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THE EFFECTS OF FINANCIAL DEVELOPMENT ON FOREIGN DIRECT INVESTMENT

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ABSTRACT

This paper empirically investigates the various effects that source and destination countries' financial development (SFD and DFD respectively) have on foreign direct investment (FDI).We establish causality by exploiting variations in both country-specific financial development and sector-specific financial vulnerability. This approach is made possible by our use of detailed databases on real manufacturing FDI projects worldwide. We find that both SFD and DFD have a large positive influence on greenfield, expansion, and mergers & acquisitions FDI, by directly increasing access to external finance and indirectly promoting manufacturing activity. The overall economic impacts of SFD and DFD tend to be similar but their direct and indirect effects vary across margins and types of FDI.

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A data appendix is available at http://www.nber.org/data-appendix/w23309

1 Introduction

Many countries actively seek to attract foreign direct investment (FDI) because they believe that multinational enterprises will contribute to economic growth by creating new job opportunities, increasing capital accumulation, and raising total factor productivity. Indeed, a large body of empirical evidence shows that FDI tends to generate net gains for both home and host countries.[1] The growth-enhancing effects of FDI flows have motivated a thorough investigation of their determinants. Robust push and pull factors are market size, cultural and physical proximity, relative labour market endowments, and corporate tax rates (Eicher et al., 2012; Blonigen and Piger, 2014). Financial development should certainly be added to this list.[2] FDI flows strongly grew during the period 2003-2007 but experienced an abrupt decline the two following years.[3] The fact that the tight external financing conditions resulting from the global financial crisis have been partly blamed for this fall (UNCTAD, 2010) suggests that access to external finance is an important determinant of FDI. We investigate this issue, by providing a comprehensive and causal exploration of the various effects that source and destination countries' financial development (SFD and DFD respectively) have on FDI.

We are not the first cross-country study to look at the effects of financial development on FDI.[4] However previous research broadly suffers from three key shortcomings: inadequate measurement of FDI, absence of causal identification, and limited scope.

The majority of studies have used balance of payments (BOP) FDI data, aggregated at the country-level. While widely available, these data provide a poor picture of the international expansion of multinational enterprises (MNEs) because they only include the funds which have been provided by parent companies in the forms of equity capital, intercompany debt, or reinvested earnings.[5] They notably ignore external funds raised in host countries, preventing any examination of the impact of DFD on real FDI and possibly leading to the wrong conclusions; if SFD and DFD are substitutes, higher investment in new or existing foreign affiliates can occur despite observing lower BOP FDI.[6] BOP FDI data also provide a murky picture of foreign investment by being reported on a net basis and mixing together flows of funds for new foreign affiliates, existing foreign affiliates, and parent companies. Hence, without a good proxy

[1] Excellent surveys of the literature can be found in Moran (2001), Navaretti and Venables (2005), Caves (2007) Dunning and Lundan (2008), or Moran (2011).

[2] The World Economic Forum (World Economic Forum, 2012) defines financial development in its 2012 *Financial Development Report* as "the factors, policies, and institutions that lead to effective financial intermediation and markets, as well as deep and broad access to capital and financial services" (p.3).

[3] Global FDI flows declined by 20% in 2008 and a further 37% in 2009.

[4] See, for example, Hausmann and Fernàndez-Arias (2000), Albuquerque et al. (2005), Di Giovanni (2005), Ang (2008), Hijzen et al. (2008), Coeurdacier et al. (2009), Hyun and Kim (2010), or Mohamed and Sidiropoulos (2010). These studies tend to find a positive but not always statistically significant impact of SFD or DFD on balance of payments FDI flows or cross-border mergers and acquisitions (M&A) transactions.

[5] For example, Feldstein (1995) points out that the total value of assets of U.S. foreign affiliates (what he calls the 'natural' definition of U.S. FDI stock) was almost three times greater than the 'narrow' BOP definition of U.S. FDI stock in 1989.

[6] Note that this issue cannot be solved by the use of bilateral FDI data.

for real FDI, investigating the impact of SFD and DFD on the foreign expansion of firms is difficult.

To a certain extent, this measurement issue disappears when studies use data on cross-border M&A. However, this does not solve the problem of causal identification. Financial development is likely to be correlated with other country attributes which can influence FDI, such as overall institutional quality, human capital, natural resources, capital controls liberalisation, or foreign ownership restrictions. Even with a large number of control variables, the risk of an omitted variable bias remains and multicollinearity may become an issue. Some studies have included country fixed effects, controlling in that way for any time-invariant factor potentially correlated with financial development. As discussed by Coeurdacier et al. (2009), this strategy may not be fruitful. Measures of financial development often exhibit low time-series variation, generating imprecise estimates, and relying on time-series variation to identify the parameters does not necessarily lead to the estimation of the relationship of interest if permanent and transitory changes in financial development have very different effects on FDI.[7] Overall, without a proper identification strategy, it is nearly impossible to establish that SFD and DFD are long-run causal determinants of FDI.

As a way of circumventing a potential omitted variable, a few studies use confidential firm-level data from a single source country (Japan or the United States) and rely on ingenious natural experiments to identify the causal effects of SFD on the occurrence of Japanese FDI (Klein et al., 2002) or of DFD on the sales or capital expenditures of U.S. foreign affiliates (Desai et al., 2006; Antras et al., 2009). The estimated effects are largely positive. However, these studies are confined to specific events and specific source countries, casting doubt on the external validity of their findings. They also do not cover how the effects of SFD and DFD can diverge with the nature of the FDI project (greenfield, M&A, or expansion) or across margins of FDI (occurrence and number of FDI projects vs. average size of the projects).[8] Finally, they do not explore in a comprehensive manner the direct and indirect effects that SFD and DFD can have on FDI. While the vast majority of existing studies have stressed how financial development can increase FDI by improving access to external finance, SFD and DFD may also have indirect and not necessarily positive impacts on FDI, by promoting overall economic activity in source and destination sectors.

In response to these various gaps in the literature, we use comprehensive and under-exploited data on real manufacturing FDI projects during the period 2003-2006 to investigate the various

[7] For instance, average inward FDI may be higher in countries where the average stock market capitalisation to GDP ratio is higher, because it reflects easier access to external finance or more potential targets for cross-border M&A. However, temporary departures of the ratio of stock market capitalisation to GDP from its average size may have a negative impact on inward FDI if foreign investors are attracted by temporarily undervalued host-country assets (so-called 'fire-sale' FDI). Hence, in this scenario, the time-series effect of DFD on FDI would not not be informative of the cross-sectional effect of DFD on FDI.

[8] Policymakers may be particularly interested in work on greenfield and expansion FDI as they tend to perceive these foreign projects as having more benefits, in terms of new jobs and production activity created, than M&A (Sauvant, 2009).

effects of financial development on bilateral FDI in a difference-in-differences approach, where we exploit variations in both country-specific financial development and sector-specific financial vulnerability. In doing so, we can make a substantial contribution to the existing literature. Our data provide us with a worldwide coverage of source and destination countries and allow us to look at the impacts of both SFD and DFD on FDI. We have the opportunity to investigate how various types of real FDI (greenfield, expansion, M&A) at different margins (extensive or intensive) respond to financial development. By focusing on the relationship between sector-specific dependence on external finance and financial development, our identification approach, which is novel in the context of bilateral FDI, increases the likelihood that we identify causal effects.[9] The intuition is that engaging in FDI involves substantial upfront fixed costs that financially vulnerable firms (i.e. firms with high requirements for external capital) will struggle to finance without easy access to external finance (Buch et al., 2009). Hence, causal effects of SFD and DFD can be isolated by looking at whether financial development has a disproportionate impact on FDI in more financially vulnerable manufacturing sectors. Finally, to a certain extent, we are able to decompose the total effects of SFD and DFD into the direct and indirect effects suggested by our integrative literature review.

Our empirical results unambiguously indicate that a deep financial system in source and destination countries strongly facilitates the international expansion of firms through FDI. The total effects of SFD and DFD on relative greenfield FDI in financially vulnerable manufacturing sectors, as well as on the overall level of aggregate greenfield FDI, are positive, statistically significant, economically large, and complementary. SFD and DFD have net positive effects on new greenfield FDI by directly increasing access to external finance and indirectly promoting manufacturing activity in source and destination countries. This direct impact of financial development accounts for most of the total effects of SFD and DFD and primarily operates at the intensive margin through its positive contribution to the average size of FDI projects. Expansion FDI and M&A FDI also positively respond to greater SFD and DFD but not necessarily in the same way as greenfield FDI. Lastly, economic impacts of SFD and DFD on FDI appear to be similar overall, but they do not necessarily have the same influence on the extensive and intensive margins of the different types of FDI. These results substantially expand existing research on FDI. In common with the few studies which have investigated in a causal manner some of the effects of SFD or DFD on FDI, we find a positive effect of financial development on the expansion of MNEs. However, we reach this conclusion by very different means,[10] and

[9] See, among others, Rajan and Zingales (1998), Beck (2002), Braun and Larrain (2005), Kroszner et al. (2007), Manova et al. (2011), Chor and Manova (2012), or Manova (2013) for use of this identification strategy in the fields of economic growth or international trade.

[10] In the most recent version of their working paper, using a difference-in-differences approach similar to ours, Bilir et al. (2014) investigate the effects of DFD on the levels of foreign sales of U.S. MNEs. They also find an overall positive effect of DFD on the relative volume of sales in financially vulnerable sectors. However, most of their discussion and robustness checks tend to be focused on how DFD influences the share of affiliate sales to various destination markets. Hence, while their paper is extremely rich, a larger fraction of our paper is devoted to the analysis and robustness of the effects of DFD on relative FDI in financially vulnerable sectors. In addition,

our findings yield novel insights.

Our research has implications for our understanding of both the effects of FDI on economic growth and the functioning of MNEs' internal capital markets. Many studies have stressed that a well-developed financial system is crucial for local firms to benefit from foreign technology spillovers (Hermes and Lensink, 2003; Alfaro et al., 2004, 2009, 2010) while other studies have highlighted positive links between the domestic and foreign activities of firms (Desai et al., 2005, 2009; Herzer, 2010; Navaretti et al., 2010). We show that SFD and DFD promote outward and inward FDI, thereby contributing indirectly to economic growth in source and destination countries. Highlighting the role of external finance in the expansion of MNEs also helps to understand the sources and limitations of their internal capital markets. The financial advantage that foreign firms tend to enjoy over local firms (Desai et al., 2004b, 2008; Alfaro and Chen, 2012) is related to their home countries' financial depth and, beyond short-term horizons, MNEs cannot fully bypass restricted local access to external finance by making use of foreign sources of funds.

Finally, our study is related to works investigating the effects of credit constraints on international trade. The positive effect of SFD on the volume of exports of firms belonging to financially vulnerable sectors is well documented.[11] Expansion through FDI involves much higher fixed costs than exports (Buch et al., 2010), and therefore our results are fully in agreement with those of the trade literature.

The rest of the paper proceeds as follows. In Section 2, we review the various effects that SFD and DFD are likely to have on FDI. In Section 3, we describe our FDI data. and introduce our difference-in-differences models. In Section 4, we describe our variables of interest and the estimation methods. We also provide some stylized facts. In Section 5, we present our empirical results. Finally, we conclude in Section 6.

2 The various effects of financial development on FDI

In this section, we examine in an integrative literature review the various structural effects that SFD and DFD may have on FDI.[12] When discussing the existing empirical literature, we focus on the few studies which have adopted robust causal identification strategies.

their sample is limited to the foreign activities of MNEs headquartered in the United States, they ignore the role of SFD, and they do not distinguish between various types of FDI.

[11] See for example Beck (2002, 2003), Amiti and Weinstein (2011), or Manova (2013). Foley and Manova (2015) provide an excellent survey of this literature.

[12] In the short run, MNEs may engage in opportunistic FDI to take advantage of a transient improvement of financial conditions at home (Baker et al., 2009) or temporary disruptions in host countries' financial markets (Krugman, 2000; Aguiar and Gopinath, 2005; Desai et al., 2008). Given our identification strategy, which largely rely on cross-country differences in financial development, this 'short-term' literature is beyond the scope of this paper.

