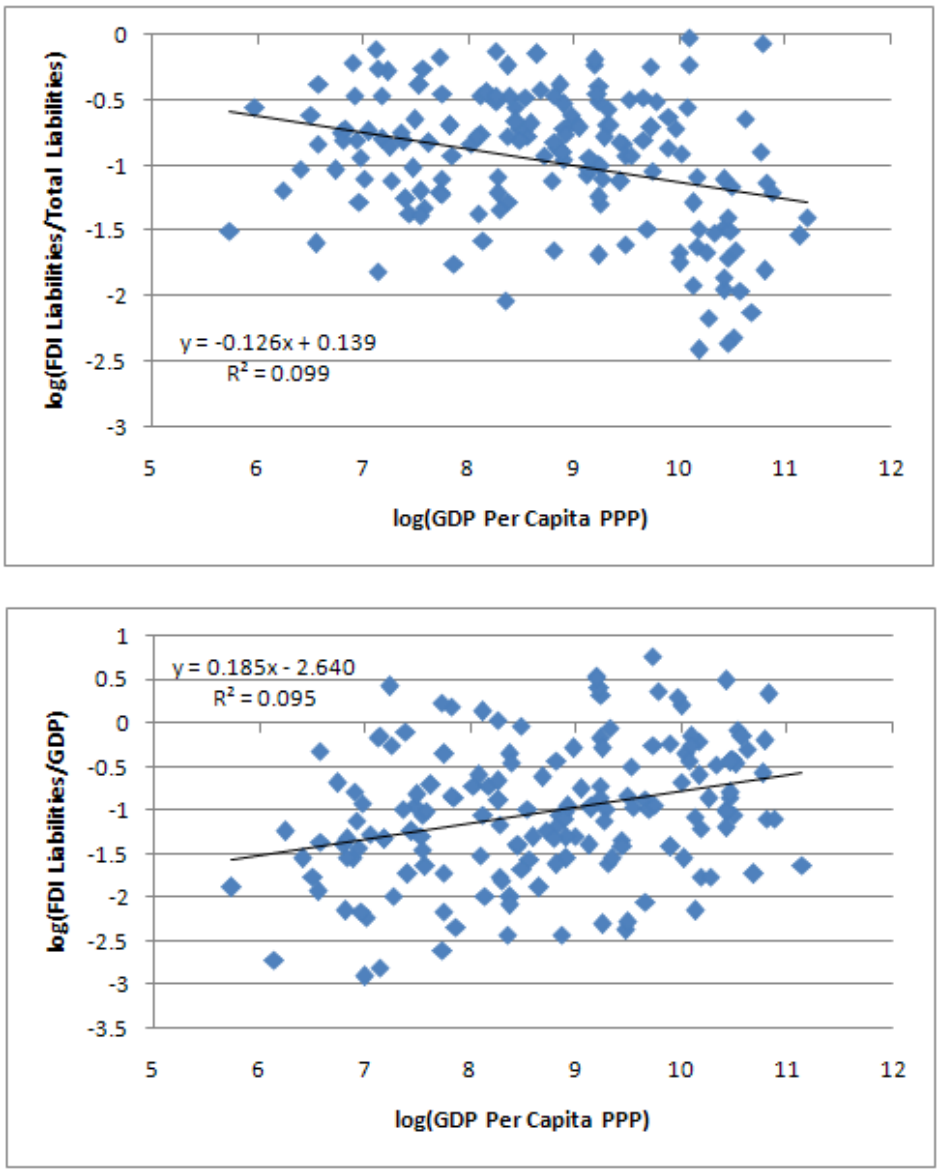

Figure 1: FDI Liabilities and Development.

the ratio of FDI liabilities to total liabilities (top panel of figure (1). The relationship becomes positive if it is assumed that entry costs are relatively higher in less developed countries, which is in line with the data when one does not control for financial openness. It is important to note that the model does not require unrealistically high differences in entry costs in order to deliver this result.

Another feature of the model is that the return to FDI is higher than the international lending rate. This feature of the model can explain why more developed countries earn higher returns on their international assets (see Mendoza et al. (2009)).

Finally, the framework with gross capital flows allows us to discuss the effects of capital controls imposed by an individual country on its net foreign asset position. An important implication is that the nature of such controls plays a determining role. If controls are imposed on capital inflows then the country will experience an improvement of net foreign asset position and this finding applies not only to FDI but also to portfolio and debt flows. Given the prevalence of capital controls in the world economy, especially in developing countries, this channel may have important implications on global imbalances.

