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Comments are welcome

Abstract

We present evidence that the level of financial development in FDI recipient countries systematically affects the spatial distribution of multinational corporations' (MNCs) sales. Using detailed proprietary survey data collected by the Bureau of Economic Analysis (BEA) on US multinational activity abroad, we find that stronger financial development in the host country has a negative effect on the share of MNC affiliate sales that remain in the host country, indicating a reduced propensity towards horizontal FDI. Conversely, the share of affiliate sales that is re-exported to third-country destinations increases, suggesting an increased propensity towards export-platform FDI. We provide a three-country model with heterogenous firms that rationalizes these observations: More financially developed host countries foster entry by domestic firms, making the local market more competitive for MNC products. This leads MNCs to orient their affiliates away from servicing the local market towards third-country markets instead.

Keywords: Credit constraints, horizontal FDI, vertical FDI, export-platform FDI, heterogenous firms.

JEL Classification: F12, F23, G20

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1 Introduction

The international organization of production has been growing, not just in scale, but also in complexity in recent decades. Multinational corporations (MNCs) now face a rich set of options with regards to how to arrange and organize their production processes to serve different markets. MNCs can choose to set up full-fledged production facilities in foreign countries, with the primary intention of selling the output directly to these local markets. This strategy of horizontal FDI is particularly attractive when the transport cost of shipping final goods to these markets is high, and when the loss of plant-level scale economies is minimal; the familiar proximity-concentration tradeoff would then favor horizontal FDI over exporting as the main method of servicing these markets.[1] On the other hand, vertical FDI arises when firms locate production stages abroad primarily to take advantage of lower factor prices. Such cross-border fragmentation of the production line is more likely when factor price differences across countries are large, and when the cost of shipping components is low.[2] While the literature has traditionally stressed the difference between these horizontal and vertical motivations for FDI, recent trends (highlighted, for example, by Hanson et al. (2001) and Ekholm et al. (2003)) have pointed out that reality does not conform to this neat dichotomy. In practice, FDI often takes place for a hybrid purpose, both to tap into lower host country wages, and to provide a base for servicing large third-country markets, a phenomenon termed export-platform FDI.

Table 1 illustrates how each of these three motives for FDI – horizontal, vertical, and export-platform – is manifest in the data on MNC activity. This Table provides a breakdown of US foreign affiliate sales by sales destination, based on data collected from all US multinationals by the Bureau of Economic Analysis (BEA).[3] (A detailed discussion of this dataset is deferred to Section 4.) Focusing on the first three rows of information, note that the typical affiliate channels the bulk of its sales (about 70%) to the local host country market, affirming the importance of horizontal FDI. This nevertheless leaves a substantial share to sales to third-country markets as well as back to the US, which speaks

[1]See, for example, Markusen (1984), and Markusen and Venables (1998, 2000), for formal treatments of this proximity-concentration tradeoff. Another common prediction of these models is that horizontal FDI is more likely the more similar the parent and the foreign countries are in their market size and factor endowment mix, the intuition being that this facilitates setting up a replicate of the production plant in the host country. With regards to empirical evidence, Brainard (1997) confirms that higher trade costs and lower plant-level scale economies are associated with an increase in MNC sales relative to exporting. Helpman et al. (2004) further show that industries characterized by a high degree of firm heterogeneity in productivity levels have higher levels of MNC sales relative to exports.

[2]Helpman (1984) builds a model within the Heckscher-Ohlin paradigm to explain how multinational activity can emerge between two countries that differ in their relative factor endowment mix. On the growing relevance of vertical FDI, Hummels et al. (2001) and Hanson et al. (2001, 2005) document the rise of vertical production networks, as evidenced by the increase in US parent firm shipments of intermediate goods to overseas affiliates for further assembly or processing, particularly to host countries where unskilled wages and trade costs are lower. Separately, Yeaple (2003b) confirms that skill endowments matter for FDI, by showing that total US foreign affiliate sales at the country-industry level depend positively on host-country skill abundance interacted with a measure of industry skill intensity.

[3]Our use here of affiliate sales data echoes the view in Lipsey (2003) that such micro data provide a more direct and meaningful measure of MNC production and activity than figures derived from national income accounts.

to the relevance of the export-platform and vertical motives respectively behind FDI.[4]

In this paper, we explore how conditions in the FDI recipient country influence the nature and composition of MNC activity. We focus specifically on the role played by the level of financial development in the FDI host, a key country characteristic that speaks to the ease with which prospective local businesses can obtain secure sources of private credit to fund entry or investment.[5] Using the BEA data on US multinational activity abroad, we find that US affiliates operating in countries with more mature levels of financial development (as measured by a higher private credit to GDP ratio) tend to channel a smaller share of their total sales to the local host country market. We interpret this accordingly as a decreased propensity towards horizontal FDI. Conversely, better host country financial development is associated with a higher share of sales to third-country markets, which we view as an increased propensity towards export-platform FDI. We generally also find a smaller positive effect on the share of return sales to the US market, although this last effect is not statistically significant. These empirical patterns are present in the spatial distribution of individual affiliate sales, as well as in the data aggregated to the country level.