2.1 Direct effects

Firms wishing to engage in FDI must incur substantial upfront fixed costs. As for exporting, market research needs to be done to identify profitable destinations and learn about their specificities, products may have to be modified to meet foreign tastes or regulatory requirements, distribution and servicing channels must be established (Roberts and Tybout, 1997). Some of these costs may have to be incurred once and may not apply for follow on investments. However, crucially, each new FDI project also involves establishing or purchasing a production facility in the destination country (Helpman et al., 2004; Buch et al., 2010). The ability of firms to finance the upfront fixed costs of FDI with internal funds varies across sectors. Some sectors are technologically more dependent on external finance, meaning that firms' desired investment levels typically exceed their internal cash flows. This may be due to a large initial project scale, a long gestation period, a short harvest period, or the requirement for continuing investment (Rajan and Zingales, 1998). Firms in these financially vulnerable sectors will have to rely heavily on external finance to engage in FDI since they will only be able to internally finance a small fraction of the fixed costs of FDI (Buch et al., 2009, 2010).[13] Firms' access to external finance depends on financial development. Hence, higher SFD should have a ***positive*** *direct external finance effect* on the volume of outward FDI, which ought to be larger in more financially vulnerable sectors.[14] Klein et al. (2002) provide some evidence that credit constraints influence outward FDI. They show that the number of FDI projects undertaken by Japanese firms in the United States during the Japanese banking crisis was inversely correlated with the deterioration of the financial health of their main bank. Their results suggest that a rise in firm-specific credit constraints resulted in lower FDI.

Higher DFD can also have a ***positive*** *direct external finance effect* on the volume of inward FDI if a fraction of the external financing required by financially vulnerable firms to engage in FDI is raised in the destination country. Firms may choose to use this source of external finance if local financing conditions are favourable (Desai et al., 2004a; Harrison et al., 2004a; Shapiro, 2006). They may also be constrained to do so if source countries' financial institutions are reluctant to fully cover the costs of FDI (or ask for a risk premium) because monitoring a foreign project and enforcing cross-border claims raise difficulties which are not present with the financing of a domestic project (Buch et al., 2009; Bilir et al., 2013). The importance for U.S. MNEs to operate in host countries with high DFD is highlighted in Feinberg and Phillips (2004), Desai et al. (2006), and Bilir et al. (2014). These three studies show that the expansion

[13] External finance is a complementary source of funds for these firms because the range of their investment opportunities expands with its availability. This does not necessarily imply that external finance will be accessed after exhaustion of internal funds. Firms can raise more external funds than the level of their internal funds would dictate if they find advantageous to do so, e.g. to benefit from the tax deductibility of interest payments or simply to maintain financial slack. See the survey of chief financial officers on their capital structure choice by Graham and Harvey (2001).

[14] Low endowment in tangible assets that might serve as collateral can be another source of financial vulnerability (Braun, 2003; Buch et al., 2009; Manova, 2013).

of the activities of U.S. foreign affiliates is constrained in host countries where external finance is relatively limited and expensive, despite the inherent financial advantage that foreign affiliates have over local firms as a result of their access to internal capital markets (Desai et al., 2004b).[15]

While SFD and DFD can be expected to have a joint positive impact on FDI, SFD is likely to matter relatively more for the funding of new FDI. Parent companies have had time to develop close relationships with their lenders in the home country and the literature on banking relationship suggests that these repeated interactions tend to translate into better borrowing conditions, such as an increase in the availability of credit or favourable contract terms (Boot, 2000; Ongena and Smith, 2000). In contrast, relationships between the parent company (or the new foreign affiliate) and local banks in host countries may be more tenuous.

Antras et al. (2009) raise the possibility that higher DFD can have a ***negative*** *direct disintegration effect* on FDI if it encourages greater substitution of foreign outsourcing for integration. The reason is that lenders are less likely to require the MNE to hold an equity share in its financially vulnerable foreign partner in countries with deep financial development because strong financial institutions ensure that the efforts of the entrepreneur are monitored and aligned with value maximization. Higher DFD may therefore alleviate the external pressure on an MNE to hold a controlling interest in foreign firms involved in its supply chain, reducing in that way its engagement in FDI. Antras et al. (2009) empirically confirm this theoretical prediction by showing that U.S. firms tend to engage more in arm's length technology transfers as opposed to only engaging in FDI in more financially developed countries. However, this finding does not imply that greater DFD necessarily reduces overall multinational activity. Antras et al. (2009) theoretically and empirically show that higher DFD increases the number and scale of U.S. foreign affiliates due to stronger investor protections.[16] Hence, in destination countries, the positive direct access to external finance effect of DFD is likely to dominate any potential negative direct disintegration effect.

2.2 Indirect effects

Beyond their direct effects, higher SFD and DFD can also have an influence on FDI through their promotion of overall economic activity, especially in financially vulnerable sectors (Rajan and Zingales, 1998; Braun, 2003; Klapper et al., 2006; Manova, 2013).

In source countries, the higher number of potentially larger producers associated with more SFD should mechanically increase the number of FDI projects in a given sector. At the same time, more active firms can also lead to an increase in competition. On the one hand, lower

[15]This study shows that parent borrowing partly substitutes for external borrowing in host countries where low financial development results in a relatively high cost of external finance.

[16]In addition, vertical integration of suppliers in countries with low DFD requires MNEs not to be themselves financially constrained by host countries' financial development. As previously mentioned, this is unlikely to be the case, especially in financially vulnerable sectors.

profits for each firm operating in the sector may reduce the ability of some of them to engage in FDI, for instance because a share of the fixed costs of each FDI project must be covered by firms' internal funds. On the other hand, stronger domestic competition could encourage firms to allocate a greater fraction of their limited financial resources towards foreign expansion rather than domestic expansion,[17] and greater financial development should allow firms to compensate part of the shortfall in internal funds with external funds. Empirically, in the context of the effects of credit constraints on international trade, Manova (2013) finds that financial development indirectly increases exports through its positive impact on overall production. This suggests that the ***positive*** *indirect access to external finance effect* of SFD is likely to dominate any potential ***negative*** *indirect competition effect*.

In destination countries, Ju and Wei (2010) and Bilir et al. (2013) have highlighted that DFD can also have a ***negative*** *indirect competition effect* in making a country a less attractive destination than before to MNEs. This ought especially to be the case for FDI aimed at serving the local market because, with higher DFD-induced entry of (local and foreign) producers, the price of local inputs may increase and, relative to MNEs targeting other markets, the volume of their (potential) sales unambiguously falls.[18] The empirical results of Bilir et al. (2013) are consistent with greater DFD having a negative indirect competition effect on FDI in addition to a positive direct financing effect. The overall sales of U.S. MNEs are larger in financially advanced countries, but both the level of individual affiliates' local sales and the share of local sales in total affiliate sales fall when DFD increases.

While greater sector-specific activity may increase competition forces, it is also likely to generate external economies of scale, which can encourage firms to agglomerate in a given location rather than disperse their activities to avoid competition.[19] For example, Crozet et al. (2004) provide a simple theoretical model in which they highlight how the overall effect of a large number of firms on the profit of a prospective foreign investor is ambiguous due to the existence of both a negative competition effect and a positive agglomeration externality. Their empirical evidence, consistent with earlier work (Head et al., 1999; Barrell and Pain, 1999; Norbäck, 2001), suggests that the latter effect dominates as they find that a larger number of existing domestic and firms in a given sector and location has a positive influence on the location choice of MNEs (see also Bobonis and Shatz (2007)).[20] Overall, the growth of local

[17]The redeployment of scarce financial resources by MNEs towards more profitable markets when economic conditions change in a given market have been put forward by Stein (1997), Mudambi (1999), Feinberg and Phillips (2004), and Bilir et al. (2014).

[18]Unfortunately, our data do not allow us to distinguish between vertical and horizontal FDI.

[19]These economies of scale may be due to information sharing, labour market pooling or the existence of specialised suppliers (see Rosenthal and Strange (2004) for a survey).

[20]It could be argued that this positive agglomeration effect purely reflects the tendency of foreign firms to locate in geographical areas with favourable sector-specific factor endowments, as signalled by the large volume of production in a given sector. This is unlikely to be entirely the case. In the absence of agglomeration benefits, clustering of firms would gradually make the location *less* attractive by increasing the competition among firms for access to the same local inputs or local market (Head et al., 1995). It is also much harder to explain, on the basis

manufacturing sectors induced by higher financial development should have a ***positive*** *indirect agglomeration effect* on inward FDI, which is likely to dominate any potential negative indirect competition effect. The possibility of an indirect agglomeration effect has been neglected by the existing literature.

2.3 Type and margins of FDI

2.3.1 Greenfield, M&A, expansion FDI

Firms can initially invest abroad by establishing a new foreign affiliate (greenfield FDI) or acquiring an existing local firm (M&A FDI). The various effects of financial development that we have discussed in this section should broadly influence in similar ways both modes of entry, although qualifications may be raised. It could be argued that the access to external finance effect of financial development matters less for M&A FDI. Relative to establishing a new foreign affiliate, the purchase of an existing firm may involve smaller fixed costs because it allows a foreign investor to save on some costs, such as the identification of distribution and servicing channels (Caves, 2007). Nevertheless, the acquisition price is likely to reflect the value of these intangible assets and, for both types of FDI, firms in financially vulnerable sectors should still benefit from greater financial development to finance the acquisition of new or existing foreign assets. It could also be pointed out that most papers discussing the impact of existing sector-specific activity on the attraction of MNEs seem to have in mind, or deal with, greenfield FDI. A negative indirect competition effect can still occur for M&A FDI, although its potential existence could be weaker than for greenfield FDI given that a M&A does not add another seller to the market and may eliminate a potential rival (Navaretti and Venables, 2005; Caves, 2007). A high volume of existing sector-specific activity can also increase the quantity (Head and Ries, 2008) and the quality of potential targets.

Once their initial FDI has been made, some MNEs may decide to expand the activities of their foreign affiliate and, for a fraction of them, will again require access to external finance. Several reasons argue for a larger role of DFD than SFD in the financing of this expansion FDI in financially vulnerable sectors. As mentioned in the previous section, the literature suggests that financially vulnerable firms have to rely on both SFD and DFD to finance a new FDI because cross-border projects are difficult to monitor and international claims cannot be easily enforced. To a large extent, this dual financing need disappears with expansion FDI, since it does not involve a cross-border investment and the foreign affiliate has established local banking relationships. In addition parent companies in financially vulnerable sectors ought

of a factor-endowment location theory only, the positive impact that the agglomeration of domestic firms in the same industry but different sites exerts on the location of foreign firms in a given location. The coefficient on the existing volume of sector-specific activity in a given activity is more likely to encompass both endowments effects and agglomeration effects. Barry et al. (2003) attempt to make this decomposition when investigating the location of foreign firms in Ireland. They find that the coefficient on the proxy for the endowment effect is frequently non-significant when proxies for efficiency agglomeration benefits are included in the estimated location model.

to face constraints on the total amount of external finance they can raise. They are therefore likely to encourage their established foreign affiliates to be financially autonomous in order to preserve some financial slack, notably for situations where their involvement can be mandatory, e.g. establishment of a new foreign affiliate.[21] Brooke and Remmers (1978) present case studies showing that foreign affiliates quickly acquire financial autonomy and Feinberg and Phillips (2004) show how financially-constrained MNEs prioritise the use of their scarce financial resources within their international network. Notwithstanding these arguments, SFD may nevertheless play a complementary role by allowing parent firms to finance the fixed costs related to managing a more complex international production network (Yeaple, 2003).

