Measuring the Determinants of Backward Linkages from FDI in Developing Economies

Is It a Matter of Size?

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Abstract

The main focus of the paper is the measurement of the potential for externalities related to foreign direct investment. A series of novel proxies are drawn from the Enterprise Survey database of the World Bank-IFC and tested against hypotheses considered in the foreign direct investment literature. Using these proxies, an econometric assessment of the determinants of backward linkages in developing economies is presented. The results show that export-oriented foreign direct investment, wholly owned subsidiaries (as opposed to joint ventures), and foreign owned firms relying on foreign technologies are less likely to develop links with domestic companies. In addition, the analysis finds that some sectors (food, wood, auto, and auto-parts) are more prone than

others (textiles and electronics) in developing backward linkages. Apart from the type of foreign direct investment and sector-specific characteristics, the size of the host economy matters. Foreign owned subsidiaries in most service oriented Caribbean islands buy a low percentage of inputs from domestic firms. This may be because in small islands there are not enough local suppliers with sufficient quality and capacity to meet the demands of multinationals. However, the paper presents the case of the Dominican Republic, the largest economy in the Caribbean, which has struggled to develop backward linkages because of the relative isolation of special economic zones from the rest of the economy.

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1 Why FDI matters for growth and volatility

Developing economies are often in need of stable sources of foreign financing in order to leverage their growth potential (Wolf, 2005). Among other capital flows, foreign direct investment (FDI) is often considered a superior alternative due to the attributed benefits it brings to the host economy: permanence in the long run, knowledge spillovers, and other positive externalities.

FDI is defined by international organizations as “inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor”.² In addition to mergers and acquisitions, FDI would also include greenfield investments, such as the setting up of new factories or subsidiaries by foreign investors or multinational corporations (MNCs) in a country different from that of the source of capital.

Due to its long term nature, FDI is considered to be a source of economic stability and development. The direction of causality is somewhat unclear, since foreign entrepreneurs seem to be more predisposed to invest in countries with a higher degree of government stability and protection for investors (Sánchez-Martín et al, 2014), which probably constitutes a mutually reinforcing process. Nonetheless, FDI is a preferred source of international capital, and governments around the globe try to attract it for multiple reasons, including compensating current account deficits, signaling macroeconomic stability, generating employment, and allowing for externalities and technological upgrading. Governments often use special economic zones, tax breaks and improvements in the business environment in order to appeal to the interest of the foreign investor.

In turn, other capital flows, such as portfolio debt flows, including portfolio bond flows and commercial bank loans, are short term, volatile and pro-cyclical, accentuating macroeconomic volatility in some developing countries. Recent evidence suggests that developing economies with a higher exposure to portfolio investments and foreign loans suffered more severe liquidity crunches than those more dependent on FDI (Tong and Wei (2011)). With regard to portfolio equity flows, that is, equity investments by foreigners below the abovementioned 10% threshold, while initially thought to be relatively volatile and short term, there is an increasing number of authors who consider it to be similar in nature to FDI (Hattari and Rajan, 2011).

There are different motivations or typologies of FDI. Drawing from the eclectic paradigm of international production (Dunning (1973) and (1980)), a knowledge-capital model was developed (Helpman (1984), Markusen (1984), Krugman and Venables (1995), Markusen and Maskus (1999)) featuring multiple production facilities that allow for separate cross-support centralized services and dispersed production. According to this model, there are three main types of FDI: horizontal (serving demand in the host country), vertical (acting as an export platform), and strategic asset seeking FDI (exploiting resources and raw materials).

Horizontal FDI tends to be established when the origin and host countries are similar in size and total demand is significant (large market). Conversely, vertical MNCs will appear when economies are dissimilar in size and

² World Bank, World Development Indicators.

endowments. Shatz and Venables (2000) argue that FDI in developed economies is mainly horizontal, whereas in developing economies it tends to be vertical. Venables (2003) considers that horizontal FDI is likely to be a substitute for trade, as firms use FDI to supply the market instead of imports and wind up competing with local firms. By contrast, vertical FDI is a complement to trade, and may even create trade flows. It is export oriented, so it does not usually compete with local companies. These different characteristics are relevant since they imply that economic integration will have a varied impact depending on the type and motivations of FDI. Today, it is generally accepted that FDI and international trade are complements rather than substitutes. To our knowledge, researchers have analyzed the orientation of foreign owned companies (horizontal, vertical, etc.) in certain countries and sectors, but not at the world level, as we do below. As later discussed, the type and orientation of foreign affiliates is likely to influence the potential for spillovers.

Foreign direct investment often entails a transfer of knowledge from the MNC to its subsidiary or foreign affiliate, and it also affects the behavior of local companies as well as other elements of the business environment. The costs and barriers of doing business in a foreign country imply that MNCs possess some advantage in comparison with local firms, either due to lower costs from economies of scale, or superior technology. As pointed out by Markusen (1995), a common feature of MNCs is their high level of expenditure on Research and Development (R&D). Through investments in R&D, MNCs are able to improve their processes and products, and increase their productivity levels. Another common characteristic is the concentration of MNCs in sectors which are intensive in skilled labor. Skilled workers play a critical part in mastering superior technology owned by the MNCs and also in implementing advanced management techniques, resulting in lower production costs and/or higher product quality (Harding and Javorcik, 2011).

A series of stylized facts support the claim that FDI can improve productivity in host countries. As MNCs are responsible for most of the world's R&D (UNCTAD 2005), they are able to transfer new technology and management techniques to their subsidiaries. The use of a skilled workforce is another channel that could help improve productivity. The evidence shows (Arnold and Javorcik (2009)) that MNCs not only use skilled labor intensively, they are also more likely to offer training to their employees. At a later stage, these skilled employees may migrate to domestic companies, which would benefit from acquired knowledge through labor turnover. These same authors have also found that foreign acquisition of a firm has a positive effect on its productivity, both in the short and medium terms. Acquired firms have shown higher output and investment levels, rising wages and greater employment than firms with similar characteristics that remain locally owned. Foreign owned plants also seem to be more integrated into the global economy through greater exports and imports.

The increase in productivity from FDI could go beyond the subsidiaries of MNCs and spill over onto other firms in the host economy. But it would be difficult for technological transfers to take place intra-industry (horizontal) since local firms may lack absorptive capacity; MNCs might be export oriented and local firms domestically oriented; and MNCs would try to minimize technology leakages to competitors (Getler and Blalock (2008)). Moreover, as some firms have stated in surveys, the arrival of MNCs is often accompanied by increased competition and a loss of market share by the local firms.

Nevertheless, domestically owned firms may benefit from FDI in other (vertical) industries, either from being higher up the value chain as suppliers of MNCs (backward linkages) or downstream as clients of MNCs (forward linkages). These benefits could come from learning about new technologies and new techniques such as design, procurement, market information and tooling (Kneller and Pisu (2007)), or simply from accessing cheaper inputs of production (in the case of forward linkages) or even enjoying a new demand for relatively more sophisticated products (backward linkages). Most empirical studies have not been able to find evidence of forward linkages.³ There is, however, well-established evidence of backward linkages of FDI. For example, Javorcik (2004) and Getler and Blalock (2008) have shown that there are spillover effects of FDI on local industries supplying MNCs in Lithuania and Indonesia, respectively.

In sum, three main points emerge from this literature review: (i) FDI is preferred among other capital flows because it is expected to result in greater macroeconomic stability, it helps finance current account gaps, and it is long term in nature; (ii) the motivations for FDI vary (horizontal, vertical or asset seeking), implying that not all types of subsidiaries may be equally beneficial for the host economy or create the same potential for externalities; and (iii) both the theoretical and empirical literature highlight a series of channels of spillover effects through which FDI could influence productivity and, indirectly, economic growth. Most of these externalities have been studied in specific countries, and little is known about the scope of these spillovers around the globe and across sectors.

It is the aim of this paper to contribute to the existing literature in the following ways: (i) defining a series of proxies, drawn from the WB-IFC Enterprise Survey database, to measure the channels through which externalities are expected to be transmitted (backward and forward linkages, skilled capital, licensed technologies and quality certificates); (ii) using these proxies, to determine the motivation of foreign owned firms (horizontal versus vertical) across sectors and regions of the world; we understand that this is the first time that this has been done; (iii) econometrically testing for the presence of backward linkages; and (iv), as a case study, assessing whether the cause for lackluster growth in the Caribbean is partly due to the type of FDI received by these countries, especially in the service oriented islands.⁴

³ An exception is Xu and Sheng (2012) in a study on China, where positive forward linkages were possible through the purchase by domestic firms of high-quality intermediate goods produced by foreign firms.

⁴ Throughout the paper, the following taxonomy for Caribbean states will be used: Service Oriented includes Antigua and Barbuda, The Bahamas, Barbados, Dominica, Grenada, Jamaica, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines; Service and Manufacturing oriented includes Belize, Dominican Republic, and Haiti (when data is available); and Commodity Exporters includes Guyana, Suriname, and Trinidad and Tobago.