To rationalize these observations regarding the effects of the host country credit environment on the destination of MNC sales, we develop a trade model with heterogenous firms along the lines of Melitz (2003) and Grossman et al. (2006). There are three countries in our model, in order to provide an export-platform motive for FDI: The North comprises two identical large economies (which we call "West" and "East"), while production costs are lower in the third country ("South").[6] In the differentiated goods industry ("manufacturing"), firms are heterogenous in their productivity levels. We consider the decision problem of a manufacturing firm from West; the situation for firms in East is entirely symmetric. The productivity draw that the Western firm obtains determines which markets the firm can enter, as well as the mode (exports or FDI) for servicing each market. Exporting incurs an iceberg transport cost, but requires a lower fixed cost than FDI. If on the other hand the Western firm chooses to locate production in South, it stands to benefit from the lower wage costs in that country. In our analysis, we will focus on a situation in which it is only the most productive Western firms that can overcome the high fixed cost of FDI in South, and subsequently use that Southern plant as a global production center for servicing all three markets.

[4]The share of affiliate sales to the US market serves as a proxy for vertical FDI, in the sense that production has been fragmented with headquarter services provided in the MNC's home country, while physical production and assembly are conducted in the FDI host country.

[5]See Navaretti and Venables (2004, Chapter 6) and Blonigen (2005) for a review of the broader literature on other country characteristics that affect FDI. See also Bénassy-Quéré et al. (2005), who find evidence that strong host country institutions, such as secure property rights enforcement and the lack of corruption, have a positive impact on FDI. (Their study uses FDI stock data from the OECD, and testing is implemented using a gravity equation regression specification.)

[6]This three-country structure is also employed in Ekholm et al. (2003), Yeaple (2003a), and Grossman et al. (2006) to explore the international production strategies available to MNCs when there is a large third-country market that MNCs may wish to service.

We introduce a need for financial intermediation by requiring that firms borrow to finance upfront their fixed costs of production. However, credit markets are imperfect in South, so that some prospective Southern firms cannot enter their own local industry due to an inability to gain access to credit, even though their profits would be positive if they could otherwise finance their fixed costs. We then formally derive how shifts in the level of financial development in South will affect the equilibrium in the manufacturing industry, and in particular, the activities of Western MNCs. Intuitively, an easing of credit constraints in South facilitates entry by more Southern firms into the local manufacturing sector, so that Western firms now face increased competition in the Southern market (assuming that all manufacturing varieties are substitutes in consumption). As a consequence, this induces Western MNCs located in South to channel their sales away from the local market, towards servicing the third-country and home markets instead. This competition effect thus generates shifts in affiliate sales destinations that match our main empirical findings, namely an increase in the share of platform sales to other countries and a decrease in the share of horizontal sales to the local market. Our model also predicts a larger increase in the share of third-country sales than in the share of sales back to the home country, since Western MNCs face an additional margin of competition in their home market from purely domestic firms (Western firms that only serve their domestic economy). This dovetails with our empirical finding of a smaller impact of host country financial development on vertical sales to home than on platform sales to other countries.

Our paper adds to an active and extensive literature on the role of financial development in economic growth and trade. Empirical work at the cross-country level has shown that financial development plays an important role in raising growth rates in sectors that are inherently more dependent on external sources for their capital financing needs (Rajan and Zingales 1998). Evidence from trade flows has also confirmed that a more mature credit environment tends to boost manufacturing exports (Beck 2002), as well as to promote specialization in industries that are more dependent on external finance (Beck 2003, Manova 2006).[7] With regards more specifically to FDI, Alfaro et al. (2004) show that FDI inflows boost economic growth significantly for host countries that have strong levels of financial development; this relationship between FDI and growth is otherwise nondescript if the mediating role of financial development is not taken into account.

Our paper also falls within a body of work that seeks to model the complex FDI strategies that MNCs adopt in a world with multiple markets. Ekholm et al. (2003) show how export-platform FDI

[7]Manova (2006) further decomposes this effect of credit constraints into the shares that act on the intensive and extensive margins of trade respectively. On a related note, Becker and Greenberg (2005) show that countries with more mature levels of financial development exhibit greater export volumes in high fixed cost industries. See also Wynne (2005) who advances the idea that wealthier countries have a comparative advantage in credit-constrained industries. For theoretical work on how credit constraints influence the pattern of trade, see Matsuyama (2005).

can emerge as the mode for servicing a large third-country market when wage costs in South, the shipping cost for components, and the fixed cost of setting up an additional plant are all low. They discuss how a free trade agreement between South and the third-country market can encourage more export-platform FDI, as transport costs from the FDI host market to the final sales destination are lowered.[8] Separately, Yeaple (2003) and Grossman et al. (2006) emphasize the role of various complementarities in the production and transport cost parameters faced by MNCs in determining their optimal cross-border integration strategies. For example, moving one stage of production to South lowers unit costs and raises total output, thereby creating an added incentive to locate other stages of production in South as well to benefit from the lower costs there. Our modelling approach resembles most that of Grossman et al. (2006), in that we incorporate firm heterogeneity in productivity levels. That said, our primary goal here is not to characterize the full range of organizational forms that can emerge, but to analyze instead how conditions (specifically, financial development) in the FDI host country impact the sales activities of MNCs who locate their production there.