This paper is related with Antras and Yeaple (2015) who in addition to the empirical data discussed above present a stylized model of vertical FDI, in which the advanced region has advantage in innovation/entry and in the production of headquarter services. The model predicts that the advanced region makes FDI in the developing region. As the authors point out the disadvantage of the model is that the significant share of output produced by foreign affiliates is exported back to the advanced region. However, according to the data very few foreign affiliates are engaged in foreign trade and most of their production is sold locally. The model presented in this paper has no such a counterfactual feature. Another disadvantage of their approach is that FDI flows from one region into the other and the developing region does not make any FDI. As was shown above in reality advanced countries individually and as a group attract more FDI in absolute volumes than developing countries. The model presented in this paper with gross FDI flows solves this problem. Both regions attract and make FDI. In the extended version of the model with multiple countries advanced countries attract more FDI in absolute values but less as a share of GDP, which is the case in the data.

Mendoza et al. (2009) offer an alternative approach to explain why developed countries make relatively more FDI and portfolio investments. According to their study developed countries have better contract enforcement mechanisms, which enable them to reduce the risk from risky investments (FDI and portfolio). However, in order to obtain this result the authors need to assume that the contract system is "residence based", i.e. the enforcement of financial contracts is determined by the law of the country where the agent resides. Recent cases of the expropriation of the assets of foreign multinationals in Russia, Argentina, Bolivia and asymmetric regulations applied by the Chinese authorities and attacks by state media against Western multinationals demonstrate that in developing countries firms from advanced economies do not enjoy the same legal environment as at home.

This paper is also related with the literature that extends trade models with heterogeneous firms to study FDI. Ramondo and Rodrguez-Clare (2013) use a model with exports and multinational production to quantify the gains from these activities. Ramondo and Rappoport (2010) study the role of FDI in international risk diversification process.

A different approach is developed by McGrattan and Prescott (2009) who introduce FDI flow decisions into the neoclassical growth model to study the effect of FDI on economic growth and welfare. McGrattan and Prescott (2010) use a similar model to explain the relatively higher returns of US multinational companies.

The rest of the paper is organized as follows: Section 2 develops the analytical framework of the model. Section 3 describes the calibration of parameters and the results of simulations. Section 4 discusses the effect of capital controls on net capital flows. The last section offers some concluding remarks.

2 Analytical Framework

The model described in this section is based on Ramondo and Rappoport (2010), which introduces FDI decisions into the Melitz (2003) framework. In the model heterogeneous firms in each country produce intermediate goods that cannot be traded internationally. In order to serve foreign markets firms can open production plants and produce in these locations. Intermediate goods are used to produce the final good, which is internationally tradable. The main results presented in this paper do not rely strongly on the specific structure of the model, similar results can be obtained in the framework developed by Helpman et al. (2004) or Ramondo and Rodrguez-Clare (2013), where intermediate goods also can be traded internationally[3,4].

There are two periods and no uncertainty. In the first period each country receives endowment $Y_i(0)$. During the first period consumption and production decisions are made. In the second period production takes place. The utility function of the representative consumer in country $i \in I$ is given by

$$U = log(C_i(0)) + \beta log(C_i(1)). \tag{1}$$

The final good production in country i is given by

$$Y_i = A_i L_{if}^{\alpha} Q_i^{1-\alpha}, \tag{2}$$

where L_{if} denotes labor used in the final good production, Q_i is the aggregate index over a continuum of intermediate goods with a constant elasticity substitution $\eta > 1$ and A_i is the productivity level of the final good production sector.

There is a continuum of intermediate goods producing firms, which compete monopolistically. The productivity of a firm $z(\omega)$ is drown from a country-specific distribution $G_i(z)$. Firms in the intermediate goods sector operate a linear technology with labor as the only input:

$$q_{ij}(\omega) = z(\omega) l_{ij}(\omega), \tag{3}$$

where $q_{ij}(\omega)$ is the output produced by a firm from country i in country j and $l_{ij}(\omega)$ is the labor used by the firm in the appropriate location. In order to produce in the domestic economy firms do not need to pay a fixed cost but to set up a production in a foreign market firms need to pay a fixed cost f. If the firm operates only in

[3]At the end of the section I provide some points that explain why this particular framework is better suited for the analysis of the question studied in this paper.