2 FDI externalities

2.1 Defining the channels and measuring the intensity across sectors

In this section, we measure the intensity across industries of a series of channels of FDI spillovers, such as technology transfers, labor turnover or forward and backward linkages. An important caveat is that by using the World Bank – IFC Enterprise Surveys we are not able to test for productivity spillovers directly, derived, for example, from backward linkages between FDI and growth. The questionnaire of the Enterprise Surveys does not explicitly ask local companies whether they sell part of their products to foreign companies established in their country, or whether they have benefited from interaction with these companies. In order to extract information from the survey, we use proxies for the channels through which spillovers may occur by looking at their presence in foreign affiliates (rather than in their domestic counterparts). The advantage of using this methodology is the availability of data across industries for most of the developing countries in the world, which allows broad international comparisons going beyond specific sectors or economies.

We use the variable *percentage of inputs of domestic origin* in the foreign affiliate as our proxy for backward linkages, a channel for productivity spillovers. We understand that when foreign subsidiaries declare that they have bought a large percentage of their inputs from local suppliers, say 70 percent, the intensity of backward linkages will be stronger than in those industries or countries in which this percentage is smaller. This approach, which focuses on the demand for inputs from foreign MNCs, is complementary to that presented by Javorcik (2004) and Blalock and Gertler (2008), who adopt the perspective of the local supplying sector and look for foreign presence downstream in the supply chain.

Similarly, we proxy forward linkages with the *percentage of indirect exports* of foreign owned companies. The forward channel is usually measured as “the weighted share of output in upstream sectors produced by firms with foreign capital participation” (Javorcik (2004)). Our limitation is that we do not have input-output matrices for the different countries in the world, covering the different stages of the value chain. Thus, we simply signal the intensity of forward linkages for products sold by foreign subsidiaries that are going to be exported abroad by third companies. Part of these final exports, however, may be completed by foreign owned companies (usually in Special Economic Zones). In the event, there would be no significant forward interaction with domestic companies. Alternatively, inputs to local companies for the production of goods that are not exported would constitute a *bona fide* forward linkage that we are unable to measure directly from our data set.

Following this approach, Figure 1 depicts the average presence of forward and backward linkages between foreign owned affiliates and local companies in different sectors, for most of the developing economies in the world.⁵ Note that there does not seem to be a clear relationship between the percentage of domestic inputs (backward linkages) and the percentage of indirect exports (forward linkages), which would suggest that backward and forward linkages do not necessarily go hand in hand. For example, foreign affiliates in the garment and electronics sectors tend to present a high percentage of indirect exports (over 9 percent), but

⁵ More detailed tables related to the figures presented in this section are included in the Annex.

they buy less than 35 percent of their inputs from the domestic market. Foreign subsidiaries in the automobile sector, on the other hand, present both high indirect exports (above 8 percent), as well as much higher reliance on local inputs (close to 55 percent). Another example would be garment manufacturers that need to import fabric from abroad and present less scope for backward linkages than textiles (a lower value added activity). Similarly, the production of electrical appliances requires small components that are usually imported, whereas the establishment of foreign automotive companies in a developing economy often results in the development of a series of local supply industries (as occurred in Turkey and many other countries).

Figure 1 Intensity of forward and backward linkages of FDI across sectors⁶ in developing countries

Source: Authors' calculations using World Bank – IFC Enterprise Surveys. See Annex.

Unsurprisingly, foreign affiliates in the food and wood sectors tend to rely on local inputs to a greater extent. Whereas, MNCs in the retail, leather and other services sectors tend to transform imported goods. Hotels and restaurants, metals, non-metals, and other manufacturing seem to be sectors presenting intermediate levels of backward and forward linkages.

We also measure the scope for knowledge spillovers from the reliance of foreign owned subsidiaries on *quality certificates* and *foreign licensed technologies*. When MNCs establish affiliates abroad, they often transfer knowledge to them in the form of production processes, management formulas, and distinctive technologies. Even when the foreign affiliate is unlikely to share this knowledge with competing companies,

⁶ The following sectors are defined in the World-Bank IFC enterprise surveys: “texti”=Textiles; “leat”=Leather; “garm”=Garments; “food”=Food; “meta”=Metals and machinery; “elec”=Electronics; “chem”=Chemicals and pharmaceuticals; “wood”=Wood and furniture; “nonm”=Non-metallic and plastic materials; “auto”=Auto and auto components; “oman”=Other manufacturing; “reta”=Retail and wholesale trade; “hote”=Hotels and restaurants; “oser”=Other services; and “ocon”=Other: Construction, Transportation, etc.

information leakages, reverse engineering, or learning by doing processes may occur, especially in countries with a low level of protection of property rights. The foreign affiliate might also be willing to share knowledge with local partners (associates) or suppliers (through backward linkages). Thus, even though we are not able to actually measure knowledge spillovers, we believe they would be more likely to occur in those sectors and/or economies in which foreign companies rely more heavily on technology licenses and quality certificates, as proxies for the economic complexity of the production process. The right panel in Figure 2 shows how the use of quality certificates is more prevalent in sectors featuring a high technological content, as per the OECD technology intensity Index (2011). This suggests that, a priori, the quality certificate and foreign licensed technology variables in the World Bank-IFC Enterprise Surveys could be suitable proxies for measuring the potential for knowledge spillovers.

Figure 2 Reliance on foreign technologies (left), quality certificates and technological intensity (right) in FDI affiliates

Source: Authors' calculations using World Bank – IFC Enterprise Surveys and OECD technology index.

Foreign owned companies dependent on licensed foreign technologies often count on quality certificates. There seems to be an almost linear relationship between these two variables in the left panel of Figure 2. One of the exceptions is leather, which often requires a quality certificate to prove the authenticity of the materials or a traditional tanning process, whereas processing activities are relatively well known and widespread, and companies do not normally require foreign licensed technologies to produce them. Also note from Figure 2 that services (retail, hotels and restaurants, other services) generally present a relatively low degree of quality certificates, and an even lower usage of licensed foreign technologies, as these activities do not usually depend on patents or intellectually protected processes. Whereas automotive and electrical appliances sectors are highly dependent on quality certificates and foreign technology licenses given their relatively high degree of economic complexity.

Another channel highlighted by the literature for FDI spillovers is labor turnover: workers in foreign subsidiaries acquire knowledge and information that might be extremely valuable for competing local

companies that may be willing to hire them at some point. We proxy these externalities by considering the *percentage of skilled workers* in foreign owned companies in a certain sector or country. In addition, it is our understanding that human capital intensive industries are more likely to produce spillovers than less complex industries. Drawing on the World Bank-IFC Enterprise Survey of foreign affiliates in the world, the sectors employing the highest proportion of skilled workers are hotel, automotive and electronics, since they require skills such as speaking foreign languages (hotels and restaurants), or a relatively high technical formation (see Figure 3). The food production and construction sectors tend to employ a larger share of unskilled workers.

Figure 3 Export orientation and reliance on skilled workers across industries

Source: authors' calculations using World Bank – IFC Enterprise Surveys

Finally, we also examined the motivation or orientation of FDI as suggested by the *knowledge-capital* model discussed in section 3. We use the variable *percentage of direct exports* of a foreign owned company as an indicator of its orientation towards export activity (vertical FDI when the percentage is high) or the domestic market (horizontal FDI if low).

As shown in Figure 3, the most export oriented sectors are electronics, garments and textiles. MNCs in these sectors often establish export platforms in countries with relatively cheap and skilled labor, whereas services tend to be consumed in the host country rather than exported. The automobile industry seems to be, in general, more market (locally) than export oriented, although, as mentioned above, this sector often tends to engage in indirect exports and global value chains. Overall, there does not seem to be a strong relationship between export orientation and the employment of skilled workers in foreign affiliates around the world.

The motivation for, or type of FDI is not *per se* a channel for FDI externalities. But it is expected to influence the intensity of the channels for spillovers. Altenburg (2000) argues that domestic-market-oriented foreign subsidiaries (horizontal FDI) are more likely to purchase inputs locally than export-oriented (vertical FDI), thus presenting more backward linkages. In general, market-seeking (horizontal) FDI seems to be more likely

to provide higher spillover potential as it tends to present higher linkages with the rest of the economy (Farole and Winkler, 2012).

2.2 Understanding the determinants of backward linkages in foreign owned affiliates

This section tests whether the different variables that we have considered in the previous section are suitable proxies for the different spillover channels discussed in the theoretical literature. Specifically, this section assesses the determinants of backward linkages econometrically, drawing on a number of studies that in the past ten years have established theoretical models and conclusive empirical evidence on the positive effect of FDI spillovers on productivity.⁷ These studies will provide a guide in understanding whether our proxy variables, drawn from the WB-IFC Enterprise Surveys, behave as expected.