In this regard, the effect of host country financial development on MNCs has received a fair amount of attention, with most prior work focusing on the influence of the local credit environment on the capital financing decisions of MNC affiliates. Feinberg and Phillips (2004) identify how a poorly developed capital market in the host country places limits on the expansion prospects of US affiliates. While internal financing from the US parent does provide an alternative source of funding (Desai et al. 2004), this appears for the typical affiliate to be insufficient to entirely remove credit constraints in some host countries.[9] Adopting a principal-agent perspective on the role of US parent companies, Antràs et al. (2007) develop a framework in which financiers in the host country require the participation of a US parent to ensure monitoring of local affiliates. In countries with weak financial development, the regulatory system is unable to adequately protect these local financiers, prompting them to require US parents to take larger direct investment stakes in the local affiliate, as opposed to arms-length licensing arrangements.

We move away in this paper from this issue of the sources of MNC affiliate financing. Our model simplifies the financing decision by assuming that Northern firms can access external capital at a fixed world interest rate and need not rely on Southern credit markets. While this is done for convenience, all that is necessary for our story is that Southern firms are more burdened than Northern firms by poor access to credit. Instead, we turn our attention to how improvements in host country financial development also promotes entry of local (Southern) firms. This increases the level of market

[8] Export-platform FDI also depends on accessibility to third-country markets: Gao and Yu (2005) show that platform sales are increasing in a measure of the host country's market access to the rest of the world.

[9] Constantini (2006) shows that weak financial development is particularly detrimental to smaller firms, and tends to skew the distribution of firm sizes even more towards large firms.

competition in the Southern market, which induces Northern MNCs to shift their affiliate sales away from servicing the host country market.

This paper proceeds as follows. Section 2 sets up the three-country model with heterogenous firms. Section 3 derives the comparative statics regarding the effect of host country financial development on the spatial distribution of MNC affiliate sales. Section 4 presents the empirical results, using both firm-level and aggregate data on US multinational activity abroad. Section 5 concludes. Detailed proofs of the theoretical results are in the Appendix (Section 7).

2 Credit Constraints in a Model with Heterogenous Firms

We develop a three-country model with heterogenous firms to analyze how conditions in the FDI host country systematically affect the sales decisions of multinational affiliates based there. In particular, we focus on the role of host country financial development and its effect on the relative propensity of MNC affiliates to service the local market versus home or third-country markets.

In our model, the developed North consists of two identical countries ("West" and "East"). Being mature economies, these countries are large consumer markets, but wage costs are also higher. The remaining country is a low-wage economy ("South"), which can be thought of as a developing country. Each of the three economies, West, East and South, is made up of two sectors: (i) a homogenous good sector ("agriculture"), and (ii) a differentiated goods sector ("manufacturing"). The homogenous good is produced using a constant returns to scale technology, and we shall assume that output in this sector is strictly positive in equilibrium in each country.[10]

Labor is the sole factor of production, with the nominal wage pinned down by the constant marginal product of labor in the respective domestic agriculture sectors. We normalize the nominal wage in the two developed countries (West and East) to 1, and denote the wage in South by $\omega < 1$, with the assumption being that Southern labor is less productive in agriculture than Northern workers.[11] Note that in our model, the two Northern countries, West and East, are completely identical, and this symmetry will be important for simplifying the set of equations that describes the global industry equilibrium in the manufacturing sector.

Utility: The utility function of a representative consumer from the developed North (subscript

[10] We will require that the labor force in each country be sufficiently large to ensure a positive amount of employment and output in the homogenous good sector.

[11] For this factor price differential to be consistent with the presence of some agricultural production in all three countries, we require either that the homogenous good be prohibitively costly to trade across borders, or that the homogenous good be a country-specific product for which there is no foreign demand.

$n = e, w$, for East and West respectively) is given by:

$$U_n \;=\; y_n^{1-\mu}\left[\sum_{j\in\{e,w\}}\left(\int_{\Omega_{nj}} x_{nj}(a)^{\alpha}\; dG_j(a)\right)^{\frac{\beta}{\alpha}}\right]^{\frac{\mu}{\beta}} \tag{2.1}$$

while the corresponding utility function for Southern consumers (subscript s) is:

$$U_s \;=\; y_s^{1-\mu}\left[\sum_{j\in\{e,w,s\}}\left(\int_{\Omega_{sj}} x_{sj}(a)^{\alpha}\; dG_j(a)\right)^{\frac{\beta}{\alpha}}\right]^{\frac{\mu}{\beta}} \tag{2.2}$$

Utility in country i ($i \in \{e, w, s\}$) is thus a Cobb-Douglas aggregate over consumption of the homogenous good (y_i) and differentiated varieties of manufactures, where the share of expenditure spent on manufactures is parameterized by $\mu \in (0, 1)$. Here, $x_{ij}(a)$ denotes the quantity of a country j manufactured variety (indexed by a) that is consumed in country i. (As a notational rule of thumb, the first subscript identifies the country of consumption, while the second subscript refers to the country of origin of the producing firm.[12]) We define Ω_{ij} to be the set of manufactures from country j's differentiated goods sector available to consumers in i. When $i \neq j$, this set consists of all varieties exported from j to i, as well as varieties produced locally in i by a country j multinational affiliate (if FDI takes place). Similarly, when $i = j$, Ω_{ii} is the union of all indigenous varieties produced domestically, and all varieties produced by country i multinationals abroad that are then re-exported back to the home market.