[4]It should be emphasized that the contribution of the paper is not the model but its application to explain the relationship between economic development and FDI flows.

its domestic market and has no activities in foreign markets then $q_{ij}(\omega) > 0$ only for $i = j$. Monopolistic competition implies that the price set by a firm is a markup over the marginal cost given by

$$p_{ij}(z) = \frac{\eta}{\eta - 1} W_j \frac{1}{z}, \tag{4}$$

where W_j is the wage in the country where the production takes place. Given this pricing function and the price of the index of intermediate goods P_j, total expenditure in country j on the good produced by a firm form country i with productivity z is given by

$$x_{ij}(z) = (\frac{p_{ij}(z)}{P_j})^{1-\eta} Q_j P_j. \tag{5}$$

The firm's optimization problem in turn implies that its profits from operations in country j are given by

$$\pi_{ij}(z) = x_{ij}(z)/\eta. \tag{6}$$

It is assumed that all firms from country i are owned by domestic agents. The budget constraint of the representative agent is given by

$$C_i(0) + \frac{C_i(1)}{R} = B_i + \frac{L_i W_i + \int_{z \in Z} \pi_i(z) dG_i(z)}{R}, \tag{7}$$

where R is the interest rate, B_i is the initial wealth, net of the cost of starting foreign productions. $\pi_i(z)$ are profits made by a firm with productivity z in all locations $\pi_i = \sum_{j=1}^{I} \pi_{ij}(z)$, where $\pi_{ij}(z)$ are profits made in location j given by equation (6). The optimization problem of the consumer implies the following Euler equation:

$$C_i(0) = R\beta C_i(1). \tag{8}$$

A firm from country i will produce in j if its value weakly exceeds the fixed cost of entry

$$V_{ij}(z) = \frac{\pi_{ij}(z)}{R} \geq f. \tag{9}$$

Profits are discounted because fixed costs are payed in the first period. Consequently, there exists a $\bar{z_j}$ for each country that for all foreign firms with productivity $z \geq \bar{z_j}$ will produce in that country. It is important to note that even if the fixed cost is the same for all countries $\bar{z_j}$ may not be the same because it also depends on some other characteristics of the economy, which will be discussed in more detail later. Using this notation the initial wealth of the consumer, net of fixed costs is given by

$$B_i = Y_i(0) - \sum_{j=1}^{I} f(1 - G_j(\bar{z_j})). \tag{10}$$

Let $Z_{ij} \equiv \int_{\bar{z_j}}^{\infty} z_{ij}^{\eta-1} dG_i(z)$ be the index that aggregates the productivity of firms from country i that have production plants in country j and $Z_i = \sum_{j=1}^{J} Z_{ji}$ be the index of productivity of firms operating in country i from all other countries including i itself. Similarly, $L_{ij} = \int_{\bar{z_j}}^{\infty} l_{ij}(z) dG_i(z)$ shows the total labor used in the intermediate goods production sector in country i by firms from country j. For a given country the

labor used in intermediate and the final goods production sectors should be equal to total labor supply:

$$L_i = L_{if} + \sum_{j=1}^{J} L_{ji}. \tag{11}$$

The market clearing condition for each intermediate good requires that output is equal to demand. Combining (5) and (3) this can be written as

$$(\frac{p_{ij}(z)}{P_j})^{-\eta} Q_j = z l_{ij}(z). \tag{12}$$

The ratio of the price index of intermediate goods to wage can be obtained by integrating over individual prices from equation (4)

$$\frac{P_i}{W_i} = \frac{\eta}{\eta - 1} Z_j^{\frac{1}{\eta-1}}. \tag{13}$$

Combining this equation with the fact that the low of one price holds in the final good sector, which implies equalization of the unit cost of this good, the price index of the intermediate goods and wage can be written as

$$P_i = \phi_1 A_i Z_i^{\frac{\alpha}{1-\eta}}, \tag{14}$$

$$W_i = \phi_2 A_i Z_i^{\frac{1-\alpha}{\eta-1}}, \tag{15}$$

where ϕ_1 and ϕ_2 are positive constants [5]. Using these conditions and making some rearrangements total output in country i can be expressed as:

$$Y_i = \phi_3 A_i L_i Z_i^{\frac{1-\alpha}{\eta-1}}, \tag{16}$$

where ϕ_3 is a positive constant[6]. This expression implies that the level of output of two countries of equal size may differ due to three factors. First, it is strictly increasing in human capital. Second, it is strictly increasing in the productivity of the final good sector, which is common across all firms in a given country. Finally, it is strictly increasing in the aggregated firm-specific productivity of all firms operating in the economy. The last part depends not only on the productivity of domestic firms but also on the inflow of technology from other countries. Clearly, economies with lower entry restrictions and more friendly policies (lower f) will be able to attract more FDI and increase their output and welfare, however this paper is more concerned about the relationship between economic development and FDI flows for a given level of financial openness. To complete the description of the model expression (17) derives profits earned by a firm from country i in market j with productivity z

$$\pi_{ij} = \frac{1-\alpha}{\eta} \frac{z^{\eta-1}}{Z_i} Y_j = \phi_3 \frac{1-\alpha}{\eta} z^{\eta-1} L_j Z_j^{\frac{1-\alpha}{\eta-1}-1} A_j. \tag{17}$$

[5] $\phi_1 \equiv (1-\alpha)^{(1-\alpha)} \alpha^{\alpha} (\frac{\eta-1}{\eta})^{\alpha}$ and $\phi_2 \equiv (1-\alpha)^{(1-\alpha)} \alpha^{\alpha} (\frac{\eta-1}{\eta})^{(1-\alpha)}$.

[6] $\phi_3 \equiv \phi_1 \frac{\eta}{\eta-1+\alpha}$.

The first equation can be obtained by substituting expression (4) into (5) and using the expression for profit function given by (6)[7]. The second equation in turn is obtained by plugging the expression for total output in country j from (16). A firm from country i will produce in country j if the discounted profit exceeds the fixed cost f. Using the fact that for the marginal firm that makes FDI in country i the discounted profit is equal to the fixed cost it is possible to obtain the threshold productivity level $\bar{z}_i$. The level of profit depends on the productivity of a firm and on the characteristics of the economy, in which it operates. In particular, labor productivity and productivity of the final goods producers positively affects profits. The effect from the aggregated firm-specific productivities is ambiguous and depends on the parameters of the model. The intuition is that the increase in Z_j has two effects. The first one is positive because it increases the productivity of the country and expenditures of consumers. The second one is negative because it increases competition and reduces the profit of the firm. Following Ramondo and Rappoport (2010) this paper assumes that $\eta > 2 - \alpha$. This assumption implies that the second effect dominates.

Now, based on this analysis it is possible to describe the implications of the model regarding FDI flows between countries with different development levels. When comparing two countries of equal size it is intuitive to assume that the more developed country has higher level of human capital, better technologies in the production of the final good and intermediate goods. For outward FDI the situation is clear. If two firms are deciding to make FDI in a given country the one with higher firm-specific productivity is more likely to enter. Under the assumption that firm-specific technology is higher in developed countries a larger mass of firms will find optimal to make FDI in any destination compared with less developed economies. This implies that advanced countries make more FDI.

Concerning inward FDI the situation is ambiguous. This can be seen from equation (17). On the one hand, aggregate output is higher in a more developed country, which increases profits and makes entry more attractive. On the other hand, competition is fierce and has negative effect on profits, which makes entry less attractive. Consequently, whether developed countries attract more or less FDI compared with developing countries depends on the specific values of the parameters of the model.

A critical point in this paper is to distinguish the sources of productivity differences between countries. The productivity of the final good production sector can be interpreted as a factor to which all firms have access, such as infrastructure, legal environment etc. Firm-specific productivity is a factor that can be used only by a particular firm and it can be used not only in its home country but also in all locations where it produces.

3 Calibration and Results

To calibrate the model I assume that there are two regions in the world - advanced and emerging[8]. The regions have different levels of human capital but have equal pop-

[7]In deriving this expression I also use the fact that $Q_j P_j = (1-\alpha)Y_j$, which is obtained from the optimization problem of the final good producing firms.

[8]Advanced countries are all countries classified as high income countries by the World Bank and emerging countries are all countries classified as upper middle income and lower middle income.

ulation and the same degree of openness. As mentioned earlier this assumption is made to abstract from other factors and investigate the relationship between economic development and FDI flows[9]. Calibration procedure follows Ramondo and Rappoport (2010) and references therein. Table (1) provides the description and values of the parameters that are borrowed from these studies. One deviation from Ramondo and Rappoport (2010) is that instead of using the approach described in Klenow and Rodriguez-Clare (2005) to assign values for human capital I follow Schoellman (2012). The advantage of the latter is that it takes into account not just years of schooling but also the quality of education to construct human capital. The level of human capital in the advanced economy H_A is normalized to one and in the emerging economy it is set $H_E = 0.6$, which is the ratio of median human capital levels between the two groups according to this approach.