We proxy backward linkages by the percentage of inputs of domestic origin a foreign owned subsidiary buys in a given developing country. As noted above, according to theory and some existing empirical evidence, market (horizontal) oriented FDI is expected to be more predisposed to backward linkages than export (vertical) oriented FDI (*Hypothesis 1 –H1–*, see Altenburg (2000)). Thus, we would expect to find a negative relationship between the percentage of inputs of domestic origin and the percentage of sales in the form of exports in foreign owned companies. In addition, subsidiaries with a lower percentage of foreign participation (joint ventures) would be expected to rely more on local inputs (*Hypothesis 2–H2–*, see Chen and Chang (2011)). Finally, we would like to see whether certain characteristics of the foreign affiliate (such as the use of technology, quality certificates or skilled labor, the number of years it has been operating, or the degree of foreign ownership) affect the development of backward linkages.

In order to better understand the interaction of these different variables, some of which do not have clear causality established in the literature, a matrix of correlations is presented in Table 1. Correlations are in general relatively weak, with only two cases above 0.2 (quality certificates and foreign technology licenses, as well as years of operation and quality certificates). In the case of certificates and licenses, and even when it is not strictly necessary, we avoid including both variables at the same time in the right hand side of a regression. A variable inflation factor is also calculated after each of the regressions, showing very low values for all the variables (below 2), which confirms that there are no multicollinearity issues.⁸

⁷ Unfortunately, very little is available on forward linkages (Javorcik, 2004).

⁸ Drawing from one of the components of the variance for an estimated coefficient it is possible to calculate a Variable Inflation Factor as follows: $VIF = \frac{1}{(1-R_j^2)}$, where R_j^2 is the coefficient of determination of the auxiliary regression of x_j against the remaining independent variables. As a rule of thumb, when $VIF > 5$ there is multicollinearity.

Table 1 Correlation matrix for the different channels of FDI spillovers and other relevant variables

	foreignlic	backward	hitech	%indirectexp	%directexp	%foreignown	yearsop	qualitycer	skilled
foreignlic	1								
backward	-0.0864	1							
hitech	0.1379	-0.1006	1						
%indirectexp	0.0425	-0.0798	-0.0288	1					
%directexp	0.0181	-0.1839	-0.0083	-0.1489	1				
%foreignown	0.0655	-0.1253	0.0049	0.0158	0.1294	1			
yearsop	0.0842	0.0892	0.0804	-0.0735	-0.1064	-0.127	1		
qualitycer	0.2563	-0.0027	0.1722	0.0311	0.0988	-0.0204	0.2043	1	
skilled	0.0699	-0.0454	0.0688	0.0267	0.0818	0.017	-0.005	0.0815	1

Source: authors' calculations using WB-IFC enterprise surveys

A series of ordinary least squares (OLS) regressions were performed to test the three hypotheses mentioned above. The *percentage of inputs of domestic origin* of foreign owned affiliates in developing countries is the dependent variable, our proxy for backward linkages. The potential determinants of backward linkages are included on the right hand side and listed under the first column of Table 2, which reports the results for more than 3,500 foreign owned subsidiaries in developing economies around the world. *Hypothesis 1 is not rejected* since the coefficient for the variable direct exports as a percentage of total sales of the affiliate is negative, highly significant, and robust (relatively stable) across the different specifications (columns II through VIII). Thus, export oriented (vertical) FDI tends to develop less scope for backward linkages relying less on domestic suppliers than market-seeking (horizontal) FDI. Interestingly, we find a similar effect in companies that tend to work through indirect export channels (our proxy for forward linkages). Thus, in general, export oriented firms tend to depend less on domestic suppliers and there is a negative relationship (if any) between backward and forward linkages.

We also find strong support for *hypothesis 2*, that is, affiliates with a lower degree of foreign ownership (joint ventures) normally use a higher percentage of inputs of domestic origin (larger scope for backward linkages). This may be due to domestic shareholders of foreign affiliates being more knowledgeable about local markets, and hence better able to identify reliable suppliers in upstream industries than, say, the foreign manager of a wholly owned branch of a MNC that is working in the host country for the first time.

Quality certificates, however, do not seem to influence backward linkages. In addition, the coefficient for foreign licensed technologies is negative, highly significant, and robust across all specifications. This suggests that foreign owned affiliates with foreign technology would tend to develop less backward linkages with local companies than other foreign affiliates. This could be the result of the MNC having already identified international suppliers to serve the needs of specific production processes using a given technology, or perhaps simple reluctance to engage with local suppliers that might share the technology with other potential competitors (Dunning (1980)). An alternative explanation would be that local firms do not have sufficient capacity or quality to supply inputs for production processes with relatively high technological complexity.

Table 2 Regression results: determinants of backward linkages in foreign owned companies

	I	II	III	IV	V	VI	VII	VIII
	OLS	OLS	OLS	OLS Rob.	OLS Rob. Sector FE	OLS Rob. Country and sector FE	OLS Rob. Country and sector FE	IV 2SLS Sector FE
R-squared	0	0.047	0.063	0.065	0.1198	0.2186	0.2251	0.1198
N	4349	4247	3590	3590	3588	3588	3534	3588
% direct exports (H1)		-0.156*** (-9.76)	-0.178*** (-10.56)	-0.178*** (-10.45)	-0.144*** (-8.08)	-0.117*** (-6.11)	-0.118*** (-6.18)	-0.144*** (-8.36)
qualitycer	-0.399 (-0.34)							
% indirect exports		-0.176*** (-5.65)	-0.195*** (-5.98)	-0.191*** (-5.81)	-0.153*** (-4.70)	-0.117*** (-3.52)	-0.116*** (-3.48)	-0.153*** (-4.72)
% of foreign ownership (H2)		-0.112*** (-5.45)	-0.114*** (-5.28)	-0.115*** (-5.32)	-0.108*** (-5.14)	-0.0998*** (-4.63)	-0.100*** (-4.71)	-0.108*** (-5.14)
years of operation		0.106*** (3.81)	0.0931** (3.24)	0.0946*** (3.54)	0.0683* (2.54)	0.00372 (0.13)	0.0112 (0.4)	0.0683* (2.42)
foreign tech. licenses		-4.316*** (-3.52)	-5.935*** (-4.65)	-5.981*** (-4.79)	-5.623*** (-4.62)	-7.535*** (-6.22)	-7.674*** (-6.37)	-5.623*** (-4.50)
skilled labor			-2.701 (-1.50)	-2.942 (-1.60)	0.254 (0.14)	0.0304 (0.02)	-0.00386 (-0.00)	0.254 (0.14)
small islands dum				-14.35 (-1.69)	-14.11 (-1.55)			-14.11 (-1.74)
caribbean dum				-10.41* (-2.17)	-9.209* (-2.00)			-9.209* (-1.99)
logGDP							6.584*** (4.28)	
_cons	47.68*** (59.74)	60.29*** (31.28)	66.58*** (28.75)	67.00*** (28.96)	62.61*** (23.22)	32.03*** (4.45)	32.03*** (4.45)	62.61*** (23.1)

Source: Authors' calculations using WB-IFC Enterprise Surveys. *, **, and *** signal significance of the regression coefficients at the 10%, 5%, and 1% levels, respectively; t-statistics are in parentheses.

The coefficient on employment of skilled labor in foreign affiliates is not significant. This means that companies employing low or highly skilled workers could, in principle, present a similar scope for backward linkages.

Finally, two dummy variables for Caribbean countries and other Small Island Developing States (SIDS) are included in the regressions to test whether economic size can be a limitation for the development of backward linkages. Small economies may not be able to develop economies of scale or may have a limited variety of competitive suppliers in most industries. The Caribbean dummy is significant at the ten percent level of confidence suggesting that foreign owned companies develop less backward linkages there than in other regions of the world. This does not seem to be the case for other SIDS, although it is worth noting that

data in World Bank Enterprise Surveys are only available for a sub-sample of these countries. When we include the log of the GDP in regression VII, it turns out to be positive and strongly significant. This implies that host economies of small size may be constrained to develop backward linkages when receiving foreign direct investment.

A series of checks and controls have been applied to ensure the reliability of the econometric results. Firstly, the coefficients of the different independent variables present small variations, meaning that they are robust across the different specifications. Secondly, some of the regressions are run with robust standard errors to correct for potential heteroskedasticity (columns IV to VII). Thirdly, specification VIII has been run under a two-stage least squares (2SLS) form to control for the potential endogeneity of the regressors.⁹ STATA results show that no endogenous regressors have been found, and the Hausman test confirms that the regression under OLS (column V) is preferred to 2SLS (VIII), although the coefficients do not vary considerably. Finally, as additional controls, we have introduced country-year fixed effects (columns VI and VII) and sector fixed effects (V to VIII). When country fixed effects are included the coefficient for “years of operation” becomes insignificant.