The sub-utility derived from manufactures is a Dixit-Stiglitz aggregate over consumption of varieties. We stipulate that $0 < \beta < \alpha < 1$, which translates into a basic home-bias assumption: Manufactured varieties from the same country are closer substitutes than two varieties drawn from different countries. While South demands varieties from all three countries, Southern varieties themselves do not enter the utility function for Northern consumers (see (2.1)). One could argue for example that Southern goods do not cater to developed country tastes because they are inherently of a poorer quality.[13] That said, the key purpose of this simplifying assumption is that it allows us to examine the Southern industry without having to worry about feedback effects from Northern demand for Southern goods.

Each differentiated variety is produced by a separate firm. Varieties are indexed by a, the per unit output labor requirement for production of a given variety. $1/a$ is thus a measure of each firm's labor productivity. Upon paying the fixed cost of entry into the industry, each firm draws its a from a distribution $G_j(a)$ that represents the existing slate of technological possibilities. The resulting

[12]In particular, $x_{ii}(a)$ denotes country i's absorption of a variety from a country i firm.

[13]An alternative story would be that the fixed costs of attempting to penetrate the Northern market are prohibitively high, so that no Southern firm can profitably do so.

productivity differences across firms are the key dimension along which firms in the manufacturing sector are heterogeneous.

Maximizing (2.1) and (2.2) respectively subject to the standard budget constraints implies the following familiar iso-elastic demand functions for each variety of manufactures: $x_{ij} = A_{ij} p_{ij}(a)^{-\varepsilon}$, where $p_{ij}(a)$ denotes the corresponding price of the country j variety in country i, and $\varepsilon = \frac{1}{1-\alpha} > 1$ is the elasticity of substitution between different varieties of manufactures from the same country. Exploiting the symmetry between West and East, we have the following expressions for the level of aggregate demand A_{ij} in each country i for manufactures from j:

$$A_{ww} = A_{ee} = \frac{\mu E_n P_{ww}^{\varepsilon-\phi}}{P_{ww}^{1-\phi} + P_{ew}^{1-\phi}} \tag{2.3}$$

$$A_{ew} = A_{we} = \frac{\mu E_n P_{ew}^{\varepsilon-\phi}}{P_{ww}^{1-\phi} + P_{ew}^{1-\phi}} \tag{2.4}$$

$$A_{sw} = A_{se} = \frac{\mu E_s P_{sw}^{\varepsilon-\phi}}{P_{ss}^{1-\phi} + 2P_{sw}^{1-\phi}} \tag{2.5}$$

$$A_{ss} = \frac{\mu E_s P_{ss}^{\varepsilon-\phi}}{P_{ss}^{1-\phi} + 2P_{sw}^{1-\phi}} \tag{2.6}$$

where $P_{ij}^{1-\varepsilon} = \int_{\Omega_{ij}} p_{ij}(a)^{1-\varepsilon}\, dG_j(a)$ is the ideal price index of manufactures from country j faced by country i. Here, E_i is the total expenditure by consumers in i; in particular, $E_w = E_e = E_n$.[14] These aggregate expenditure levels are exogenous in our model, being equal to the nominal wage times the size of the workforce in each country. Note also that $\phi = \frac{1}{1-\beta} > 1$ is the cross-country elasticity of substitution between manufacturing varieties. Bear in mind that $\beta < \alpha$ implies that $\varepsilon > \phi$, which is precisely the statement that manufactured varieties from the same country are closer substitutes in consumption than varieties drawn from different countries. In particular, from (2.3) and (2.4), the fact that Western goods are not equally substitutable for manufactures from East ($\varepsilon \neq \phi$) explains why the demand levels for Western goods differs in the two developed countries, West and East ($A_{ww} \neq A_{ew}$). As we will show below, the condition $\varepsilon > \phi$ is a key condition for signing various comparative statics related to the effect of Southern financial development.

2.1 Industry set-up in the Northern countries

The structure of the Northern manufacturing sector is an extension of that in Helpman et al. (2004). We describe this industry structure for West, with the situation in East being entirely symmetric.[15]

[14] Prior three-country models, such as Ekholm et al. (2003), Yeaple (2003a), and Grossman et al. (2006), have generally assumed that the size of the Southern market is negligible, in order to focus on the MNC's decision over how to service the two large Northern markets. However, Southern demand for Northern manufactures plays a crucial role in our model, in order for changes in the level of competitiveness in the Southern market to have an impact on the Northern industry equilibrium and MNCs' behavior. Note also that it may be natural to assume that $E_n > E_s$, namely that each Northern country is a larger consumer market than South, but this will not be necessary for our results.

[15] The corresponding equations for East can be obtained by interchanging the subscripts 'w' and 'e'.