2.3.2 Extensive and intensive margins of FDI

The existence and strength of each distinct effect of financial development can be expected to vary across the margins of FDI. Following Mayer and Ottaviano (2008), the yearly volume of bilateral FDI (FDI_{ijst}) between two countries i and j in a given sector s can be decomposed into the number of FDI projects (N_{ijst}), the extensive margin, and the average size of FDI projects ($\left(\frac{FDI_{ijst}}{N_{ijst}}\right)$), the intensive margin. An alternative formulation of the extensive margin is whether FDI is greater than zero ($FDI_{ijst} > 0$).[22]

The direct positive access to external finance effect should operate at both the extensive and intensive margins of FDI, as long as the fixed costs of FDI are not independent of the volume of production in the foreign country. The intuition is that a large volume of production ought to require a larger fixed investment compared to a smaller volume of production, e.g. a bigger production facility may need to be built or acquired. In the presence of financial constraints, some firms may not be able to engage in FDI. Other firms may choose to produce lower quantities in order to reduce the fixed costs necessary to engage in FDI because they cannot afford the level of external finance required to produce at the optimal scale in the foreign market. For this second group of firms, FDI will therefore occur but the size of the FDI project will be smaller than in the absence of financial constraints.[23] Conversely, with higher financial development, more firms will be able both to engage in FDI and to afford the fixed costs consistent with their optimal production levels, causing an increase in the probability of observing FDI as well as

[21] This does not prevent parent companies from facilitating their foreign affiliates' access to external finance by guaranteeing the local loans made to the latter (Shapiro, 2006).

[22] As surveyed in Gopinath et al. (2013), the trade literature tends to decompose exports into the number of exporters (firm extensive margin) and the average exports per exporter (firm intensive margin). However trade papers which do not have access to disaggregated data classifies the presence of positive exports to a country as the extensive margin and the value of exports conditional on positive exports as the intensive margin. See for example Egger et al. (2011).

[23] Given our empirical measure of FDI, we focus on the initial fixed costs of FDI. In Buch et al. (2009), firms wishing to engage in FDI face the same fixed cost of market entry but do not have the same liquidity constraints. In the presence of a binding collateral constraint firms with limited internal funds have to restrict output below the optimal level because these firms cannot fully cover the variable costs associated with greater production. See also Manova (2013) for a very similar discussion in the context of international trade.

in the number and average size of FDI projects.[24] As previously discussed, at the intensive margin, the direct positive access to external finance effect of SFD is likely to be stronger than that of DFD for greenfield FDI whereas the opposite is likely to be true for expansion FDI. In the case of M&A, SFD and DFD may equally matter if the foreign buyer benefits from the local banking relationships previously established by the seller.

Regarding the other effects of financial development, the existing literature shows that they operate mainly at the extensive margin by influencing the number of firms desiring to establish an affiliate in a given foreign location through greenfield or M&A FDI. However, based on firm-level foreign affiliates' sales data, the findings of Braunerhjelm and Svensson (1996) and Bilir et al. (2014) suggest, respectively, that the DFD-induced positive indirect agglomeration effect and negative indirect competition effect can also influence FDI at the intensive margin. For the latter effect, this will notably be the case if the purpose of the FDI is to serve the local market. Financial development may also have indirect effects on expansion FDI. The positive impact of SFD on the scale of sector activity should increase the probability that at least one firm expands its activity in a given location. In addition, expansion FDI is likely to share with greenfield FDI the same sensibility to the DFD-induced factors shaping host countries' attractiveness.

2.4 Expected effects of SFD and DFD on FDI flows

Overall, on the basis of this integrative literature review, we anticipate SFD and DFD to have both direct and indirect net positive effects on FDI, with the presence and influence of these effects varying across types and margins of FDI. Furthermore, each of the effects described above ought to become stronger as sector-specific financial vulnerability increases: local and foreign firms operating in sectors strongly dependent on external finance should be more sensitive to external financing conditions in source and destination countries than firms operating in sectors less dependent on external finance. We will exploit this feature in our empirical approach to establish causality. Finally, while our description of the different effects of financial development can be understood as a series of comparative statics analyses in which SFD and DFD influence MNEs' aggregate desired foreign capital stocks, we can still expect these effects to influence FDI flows. The intuition is that a change in the fundamental determinants of FDI stocks induces changes in the size of FDI flows outwith and within the new steady state. We elaborate on this point in Appendix A.

[24] The average size of each FDI project could *fall* following an increase in financial development if the number of projects grew faster than the size of each project. For example, higher financial development could disproportionately favour the entry of relatively small firms. However, results of Manova (2013) in the context of international trade do not support this possibility.

3 FDI data and econometric models

3.1 Greenfield and M&A bilateral FDI data

Our bilateral FDI data need to meet three requirements. First, they must be available for a relatively large number of manufacturing sectors. Second, they must reflect the fixed costs involved with the expansion of firms abroad. Third, values of these costs must be inclusive, in the sense that all sources of funds are accounted for.

Our greenfield and expansion FDI data come from the *fDi Markets* database compiled by fDi Intelligence, a division of the Financial Times.[25] This database is the most comprehensive source of firm-level information on cross-border greenfield investment available, covering all countries and sectors worldwide since 2003. Data include the name of the country in which the firm engaging in greenfield FDI is headquartered, the name of the destination country, the year of investment, the recipient sector, the function (nature) of the FDI project, the type of project (new, expansion), and the capital investment (capital expenditures) associated with the project.[26] There is no minimum investment size for a project to be included but the equity stake of the foreign investor cannot be lower than 10%. Data are collated through daily searches of Financial Times newswires and internal information sources, other media sources, project data received from industry organizations and investment agencies, and data purchased from market research and publication companies. Each project is cross-referenced against multiple sources, with the main focus on direct company sources. *fDi Markets* is the primary source of greenfield FDI data for various international organizations (UNCTAD, World Banks), consultancies (the Economist Intelligence Unit), major corporations and over 100 governments. Given that we do not have any parent-specific data, besides a numeric identifier, we can aggregate the firm-level data provided by the *fDi Markets* database at the country-sector level without any loss of information.[27]

Crucially for our study, the *fDi Markets* database does not make a distinction between the different sources of foreign affiliate financing, which can be internal or external to the MNE.[28] Given that we are interested in the impact of both SFD and DFD on real FDI, the absence of

[25] http://www.fdimarkets.com/

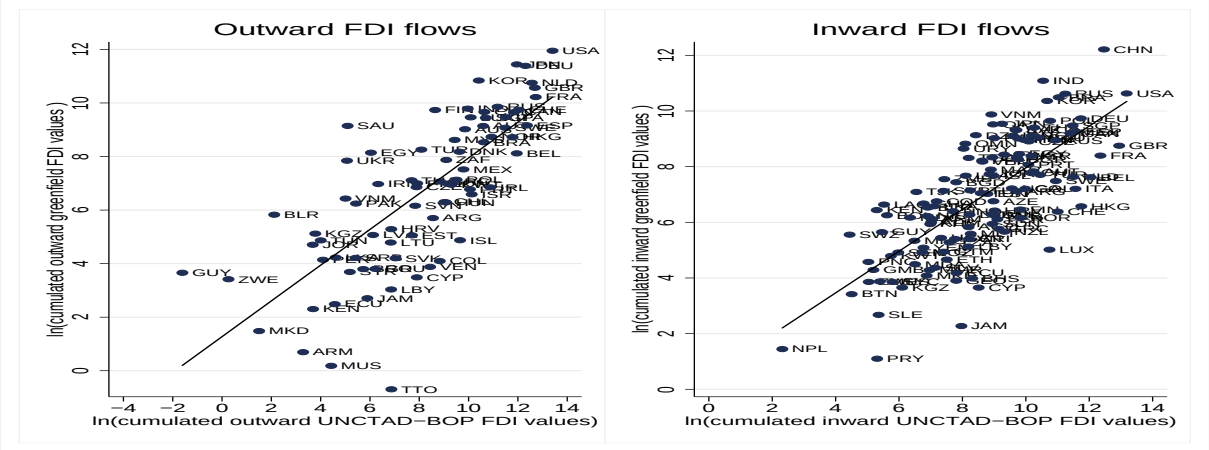
[26] Data on capital investment are based on the investment the company is making at the time of the project announcement or opening. The data include estimates for capital investment (derived from algorithms) when a company does not release the information. These estimates may introduce measurement error in our main dependent variable, the sector-specific bilateral value of FDI, generating larger variances in our estimators.

[27] Of course, we do not deny that MNEs are heterogeneous firms. For example, within a given sector, firms are likely to vary in the credit constraints that they face. What we mean is that, given the FDI data that we have, we would not obtain different results by using unit-level data (Rabe-Hesketh and Skrondal, 2012).

[28] Internal sources of funding are equity and debt provided by the parent company and funds from (potential) sister subsidiaries. External sources of funding are borrowing from unrelated sources in the parent country, destination country or third-country, and local equity. This distinction of sources of funds is porous. The internal funds provided by the parent company may have been raised externally and borrowing by the foreign subsidiary may have been done with the guarantee of the parent company.

a distinction between internal and external financing makes the data provided by *fDi Markets* database a much better measure of FDI flows than balance of payments (BOP) FDI data, which do not take into account, among other things, that a proportion of the financing for a newly-established foreign affiliate can originate from unrelated parties in the destination country.[29] Furthermore, contrary to BOP FDI flows, our FDI data only reflect the initial fixed costs incurred by firms engaging in FDI,[30] provide information on the extensive and intensive margins of FDI, are not distorted by 'round-tripping' and 'trans-shipping' phenomena,[31] are recorded on a gross basis[32] and, finally, are available for a large number of countries and sectors. Figure 1 plots the cumulated values of outward and inward greenfield manufacturing FDI over the period 2003-2006 against economy-wide FDI flows compiled by UNCTAD on the basis of BOP statistics. There is a strong correlation between the values of these two sources of FDI statistics. This suggests that the greenfield FDI data that we use in this paper are not affected by gross inconsistencies.

Figure 1: fDi Markets FDI flows vs.UNCTAD-BOP FDI flows



Note: Cumulated values over the period 2003-2006. fDi Markets FDI flows: manufacturing sectors only; UNCTAD-BOP FDI flows: all sectors.

On the basis of these data, we therefore proxy greenfield and expansion FDI as the sector-specific bilateral cumulated value of the capital investments made by firms to establish a new production facility, or expand the production capacity of an existing operation, abroad. These

[29] As previously mentioned, BOP FDI data only capture the portion of the funding of existing and new foreign affiliates coming from the parent company. Feldstein (1995) illustrates how using only BOP data fails to provide an accurate picture of the activities of U.S. MNEs abroad.

[30] BOP FDI flows also include sources of funds for already established foreign affiliates, e.g. reinvested earnings.

[31] 'Round-tripping' refers to the situation where different treatments of foreign and domestic investors encourage the latter to channel their funds into special purpose entities (SPEs) abroad in order to subsequently repatriate them in the form of incentive-eligible FDI. With 'trans-shipping', funds channeled into SPEs in offshore financial centres are redirected to other countries, leading to strong divergences between the source country of the FDI and the ultimate beneficiary owner. The *fDi Markets* database reports the ultimate parent company.

[32] BOP FDI flows are recorded on a net basis, i.e. funds that parent companies provide to their foreign affiliates net of funds that affiliates provide to their parents during a given period.

variables should capture a large fraction of the fixed costs incurred by MNEs when engaging in greenfield or expansion FDI.[33] We will also exploit in various ways the sector-specific bilateral cumulated number of new and expansion FDI projects.

A drawback of the *fDi Markets* database is that it does not cover M&A FDI flows. We remedy this issue by using the *Zephyr* database, a product from Bureau Van Djik, which provides comprehensive information on cross-border M&A deals, covering all countries and sectors worldwide since 2003.[34] Data include the name of the country in which the firm engaging in M&A FDI is located, the name of the destination country, the year of the completed transaction, the source sector, the recipient sector, the equity stake, and, sometimes, the deal value. There is no minimum deal value and data come from different media sources (news publication, company press release, stock exchange announcement, etc...). Unfortunately, deal values are missing for a large number of M&A transactions (about 60%).[35] This explains why we focus on the sector-specific bilateral cumulated number of horizontal cross-border M&A deals, involving the purchase of at least a 10% equity stake in the foreign company.