Fourteen dummy variables were created to capture the fixed effects for each of the fifteen sectors defined in the database, and were introduced in regressions V to VIII. When all the other sector dummies are zero, metals and machinery is defined by default and was selected since the percentage of inputs of domestic origin is similar to the average for all the observations. An additional regression was run to obtain the coefficients featuring only the dependent variable and the sector fixed effects. These coefficients signal the propensity for backward linkages of foreign owned companies in the different sectors. As Figure 4 shows, the food and wood present large backward linkages, whereas electronics, garment, retail and wholesale trade, as well as other services rely less on inputs from the host economy. Notice how the confidence interval for leather is wide due to small sample issues for this concrete sector. Overall, these econometric results provide a broadly similar sector picture to that presented in Figure 1, but with the advantage of greater precision.

⁹ If there is a correlation between any of the explanatory variables and the disturbance term there is said to be a problem of endogeneity. This problem usually emerges in a context of model misspecification, and as a result, estimated coefficients will be biased. To avoid endogeneity, it would be sufficient to find an appropriate proxy variable that is not correlated with the disturbance, and apply OLS for estimation. Alternatively, it is possible to apply 2SLS, where the different independent variables found to be endogenous are regressed on all of the exogenous variables in the model (step 1). Then, in a second step, OLS is applied in an equation in which the endogenous variables have been substituted with the predicted values from the first stage (see, for example, Gujarati 2004:770-783). When applying this method, STATA software reports that there are no endogenous variables in the original specification, and for that reason results for specifications IV and VIII are similar.

Figure 4 Propensity for backward linkages across sectors (fixed effects)

Source: Authors' calculations using WB-IFC Enterprise Surveys.

In sum, we have empirically tested the determinants of backward linkages stemming from foreign owned companies (often MNCs) in developing economies using the World Bank-IFC Enterprise Survey data set. The results support the two main hypotheses we have formulated and that have been drawn from existing literature: export oriented FDI tends to present less backward linkages than horizontal FDI, and foreign subsidiaries in the form of joint ventures have higher reliance on domestic inputs. Thirdly, certain FDI affiliate characteristics, such as having foreign technology licenses, negatively influence the scope for backward linkages. On the other hand, skilled labor and quality certificates are not found to be significant determinants. Apart from the type of FDI (horizontal or vertical) and firm characteristics, the sector of activity does matter for the development of backward linkages. Finally, the size of the host economy positively influences the establishment of backward linkages between foreign owned affiliates and local firms.

The next section attempts to measure the channels of FDI spillovers in specific developing economies or regions. This should help us to understand the type of FDI they are receiving and the potential scope for externalities affecting productivity and, ultimately, economic growth. We are especially interested in the Caribbean where there is some evidence that backward linkages from foreign owned companies to local suppliers are lower than in other parts of the world. We want to test whether limited backward linkages in the Caribbean are due to the small size of the economies and/or to the type of FDI the region receives.

3 Case study: Understanding the low potential for FDI externalities in the Caribbean

This section assesses the potential for FDI spillovers in the Caribbean using the proxies we introduced and tested in the previous sections. We motivate this section by presenting the puzzle of why abundant FDI has not been sufficient to foster sustained increases in productivity and economic growth in the Caribbean.

3.1 Motivation: Large FDI inflows and slow growth in the Caribbean

There is no dearth of foreign direct investment (FDI) in the Caribbean. FDI inflows averaged 9.5% of GDP to the Caribbean from 2005 to 2012, and represented more than 38% of gross fixed capital formation, versus 4.1% and 18%, respectively, for Latin America.¹⁰ In fact, FDI inflows to the Caribbean are large in relation to other developing countries including other small island developing states (SIDS). A scatter diagram of FDI/GDP against the economic size of developing countries (see Figure 5 Left Panel) shows a slightly negative relationship, that is, the smaller the economy, the larger the dependence on foreign investment tends to be. Domestic savings tend to be less in smaller countries, amongst other reasons due to indivisibilities in the provision of public goods and correspondingly larger public sector expenditures.¹¹ Related to this, developing countries which run large current account deficits typically have more FDI than those that run surpluses.¹² As can be observed, some Caribbean economies are outliers both in terms of FDI inflows relative to size of the economy and to the current account balance.

However, as Figure 6 shows, despite very high levels of FDI accumulation, the growth rate of Caribbean countries is below the average for developing countries, although comparable with other SIDS. Note that service oriented countries in the Caribbean, a subgrouping of the smallest islands, are those that have received the highest stock of FDI relative to GDP and that, nonetheless, exhibit the lowest rates of growth during the time period under consideration (2000-2012).

¹⁰ Data drawn from the World Development Indicators of The World Bank and from the United Nations. Latin America excludes the Caribbean.

¹¹ See de Piniés, Varma and Wacker (2014).

¹² The initial flow of FDI typically induces real appreciation of the currency of the host country which can lead to a loss of external competitiveness and a worsening of the current deficit. The stock of FDI in the host country must also be repaid via factor payments, which tends to worsen the current account.

Figure 5 FDI/GDP in relation to the economic size of developing countries (left) and the Current Account/GDP (right), average 2000-2012

Note: Left Panel: Linear and quadratic regressions. Right Panel: Non-parametric regression. Authors' estimations. Data source: IMF IFS and WB WDI. Color code: Red for Caribbean Service Oriented; dark red for Caribbean Commodity exporters; orange for Caribbean service and manufacturers; yellow for SIDS; blue for Latin American excluding Caribbean; green for the rest of the developing economies.

Figure 6 Real GDP growth rates (left) and stock of FDI liabilities as a percent of GDP (right), average 2000-12

Source: WB WDI and Philip R. Lane and Gian Maria Milesi-Ferretti; <http://www.philiplane.org/EWN.html>

Why has FDI failed to stimulate growth in the Caribbean? The question itself presumes a conclusion which we cannot draw since a proper counterfactual has not been constructed. What might have been the rate of growth in the developing countries in the absence of FDI is a difficult question to answer that is doubly hampered in the case of the Caribbean due to scarcity of data. In general, causality between FDI and growth is hard to establish. Carkovic and Levine (2005) have shown that once endogeneity is fully controlled and country specific factors are taken into account, FDI does not exhibit a strong independent influence on economic growth. Nevertheless, these and many other authors have shown that FDI and long term growth

are usually positively correlated.¹³ FDI might be acting as a signaling device for successful growth, or sound macro and micro policies may be inducing both FDI and economic growth simultaneously. In addition, as previously discussed, there is micro level evidence pointing to positive externalities emanating from foreign owned companies to local industries in host countries. But, as is evident in the Caribbean, growth and FDI apparently do not always go hand in hand.

A first reason why FDI may not be contributing to economic growth in the Caribbean as much as might be expected is that it may not have increased productive capacity. This may have happened because natural disasters, which are more frequent and destructive in the Caribbean than elsewhere, may have damaged the existing capital stock and FDI simply replaced it.¹⁴ Alternatively, recorded FDI may represent acquisitions of the existing capital stock without any corresponding productivity enhancements. In addition, foreign investment in part of the Caribbean may have been motivated principally by tax haven and fiscal exemption considerations, with little capital formation accompanying it.

A second line of reasoning why FDI may not lead to stronger growth is that it might be fueling Dutch disease through the real appreciation of the domestic currency which could impact the competitiveness of other productive sectors in the economy and stymie growth. Anecdotal evidence suggests that FDI in the Caribbean has raised prices of land and other factors of production with little or no impact on growth.

Thirdly, there may be an absence of key enabling factors that impede beneficial effects from FDI. For example, as shown by Javorcik and Spatareanu (2009), less credit constrained firms are more likely to become suppliers to MNCs. Similarly, according to Alfaro et al (2004), FDI leads to faster growth only if financial markets are well developed.

Fourthly, the potential for positive externalities stemming from FDI in the Caribbean may be low. The small size of most Caribbean countries may be limiting the development of backward¹⁵ and forward linkages between foreign owned affiliates and local companies. In addition, the type of FDI that the Caribbean is receiving may be concentrated in sectors that are not intense in the use of technology, thus limiting the scope for knowledge spillovers.

While explanations one to three are beyond the scope of this paper, this section attempts to contrast whether there is evidence of the fourth hypothesis.

3.2 Understanding the potential for FDI spillovers in the Caribbean

At first glance (see Table 3 in the Annex), when comparing across regions, it seems that the Caribbean presents significant forward linkages (through high indirect exports), while backward linkages are average

¹³ See de la Torre, Beylis and de Piniés (2014)

¹⁴ See J. de Piniés, Varma and Wacker (2014).