Upon entering the industry, each firm in West obtains a productivity draw, a, from the distribution $G_w(a)$. The firm then decides whether to engage in production or to exit entirely, the latter option being exercised if it receives a very low productivity draw. Should the firm choose to stay in, production for the home economy incurs a per-period fixed cost of f_D units of Western labor. One can interpret these fixed costs as headquarter services such as managerial expertise or recurrent investment in maintaining equipment. At the start of each period, firms require external financing to pay their fixed costs upfront. For simplicity, we assume that firms cannot finance these out of retained earnings from previous periods because management does not have control rights over these earnings which have to be transferred instead as dividends or profits to the firm's owners. Firms thus borrow for each period's fixed costs at a (gross) interest rate equal to $R > 1$, set exogenously by conditions in an international capital market that we do not model explicitly.

Firms price at a constant mark-up over marginal costs, so that the home price for a Western variety is $p_{ww}(a) = \frac{a}{\alpha}$. Individual firms take the aggregate demand levels in each market as given. Profits from sales in the domestic market are thus equal to:

$$\pi_D(a) \quad = \quad (1-\alpha)A_{ww}\left(\frac{a}{\alpha}\right)^{1-\varepsilon} - Rf_D \tag{2.7}$$

In addition, firms that are sufficiently productive will contemplate exporting to East or South (or both). Exporting to each foreign market incurs a per-period fixed cost of f_X units of Western labor, which would include headquarter services that go into maintaining an overseas distribution network. At the same time, exporting incurs an iceberg transport cost that raises prices by a multiplicative factor $\tau > 1$. The Western firm's profit functions from exporting to East and South are thus respectively:

$$\pi_{XN}(a) \quad = \quad (1-\alpha)A_{ew}\left(\frac{\tau a}{\alpha}\right)^{1-\varepsilon} - Rf_X \tag{2.8}$$

$$\pi_{XS}(a) \quad = \quad (1-\alpha)A_{sw}\left(\frac{\tau a}{\alpha}\right)^{1-\varepsilon} - Rf_X \tag{2.9}$$

The FDI decision: Alternatively, Northern firms that are sufficiently productive can choose to go multinational. Establishing an overseas plant confers several advantages, allowing the MNC to move closer to its foreign markets (saving on transport costs), as well as potentially lowering its costs should the MNC choose to locate in the low-wage South. However, setting up a production facility abroad requires a high per-period fixed cost equal to f_I units of Northern labor. A Western MNC will in general face a wide array of organizational possibilities: Apart from servicing the host country market, the Western headquarters may also want to use the foreign affiliate as an export platform to a third country or even back to its home (Western) market. We assume that such re-exporting incurs both the above-mentioned fixed cost, f_X, of maintaining a distribution network per market, as well as the same iceberg transport cost factor, τ.

To keep the analysis tractable (and to economize on the number of additional productivity cut-offs introduced), we focus on the case in which: (i) Western firms that are sufficiently productive conduct FDI only in the low-wage South and not in East (even though East may be a bigger market); and (ii) if a Southern affiliate is established, it automatically becomes the Western firm's global production center servicing all three countries. In the discussion below, we show that two conditions, namely $\tau\omega < 1$ and $f_X < f_D < f_I$, suffice to ensure that this will be the optimal organizational mode for Western MNCs. Intuitively, the Southern wage ω must be sufficiently lower than the Northern wage after adjusting for transport costs, if it is to be optimal for MNCs to use South as an export platform to all three countries. As for the latter assumption ($f_X < f_D < f_I$), this reflects the idea that the fixed cost of an export distribution network is typically smaller than the fixed cost of running a domestic plant, which in turn is smaller than the fixed cost of running an overseas production facility.

Consider then a Western firm that is sufficiently productive to contemplate FDI. Observe that if this firm has established a plant in South, it is automatically more profitable to also use that Southern affiliate as an export platform to East, rather than servicing East via direct exports from West or via direct FDI in East. This follows from the inequality:

$$(1-\alpha)A_{ew}\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} - Rf_X \;>\; \max\left\{(1-\alpha)A_{ew}\left(\frac{\tau a}{\alpha}\right)^{1-\varepsilon} - Rf_X,\; (1-\alpha)A_{ew}\left(\frac{a}{\alpha}\right)^{1-\varepsilon} - Rf_I\right\}$$

which holds since $\tau\omega < \tau$, $\tau\omega < 1$ and $f_X < f_I$ (bearing in mind that $1-\varepsilon < 0$). In particular, this rules out the case where the MNC establishes production affiliates in both South and East.

Moreover, conditional on setting up a Southern affiliate, it is optimal to use that affiliate to service even the firm's home (West) market. This follows from:

$$(1-\alpha)A_{ww}\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} - Rf_X \;>\; (1-\alpha)A_{ww}\left(\frac{a}{\alpha}\right)^{1-\varepsilon} - Rf_D$$

which holds since $\tau\omega < 1$ and $f_X < f_D$. Thus, it is more profitable to produce in South and export to West while shutting down home production, rather than incur the fixed costs and higher wages of production at home.