The *fDi Markets* database provides data on the recipient sector only. Hence, while we know in which sector the FDI project takes place, we have no information on whether the parent firm belongs to the same sector. We must therefore assume that the main sector of activity of the parent firm is the same sector as the sector in which the parent firm invests in the destination country. Failure of this assumption will obviously make our identification strategy less powerful, by blurring the potential link between external dependence and financial development. This is especially true on the source side; on the destination side, it can still be expected that MNEs wish to invest in countries where their foreign subsidiaries in need of external finance can acquire a large degree of financial autonomy through access to local sources of funding. Nevertheless, given that sector-level FDI data are aggregated at a relatively high level, it is likely that parents and foreign subsidiaries operate in the same broad manufacturing sectors.[36] Furthermore, we can make use of the fact that the *Zephyr* database includes the primary sectors of both the acquiring and target firms to assess in a more direct manner how much the assumption of identical source and destination sectors distorts our results.

[33] Other costs to produce and sell the goods may naturally be incurred before or after these capital expenditures. While our dependent variable does not include these costs in principle, they play a role in firms' ability to self-finance their capital expenditures.

[34] http://www.bvdinfo.com/en-gb/products/economic-and-m-a/m-a/zephyr

[35] Missing data on deal values are not a specific feature of the *Zephyr* database. Di Giovanni (2005) reports that only 44% of the cross-border deals recorded in the database produced by *Thomson Financial Securities Data* have a value attached to them.

[36] Alfaro et al. (2009) find that 70% of foreign subsidiaries operate in the same manufacturing sector as their parent at the two-digit SIC level.

3.2 Econometric models

In this section, we describe in general terms the two econometric models that we estimate. We will present in the next section our proxies for the key independent variables included in our models.

3.2.1 Overall effects of financial development

We are interested in the causal effects of SFD and DFD on FDI. This is a complicated endeavour, notably because financial development is likely to be correlated with other country attributes that can influence FDI, such as overall institutional quality, human capital, natural resources, capital controls liberalization, or foreign ownership restrictions. To establish causality with more certainty, we exploit the fact that the hypothesized effects of financial development highlighted in Section 2 should be stronger in more financially vulnerable sectors. This leads us to estimate a difference-in-differences model, where we focus on the interactions between SFD or DFD and a sector's financial vulnerability (FV):

$$FDI_{ijst} = exp(\beta_1[ln(SFD_{it-1}) \cdot FV_s] + \beta_2[ln(DFD_{jt-1}) \cdot FV_s] + \alpha_{ijt} + \alpha_{st})\epsilon_{ijst} \quad (1)$$

where FDI_{ijst} corresponds to one of our measures of the cumulated value of the fixed costs incurred by parent firms headquartered in source country i to engage in FDI in manufacturing sector s of destination country j at time t, SFD_{it-1} and DFD_{jt-1} are time-varying measures of financial development in source and destination countries respectively, FV_s is a time-invariant measure of sector-specific financial vulnerability, α_{ijt} are time-varying country-pair fixed effects, α_{st} are time-varying sector fixed effects, and ϵ_{ijst} is a multiplicative error term.

The theoretical and empirical literature suggest that key determinants of FDI are likely to be market size, income level, institutional quality, restrictions on outward and inward FDI, trade costs, and differences in factor endowments (Navaretti and Venables, 2005; Blonigen, 2005). However, as pointed out by Blonigen and Piger (2014), this list of determinants is by no means exhaustive. Instead of trying to account explicitly for all these factors in our model, we implicitly control for all the determinants of bilateral FDI at the country and country-pair levels by including time-varying country-pair fixed effects in our econometric model.[37] We also include time-varying sector-specific fixed effects to control for factors and yearly shocks which are common to sectors across countries. In this way, we limit the risk of functional form misspecification, i.e. omitted variable bias. Furthermore, we maximize sample size because we are not faced with the issue of including explanatory variables with heterogeneous spatial-temporal coverages.

[37] Note that these fixed effects capture the country-level effects of financial development on FDI, such as the promotion of a larger market size.

Identification of the overall effects of SFD and DFD on FDI is achieved through the presence of interaction terms between country-level financial development and sector-specific financial vulnerability, $[ln(SFD_{it-1}) \cdot FV_s]$ and $[ln(DFD_{jt-1}) \cdot FV_s]$. Precise identification of the coefficients on these variables, β_1 and β_2, is possible because the estimation of the parameters relies on country-sector variation in FDI, which is largely unaccounted for by the country-level fixed effects that we include in model 1.[38] The absence of fixed effects at the country-sector level also means that differences in financial development across countries can be exploited to identify the coefficients on the interaction terms, in addition to the information provided by changes in financial development within countries. Given the short time dimension of our panel, being able to use the variation in financial development between countries is crucial for a successful identification of the coefficients on the SFD-FV and DFD-FV interaction terms. A corollary is that the proxy for financial development does not have to be time-varying.[39]

β_1 and β_2 indicate, holding other factors constant, the multiplicative change in FDI in a given sector induced by higher financial development *relative* to the multiplicative change in FDI induced by the same change in financial development in a less financially vulnerable sector.[40] β_1 and β_2 correspond therefore to the overall effects of financial development on the relative volume of FDI in financially vulnerable sectors. For instance, following an increase in SFD of ΔSFD, the ratio of the factor change in FDI in a sector with high financial vulnerability to the factor change in FDI in a sector with low financial vulnerability (FV) is $exp(\beta_1[FV_H - FV_L] \times \Delta SFD)$. We expect $\beta_1 > 0$ and $\beta_2 > 0$.

3.2.2 Direct and indirect effects of financial development

In model 1, we do not control for sector-specific activity. This means that the coefficients β_1 and β_2 can be interpreted as capturing both the direct effects of financial development on FDI and the indirect effects of financial development on FDI operating through the impact of financial development on overall manufacturing activity. Hence, β_1 and β_2 capture the total effects of financial development on FDI. In a second stage, we would also like to know how much these total effects can be attributed to the direct or indirect effects of financial development on FDI. We can achieve this by including in our initial econometric model the pre-sample size of the source and destination manufacturing sectors. By controlling for this intervening variable in the relationship between financial development and FDI, the coefficients on the interaction terms between country-level financial development and sector-specific financial vulnerability will reflect the effects of financial development on FDI holding other factors fixed, including

[38] Using the number of projects as our dependent variable, calculations of pseudo-R^2 suggest that more than 50% of the variation in the dependent variable remains to be explained, once the various fixed effects are controlled for.

[39] For example, see Rajan and Zingales (1998) or Manova (2013) for the use of time-invariant measures of financial development in combination with country fixed effects.

[40] Given our multiplicative model, these difference-in-differences estimators correspond here to 'ratio-in-ratios' estimators.

sector-specific activity. These coefficients will therefore only capture the direct effects of financial development on FDI.[41]

We estimate the following augmented exponential model:

$$\begin{aligned} FDI_{ijst} &= exp(\gamma_1[ln(SFD_{it-1}) \cdot FV_s] + \gamma_2[ln(DFD_{jt-1}) \cdot FV_s] \\ &\quad +\gamma_3 ln(Y_{is}) + \gamma_4 ln(Y_{js}) + \alpha_{ijt} + \alpha_{st})\epsilon_{ijst} \end{aligned} \tag{2}$$

where Y_{is} is pre-sample value added of sector s in source country i and Y_{js} is pre-sample value added of sector s in source country j. The coefficients γ_1 and γ_2 capture only the direct effects of financial development on relative bilateral FDI in financially vulnerable sectors. This implies that we can gain some insights into the presence and relative strength of the indirect effects of financial development on FDI by examining the signs, sizes, and statistical significance of the differences $(\beta_1 - \gamma_1)$ and $(\beta_2 - \gamma_2)$. We expect these differences to be positive.

To investigate the effects of SFD and DFD at the different margins of FDI, we will re-estimate model 2 with measures of the extensive and intensive margins of FDI. Our two measures of extensive margins are: i) a binary variable taking the value of one if $FDI_{ijst} > 0$ and zero otherwise; (ii) the number of bilateral FDI projects N_{ijst}. Our measure of extensive margin is the average size of the bilateral FDI projects $\overline{FDI}_{ijst} = \frac{FDI_{ijst}}{N_{ijst}}$ when $FDI_{ijst} > 0$.

4 Independent variables and estimation method

4.1 Financial development

Our main measure of financial development ($SFD_{it-1}; DFD_{jt-1}$) is the domestic credit allocated to the private sector by banks and other financial intermediaries, normalized by GDP. This financial development measure, which reflects the actual use of external debt financing in the economy, has been extensively used in the growth, finance, and international trade literature (Levine, 2005). Data come from Beck et al. (2009). We lag this variable by one year to reduce any potential simultaneity bias and we adopt a logarithmic transformation to attenuate the influence of outlying values. The private credit to GDP ratio varies a lot across countries with a mean value of 56% and a standard deviation of 50% over the 2003-2006 period.

[41] This distinction between the direct and indirect effects of a variable is well discussed in popular textbooks, e.g. King and Levine (1994), Murray (2006), or Wooldridge (2015). Hermes and Lensink (2003) provide an illustration of these concepts when they investigate the impact of FDI on economic growth. They argue that FDI can affect growth through an indirect effect on investment or a direct effect on efficiency. They attempt to isolate the presence and strength of these two effects by first omitting and then including the investment share in GDP in their econometric models. Another example is Betts (1995), which investigates whether high school quality has a direct influence on subsequent earnings or an indirect influence through inducing students to acquire more education. To assess the existence of these various channels of influence, the author runs regressions with and without years of education.

We also verify that our results are robust to a time-invariant institution-based measure of financial development (FIN_INST). This measure corresponds to the log of the average values of two *World Bank Doing Business* indexes measuring the quality of financial institutions: the strength of legal rights index, which indicates 'the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders,' and the depth of credit information index, which assesses 'the rules and practices affecting the coverage, scope and accessibility of credit information available through either a public credit registry or a private credit bureau'.[42] Development of these financial institutions should encourage the provision of external finance by facilitating the use of a broad range of movable assets as collateral, increasing the rights of creditors in case of bankruptcy, and reducing informational asymmetries. The coefficient of correlation between the log of the private credit to GDP ratio and this measure of the quality of financial institutions suggests that it is indeed the case: it is equal to 0.52, statistically significant at the 1% level.

4.2 Measures of sector-specific financial vulnerability

Our main indicator of sector-specific financial vulnerability (FV_s) is the Rajan and Zingales (1998) measure of external dependence (ED). They calculated a manufacturing sector's need for external finance as the fraction of capital expenditures that were not financed with cash flows from operations, for a sample of publicly traded US firms in the 1980s. For each firm, the ratio was averaged over the 1980s and the final ED measure corresponds to the sector median. The key assumption underlying the validity of their ED proxy is that the ranking it generates across sectors is stable across countries because a sector's need for external finance is intrinsically linked to sector-specific, but country-invariant, technological characteristics. By using U.S. data on publicly traded firms, Rajan and Zingales (1998) increase the likelihood that they correctly identify a sector's technological demand for external financing. Large firms typically face fewer financing obstacles than small firms and if there is any country in which firms' actual use of external finance reflects their desired level, the United States is perhaps the closest one can find, given the sophistication of its financial system.

Firms which rely on external finance to conduct their day-to-day trading operations or invest in new growth opportunities at home can be expected to be those which need external financing to expand abroad. The establishment or expansion of a foreign affiliate requires substantial purchases of new (e.g. land, building, machinery) or existing foreign fixed assets. It is also plausible that any product which entails high R&D, marketing or distribution costs at home will similarly involve large customisation, marketing and distribution fixed costs when produced and

[42] Data, definitions, and more information can be found at http://www.doingbusiness.org/data/exploretopics/getting-credit/. Both indexes have been rescaled on a common 1-10 scale (worst to best). Given that data are only available for the years 2005 and 2006, we use the average size of each index over these two years to construct our institution-based measure.

sold in foreign markets (Manova, 2013). The ED measure developed by Rajan and Zingales (1998) is based on a sample of large U.S. companies which are likely to have activities abroad. This sample composition helps to make it a good proxy for the typical external financing needs of MNEs in a given sector.