¹⁵ See Hirschman (1958) for an early treatment of backward linkages; more modern treatments are offered in Krugman and Venables (1995) and Javorcik (2004).

relative to the rest of the world. The Caribbean, however, is very heterogeneous. The sub-regions of the Caribbean present important differences in relation to their average forward and backward linkages (see Figure 7). Foreign affiliates in smaller service oriented Caribbean islands buy only 42 percent of their inputs from local companies, similar to that of other SIDS and Central American countries; yet the scope for forward linkages seems to be very high. Caribbean economies that are both manufacturers and services oriented (CARman) have a high degree of backward linkages; but as we will see, this is only due to the fact that Belize is an outlier; backward linkages in Dominican Republic which is classified as manufactures and service oriented, are in fact also well below the world average of 49 percent. In contrast, commodity export oriented Caribbean countries present intermediate levels of intensity in backward and forward linkages.

Figure 7 Intensity of forward and backward linkages of FDI from MNCs across regions¹⁶

Source: authors' calculations using WB-IFC enterprise surveys

There is also large heterogeneity in terms of the average percentage of inputs of domestic origin acquired by foreign owned affiliates in the Caribbean. For example, FDI in Dominica and St. Lucia seems to have built relatively strong backward linkages with local companies, but the rest of the small service-oriented Caribbean islands have not. Nonetheless, given the large confidence intervals for the country fixed-effect coefficients, note that data limitations and small sample issues at the individual country level preclude us from taking this evidence as final.

¹⁶ The following regions are defined in the World Bank-IFC enterprise surveys: Africa (AFR), East Asia and Pacific (EAP), Europe and Central Asia (ECA), South Asia (SAR), and Latin America and the Caribbean (LAC). Sub regions within LAC include South America and Mexico (SAM), Central America (CAM), and the Caribbean (CAR). Countries in the Caribbean are further clustered into three groups: "CARserv" or service-oriented Caribbean countries: Antigua and Barbuda, The Bahamas, Barbados, Dominica, Grenada, Jamaica, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines; "CARman" that is, service and manufacture-oriented Caribbean countries: Belize and Dominican Republic (Haiti is not a part of the sample); and "CARres", resource-based Caribbean countries: Guyana, Suriname and Trinidad and Tobago.

3.3 Why do Caribbean service oriented islands have low backward linkages?

Drawing on the econometric results presented in section 2.2, three factors could be hampering the development of backward linkages in service oriented islands in the Caribbean. These are: the size of the economy, the type of FDI received, and the sectors in which foreign capital is being invested.

Figure 8 shows a scatter plot for all the developing countries in our data set featuring average percentage of inputs bought by foreign owned firms, and the size of the economy measured as the log of GDP in current US\$ in the year of the survey. A positive relationship between the size of the host economy and the scope for backward linkages is present as confirmed by our econometric results. Thus, economic size may be limiting the potential for the formation of stronger backward linkages in the Caribbean. Nonetheless, as shown in the figure, size is not the only explanatory factor, since there is a large degree of heterogeneity even for islands with a similar log of GDP.

Figure 8 Size of the economy and reliance on inputs of domestic origin by MNC's across the world

Source: authors' calculations using WB-IFC enterprise surveys, and World Development Indicators

Figure 9 Average backward linkages in the Caribbean, compared to other developing economies

Source: authors' calculations using WB-IFC Enterprise Surveys, and World Development Indicators

Note: data on inputs from domestic origin was not collected for services in the Caribbean

A second hypothesis behind relatively low backward linkages in the region would be that certain industries in the Caribbean might be generating fewer backward linkages. To test this hypothesis, we compare the size of the coefficients for sector-specific fixed effects (see the previous econometric results) with the average intensity of domestic purchases by the foreign owned companies. Figure 9 shows that, in general, foreign owned affiliates in manufacturing sectors in the Caribbean tend to present similar backward linkages to FDI in the rest of the world.¹⁷

Given that size and sector fixed effects do not provide a good explanation of the observed low backward linkages in services oriented Caribbean islands, we also analyzed the type of FDI that was received. Figure 10 shows that foreign affiliates in Caribbean resource producing and manufacturing countries are much less export oriented and present very low reliance on licensed foreign technologies (only 7 percent use them). As we noted in section 2, horizontal FDI (whose proxy is the percentage of domestic sales) generates more backward linkages. With the exception of the Dominican Republic, this could help explain the relatively larger backward linkages observed in this group of countries. On the other hand, foreign affiliates in service-oriented Caribbean islands are much more export oriented (less inclined to sell in the domestic market) and apparently have a relatively high use of foreign technologies (24 percent), which leads FDI to present fewer backward linkages with the local economy.

¹⁷ Unfortunately, data for backward linkages in services was not compiled when the Enterprise Surveys were conducted in the Caribbean.

Figure 10 Foreign technology use and percentage of national sales by MNCs

Source: authors' calculations using WB-IFC enterprise surveys

It is worth noting that economies in East Asia and the Pacific also attract more export platforms, especially in industries of relatively high complexity. MNCs endow affiliates in that region with licensed technologies in a higher proportion than any other region in the world. East Asia is also one of the most foreign trade integrated areas in the world (Baldwin, 2006), which allows for a higher intensity of participation in global value chains. Thus, even if the scope for backward linkages in East Asia and Pacific countries seems to be relatively low, there are other channels through which technology transfer is likely (through interrelations and value chains). In contrast, export-oriented FDI in the Caribbean does not normally receive inputs from or sell products to neighboring islands, due to insufficient connectivity and relatively high transport costs in the region. Thus, the scope for spillovers in these islands remains low (with the exception, perhaps, of potentially high forward linkages).

In sum, understanding the potential for FDI spillovers in the Caribbean is not straightforward, given cross country variation. In general, Caribbean commodity export oriented economies present intermediate levels of backward and forward linkages. Service oriented islands have high levels of forward linkages through indirect exports, but low levels of backward linkages (with the notable exceptions of Dominica, St. Lucia, and, possibly, Jamaica). These are due to the size of the economy, sector considerations and, especially the type of FDI these countries are receiving, which is mainly export oriented and relies to a great extent on foreign technologies.

3.4 Special economic zones functioning as enclaves in the Dominican Republic

The Dominican Republic (DR) is the largest economy in the Caribbean, and develops a wide range of activities both in the services and manufacturing sectors. The DR is often considered an example of successful implementation of Special Economic Zones (SEZs) which fueled economic growth in the country during the

1990s. Although having experienced a sharp decline in employment due to the expiration of trade preferences in textiles in 2004, there are signs of recovery. The extent to which foreign companies in SEZs have been contributing to technological and capacity upgrading in the rest of the economy remains an open question.

The literature on economic development in the DR has traditionally pointed to the existence of weak linkages between SEZs and domestic firms (Kaplinksy, 1993). SEZs are often characterized as “enclaves” that are relatively isolated from the rest of the economy, reducing the potential for positive externalities and spillovers to the rest of the economy (knowledge transfers, forward and backward linkages, etc.). When looking at specific industries within Free Trade Zones, Senderowitsch and Tsikata (2010) conclude that only SEZ food production enterprises have relatively strong backward linkages to local suppliers. Textile and other manufacturing seem to have weaker backward and forward linkages, similar to mining, construction, and utilities. Recently, SEZs started to export higher value-added products such as medical equipment and pharmaceuticals, but these sectors still import most of their inputs and have built few supply arrangements with domestic suppliers (Sánchez-Ancochea, 2012).

The weakness of backward linkages highlighted by the literature on SEZs in the DR is confirmed in the light of recent data. According to World Bank-IFC Enterprise Surveys, surveyed foreign owned affiliates established in the country would buy just 32 percent from local suppliers compared to a world average of around 50 percent. According to the 2012 Census of Special Economic Zones, elaborated by the Central Bank of the DR, the share of local inputs used by SEZ firms would be only 19 percent.

Why are backward linkages in the DR so weak? Drawing on the econometric results presented in Table 2, a first reason is that the type of foreign investment received by the country seems to be negatively contributing to the development of backward linkages. Foreign owned firms in the DR are more export oriented (indirectly or directly selling nearly 30 percent of their output abroad)¹⁸ and rely more on licensed foreign technologies (33 percent) than in the rest of the world (21 percent and 18 percent, respectively).

A second explanation for low backward linkages is sector specific. Based on customs data, the value of imports of clothing companies established in SEZs in the DR is above fifty percent of the value of their exported output¹⁹. Considering that distribution and/or sales margins are often above 30 percent implies that the value of the SEZ inputs from the local market must be relatively small. When imports are further disaggregated among final, intermediate, and primary products, a clothing export company’s average composition of imports is 65% intermediate, 10% primary, and around 25% final product. Since the DR does not produce cotton, it must be acquired abroad. Thus, the fact that the Dominican Republic is not a producer of cotton or leather, seems to preclude foreign owned textile firms (originally, low value added *maquilas*) developing stronger backward linkages with local suppliers.