It remains to check that the optimal decision for the Western MNC is to locate its overseas affiliate in South, rather than in East. This requires that total profits from servicing all three countries out of a production plant in South must exceed the profits from setting up the production plant in East instead:

$$\begin{aligned}
&(1-\alpha)A_{ww}\left(\tfrac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} - Rf_X + (1-\alpha)A_{ew}\left(\tfrac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} - Rf_X + (1-\alpha)A_{sw}\left(\tfrac{a\omega}{\alpha}\right)^{1-\varepsilon} - Rf_I \\
&\quad > \max\left\{(1-\alpha)A_{ww}\left(\tfrac{a}{\alpha}\right)^{1-\varepsilon} - Rf_D,\; (1-\alpha)A_{ww}\left(\tfrac{\tau a}{\alpha}\right)^{1-\varepsilon} - Rf_X\right\}\ldots \\
&\quad\quad \ldots + (1-\alpha)A_{ew}\left(\tfrac{a}{\alpha}\right)^{1-\varepsilon} - Rf_I + (1-\alpha)A_{sw}\left(\tfrac{\tau a}{\alpha}\right)^{1-\varepsilon} - Rf_X
\end{aligned}$$

Note that when FDI is undertaken in East instead, the home market (West) can be serviced either through domestic production or re-exports from East, while South would be serviced by exports from the developed North. The expression on the right-hand side of the above inequality captures total profits from this alternative mode of organization. Once again, it is easy to check that this inequality holds since: $\tau\omega < 1$, $\tau < 1$, $\omega < \tau$ and $f_X < f_D$, so that it is not optimal to conduct FDI in the high-wage East.

In sum, the conditions $\tau\omega < 1$ and $f_X < f_D < f_I$ guarantee that the FDI decision is in effect a decision over whether to relocate the global production center of the firm to South, with only headquarter activities being retained in West. With these parameter assumptions, and taking into account revenues from all three markets, the profit function from conducting FDI in South for a firm with productivity $1/a$ is therefore:

$$\pi_I(a) = (1-\alpha)A_{sw}\left(\frac{a\omega}{\alpha}\right)^{1-\varepsilon} + (1-\alpha)(A_{ww}+A_{ew})\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} - R(f_I + 2f_X) \quad (2.10)$$

Patterns of production: The productivity level of each firm in West determines the markets it is able to service and its mode of organization. Firms engage in production for the domestic Western market if profits from (2.7) are positive. Solving $\pi_D(a) = 0$, this pins down a zero-profit cut-off value, a_D, which is the maximum labor input coefficient at which production for the domestic market is sustainable. Similarly, setting $\pi_{XN}(a) = 0$ yields a cut-off, a_{XN}, below which exporting to East is profitable, while solving $\pi_{XS}(a) = 0$ delivers the analogous cut-off, a_{XS}, for exporting to South. These three cut-off values are given by:

$$a_D^{1-\varepsilon} = \frac{Rf_D}{(1-\alpha)A_{ww}(1/\alpha)^{1-\varepsilon}} \quad (2.11)$$

$$a_{XN}^{1-\varepsilon} = \frac{Rf_X}{(1-\alpha)A_{ew}(\tau/\alpha)^{1-\varepsilon}} \quad (2.12)$$

$$a_{XS}^{1-\varepsilon} = \frac{Rf_X}{(1-\alpha)A_{sw}(\tau/\alpha)^{1-\varepsilon}} \quad (2.13)$$

There is a fourth cut-off, a_I, that determines when FDI becomes feasible. Focusing on the situation where the Southern affiliate becomes the global production center for the Western firm, FDI is more profitable than basing production in West when: $\pi_I(a) > \pi_D(a) + \pi_{XN}(a) + \pi_{XS}(a)$. Solving this as an equality delivers the following expression for a_I:

$$a_I^{1-\varepsilon} = \frac{R(f_I - f_D)}{(1-\alpha)[A_{ww}((\frac{\tau\omega}{\alpha})^{1-\varepsilon} - (\frac{1}{\alpha})^{1-\varepsilon}) + A_{ew}((\frac{\tau\omega}{\alpha})^{1-\varepsilon} - (\frac{\tau}{\alpha})^{1-\varepsilon}) + A_{sw}((\frac{\omega}{\alpha})^{1-\varepsilon} - (\frac{\tau}{\alpha})^{1-\varepsilon})]} \quad (2.14)$$

Note that the conditions: $f_I > f_D$, $\tau\omega < 1$, $\omega < 1 < \tau$, and $\varepsilon > 1$, ensure that $a_I > 0$.