Table 5 in Appendix B provides the values of this measure of financial vulnerability for the 13 broad manufacturing sectors present in the *fDi Markets* database. Most sectors (85%) have a positive and large dependence on external finance (ED $\geq$ 0.19 for 60% of them).

4.3 Measure of sector-specific manufacturing activity

Our sector-specific data on manufacturing value added come from the CEPII *Trade and Production Database*.[43] We use information on value added in 2002 for the whole period covered by our FDI data (2003-2006). There are two reasons for this. First, using pre-sample values reduces a simultaneity bias between our dependent variables and manufacturing activity and we still expect the 2002 values to reflect structural differences in sector-specific activity across countries. Second, non-missing values are the most prevalent in this year, although our sample is still reduced by half when we estimate model 2.

4.4 Sample and estimation method

The sample varies depending on the dependent variable used. Concerning greenfield FDI projects, at the most disaggregated level, the underlying data that we use to estimate models 1 and 2 correspond to 7604 FDI projects in a production or processing facility made by 3919 parent companies located in 83 source (developed and developing) countries, in 13 broad manufacturing sectors of 125 (developed and developing) destination countries during the period 2003-2006. Whichever the FDI proxy used, we restrict the sample to the period 2003-2006 because we wish to focus on the long-term effects of financial development on FDI and, therefore, we do not want our empirical analysis to be contaminated by the credit crises which started around 2007-2008 in a large number of developed and developing countries. Some descriptive statistics can be found in Appendix C, Table 6.

It is common in the FDI literature to model the conditional mean of $ln(FDI)$ instead of the conditional mean of FDI. One fundamental problem with using log-linear models is that observations for which no FDI is observed in a given sector-country pair-year would be dropped from the sample. This truncation issue does not arise when the conditional mean of FDI is modeled directly using an exponential function, as we have done in models 1 and 2. Consistent estimation of the conditional mean parameters β_1 and β_2 can be achieved by using a Poisson fixed effects estimator. This estimator is robust to distributional misspecification and therefore,

[43] http://www.cepii.fr/anglaisgraph/bdd/TradeProd.asp

as long as the conditional mean function is correctly specified, this estimator is consistent even if the dependent variable is continuous (Winkelmann, 2008; Wooldridge, 2010). We use the Hausman et al. (1984) conditional maximum likelihood version of the Poisson fixed effects estimator, which does not involve the inclusion of a large number of dummy variables to account for the time-varying country-pair specific effects; the fixed effects are conditioned out from the model estimation and are therefore not treated as parameters to be estimated. Standard errors are clustered at the country-pair level to deal with potential correlation of errors over time and across sectors.

Other methods have been suggested in the literature to deal with zero values, e.g. estimating a regression model by ordinary least squares where the dependent variable is ln(FDI) or ln(FDI+constant); different variants of the Tobit model. However, the Monte-Carlo simulations of Santos Silva and Tenreyro (2006), Westerlund and Wilhelmsson (2011) and Gopinath et al. (2013) indicate that all these alternative estimators to the Poisson Quasi Maximum Likelihood estimator (QMLE) perform very poorly when the sample includes zero values and heteroskedasticity is present, as in the case of our empirical application.[44] On the other hand, the Poisson QMLE is robust to various patterns of heteroskedasticity as well as to a large number of observations for which the value of the dependent variable is equal to zero, including when the reported absence of economic activity is due to the omission of small transactions.

For the estimation of model 2, in addition to a fixed effects logit estimator, we will also use a Poisson fixed effects estimator to model the extensive and intensive margins of FDI.[45] It is important to note that modeling the average size of the investments conditional on the presence of positive FDI does not result in a sample selection issue. Given that we are interested in how financial development influences the intensive margin, the observations for which FDI is positive form an appropriate subsample of the population of interest (Wooldridge, 2010).

4.5 Stylized facts

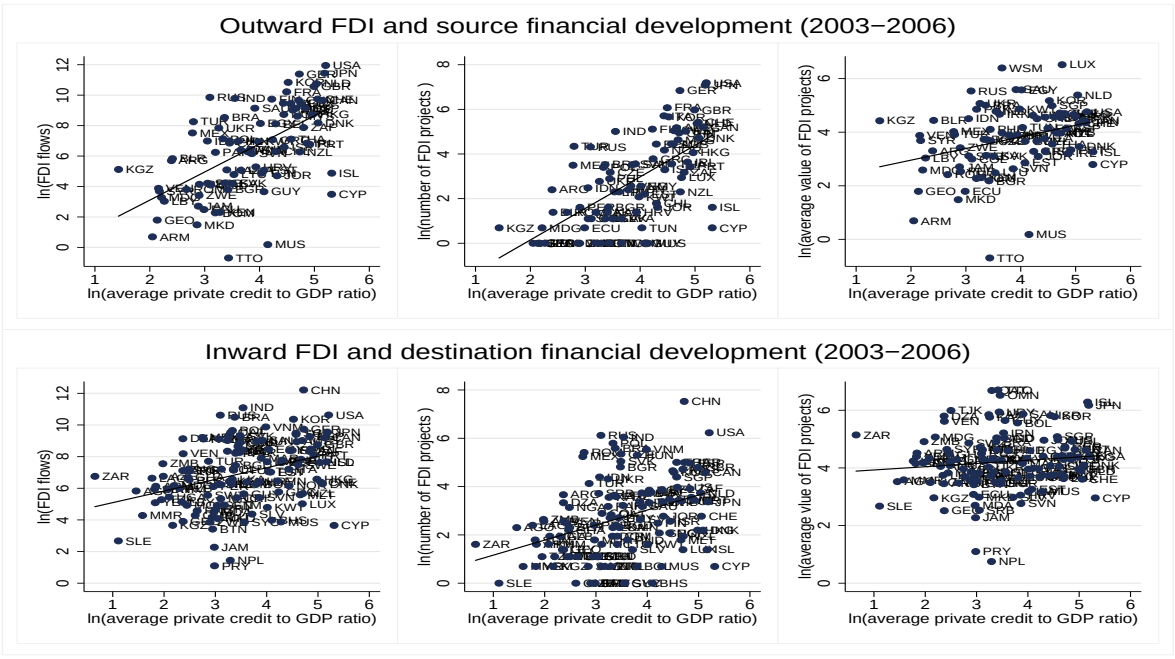
For our stylised facts, we focus on greenfield FDI: we have comprehensive data and we expect this entry mode to be highly sensitive to both SFD and DFD. Figure 2 shows the unconditional relationship between greenfield FDI and financial development, on the source and destination sides at different margins of FDI. The five largest sources of greenfield FDI are OECD coun-

[44] Heteroskedasticity influences the consistency of the estimators because log-linearization of multiplicative models induces a correlation between the transformed error term and the explanatory variables. In addition, simulations in the cited papers indicate that the Poisson QMLE does not suffer from an incidental parameters problem.

[45] We are fortunate to know the number and size of the FDI projects. In the context of international trade, some studies without access to firm-level data, such as Manova (2013), have used the two-step approach developed by Helpman et al. (2008) to identify the effects of financial development on average firm-level exports. Santos Silva and Tenreyro (2015) have raised strong doubts about the robustness of this methodology, especially when heteroskedasticity is present.

tries while the five largest recipient countries are the BRIC countries and the United States.[46] Firms located in financially developed countries tend to engage much more in FDI than those located in less financially developed countries (upper panel) while financially developed destination countries tend to receive more FDI than less financially developed countries (lower panel). These positive relationships between FDI and financial development, which seem slightly weaker on the destination side, are apparent when looking at the overall value of FDI, the number of FDI projects, or the average size of FDI projects.

Figure 2: FDI and financial development



Note: Greenfield FDI data. Cumulated values over the period 2003-2006.

It is also informative to look at the sources of external financing of U.S. majority-owned foreign affiliates, for which detailed data are available (U.S. Bureau of Economic Analysis, 2004). It can be seen in Figure 3 that the majority of external finance is raised in host countries, mainly in the form of debt. Only one quarter of the external finance can be attributed to U.S. parents and BOP FDI stocks would only capture this source of external funds.

These stylised facts suggest that financial development in source and destination countries plays an important role in promoting bilateral FDI. However, they may also simply be driven by factors not directly related to financial development. The patterns exhibited in Figure 2 could reflect the impact of good governance on FDI and the high share of local borrowing in Figure 3 could be related to the U.S. MNEs optimising their corporate capital structures according to the tax rates, currency risk, or political risk they face in host countries (Desai

[46]The BRIC countries are Brazil, Russia, India and China.

Figure 3: External financing of U.S. foreign affiliates

Notes: U.S. majority-owned foreign affiliates operating in the manufacturing sector, year 2004, reinvested earnings are excluded. Data from U.S. Bureau of Economic Analysis (2004).

et al., 2004a; Lehmann et al., 2004a; Aggarwal and Kyaw, 2008). The external funds coming from US parents may also have been generated internally in their home country. In the next section, we investigate in depth the causal effects of financial development on FDI.

5 Results

5.1 The overall effects of financial development on greenfield FDI

Our initial results are presented in Table 1. In column (1), we estimate model 1 by pooled Poisson QMLE. We omit the time-varying country-pair fixed effects, but, in addition to the financial development variables, we control for source and destination income and income per capita, bilateral distance, contiguity, language similarity, colonial links, time zone difference, source and destination institutional quality, and source and destination human capital stock.[47] The coefficients on the interaction terms involving country-specific financial development and sector-specific external dependence are positive and statistically significant at the 1% level. Higher financial development, on both source and destination sides, increases the relative volume of FDI in financially vulnerable sectors. In column (2), we control for time-varying country-pair fixed effects. The coefficients on the interaction terms remain positive and statistically significant, with little evidence of an omitted variable bias.[48]

[47] Yearly data on income per capita come from PWT 7.0 (Heston et al., 2011). Data on human capital stock in 2000 (average years of schooling for population aged 25 years and over) come from Barro and Lee (2010). The measure of institutional quality is the yearly average value of three components of the Heritage Foundation's Index of Economic Freedom: Investment Freedom, Property Rights, Freedom from Corruption (http://www.heritage.org/index/explore). Other variables come from Head et al. (2010).

[48] Time-varying country-pair fixed effects are always included in subsequent regressions.

Table 1: Financial development and greenfield FDI

	Volume of bilateral greenfield FDI, by sector							
	Pooled estimator	FE estimator	Other interactions	Stock market indicator	Financial institutions	Asset tangibility	Interaction SFD & DFD	Income groups
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
S. ln(CRED/GDP)	-0.132							
	(0.160)							
D. ln(CRED/GDP)	-0.067							
	(0.112)							
S. ln(CRED/GDP) X ED	1.666***	1.318***	1.047***			0.927***	1.232***	1.371**
	(0.330)	(0.322)	(0.358)			(0.300)	(0.327)	(0.585)
D. ln(CRED/GDP) X ED	1.025***	1.102***	0.986***			0.858***	0.963***	1.169**
	(0.187)	(0.237)	(0.218)			(0.205)	(0.246)	(0.475)
S. ln(STM/GDP) X ED				0.566*				
				(0.312)				
D. ln(STM/GDP) X ED				0.447***				
				(0.156)				
S. ln(FIN_INST) X ED)					1.893***			
					(0.653)			
D. ln(FIN_INST) X ED)					1.476***			
					(0.514)			
S. ln(CRED/GDP) X TANG						-3.640***		
						(0.850)		
D. ln(CRED/GDP) X TANG						-2.647***		
						(0.774)		
S. X D. ln(CRED/GDP) X ED							0.575	
							(0.360)	
S. ln(CRED/GDP) X ED X S. DV								-0.302
								(0.766)
D. ln(CRED/GDP) X ED X D. DV								-0.350
								(0.520)
Observations	536549	33618	31759	31434	35373	33618	33618	33618

***p-value<0.01 **p-value<0.05 *p-value<0.10. Cluster-robust standard errors in parentheses. S: Source. D: Destination. ED: external dependence. TANG: asset tangibility. DV: developing country dummy variable. Time-varying country-pair fixed effects are included in regressions (2)-(7). Regression (1) does not include time-varying country-pair fixed effects but controls for a range of monadic and dyadic control variables (see main text). Regression (3) includes interaction terms between (i) financial development and various sector-specific variables; (ii) the ED variable and various country-specific variables (see main text). Interactions between ED and DV are included in column (7). Time-varying sector fixed effects are included in all regressions.