Firm-specific productivities are drown from Pareto distribution with shape parameter γ (common across regions) and scale parameter proportional to human capital $G_i(z) = 1 - (\frac{H_i}{z})^{\gamma}$. This assumes that countries with higher level of human capital on average have more productive firms, which is due to the fact that entrepreneurs and managers in these countries have better skills, knowledge and business practices. This assumption is in line with the findings of a recent study by Gennaioli et al. (2013). The authors use micro data from 20 countries and argue that entrepreneurial human capital plays a large role in raising firm productivity.

Table 1: Parameter Values

Parameter	Value	Source	Definition
η	3	Broda and Weinstein (2006)	Elast. of subst. for intermed.
γ	4	Helpman et al. (2004)	Shape parameter of Pareto dist.
α	0.5	Alvarez and Lucas (2007)	Labor share in manuf. sector

The remaining two parameters are chosen to match two targets in the data. The entry cost parameter is set $f = 0.03$ in both regions. With this value the share of output produced by firms from the advanced region in the intermediate goods production of the developing region is around 58%. According to Ramondo (2013) the sales of foreign affiliates account for about 58% of world GDP. Alternative values of f have no qualitative effect on the results of the paper because the fixed cost parameter is the same for both regions. Finally, the productivity in the final good sector is chosen so that the ratio of total output in both regions matches the ratio of per capita GDP in PPP of both regions in the data, which is 3.3 times higher in the advanced region. This procedure implies that the productivity in the final good sector of the advanced region is 1.67 times higher than in the developing region.

With this calibration outward technology flow - given by Z_{ij} - from the advanced region to developing region is significantly larger than the outflow from the developing region. Moreover, the outflow is larger not only in absolute terms but also in relative terms. The relative share of outward FDI can be expressed as the ratio of technology used abroad by firms from country i to total technology used at home (Z_{ij}/Z_i). According to this measure the relative share of FDI done by the advanced region is 3

[9]Below I drop this assumption.

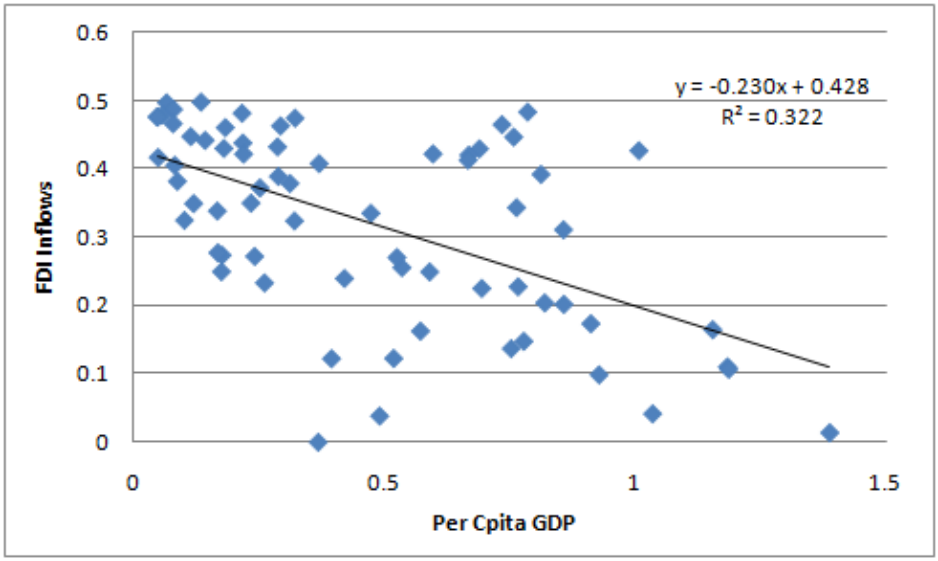

Figure 2: FDI Liabilities and Development.

times larger than in the emerging region. According to the column V of table (2) the share of FDI done by high income countries is 3.6 times larger than in upper middle income countries and even more in lower middle income countries, which is somewhat larger than in the model.