To lend some realistic structure to the industry equilibrium, we stipulate that: $0 < a_D^{1-\varepsilon} < a_{XN}^{1-\varepsilon} < a_{XS}^{1-\varepsilon} < a_I^{1-\varepsilon}$, which describes a natural sorting of West's firms to the various modes of organization. The upper panel of Figure 1 illustrates this sorting pattern based on $a^{1-\varepsilon}$, which is a proxy for firm productivity levels (since $1 - \varepsilon < 0$). The least productive firms with $a^{1-\varepsilon} < a_D^{1-\varepsilon}$ have labor input requirements that are too high and exit the industry immediately upon observing their productivity draw. Firms with productivity levels between $a_D^{1-\varepsilon}$ and $a_{XN}^{1-\varepsilon}$ produce only for the domestic West market. Using the cut-off expressions in (2.11) and (2.12), this assumption that $a_D^{1-\varepsilon} < a_{XN}^{1-\varepsilon}$ reduces to: $\tau^{\varepsilon-1}(\frac{f_X}{A_{ew}}) > \frac{f_D}{A_{ww}}$, so that the fixed cost of exporting (normalized by the level of demand in East) must be sufficiently larger than the fixed cost of domestic production.[16] Next, those firms that are even more productive, with $a_{XN}^{1-\varepsilon} < a^{1-\varepsilon} < a_{XS}^{1-\varepsilon}$, are able to overcome the additional costs of exporting to East; based on (2.12) and (2.13), this requirement that $a_{XN}^{1-\varepsilon} < a_{XS}^{1-\varepsilon}$ boils down to the condition $A_{ew} > A_{sw}$, so that the level of market demand for Western manufactures is higher in East than in South. Firms with $a_{XS}^{1-\varepsilon} < a^{1-\varepsilon} < a_I^{1-\varepsilon}$ are further able to service the smaller Southern market.[17] Finally, it is the most productive firms with $a^{1-\varepsilon} > a_I^{1-\varepsilon}$ that can successfully conduct FDI in South.

Figure 2 provides an alternative illustration of the structure of the Western industry that focuses on the economic relations in our three-country world. Firms with $a^{1-\varepsilon} < a_I^{1-\varepsilon}$ base their production activities in West, and undertake exports to East and even to South if they are sufficiently productive (Figure 2A). On the other hand, the most productive firms with $a^{1-\varepsilon} > a_I^{1-\varepsilon}$ become multinationals. While these firms are still headquartered in West, their production activities are based in South, from which they service all three markets (Figure 2B).

2.2 Industry set-up in the FDI host country

The structure of the Southern manufacturing industry is simpler, with Southern firms producing only for domestic consumption. (Recall from (2.1) that Southern manufactures do not enter the utility function of Northern countries.) The per-period fixed cost of domestic production is f_S units of Southern labor, and Southern firms need to borrow at the start of each period to finance these fixed costs.

However, Southern firms face credit constraints, arising from institutional weaknesses that lead to imperfect protection for lenders against default risk. We model this moral hazard problem by assuming that should a firm choose to default, it would lose a fraction $\eta \in [0, 1]$ of its revenues. Thus, while firms have a temptation to default to avoid loan repayment, this is nevertheless a costly course of

[16] To be completely precise, one needs to solve for the values of A_{ww} and A_{ew} in general equilibrium and substitute them into this inequality for the full restriction.

[17] The parameter restriction that guarantees that $a_{XS}^{1-\varepsilon} < a_I^{1-\varepsilon}$ does not simplify neatly. Intuitively, it requires that the fixed cost of FDI, f_I, be sufficiently large so that FDI is only considered by the most productive firms.

action; the fraction η of revenues that is expended during default can be thought of as the pecuniary cost of actions taken to hide the firm's full financial resources from lenders. (This formulation of financial development follows, for example, Aghion et al. (2004).) Then, a Southern firm with input coefficient a defaults if and only if:

$$\eta(1-\alpha)A_{ss}\left(\frac{a\omega}{\alpha}\right)^{1-\varepsilon} < Rf_S\omega$$

that is, if the revenue loss from defaulting is smaller than the cost of repaying the loan. We interpret the parameter η as capturing the degree of financial development in South: Higher levels of η imply that default is a more costly option because credit institutions are more developed, making it more difficult for firms to hide their revenues and assets.

Rearranging the above default condition yields the following cut-off level of a that determines whether firms have access to credit:

$$a_S^{1-\varepsilon} = \frac{1}{\eta}\frac{Rf_S\omega}{(1-\alpha)A_{ss}(\omega/\alpha)^{1-\varepsilon}} \tag{2.15}$$

We assume that lenders can observe a, and hence only Southern firms with $a^{1-\varepsilon} > a_S^{1-\varepsilon}$ will be able to commence production. When $\eta = 1$, the expression for $a_S^{1-\varepsilon}$ is precisely equal to the cut-off level for domestic entry that would prevail in the absence of credit market imperfections. The $\frac{1}{\eta}$ term in (2.15) thus raises the productivity cut-off necessary for a Southern firm to successfully enter its home market, above the cut-off which would suffice in the absence of credit constraints, as illustrated in the lower panel of Figure 1. This is because there is a margin of firms with productivity levels slightly lower than $a_S^{1-\varepsilon}$ that would earn positive profits, but which cannot credibly commit to repay their loans. As η increases towards 1, this distortion from credit constraints vanishes.

2.3 Industry equilibrium

We now close the system formally by specifying the conditions that govern the entry of firms in each country. For this, it is convenient to introduce the notation: $V_i(a) = \int_0^a \tilde{a}^{1-\varepsilon} dG_i(\tilde{a})$, as this expression will show up repeatedly.