In column (3), we control for other sector-specific characteristics which may be correlated with external dependence. We include interactions between (i) sector-specific dependence on human capital and country-specific human capital stock; (ii) sector-specific contract-intensity and country-specific institutional quality; (iii) sector-specific indicator of durable goods production and country-specific financial development; (iv) sector-specific indicator of capital intensity and country-specific financial development.[49] We also control for other country-specific characteristics which may be correlated with financial development. We include interactions between sector-specific external dependence (ED) and country-specific (i) income per capita; (ii) human capital stock; (iii) institutional quality.[50] Our results remain qualitatively unchanged.

In columns (4) and (5), we investigate whether our results hold when we use other measures of financial development. In column (4), we use the log of the stock market capitalization to GDP ratio (STM/GDP), taken from Beck et al. (2009). While the private credit to GDP ratio and the stock market capitalization to GDP ratio conceptually capture different sources of ex-

[49]These measures are defined in Appendix B.

[50]This is a fairly stringent robustness check because these country characteristics are highly correlated with financial development and may lead to over-controlling; for example income per capita explains 50% of the variation in financial development in 2003.

ternal finance (debt financing and equity financing), in practice they are likely to act as proxies for a common 'financial development factor'. We still find that SFD and DFD have positive statistically significant effects on relative FDI in financially vulnerable sectors. However, use of outcome-based measures of financial development may create a simultaneity bias. Among other factors, the entry of foreign banks can be explained by them following their domestic clients abroad.[51] If their entry fosters DFD by increasing the efficiency of the domestic banking system, reverse causality between FDI and financial development can occur. Alternatively, as suggested by Manova (2013), higher relative foreign demand for goods manufactured by sectors intensive in external finance can induce more FDI in those sectors, more borrowing in source and destination countries, and a positive relationship between the relative volume of FDI in financially vulnerable sectors and financial development despite the absence of financial constraints. In column (5), to circumvent this issue, we use the previously defined time-invariant institution-based measure of financial development FIN_INST, which is less likely to be influenced by FDI. Our main results are qualitatively unchanged.

In column (5), we explore the robustness of our results when we use another sector-specific measure of financial vulnerability, asset tangibility (TANG). For a given technological need for external finance, raising outside finance should be easier for firms in sectors structurally characterized by a high level of tangible assets (Buch et al., 2009; Manova, 2013). These assets can be pledged as collateral,[52] reducing in that way the adverse selection and moral hazard problems that lenders face. We find that, on both source and destination sides, higher financial development increases relatively less FDI in more TANG sectors. These results provide evidence of a causal effect of financial development on FDI which is difficult to challenge on reverse causality grounds (Manova, 2013). As previously mentioned, it could be argued that the positive interaction between external dependence and financial development does not reflect the existence of credit constraints but simply that higher FDI in ED sectors increases the level of borrowing in the economy. However, if that latter interpretation were correct, we should not have uncovered a negative and statistically significant interaction between financial development and the availability of collaterizable assets across sectors.

We have consistently found that both higher SFD and higher DFD increases relatively more the volume of bilateral FDI in more financially vulnerable sectors. However, this does not mean that the external funds raised in destination countries necessarily complement the external funds raised in the source country. They may be substitutes in the sense that high DFD may matter less when SFD is high and vice-versa. We can directly test for this by including in column (7) a triple interaction term involving both financial development variables and the ED measure.[53] The coefficient on this triple interaction term is large, positive, but not statistically significant.

[51] See Clarke et al. (2003) for a survey of the literature.

[52] Unlike intangible assets, tangible assets can be easily liquidated in case of default.

[53] For ease of interpretation, we subtract the sample mean from the financial development variables before constructing the interaction term.

These results suggest that MNEs located in countries with high SFD still benefit from easy access to external finance in destination countries.

In the last column, we investigate whether our results vary across countries with different levels of development. For example, developing countries' MNEs could be less sensitive to SFD than developed countries' MNEs because a large number of developing countries' MNEs are state-owned.[54] They may benefit from preferential access to external finance denied to private firms. To test this possibility, we interact our two main interaction terms, and the ED variable, with a developing country dummy variable.[55] We do not find evidence that the effects of SFD and DFD on the relative volume of bilateral FDI in financially vulnerable sectors differ across country income groups.

Overall, in line with our expectations, the total effects of higher SFD and DFD on the relative volume of greenfield FDI in financially vulnerable sectors are positive, statistically significant, close in magnitude, and complementary.[56] The economic effects are also large. Using the estimates reported in column (2) and holding other factors constant, if the Philippines improved its level of financial development to that of Finland, i.e. if financial development were doubled, the multiplicative change in its outward (inward) FDI in a typically high ED sector like Transportation Equipment (75^{th} percentile of ED) would be about 23% (19%) larger than the multiplicative change in its outward (inward) FDI in a typically low ED sector like Beverages (25^{th} percentile of ED). In addition, when we calculate the overall effects of SFD and DFD on aggregate greenfield FDI flows, we find that doubling SFD (DFD) leads, on average, to 31% (29%) more total FDI.[57] This substantial effect reflects the fact that a large share of FDI flows take place in sectors intensive in external finance; the investment-weighted average value of external dependence of bilateral FDI is 0.29.

[54]The World Investment Report 2006 (UNCTAD, 2006) reports that one-quarter of the 100 largest developing countries' MNEs were state-owned in 2004, whereas the largest developed countries' MNEs are mostly privately-owned.

[55]Developing countries are those countries classified by the World Bank as low-income and middle-income countries, as reported in the 'AAA codes' dataset available at http://graduateinstitute.ch/md4stata. Results are qualitatively similar if we define developing countries as all countries which are not considered to be traditional industrial countries.

[56]In Appendix D, we report additional robustness checks. We show that our results are not driven by outliers, the use of contemporaneous values of the private credit to GDP ratio, misspecification of the empirical model, or opportunistic FDI taking advantage of a temporary improvement in external financing conditions.

[57]To obtain these results, we use the estimates of column (2) and we i) run a Poisson regression model in which the fixed effects are parameters to be estimated; ii) calculate the predicted values with the original data and sum these values across source (destination) country-year pairs; iii) calculate the predicted values when source (destination) countries' credit to GDP ratio is doubled and sum these values across source (destination) country-year pairs; calculate the overall average percentage change between these predicted values. Note that we make the implicit assumption that financial development has no effect on FDI in sectors with 'zero' need for external finance. In addition, we do not take into account indirect effects of financial development on economy-wide determinants of FDI, e.g. total GDP.

5.2 Direct and indirect effects of SFD and DFD

In Table 2, we examine at different margins of FDI how much of the overall effects of financial development on FDI can be attributed to its direct and indirect effects. As explained in Section 3.2.2, we achieve this by including in our initial econometric model the pre-sample size of the source and destination manufacturing sectors. Once these variables are included, we expect the coefficients on the SFD and DFD interaction terms to capture the direct effects only, with statistical evidence for indirect effects coming from a comparison of these coefficients with those from a regression ignoring the scale of manufacturing activity. Tests for the statistical significance of the differences in estimates can be found at the bottom of Table 2.

The existence of indirect effects requires financial development to increase sector-specific activity. We verify the presence of this channel of influence in column (1) by regressing sector-specific value added in 2002 on the interaction between the private credit to GDP ratio and the ED measure. The positive and statistically significant coefficient on the interaction term in column (1) indicates that financially vulnerable sectors are relatively larger in more financially developed countries. This result is in line with the findings of Rajan and Zingales (1998).

Table 2: Direct and indirect effects of SFD and DFD, at different margins of greenfield FDI

	Sector-specific activity	*Greenfield FDI, bilateral and by sector*							
	Value added	*Volume*		*FDI presence(=0/1)*		*Nb. projects*		*Average size*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
S. ln(CRED/GDP) X ED		1.518***	1.459***	0.442***	0.067	0.518***	0.257*	1.518***	1.464***
		(0.450)	(0.465)	(0.158)	(0.154)	(0.168)	(0.154)	(0.559)	(0.540)
D. ln(CRED/GDP) X ED		1.215***	0.890***	0.280***	0.100	0.334***	0.175**	0.724**	0.819**
		(0.294)	(0.297)	(0.093)	(0.091)	(0.087)	(0.076)	(0.314)	(0.340)
ln(CRED/GDP) X ED	0.490***								
	(0.118)								
S. ln(VA)			0.608***		0.809***		0.758***		-0.099
			(0.204)		(0.061)		(0.057)		(0.152)
D. ln(VA)			0.415***		0.445***		0.363***		-0.185
			(0.102)		(0.048)		(0.043)		(0.137)
Difference S.			0.059		0.375***		0.262***		0.054
			(0.130)		(0.045)		(0.062)		(0.050)
Difference D.			0.325***		0.181***		0.159***		-0.094
			(0.090)		(0.034)		(0.038)		(0.076)
Observations	729	15969	15969	15959	15959	15969	15969	2103	2103

***p-value<0.01 **p-value<0.05 *p-value<0.10. Cluster-robust standard errors in parentheses. S: Source. D: Destination. ED: external dependence. VA: value added. Time-varying country-pair fixed effects and sector fixed effects are included in all regressions. Pre-sample 2002 VA values are used for all years.

In columns (2) and (3), we investigate the direct and indirect effects of SFD and DFD on the volume of greenfield FDI. Column (2) shows that our previous findings hold in the smaller sample for which we have data on sector-specific manufacturing activity. In column (3), when we introduce the sector-specific activity terms, the coefficients on the two interaction terms remain large, positive and statistically significant, but lose size. On the destination side, the

difference in coefficients following the introduction of the value added term is non-negligible (27% of the initial coefficient), positive, and statistically significant. SFD and DFD appear to have positive direct and indirect effects on the relative volume of FDI in financially vulnerable sectors, with the latter effects being much stronger on the destination side.

In columns (4) and (5), we investigate the direct and indirect effects of SFD and DFD on our first measure of the *extensive margin*, the presence of FDI. We use a binary variable taking the value of one if positive FDI is observed in a given sector country-pair-year as the dependent variable. A comparison of the estimates in columns (4) and (5) shows that the large, positive, and statistically significant effects of SFD and DFD on the relative presence of FDI in financially vulnerable sectors can be attributed, to a very large extent, to the indirect effects of financial development on overall sector-specific activity in source and destination countries. In column (5), the coefficients on the interaction terms are small and statistically insignificant and the differences in coefficients reported at the bottom of Table 2 are large, positive, and statistically significant.

In columns (6) and (7) we look at a second measure of *extensive margin*, the number of FDI projects. In contrast with the previous two columns, SFD and DFD appear to have both direct and indirect positive effects on the relative number of positive FDI projects in financially vulnerable sectors; while the positive coefficients on the interaction terms are smaller when we introduce the value added terms, they still remain (weakly) statistically significant.

In columns (8) and (9), we explore the effects of SFD and DFD on our measure of the *intensive margin*, the average size of FDI projects. The coefficients on the interaction terms are large, positive, statistically significant, and little affected by the introduction of the sector-specific activity terms, indicating that the effects of financial development at this margin are mostly of a direct nature. The fact that the coefficient on the interaction term involving DFD is larger after introduction of the value added term can be interpreted as the presence of a weak negative indirect competition effect of financial development on FDI.