The model also predicts that the inflow of foreign investment into the developing region is more than 5 times higher than into the advanced region, which is significantly higher than in the data. In a two region framework these results should be treated with caution. The point is that if there are only two regions the only source for inward FDI and destination for outward FDI is the other region. In reality there are large FDI flows within advanced and developing countries as well. This problem can be addressed if the model is extended to include multiple advanced and developing countries. To address this issue I calibrate the model to 68 countries which includes both developed and developing countries using the same calibration procedure as described above[10]. In addition I take into account the size of the labor force of each country. US is chosen as a base country and its level of human capital, labor force and GDP per capita are normalized to one. I choose productivity parameters A_i for each country such that their relative per capita output matches the empirical counterpart. Figure (2) plots the relationship between relative output and the ratio of FDI inflows to GDP obtained as a result of this exercise. In line with empirical evidence there is a negative relationship between economic development and FDI liabilities. The exercise demonstrates how two different sources of productivity affecting FDI inflows interact in the calibrated model. On the one hand, the productivity of the final goods production sector makes developed countries more attractive destination for FDI because it increases profits. On the other hand, high productivity of individual firms makes markets more competitive and decreases profits, which discourages entry. In the calibrated model the second effect is slightly stronger.

This prediction of the model matches the data very well if one targets the ratio of

[10]The sample includes all advanced, upper middle income and lower middle income countries which have GDP in PPP not less then 0.5% of the US economy.

FDI liabilities to total liabilities. However, as it was pointed out earlier Antras and Yeaple (2015) argue that the ratio of FDI to GDP is relatively higher in advanced countries, a phenomenon which their model cannot explain. The framework developed in this paper can be used to provide an intuitive explanation to this phenomenon. This paper assumes that the entry costs are the same across all countries because the main purpose of this paper is to explain, *ceteris paribus*, how technological differences affect FDI flows. In practice there are substantial entry barriers enacted by governments in developing countries. Furthermore, there are serious concerns about property rights and other risks that may discourage the entry of multinational firms into developing countries. A simple way to introduce these factors into the model is to assume that the fixed cost f is relatively higher in the developing countries, another alternative is to assume that in developing countries multinational face costs that are proportional to the size of their operations or some combination of both. In this situation the slope of the line in figure (2) may be reversed and advanced countries will attract relatively more FDI. From figures (2) and (1) it also can be seen that in order to change the slope of the line one does not need to assume that there are unrealistically large costs and barriers in developing countries because despite the fact that the signs of the slopes are opposite the difference in values are not large. Obviously, the fixed cost parameter used in the literature and in this paper is a reduced form representation of a more complex regulations and procedures that firms face when they undertake activities in foreign countries but this analysis allows us to build intuition and understand why in the data the ratio of FDI liabilities to GDP is relatively low in developing countries.

Concerning FDI outflows this extended version of the model with 68 countries does not change the results much. This is intuitive because the relative shares of FDI outflows are determined by firm specific productivity distributions and the total number of countries has little effect on on the relative shares. Figure (3) plots the relationship between economic development and FDI outflows. As it can be seen the level of economic development has strong impact on the relative share of FDI outflows. The results generated by the model are very close to the empirical data presented in Antras and Yeaple (2015).

Another feature of the model is that the return from FDI exceeds the risk free rate. This is a simple consequence of the fact that only firms with discounted profits larger than the fixed cost engage in FDI activities. So, only for the marginal firm the return to FDI equals to the international lending rate for all other firms above this threshold the return is higher. Consequently, developed countries may earn higher returns on their foreign assets because more advanced technology enables these countries to make more FDI and increase its share relative to debt assets, which have lower returns. Unlike in Mendoza et al. (2009), FDI investments need not be riskier than debt assets in order to generate these results.

A key assumption made in this paper is that some part of productivity differences across regions is due to firm-specific factors. Furthermore, it is assumed that human capital plays a fundamental role in explaining these differences. As mentioned above evidence from micro data supports this assumption. There are other factors that affect firm-specific productivity level. For example, Ramondo and Rodrguez-Clare (2013) assume that firm-specific differences in productivity are due to R&D expenditures. The qualitative results of this paper will not be affected if R&D expenditures are used instead of education to calibrate distribution functions. However, education is a more