A third reason is that SEZs are legally separated from the rest of the economy which makes it more difficult to supply them locally. Foreign owned companies in SEZs often arrive in the DR with the aim of developing assembling activities for final products destined for the U.S. market. The decrease in world shipping costs,

¹⁸ This percentage would be even higher if we just take into account FDI located in SEZs.

¹⁹ See World Bank (2014).

together with declining tariffs and international trade preferences in the context of the DR-CAFTA and European Partnership Agreement between CARICOM and the European Union, as well as the exemption of the value added tax over imports for companies located in SEZs, makes it easier for these companies to rely on already well-established international suppliers than finding a local supplier with an adequate capacity and competitive pricing. Local suppliers have to face a larger tax burden, and also face the transaction cost of operating through customs to reach companies inside SEZs (which have special customs agents to expedite the process). As a result, DR companies willing and able to work for a foreign owned firm are moving into SEZs, with the undesired outcome of tax losses and linkages only being developed inside the SEZs and not permeating the rest of the economy.

In sum, the DR is an example of high FDI not guaranteeing the development of strong linkages with the local industry. Attracting export oriented FDI with a high reliance on foreign technology in relatively isolated SEZs is likely to limit the scope for interaction with domestic suppliers, thus reducing the chances for demonstration effects and technological upgrading. In addition, backward linkages are less likely to be developed if the host country is not a natural producer of some of the inputs needed by foreign owned firms settling there (e.g. cotton or leather in the case of garments and clothing in the DR).

3.5 Some policy options to enhance the presence of FDI linkages in the Caribbean

Drawing on the results of this paper, Caribbean countries could take better advantage of FDI coming to the region through a series of strategies. Small islands are likely to have less backward linkages due to their size, which limits the emergence of economies of scale and the positive dynamics derived from competition. As a result, the number of suppliers able to meet the requirements of affiliates of foreign multinationals is probably very low in these island states. In addition, the small size of the host market inevitably implies that most of the FDI arriving is export oriented, a type of investment that as we have seen relies less on domestic inputs. Nonetheless, this handicap is not necessarily binding and irreversible. Some small islands have been able to attract FDI and developed fairly strong backward linkages. Future research might fruitfully analyze why foreign owned firms in Dominica and St. Lucia feature relatively strong backward linkages in spite of their small economic size.

An alternative for small service-oriented islands based on the econometric results of this paper would be to attract FDI into sectors with stronger backward linkages (food, metals and machinery, chemicals...) rather than the garments and textiles sectors, which have low linkages. For this to work well, state support is likely to be needed to identify capable local suppliers for arriving MNCs. Linkages are more likely to be developed if part of the inputs needed in the transformation process of the MNCs is already being produced in the host economy (e.g. fruits, certain metals, etc.).

MNCs in small Caribbean islands also present a high reliance on foreign licensed technologies. This could be an opportunity for knowledge diffusion despite relatively weak backward linkages. For host economies to

benefit from these technologies, policy makers in developing countries may need to negotiate knowledge exchange initiatives and learning programs with the MNCs. The success of this initiative would depend on whether the MNC perceives the knowledge exchange program to be profitable in the long term (e.g. by developing the ability of local suppliers to produce a cheaper and higher quality input), or potentially detrimental (e.g. empowering competitors).

With regard to Caribbean commodity export oriented economies, a large share of the FDI they receive is resource-oriented. In order to boost FDI diversification beyond natural resources, these economies could use rents accruing from mining to build infrastructure and facilities that could help attract other kinds of FDI in the medium and long terms.

This paper has also briefly presented a case study on the Dominican Republic. Unlike other services and manufacturing oriented islands (i.e., Belize), and relatively large economies in the Caribbean (Trinidad and Tobago, Jamaica), foreign owned companies in the Dominican Republic have traditionally developed few backward linkages with the rest of the economy. Possible policy responses which are derived from the findings of this paper include the following:

- First, even if FDI in the DR has traditionally been export oriented, MNCs in the SEZs should be encouraged to take advantage of a relatively large host market, with nearly ten million people. DR authorities already took a first step towards higher interaction between SEZs and the domestic market in 2011 when limits on sales outside SEZs were abolished. This could boost forward linkages and attract more horizontal (local market seeking) FDI, which usually generates more backward linkages.
- Second, in the medium and long term, the enabling environment that has helped develop successful SEZs (expedited customs procedures, agglomeration economies, enhanced infrastructures, etc.) could be implemented outside of them. An eased business environment coupled with improved connectivity with SEZs, and the removal of legal hurdles to send merchandise inside the zones, would help build the currently scanty backward linkages in the DR. This would also prevent the migration of local suppliers to SEZs, which has a relatively high cost for the country in fiscal terms.
- Third, the Dominican Republic has suffered a sharp decline in textile manufacturing activities over the past decade. At the same time, this could turn out to be an opportunity to try to attract other types of FDI that develop relatively stronger backward linkages and/or perform more sophisticated processes. This would potentially allow local companies interacting with arriving multinationals to climb-up the value added-ladder. SEZs in the DR seem to be already going through structural transformation as the country is beginning to attract FDI in some emerging industries such as footwear and surgical equipment. Although the former is unlikely to generate large linkages with the local economy (due to the lack of local leather), the latter is highly complementary with an incipient chemical industry, and could potentially develop local linkages. The Dominican Republic may need to invest in its human capital to count on a skilled workforce in the future able to match the needs of foreign companies, especially those that produce increasingly complex manufacturing processes, beyond assembling activities.

4 Conclusions

This paper has explored the determinants of backward linkages between foreign owned firms and domestic suppliers in the host country. Using the World Bank-IFC Enterprise Survey, the intensity of these linkages has been preliminarily established in more than one hundred developing economies for the first time. It is worth mentioning that these surveys have not been designed to specifically ask local companies about their linkages with foreign MNCs, and for that reason we have defined proxies for backward linkages.

Results of the econometric regressions presented in this paper confirm that market oriented (horizontal) FDI is more predisposed to establishing backward linkages than export oriented (vertical) FDI as posited by Altenburg (2000). A negative and significant relationship between the percentage of inputs of domestic origin (our proxy for backward linkages) and the percentage of sales going to exports in foreign owned companies (the proxy for forward linkages) has also been found. In addition, subsidiaries with a lower percentage of foreign participation are shown to rely more on local inputs in line with Chen and Chang (2011). The reason is that it is easier for a joint venture to find reliable suppliers due to market specific knowledge of local partners. Holding foreign technology licenses is also shown to contribute significantly to developing fewer backward linkages. This could be the result of the multinational having already identified international suppliers to serve the needs of the specific production process using a given technology. Skilled labor or quality certificates, however, are not found to be significantly correlated with backward linkages.

Another important finding both in terms of foreign investment policy and understanding the development outcomes of FDI, is that the sector of destination matters. Drawing on our econometric exercise, we have shown that the food, wood and furniture, and automobile and auto parts sectors tend to develop many backward linkages. In contrast, garments, electronics, and some services sectors do not rely as much on local suppliers. Thus, the sector where FDI is concentrated does matter for the development of spillovers.

Finally, the size of the host economy affects the scope for the development of backward linkages. Small countries usually count on a limited number of firms with the capacity and quality to serve MNC affiliates that are part of global value chains. In addition, the small size of the destination market implies that FDI is mostly export-oriented and relies highly on foreign technologies, which often results in a lower degree of involvement with local firms. This could explain why, in spite of receiving large FDI inflows relative to their GDP, most Caribbean islands have struggled to develop linkages between foreign owned affiliates and domestic suppliers. It could also be part of the explanation as to why FDI does not seem to have resulted in widespread productivity increases and stronger economic growth in these islands. This is most noticeable among service oriented small islands states of the Caribbean.

While the size of the host economy is likely to have been a constraint, some Caribbean small islands, like Dominica and St. Lucia, present relatively large backward linkages for their size. It would be interesting to explore the motives for this in future research, as a benchmark for other countries. In the meantime, other service oriented small islands in the Caribbean could try to attract FDI into sectors that tend to develop stronger backward linkages (food, metals and machinery, chemicals...). They should also try to ensure that

domestic goods (e.g. food) reach the large hotel chains operated by foreign owners in these islands, provided they meet quality standards and supply requirements.

The Dominican Republic is a special case in the Caribbean which we have explored separately. With a relatively large population of ten million, it also suffers from weak linkages between foreign owned affiliates (mainly established inside SEZs) and local firms. According to data from the 2012 Special Economic Zones census, companies inside the zones purchase on average only 19 percent of their inputs from domestic suppliers. These findings confirm the perception of previous literature arguing that SEZs in the DR function like “enclaves” that are isolated from the rest of the economy (Kaplinsky, 1993; Sánchez Ancochea, 2012). The DR has taken a first step to enhance interactions among firms by eliminating export requirements for companies in the SEZ, which can now sell to the local market. A second step would ease administrative barriers, improve connectivity, enhance the framework for doing business, and optimize custom procedures in the national territory, drawing perhaps on the successful lessons learned when implementing these improvements in SEZs. Finally, the DR would need to strongly invest in its human capital to have a skilled workforce in the future able to match the needs of foreign companies, especially those with increasingly complex manufacturing processes beyond the assembling activities currently taking place.