The results in Table 2 fully support the hypotheses put forward in Section 2. SFD and DFD have net positive effects on new greenfield FDI by directly increasing access to external finance and indirectly increasing the number of active producers as well as generating agglomeration economies. These positive effects of financial development dominate any potential negative disintegration or competition effects. The estimates of column (2) and (3) suggest that the indirect effects of financial development can explain about 10-27% of the total effects of financial development on FDI, with the remaining shares accounted for by the direct effects. In addition, more than two-thirds of the total effects appear to occur at the intensive margin of greenfield FDI,[58] where only the direct effects seem to operate in a substantial way. Taken together, these findings indicate that the direct positive access to external finance effect on the average size of

[58] We use the estimates of columns (2) and (6) to generate relevant predicted values.

FDI projects is the main channel through which SFD and DFD promote greenfield FDI. These results echo those of Manova (2013) in the context of international trade.

5.3 Expansion FDI projects

In Table 3, we examine the direct and indirect effects of financial development on the various margins of expansion FDI.

In column (1), we use the full sample and we find that SFD and DFD have a positive and statistically significant impact on the relative volume of expansion FDI in financially vulnerable sectors. A comparison with the estimates of column (2) in Table 1 shows that the total effects of financial development on expansion FDI are 25-33% smaller than those on greenfield FDI. We find that doubling SFD or DFD leads on average to 22% more total FDI. This is possibly because MNEs can partly rely on the reinvested earnings of the established foreign affiliate to finance the expansion FDI (Buch et al., 2009). Columns (2)-(9) replicate the empirical analysis reported in columns (2)-(9) of Table 2. The impact of SFD is limited to a direct effect at the extensive margin whereas DFD has both an indirect effect at the extensive margin and a direct effect at the intensive margin. Interestingly, in column (9), we find that the coefficient on the interaction term involving DFD decreases when we introduce the value added term, i.e. the opposite of what we found for new greenfield FDI projects. This may be the outcome of the disappearance of a negative indirect competition effect once a foreign firm has established its position in the local market. Aitken and Harrison (1999) show that, in Venezuela, the higher productivity of foreign firms allowed them to draw demand previously met by local competitors. Furthermore, as suggested by the findings of Harrison and McMillan (2003) in financially underdeveloped Ivory Coast, heavy local borrowing by foreign firms can weaken domestic firms by exacerbating their credit constraints.[59]

We interpret the results of Table 3 in the following way. First, expanding in existing foreign locations is costly for parent companies, due to additional regulatory, organisational, or managerial fixed costs. These costs do not seem to be included in our FDI measure. Second, once foreign affiliates have been set-up, parents expect their foreign affiliates to be financially autonomous in the 'normal' conduct of their activities, with local credit markets providing the external funds required for expansion. Such arguments can explain why the direct effects of SFD and DFD only occur, respectively, at the extensive and intensive margins of expansion FDI. Third, SFD has little indirect effect on FDI because the desire and timing of a foreign expansion are idiosyncratic to each firm and do not have strong direct links with sector-specific activity. Fourth, the strong presence of an indirect effect of DFD at the extensive margin certainly reflects the fact that expansion FDI goes where new FDI took place and increased sector-specific

[59] Harrison et al. (2004b) argue that this indirect crowding out effect is not necessarily present in more financially developed countries.

Table 3: Direct and indirect effects of SFD and DFD, at various margins of expansion FDI

	Expansion FDI, bilateral and by sector								
	Volume			*FDI presence(=0/1)*		*Nb. projects*		*Average size*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
S. ln(CRED/GDP) X ED	0.888*	1.082	0.960*	0.893***	0.751**	0.807**	0.696**	-0.559	-0.529
	(0.467)	(0.663)	(0.567)	(0.298)	(0.312)	(0.324)	(0.279)	(0.751)	(0.729)
D. ln(CRED/GDP) X ED	0.836***	1.102***	0.815***	0.416***	0.217	0.304**	0.122	0.879***	0.748**
	(0.255)	(0.289)	(0.278)	(0.143)	(0.137)	(0.131)	(0.116)	(0.300)	(0.314)
S. ln(VA)			1.228***		1.049***		1.020***		0.325*
			(0.160)		(0.089)		(0.080)		(0.189)
D. ln(VA)			0.659***		0.605***		0.561***		0.340*
			(0.118)		(0.077)		(0.064)		(0.190)
Difference S.			0.122		0.142		0.111		-0.023
			(0.271)		(0.111)		(0.119)		(0.158)
Difference D.			0.287***		0.200***		0.181***		0.132*
			(0.078)		(0.049)		(0.049)		(0.070)
Observations	17121	9382	9382	9382	9382	9382	9382	1054	1054

***p-value<0.01 **p-value<0.05 *p-value<0.10. Cluster-robust standard errors in parentheses. S: Source. D: Destination. ED: external dependence. VA: value added. Time-varying country-pair fixed effects and sector fixed effects are included in all regressions. Pre-sample 2002 VA values are used for all years.

activity. Overall, the estimates of columns (2) and (3) suggest that the shares of the indirect effects in the total effects of SFD and DFD on expansion FDI are very close to those estimated for greenfield FDI (11-26%). On the other hand, in contrast to what we found for greenfield FDI, the main channel of influence of SFD and DFD differs. For SFD, 75% of the total effects appear to occur at the extensive margin of expansion FDI, whereas for DFD, 75% of the total effects seem to operate at the intensive margin of expansion FDI.[60]

In line with the arguments we formulated in Section 2, SFD and DFD have direct and indirect positive effects on the extensive and intensive margins of both greenfield and expansion FDI. However, unlike what we expected, we do not find that SFD matters relatively more for greenfield FDI and DFD matters relatively more for expansion FDI. Two reasons can be given for this difference. First, the results of Table 2 imply that MNEs engaging in greenfield FDI does not necessarily suffer from a 'liability of foreignness' when seeking to borrow locally. New foreign firms may be perceived as relatively safe borrowers by local banks, notably because they can benefit from guarantees provided by their parents (Lehmann et al., 2004b). Local banks may be part of the international network of MNEs' home banks (Clarke et al., 2003; Buch et al., 2009), allowing in that way the international deployment of existing banking relationships. Local banks may also be more willing to lend when a foreign financial institution is involved in the funding of FDI since it provides implicit monitoring of the activities of the parent company. Second, the results of Table 3 suggest that the fixed costs incurred by parent companies to manage a more complex international production network are sizable enough to generate a need for external finance in financially vulnerable sectors. On the other hand, in line with our hypothesis that extensive reliance on local credit markets may be easier to achieve for

[60] We use the estimates of columns (2) and (6) to generate relevant predicted values.

existing foreign affiliates (and desired by financially constrained parent companies), we find that only DFD has a direct positive effect on the intensive margin of expansion FDI.

5.4 Number of cross-border M&A transactions

Finally, in Table 4, we turn to the effects of financial development on the number of cross-border horizontal M&A, i.e. acquiring and target firms belong to the same sector.[61]

Table 4: Decomposition of the effects of SFD and DFD, at the extensive margin of M&A FDI

	Number of cross-border M&A, bilateral and by sector					
	FDI presence(=0/1)		*Nb. horizontal M&A*		*Nb. all M&A*	
	(1)	(2)	(3)	(4)	(5)	(6)
S. ln(CRED/GDP) X ED	0.557***	0.351*	0.822***	0.670***	0.637***	0.491***
	(0.199)	(0.204)	(0.194)	(0.203)	(0.149)	(0.149)
S. ln(CRED/GDP) X ED	0.514***	0.263*	0.627***	0.467***	0.678***	0.525***
	(0.151)	(0.145)	(0.150)	(0.153)	(0.125)	(0.120)
S. ln(VA)		0.505***		0.472***		0.382***
		(0.080)		(0.075)		(0.053)
D. ln(VA)		0.475***		0.392***		0.388***
		(0.072)		(0.082)		(0.061)
Difference S.		0.206***		0.152***		0.146***
		(0.057)		(0.066)		(0.053)
Difference D.		0.251***		0.160***		0.153***
		(0.054)		(0.067)		(0.049)
Observations	9274	9274	9274	9274	13120	13120

***p-value<0.01 **p-value<0.05 *p-value<0.10. Cluster-robust standard errors in parentheses. S: Source. D: Destination. ED: external dependence. VA: value added. Time-varying country-pair fixed effects and sector fixed effects are included in all regressions. Pre-sample 2002 VA values are used for all years.

Columns (1) to (4) show that SFD and DFD have both direct and indirect effects on the two extensive margins of M&A FDI that we consider. The coefficients associated with the presence of direct effects are larger than those we obtained when looking at greenfield FDI, in absolute terms and a share of the total effects. Furthermore, when we use the estimates of column (4), we find that a doubling of SFD (DFD) increases the total number of cross-border M&A by 24% (17%). These total effects at the extensive margin are larger than those for greenfield (15%; 10%) and expansion FDI (25%; 8%). These sensitivity differences may occur because the motives of the various entry modes differ. M&A FDI have additional motivations beyond a location advantage, e.g. acquisitions of firm-specific assets, synergies, or market power (Chapman, 2003; Nocke and Yeaple, 2007), and purchases of precise foreign targets may be more opportunistic, requiring easy access to external finance at short notice.

The exploitation of the greenfield and expansion FDI data led us to make the implicit assumption that a firm engaging in FDI in a given destination sector operates in the same sector. With the help of the M&A FDI data, we can gain some insight on whether this assumption has a major influence on our results. In column (5) and (6), instead of focusing on horizontal

[61] As mentioned in Section 3.1, we do not have reliable data on the values of cross-border M&A.

M&A, we use a larger sample in which we do not restrict the sector of the acquiring firm to be the same as the sector of the target firm. While the results are qualitatively similar to those obtained in columns (3) and (4), mixing source and destination sectors seems to generate an under-estimation of the impact of SFD on the relative number of cross-border M&A transactions in more financially vulnerable sectors. This is certainly because some firms investing in financially vulnerable sectors also operate in relatively less financially vulnerable sectors, making them less sensitive to access to external finance than what could have been expected on the basis of the sector in which they engage in FDI. This finding suggests that the positive effects of SFD on relative greenfield and expansion FDI in financially vulnerable sectors may have been underestimated too.[62]

To conclude, The results of this last section validates our hypothesis that both SFD and DFD have direct and indirect influences on all types of FDI, including cross-border M&A.

6 Conclusion

We investigated in this paper the various structural effects of financial development on foreign direct investment (FDI). We show that source and destination countries' financial development jointly promote FDI by directly increasing access to external finance and indirectly supporting overall economic activity. Governments wishing to facilitate the internationalization of their firms and to attract foreign multinational enterprises (MNEs) should thus implement measures to improve access to external finance or maintain it during credit crises. Indeed, given the high sensitivity of FDI to external finance availability that we have systematically found, tight credit conditions have certainly played a role in the drastic overall decline of FDI flows during the recent global financial crisis. Deep financial systems also matter to ensure that the ability of domestic firms to obtain external finance does not fall as local borrowing by MNEs increases. Such a negative crowding out effect, for which Harrison and McMillan (2003) find evidence in financially underdeveloped Ivory Coast, would negate some of the growth benefits associated with the presence of foreign firms. Inward FDI in financial services can help to improve host countries' financial conditions, at the risk of making the economy more vulnerable to international financial shocks (Goldberg, 2009; Cetorelli and Goldberg, 2010). For these reasons, a country's growth strategy ought to be articulated around a well-functioning and adequately regulated financial system with strong domestic foundations. This would maximise the net benefits of financial development for local and foreign investors alike.

[62] In Appendix D, we reach a similar conclusion when we explore the sensitivity of our results to the omission of the greenfield FDI of firms which have invested in separate manufacturing sectors (or different industries) over the period 2003-2010.