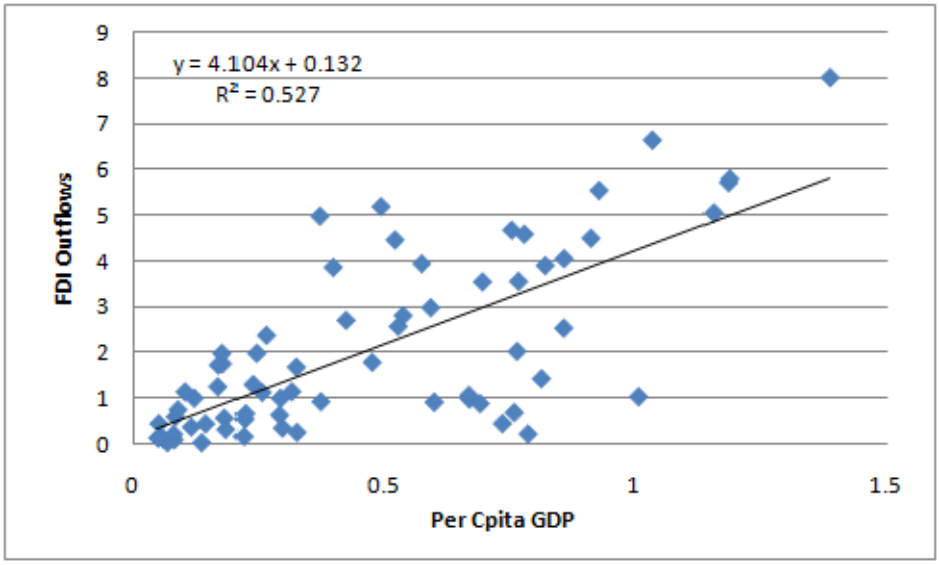

Figure 3: FDI Assets and Development.

fundamental concept and R&D itself is significantly affected by it (see Gennaioli et al. (2013)).

It is possible to use alternative frameworks to obtain similar results presented in this paper. Possible alternatives are Ramondo and Rodrguez-Clare (2013) and Ramondo (2013). However, the framework adopted in this paper has several advantages for studying FDI flows between developed and developing countries. Both of these papers assume that the differences in per capita income levels between countries are entirely due to firm-specific distributions. With this assumption it is easier to show that more developed countries do more FDI but this is a very strong assumption because there are many other factors, such as infrastructure and business environment, which are not firm-specific. Another disadvantage of these models is that they predict that less developed countries will attract relatively very large shares of FDI inflows if cost parameters are assumed to be the same. However, as the empirical analysis conducted in this paper shows even if one uses the ratio of FDI liabilities to total liabilities as a measure of relative FDI inflows, developing countries attract slightly more FDI than developed countries.

In reality FDI flows involve capital flows, which are missing from the model described so far. However, the Appendix shows that the model can be easily extended to include physical capital. This feature does not change the results of the model because capital flows are proportional to technology flows.

4 Discussion

The framework presented in this paper can be used to discuss the effect of capital controls on net capital flows. In the model capital controls can be imposed in the form of higher fixed costs or taxes. The fact that there are gross capital flows in the model provides some important insights concerning the effect of different types of capital controls. Controls imposed by a country on capital inflows will have negative effect

on them but no effect on outflows. As a result the country's NFA will improve. The opposite will happen if controls are imposed on capital outflows.

The analysis conducted in this paper is limited because it studies only FDI flows. However, the same mechanism works when one considers a model with gross portfolio flows or debt flows, which are more likely to be subject to capital controls [11]. There is significant evidence that countries impose asymmetric capital controls. In particular, a recent report by the International Monetary Fund (2013) argues that Chinese authorities impose stricter regulations on domestic agents when they borrow from abroad than when they are lending. The role of such asymmetric policies in contributing to China's and other countries NFA positions has been mostly neglected in the literature.

Most empirical studies that investigate global current account imbalances have considered the importance of capital controls but they do not distinguish between controls imposed on inflows and outflows. These studies use just one variable to capture the overall effect from capital openness (see Chinn and Ito (2007) and Reinhardt et al. (2013)). Even in this case Reinhardt et al. (2013) argue that the degree of financial openness plays an important role in explaining current patterns of capital flows between developed and developing countries observed in the data. Putting a distinction between different types of capital controls in an empirical context may further narrow the gap between the predictions of the neoclassical theory and actual capital flows.

5 Conclusions

This paper investigates the relationship between economic development and FDI flows. Following several other studies the paper confirms that according to the data developed countries make more FDI. The calibrated model can explain this phenomenon. The key mechanism that drives this result is based on the fact that firms in developed countries have more advanced technologies and business practices, which enable them to make profits in foreign markets and cover costs associated with FDI. According to the model the return to FDI is higher than the international lending rate.