In sum, this paper has empirically validated a framework to identify the factors determining the emergence of backward linkages from foreign owned firms in developing economies. The type of FDI (horizontal versus vertical, joint venture versus whole ownership, reliant on foreign technologies), the size of the host economy, and the destination sector affect the percentage of inputs of domestic origin acquired by MNCs.

The results of our econometric exercise help to better understand the factors that may be constraining the emergence of backward linkages in certain developing economies. Nonetheless, the source of our data (WB-IFC Enterprise Surveys) has not been constructed to test backward linkages and while we believe we have verified our proxies, our findings should be complemented with specific country level studies to identify and better ground more thorough explanations leading to policy options, as we have tried to do for the case of the Dominican Republic.

Finally, this paper has taken a small step towards comprehending the complexity and potential of foreign direct investment spillovers by measuring some of the channels of backward linkages and potential FDI externalities. This does not imply that economies in which foreign affiliates are developing strong relations with local companies will actually see widespread productivity increases. Actual externalities will depend on the location of the FDI industry in global value chains, its actual value added, the employment of skilled workers and distinctive production processes and, most importantly, on the nature of contractual arrangements with local companies (intellectual protection clauses, training programs, etc.), aspects that would need to be considered in further research.

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6 ANNEX

Table 3 Average Enterprise responses per region and two sample t-tests.

Region	AFR	CAM	CAR	EAP	ECA	MNA	SAM	SAR	SMI	Total	CARvsLAC	CARvsSAM	CARvsCAM	CARvsSMI	CARvsWLD
Number of FDI observations	2643	558	463	619	1301	20	2360	144	242	8350	ttest (p)	ttest (p)	ttest (p)	ttest (p)	ttest (p)
Size of the company	1.85	2.35	2.03	2.47	2.30	2.35	2.16	2.29	1.60	2.10	0 ***	0.0012 ***	0 ***	0.0000 ***	0.0523 *
% owned by foreigners	80.17	84.24	72.56	83.42	76.15	39.95	79.61	66.25	75.83	78.99	0 ***	0 ***	0 ***	0.1827	0 ***
Manager experience (years)	14.63	17.43	18.01	15.29	14.84	18.95	19.59	16.00	15.56	16.37	0.0557 *	0.0076 ***	0.3747	0.0055 ***	0.0007 ***
Quality certificate	0.32	0.40	0.32	0.51	0.48	0.60	0.43	0.47	0.29	0.40	0 ***	0 ***	0.014 **	0.4400	0.0005 ***
Licensed foreign technology	0.14	0.16	0.10	0.29	0.21	0.05	0.19	0.28	0.13	0.18	0 ***	0 ***	0.0023 ***	0.1769	0 ***
Affiliate years of operation	17.48	20.19	23.54	14.55	15.56	24.55	24.11	20.74	15.48	19.37	0.8713	0.6392	0.0122 **	0.0000 ***	0 ***
% of national sales over total	89.27	70.68	76.56	50.26	68.92	81.05	83.62	70.69	84.87	79.19	0.0048 ***	0 ***	0.0144 ***	0.0025 ***	0.0951 *
% of indirect exports over total	2.65	7.50	7.46	10.71	4.15	3.20	2.97	6.61	6.23	4.32	0 ***	0 ***	0.9799	0.5055	0 ***
% of direct exports over total	8.05	21.82	16.04	39.05	26.93	15.75	13.41	23.12	12.90	16.61	0.4795	0.06 *	0.0063 ***	0.2266	0.6946
% of inputs of domestic origin	50.32	42.40	48.28	36.91	48.10	18.80	56.81	42.15	42.34	48.97	0.041 **	0.0026 ***	0.1027	0.2425	0.8127
% of inputs of foreign origin	49.50	57.60	51.72	54.53	51.90	81.20	43.19	53.07	57.66	49.72	0.041 **	0.0026 ***	0.1027	0.2425	0.4965
% skilled workers	0.60	0.60	0.61	0.81	0.70	0.54	0.64	0.69	0.46	0.66	0.58	0.4712	0.8795	0.0414 ***	0.2141

Note: *, ** and *** signal a statistically significant difference at the 10%, 5% and 1% levels of confidence, respectively in the two sample t-test we have applied. The test compares the means of two groups (for instance, Caribbean FDI companies and Central American FDI companies) taking into account a pooled variance. Under the null hypothesis, both groups have equal mean. More information about the test and its application with STATA is available at <http://www.stata.com/manuals13/rttest.pdf>. AFR is Africa region, CAM is Central America, CAR is Caribbean, EAP is East Asia Pacific, ECA is Europe and Central Asia, MNA is Middle East and North Africa, SAR is South Asia, SMI is SIDS (Small Island Developing States), SAM is South America and Mexico, and LAC is the sum of CAM, CAR and SAM.

Source: World Bank-IFC Enterprise Survey.

Table 4 Average enterprise responses in sectors of developing countries and two sample t-tests.

Sectors	texti	leat	garm	food	meta	elec	chem	wood	nonm	auto	oman	reta	hote	oser	ocon
Number of FDI observations	378	61	457	973	565	181	526	63	423	29	1236	1839	273	980	363
% of FDI obs. in sectorial sample	10.9%	14.2%	8.8%	12.1%	12.6%	26.2%	15.9%	14.6%	98.1%	6.7%	15.2%	12.3%	11.0%	15.6%	10.2%
Quality certificate	0.37	0.54	0.23	0.46	0.56	0.74	0.57	0.30	0.53	0.76	0.36	0.30	0.36	0.36	0.41
Licensed foreign technology	0.26	0.07	0.27	0.31	0.36	0.43	0.46	0.21	0.34	0.59	0.15	0.01	0.01	0.03	0.03
% of indirect exports over total	8.23	3.72	9.30	2.93	5.63	10.73	2.37	5.16	5.19	8.41	4.70	2.43	6.12	4.01	1.55
% of direct exports over total	34.42	13.97	48.48	17.15	26.49	47.45	15.49	17.16	20.96	16.41	17.81	4.35	3.58	9.51	7.85
% of inputs of domestic origin	47.13	32.50	33.42	67.10	49.99	34.40	43.66	58.77	48.80	54.82	47.60	34.31	51.04	34.55	40.97
% of inputs of foreign origin	53.02	67.50	66.58	32.64	49.97	64.39	56.34	41.23	51.20	41.61	51.52	47.21	22.05	56.77	49.35
% skilled workers	0.67	0.62	0.73	0.57	0.69	0.81	0.65	0.78	0.66	0.84	0.64	0.69	0.88	0.73	0.51

Means tests: Sector i against all sectors (p-values)

Quality certificate	0.1676	0.0231	**	0.0000	***	0.0001	***	0.0000	***	0.0000	***	0.0000	***	0.1129	0.0000	***	0.0001	***	0.0008	***	0.0000	***	0.1693	0.0082	***	0.7302	
Licensed foreign technology	0.0000	***	0.0218	**	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.5455	0.0000	***	0.0000	***	0.0148	**	0.0000	***	0.0000	***	0.0000	***	0.0000	***
% of indirect exports over total	0.0000	***	0.7782	0.0000	***	0.0058	***	0.0528	*	0.0000	***	0.0056	***	0.6912	0.2729	0.1849	0.3806	0.0000	***	0.0767	*	0.5350		0.0014	***		
% of direct exports over total	0.0000	***	0.5155	0.0000	***	0.5788	0.0000	***	0.0000	***	0.4047	0.8923	0.0041	***	0.9731	0.1530	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***	
% of inputs of domestic origin	0.3441		0.1683	0.0000	***	0.0000	***	0.5112	0.0000	***	0.0009	***	0.0492	**	0.9222	0.4123	0.3174	0.0000	***	0.7885	0.0001	***	0.2373				
% of inputs of foreign origin	0.0908	*	0.1373	0.0000	***	0.0000	***	0.8730	0.0000	***	0.0000	***	0.0884	*	0.4137	0.2556	0.1894	0.4378	0.0006	***	0.0513	*	0.9572				
% skilled workers	0.5385		0.8209	0.0000	***	0.0000	***	0.0079	***	0.0000	***	0.8341	0.0673	*	0.6371	0.0071	***	0.2317	0.7557	.	0.4383		0.0869	*			

Note: *, ** and *** signal a statistically significant difference at the 10%, 5% and 1% levels of confidence, respectively in the two sample t-test we have applied. The t-test compares the means of sector “i” against the total taking into account a pooled variance. Under the null hypothesis, both groups have equal mean. More information about the test and its application with STATA is available at <http://www.stata.com/manuals13/rttest.pdf>. Where texti = Textiles, leat = Leather, garm = Garments, meta = Metals and Machinery, elec = Electronics, chem = Chemicals and pharmaceuticals, wood = Wood and furniture, nonm = Nonmetallic and plastic materials, auto = Auto and auto components, oman = Other manufacturing, reta = Retail and wholesale trade, hote = Hotels and restaurants, oser = Other services and ocon = Other Construction, transportation, etc.