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Appendices

A Flows and stocks of FDI

Our measures of FDI are gross flows. However, the effects that we discuss in Section 2 can be understood as influencing the aggregate desired capital stock in manufacturing sector s of destination country j at time t of MNEs headquartered in source country i (K^D_{ijst}). We can nevertheless make a link between flows and stocks by assuming, as is frequently done in the investment literature, that the stock of investment adjusts gradually towards its equilibrium level: $K_{ijst} - K_{ijst-1} = FDI_{ijst} = \lambda(K^D_{ijst} - K_{ijst-1})$, with $0 < \lambda < 1$. This process of partial adjustment reflects the fact that capital adjustments are likely to involve costs and to take time to occur.[63] It can also be assumed that K^D_{ijst} is a positive function of past capital stock due to the presence of agglomeration and information externalities (Kinoshita and Mody, 2001; Bobonis and Shatz, 2007): $K^D_{ijst} = \alpha K_{ijst-1} + x_{ijst}\beta + \epsilon_{ijst}$, with x being determinants of the aggregate desired FDI stock.

These two assumptions imply that a one-time change in any fundamental determinants of the desired capital stock can lead to large FDI flows for a long period of time.[64] Furthermore, even in a steady state, gross FDI flows proportional to K^D_{ijst} can still occur at each time period. This will be the case if there is a fixed share of foreign firms which exit the market each year, if positive FDI flows are required to sustain steady-state economic growth in an open debtor economy (Obstfeld and Rogoff, 1996), or if fundamentals such as market size grow at a common exogenous rate in every country (Fernandez-Arias, 1996; Bacchetta Philippe, 2000). Hence, financial development, by influencing K^D_{ijst}, can be expected to have a persistent effect on gross FDI flows.[65]

The positive relationship between gross FDI flows and desired capital stock, outwith and within the steady state, can explain why FDI flows and FDI stocks tend to be used interchangeably in the literature, despite the latter being a theoretically more appropriate variable.[66] One worry may be that our estimators are biased because we cannot estimate the following dynamic model: $FDI_{ijst} = \lambda(\alpha-1)K_{ijst-1} + x_{ijst}\beta\lambda + \lambda\epsilon_{ijst}$, in the absence of data on K_{ijst-1}. Indeed, given that $\phi = \lambda(\alpha - 1)$ is certainly negative, our estimators may suffer from a downward bias.

[63] See Dixit and Pyndick (1994) Hamermesh and Pfann (1996), Caballero (1999), and Bond and Van Reenen (2007) for surveys of the literature. Bertola and Caballero (1994) and King and Thomas (2006) explain how microeconomic behaviours can be reconciled with the good performance of partial adjustment models at the aggregate level.

[64] Among other studies, Cheng and Kwan (2000), Bobonis and Shatz (2007), or Egger and Merlo (2007) find that FDI stocks adjust slowly.

[65] In the case of developing countries, Fernandez-Arias (1996) Sarno and Taylor (1999) find evidence that FDI flows have very large permanent components, possibly due to the externalities generated by the existing FDI stock.

[66] Albuquerque et al. (2005), Baker et al. (2009), Coeurdacier et al. (2009), Asiedu and Lien (2011), or Eicher et al. (2012) are recent studies which have used FDI flows as dependent variable in econometric models which assume long-run positive flows even in the absence of changes in the fundamentals.

However, the fixed effects that we include in our econometric model will partly account for the existence of past investment and, with ϕ likely to be small, the omitted variable bias affecting the determinants of the desired capital stock ought to be small too.[67]

B Measures of financial vulnerability and matching with FDI data

The *fDi Markets* database classifies the FDI projects into very broad recipient sectors, which are loosely aligned with 1987 U.S. SIC codes. We match these broad sectors to the corresponding three-digit ISIC codes (rev.2) reported in Rajan and Zingales (1998) and Kroszner et al. (2007); when the *fDi Markets* categories covered several sectors, we used the median value of the financial vulnerability measure for these sectors.[68] Table 5 indicates how the matching was done. We aggregate data in the same way when using the *Zephyr* database.

Table 5: Measures of sectors' financial vulnerability

Broad *fDi Markets* Sectors	Corresponding ISIC codes	ED	H	DUR	KL	CI	TANG
Beverages	313	0.08	1.13	0.00	53.71	0.73	0.40
Food & Tobacco	311+314	-0.16	1.08	0.00	25.65	0.34	0.28
Textiles	321+322+323+324	-0.03	0.69	0.00	8.20	0.67	0.14
Wood Products	331+332	0.26	0.72	1.00	15.36	0.56	0.30
Paper, Printing & Packaging	341+342	0.19	1.04	0.00	27.76	0.54	0.32
Alternative Energy, Biotechnology, Chemicals, Pharmaceuticals	352	0.22	1.21	0.00	31.08	0.52	0.27
Rubber	355	0.23	0.99	0.00	22.46	0.60	0.36
Plastics	356	1.14	0.83	0.00	41.09	0.45	0.38
Ceramics & Glass, Building & Construction Materials	361+362+369	0.06	0.95	1.00	29.96	0.44	0.42
Metals	371+372+381	0.09	1.10	1.00	39.35	0.34	0.32
Business Machines & Equipment, Engines & Turbines, Industrial Machinery, Equipment & Tools, Space & Defence	382	0.45	1.12	1.00	21.78	0.84	0.22
Communications, Consumer Electronics, Electric/Electronic Components, Medical Devices, Semiconductors	383	0.77	1.06	1.00	19.53	0.82	0.21
Aerospace, Automotive OEM, Automotive Components, Non-Automotive Transport OEM	384	0.31	1.32	1.00	19.63	0.89	0.23
Average		*0.28*	*1.02*	*0.46*	*27.35*	*0.59*	*0.30*
Standard deviation		*0.35*	*0.18*	*0.52*	*12.03*	*0.18*	*0.08*

Notes: ED: external dependence (Rajan and Zingales, 1998);1980-1989 median level of the fraction of capital expenditures not financed with cash flows. H: human capital intensity (Braun and Larrain, 2005); 1986-1995 median of the industry's mean wage over that of the whole manufacturing sector in the U.S. DUR: durable goods production (Kroszner et al., 2007); binary variable indicating whether the sector produces durable goods. KL: capital to labour ratio (Kroszner et al., 2007); 1980-1999 median level of the ratio of fixed assets over number of employees. CI: contract intensity (Nuun, 2007); 1997 proportion of intermediate inputs that are relationship-specific (not sold on an organized exchange or reference priced). TANG: asset tangibility (Kroszner et al., 2007); 1980-1999 median level of the ratio of fixed assets to total assets.

[67] Using data for the 1970-2011 period from the External Wealth of Nations II database constructed by Lane and Milesi-Ferretti (2007), we find that the elasticity of net FDI flows with respect to existing FDI stock in a simple autoregressive model with country/time fixed effects and the log of GDP is small, as expected: -0.12.

[68] We always use the ED value for the three-digit broad ISIC sectors. In some cases, these broad sectors may not include data on subsectors, for which Rajan and Zingales (1998) and Kroszner et al. (2007) provide four-digit level specific ED values.

C Summary statistics

Table 6: Summary statistics of main variables

Variable	Mean	Std. Dev.
1. Value of bilateral **greenfield** FDI (US$M)	21.52	189.26
Number of bilateral greenfield projects	0.23	0.95
Average value of bilateral greenfield projects (US$M)	90.48	279.92
2. Value of bilateral **expansion** FDI (US$M)	14.43	89.53
Number of bilateral expansion projects	0.20	0.67
Average value of bilateral expansion projects (US$M)	73.22	156.38
3. Number of bilateral cross-border **M&A** transactions	0.16	0.53
Source (S.) ln(credit/GDP)	4.54	0.65
Destination (D.) ln(credit/GDP)	3.78	0.91

Note: Samples are those used in the regressions of Tables 1-4.

D Robustness checks

In Table 7, we provide additional robustness checks. In columns (1)-(3), we account for potential influential observations by removing, in turn, the largest source of FDI (United States), the largest recipient of FDI (China), and the two most outlying sectors in terms of external dependence ('Food and Tobacco': ED=-0.16; 'Plastics': ED=1.14). Our results are qualitatively unchanged. In column (4), we test for potential non-linear effects of financial development by interacting the ED variable with SFD/DFD and their squared values.[69] We cannot reject the absence of non-linear effects, given that the coefficients on these additional interaction terms are small and not statistically significant. As another way to to rule out the possibility of a simultaneity bias, we use the value of the private credit to GDP ratio in 1980 in column (5). Our main results are unaltered (we lose about half of the sample due to missing data).

In column (6), we investigate the sensitivity of our results to the omission of the greenfield FDI of firms which have invested in separate manufacturing sectors (or different industries) over the period 2003-2010. The coefficients are larger than those in column (2) of Table 1, notably on the source side. Hence, by not taking into account that investing firms can operate in different sectors, we may underestimate the effect of SFD on relative FDI in financially vulnerable sectors.

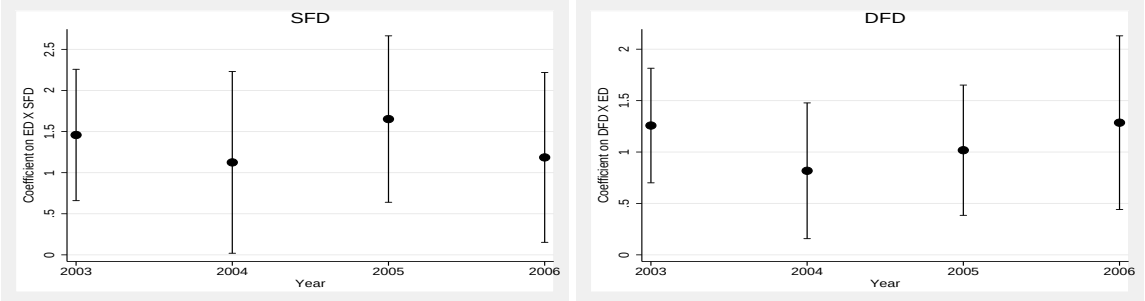
Our key hypothesis is that an industry's need for external finance is driven by deep technological reasons, implying that sector-specific external dependence tends to be stable across time and countries. Hence, we would not expect to see major differences in the sensitivity of a given industry to financial development across years. However, it is possible that our results hold only for specific years, such as the period 2005-2006, which corresponds to the peak of the lending boom in many countries. In that case, our findings may simply reflect opportunistic FDI driven

[69] For ease of interpretation, we subtract the sample mean from the financial development variables for this regression.

Table 7: Financial development and greenfield FDI: robustness checks

	Volume of bilateral greenfield FDI, by sector					
	Omission S. largest (U.S.A.)	Omission D. largest (China)	Omission ED extreme values	Non linearity	CRED/GDP 1980 values	FDI in one sector only
	(1)	(2)	(3)	(4)	(5)	(6)
S. ln(CRED/GDP) X ED	0.853***	1.307***	2.131***	1.424***		1.443***
	(0.311)	(0.327)	(0.515)	(0.405)		(0.306)
D. ln(CRED/GDP) X ED	0.940***	1.196***	1.329***	1.079***		1.164***
	(0.245)	(0.254)	(0.328)	(0.193)		(0.241)
S. ln(CRED/GDP)^2 X ED				0.297		
				(0.405)		
D. ln(CRED/GDP)^2 X ED				0.056		
				(0.249)		
S. ln(CRED/GDP)_1980 X ED					1.461***	
					(0.467)	
D. ln(CRED/GDP)_1980 X ED					1.724***	
					(0.462)	
Observations	30706	31941	25575	33618	17914	28977

$^{***}p$-value$<$0.01 $^{**}p$-value$<$0.05 $^{*}p$-value$<$0.10. Cluster-robust standard errors in parentheses. S: Source. D: Destination. ED: external dependence. Time-varying country-pair fixed effects and sector fixed effects are included in all regressions.



Note: Capped spikes delimit a 95% confidence interval.

Figure 4: Time-specific coefficients on interaction terms

by unusually good external financing conditions and not necessarily a long-term dependence of some sectors on external finance. To test this possibility, we estimate year-specific coefficients on the interaction terms between our sector-specific measure of external dependence and SFD/DFD. As can be seen in Figure 4, these coefficients tend to be stable across time, suggesting that we capture a genuine structural need for external finance of some firms to engage in FDI.