The evidence on FDI liabilities is ambiguous. Developing countries attract less FDI as a share of GDP but the paper argues this has more to do with policy barriers, weak property rights and higher risk than with technology because these countries attract relatively more FDI as a share of their total foreign liabilities. Assuming that the entry costs are symmetric across all countries the model predicts that less developed countries attract more FDI. Introducing some asymmetric frictions into the model by assuming that multinational firms face higher costs of entry in developing countries than in developed countries can reverse this prediction of the model. In this case developed countries will make and attract relatively more FDI. Identification of the exact sources of these frictions for individual countries is potentially interesting task for future research.

[11] For gross portfolio flows there is a large literature that studies international portfolio diversification inspired by Lucas (1982). Examples of models with gross debt flows is Fecht et al. (2012). In all these models, similar to the one presented in this paper, controls imposed on capital inflows or outflows will have opposite effects.

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6 Appendix

This section introduces capital into the model presented in the main text. FDI involves capital investment, which is missing from the model presented above. But as this section shows introducing capital does not significantly affect quantitative properties of the model because capital flows are the mere reflection of technology flows.

Capital is mobile across countries and investment in capital is done in units of the final good. Similar to (3) the production function of the final good producer is given by

$$Y_i = A_i[L_{if}^{\upsilon} K_{if}^{1-\upsilon}]^{\alpha} Q_i^{1-\alpha}, \tag{18}$$

where K_{if} denotes capital used in the production of final good and υ is the share of capital in the production of the final good. The production function of intermediate good producer sector is given by

$$q_{ij}(z) = z l_{ij}^{\upsilon}(z) k_{ij}^{1-\upsilon}(z), \tag{19}$$

As in the case with labor in this setup the pricing function implies a markup over the marginal cost, which is given by

$$p_{ij}(z) = \frac{\eta}{\eta - 1}(\frac{r}{1-\upsilon})^{1-\upsilon}(\frac{w_j}{\upsilon})^{\upsilon}\frac{1}{z}, \tag{20}$$

where r is the rental rate of capital, which is common across countries ($1 + r = R$). The fact that the movement of capital is free across regions implies that the marginal product of capital across sectors within a country and across countries should be equalized:

$$\frac{p_{ij}(z) q_{ij}(z)}{k_{ij}(z)} = \alpha \frac{Y_j}{K_{jf}}. \tag{21}$$

Combining this equation with market clearing condition (12) leads to an expressions for capital used by intermediate goods producer with productivity level z and final good producers given by

$$k_{ij} = (1-\alpha)\frac{z^{\eta-1}}{Z_j} K_j, \tag{22}$$

$$K_{if} = \alpha K_j, \tag{23}$$

where K_j is total capital installed in country j, $K_j = K_{jf} + \sum_{i=1}^{I} K_{ij}$, where $K_{ij} = \int_{\bar{z_j}}^{\infty} k_{ij}(z) dG_i(z)$ aggregates total capital used in the intermediate goods production sector in country i by firms from country j. Combining equations (18), (22) and (23) yields a function for total capital in country i as a function of output:

$$K_i = (1-\upsilon) Y_i. \tag{24}$$

Finally, output is given by

$$Y_i = \phi_3 A_i^{\frac{1}{\upsilon}} L_i Z_i^{\frac{1-\alpha}{\upsilon(\eta-1)}}), \tag{25}$$

where $\tilde{\phi}_3$ is a positive constant[12]. Using equations (22) and (23) the ratio of total capital owned by firms from country i in country j to total capital in country j is given by $K_{ij}/K_j = (1-\alpha) Z_{ij}/Z_j$. This expression shows the link between capital flows and technology flows discussed in the main text of the paper.

[12] $\tilde{\phi}_3 \equiv [(1-\alpha)^{(1-\alpha)} \alpha^{\alpha} (1-\upsilon)^{(1-\upsilon)}]^{\frac{1}{\upsilon}} (\frac{\eta}{\eta-1+\alpha})$.

Table 2: FDI Assets and Liabilities

	Total / GDP		FDI /GDP		FDI/Total	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
High Income	2.056	1.901	0.298	0.557	0.156	0.224
Upper Middle Income	0.619	0.833	0.023	0.371	0.041	0.462
Lower Middle Income	0.43	0.788	0.007	0.349	0.021	0.447
Low Income	0.268	0.587	0.001	0.237	0.002	0.41

Notes: Average values are reported for the period $2003 - 2007$. The data is taken from Lane and Milesi-Ferretti (2007). The World Bank's classification is used to divide countries into High Income (48 countries), Upper Middle Income (48), Lower Middle Income (48) and Low Income groups (32). Values represent the median for each group.