Source: World Bank-IFC Enterprise Survey.

Table 5 Average channels and determinants in FDI companies by sector and region

Sectors	texti	leat	garm	food	meta	elec	chem	wood	nonm	auto	oman	reta	hote	oser	ocon	Total
Number of FDI observations	378	61	457	973	565	181	526	63	423	29	1236	1839	273	980	363	8347
% of FDI obs. in sectorial sample	10.9%	14.2%	8.8%	12.1%	12.6%	26.2%	15.9%	14.6%	98.1%	6.7%	15.2%	12.3%	11.0%	15.6%	10.2%	12.8%
AFRICA																
Quality certificate	0.35	0.58	0.20	0.39	0.35	0.54	0.44	0.18	0.35		0.31	0.24	0.36	0.36	0.34	0.32
Licensed foreign technology	0.23	0.00	0.20	0.30	0.26	0.46	0.30	0.12	0.32		0.18	0.02	0.03	0.08	0.03	0.14
% of indirect exports over total	7.46	2.70	8.99	2.24	3.68	0.62	1.80	1.47	1.56		1.80	2.11	1.87	3.23	0.47	2.65
% of inputs of domestic origin	39.76	.	42.06	66.10	52.37	40.38	40.20	52.67	50.79		47.77	41.40	71.00	35.48	49.64	50.32
% skilled workers	0.57	.	0.65	0.57	0.61	0.74	0.55	0.79	0.62		0.61	0.42	0.88	0.60	0.43	0.60
CENTRAL AMERICA																
Quality certificate	0.36		0.45	0.40	0.58	1.00	0.52		0.29		0.31	0.37	0.38	0.35	0.56	0.40
Licensed foreign technology	0.55		0.45	0.26	0.17	0.25	0.43		0.24		0.31	0.00	0.00	0.00	0.00	0.16
% of indirect exports over total	28.55		11.55	4.40	5.42	0.00	5.33		0.00		7.83	5.96	18.04	5.03	7.94	7.50
% of inputs of domestic origin	22.35		26.86	58.29	27.08	30.00	30.67		35.00		45.23	.	.	.	.	42.40
% skilled workers	0.69		0.69	0.49	0.71	0.49	0.70		0.54		0.65	.	.	.	.	0.60
CARIBBEAN																
Quality certificate	0.41		0.22	0.47	0.00	0.67	0.40		0.36		0.27	0.33	0.37	0.28	1.00	0.32
Licensed foreign technology	0.25		0.44	0.20	0.33	0.33	1.00		0.00		0.03	0.00	0.00	0.00	0.00	0.10
% of indirect exports over total	3.51		22.11	6.00	0.00	0.00	8.00		2.27		8.91	0.64	20.44	6.68	0.00	7.46
% of inputs of domestic origin	46.02		30.78	69.00	53.00	36.67	56.25		45.45		50.68	.	.	.	.	48.28
% skilled workers	0.30		0.66	0.59	0.70	0.37	0.57		0.65		0.64	.	.	.	.	0.61
EAST ASIA																
Quality certificate	0.23	0.00	0.24	0.66	0.67	0.74	0.67	0.40	0.58	0.50	0.57	0.39	0.41	0.42	0.22	0.51
Licensed foreign technology	0.15	0.33	0.19	0.32	0.37	0.42	0.57	0.25	0.36	0.40	0.35	0.00	0.00	0.00	0.00	0.29
% of indirect exports over total	9.46	30.67	8.11	6.05	8.61	19.42	5.89	14.25	12.03	18.10	8.83	9.40	0.00	14.25	0.00	10.74
% of inputs of domestic origin	51.23	28.33	29.52	69.35	40.49	27.08	41.51	53.16	45.11	20.00	29.55	0.00	7.14	19.13	20.00	37.05
% skilled workers	0.72	0.68	0.81	0.70	0.79	0.89	0.78	0.87	0.83	0.80	0.79	1.00	.	0.60	0.50	0.81
EASTERN EUROPE																
Quality certificate	0.48		0.20	0.58	0.59	0.75	0.57	1.00	0.62		0.46	0.36	0.38	0.55	0.66	0.48
Licensed foreign technology	0.35		0.43	0.44	0.39	0.44	0.37	0.00	0.34		0.18	0.03	0.00	0.00	0.10	0.21
% of indirect exports over total	8.69		12.54	2.72	6.39	2.97	1.98	0.00	3.53		4.92	1.23	5.25	4.40	1.29	4.15
% of inputs of domestic origin	57.30		15.32	68.56	52.63	48.37	44.07	.	47.60		43.80	70.00	.	.	39.58	48.10
% skilled workers	0.71		0.76	0.62	0.74	0.75	0.76	.	0.60		0.70	0.79	.	1.00	0.55	0.70

Sectors	texti	leat	garm	food	meta	elec	chem	wood	nonm	auto	oman	reta	hote	oser	ocon	Total
MENA																
Quality certificate					0.00		0.00				1.00	0.60	1.00	0.75		0.60
Licensed foreign technology					0.00		1.00				0.00	0.00	0.00	0.00		0.05
% of indirect exports over total					1.00		0.00				0.00	4.20	0.00	5.00		3.20
% of inputs of domestic origin					7.00		30.00				25.00	.	.	.		18.80
% skilled workers					0.19		0.54				0.89	.	.	.		0.54
SOUTH AMERICA MEXICO																
Quality certificate	0.29		0.18	0.47	0.68	0.74	0.61	0.50	0.63	0.94	0.41	0.31	0.38	0.31	0.27	0.43
Licensed foreign technology	0.20		0.15	0.28	0.40	0.42	0.48	0.25	0.39	0.72	0.13	0.00	0.00	0.00	0.01	0.19
% of indirect exports over total	4.88		3.95	2.46	5.32	0.97	1.81	0.00	4.90	3.50	4.49	1.76	1.54	2.71	1.01	2.97
% of inputs of domestic origin	57.26		53.82	72.08	52.08	48.88	47.93	93.75	50.55	74.72	53.86	70.00	.	83.33	20.00	56.81
% skilled workers	0.70		0.81	0.55	0.68	0.69	0.64	0.57	0.59	0.85	0.65	0.56	.	0.95	0.10	0.64
SOUTH ASIA																
Quality certificate	0.69	0.33	1.00	0.64	0.67	1.00	0.53	1.00	0.75		0.50	0.29	0.21	0.29	0.00	0.47
Licensed foreign technology	0.38	0.50	0.67	0.18	0.67	1.00	0.73	0.50	0.50		0.25	0.03	0.00	0.00	0.00	0.28
% of indirect exports over total	18.04	0.00	33.33	14.09	10.00	0.00	0.00	0.00	0.00		0.00	8.00	0.00	3.57	0.00	6.61
% of inputs of domestic origin	47.29	40.00	10.00	75.00	46.11	2.50	19.20	70.00	81.25		69.33	5.91	55.00	70.00	.	42.15
% skilled workers	0.63	0.42	0.63	0.69	0.76	.	0.57	0.46	0.74		0.94	0.70	.	.	.	0.69
SMALL ISLANDS																
Quality certificate	0.00	1.00	0.25	0.33	0.33	1.00	1.00	0.11	0.50	0.00	0.21	0.29	0.26	0.25	0.43	0.29
Licensed foreign technology	0.00	0.00	0.38	0.43	0.33	0.00	0.50	0.22	0.33	0.00	0.29	0.05	0.00	0.04	0.00	0.13
% of indirect exports over total	20.86	0.00	16.88	2.56	11.11	0.00	0.00	0.31	1.67	0.00	7.14	2.60	10.00	16.50	2.00	6.19
% of inputs of domestic origin	25.14	0.00	40.00	39.15	32.14	0.00	12.50	60.88	57.83	10.00	43.17	56.75	.	22.50	.	42.34
% skilled workers	0.38	.	0.49	0.49	0.52	.	.	.	0.74	.	0.27	.	.	.	.	0.46

Note: Where texti = Textiles, leat = Leather, garm = Garments, meta = Metals and Machinery, elec = Electronics, chem = Chemicals and pharmaceuticals, wood = Wood and furniture, nonm = Nonmetallic and plastic materials, auto = Auto and auto components, oman = Other manufacturing, reta = Retail and wholesale trade, hote = Hotels and restaurants, oser = Other services and ocon = Other Construction, transportation, etc.

Source: World Bank-IFC Enterprise Survey.