Free entry: Prospective entrants in country i's manufacturing sector incur an upfront entry cost equal to f_{Ei} units of country i labor. This is a once-off "fee" that firms pay *ex ante* before they can obtain their productivity draw, $1/a$; for simplicity, we do not model this entry cost as subject to credit constraints, so one can think of these as the monetary equivalent costs of regulatory hurdles to entry.[18] On the exit side, firms face an exogenous probability, δ, of "dying" and leaving the industry in each

[18] It is a straightforward extension to verify that our comparative statics results on the effects of host country financial development are robust to subjecting this fixed cost of entry to borrowing constraints also.

period. For an equilibrium in which the measure of firms in each country is constant, this *ex ante* cost of entry must be equal to the expected profits of a prospective entrant. Using the profit functions (2.7)-(2.10) and the cut-offs (2.11)-(2.14), and integrating the expressions for expected profits over the distribution $G_i(a)$, one can derive the respective free-entry conditions for Western and Southern firms as:

$$\begin{aligned} f_{En} &= \frac{1}{1-\delta}\Bigg[(1-\alpha)A_{ww}\left(\frac{1}{\alpha}\right)^{1-\varepsilon}(V_n(a_D)-V_n(a_I)) - Rf_D(G_n(a_D)-G_n(a_I))\ldots \\ &\quad \ldots+(1-\alpha)A_{ew}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XN})-V_n(a_I)) - Rf_X(G_n(a_{XN})-G_n(a_I))\ldots \\ &\quad \ldots+(1-\alpha)A_{sw}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XS})-V_n(a_I)) - Rf_X(G_n(a_{XS})-G_n(a_I))\ldots \\ &\quad \ldots+(1-\alpha)\left(A_{ww}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}+A_{ew}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}+A_{sw}\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}\right)V_n(a_I)\ldots \\ &\quad \ldots-R(f_I+2f_X)G_n(a_I)\Bigg] \end{aligned} \tag{2.16}$$

$$f_{Es}\omega = \frac{1}{1-\delta}\left[(1-\alpha)A_{ss}\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}V_s(a_S) - Rf_S\omega G_s(a_S)\right] \tag{2.17}$$

Last but not least, we define the measure of firms in country i's manufacturing sector to be N_i, which captures the thickness of each sector from the supply side.[19] The definition of the ideal price index ($P_{ij}^{1-\varepsilon} = \int_{\Omega_{ij}} p_{ij}(a)^{1-\varepsilon}\, dG_j(a)$) then implies that:

$$P_{ww}^{1-\varepsilon} = N_n\left[\left(\frac{1}{\alpha}\right)^{1-\varepsilon}(V_n(a_D)-V_n(a_I)) + \left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}V_n(a_I)\right] \tag{2.18}$$

$$P_{ew}^{1-\varepsilon} = N_n\left[\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XN})-V_n(a_I)) + \left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}V_n(a_I)\right] \tag{2.19}$$

$$P_{sw}^{1-\varepsilon} = N_n\left[\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XS})-V_n(a_I)) + \left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}V_n(a_I)\right] \tag{2.20}$$

$$P_{ss}^{1-\varepsilon} = N_s\left[\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}V_s(a_S)\right] \tag{2.21}$$

The three-country equilibrium is thus defined by the system of equations: (2.3)-(2.6), (2.11)-(2.21), in the 15 unknowns, A_{ww}, A_{ew}, A_{sw}, A_{ss}, a_D, a_{XN}, a_{XS}, a_I, a_S, N_n, N_s, P_{ww}, P_{ew}, P_{sw}, and P_{ss}. While we cannot solve for all of these variables in closed form, we can nevertheless derive precise comparative statics.

[19] Following Melitz (2003), for N_i to be constant in steady state, we require that the expected mass of successful entrants be equal to the mass of firms that dies exogenously in each period. Specifically, letting N_i^{ent} denote the mass of firms that attempts entry each period into country i's manufacturing sector, then $N_n^{ent}G_n(a_D) = \delta N_n$ and $N_s^{ent}G_s(a_S) = \delta N_s$ in the developed Northern countries and in South respectively.

3 Host Country Financial Development and the Industry Equilibrium

How does the level of financial development in the FDI host country affect the pattern of sales of multinational affiliates? Within our model, this boils down to determining how changes in η affect the spatial distribution of Western MNC affiliate sales emanating from South. We proceed now to show how an improvement in Southern financial development systematically shifts the productivity cut-offs for West's manufacturing sector. To foreshadow our key results, a rise in η leads to an increase in both $a_{XS}^{1-\varepsilon}$ and $a_{I}^{1-\varepsilon}$, while at the same time decreasing $a_{D}^{1-\varepsilon}$ and $a_{XN}^{1-\varepsilon}$. Intuitively, a stronger credit market in South induces more entry into Southern manufactures and raises the level of competition faced in that market by Western firms. The new equilibrium thus features a smaller Western manufacturing presence in South, and biases West's firms towards solely serving the developed country markets.

To facilitate the derivations, we explicitly parameterize the set of technological possibilities in the manufacturing sector. Specifically, the productivity distribution of $1/a$ is set to be Pareto with shape parameter k and support $[1/\bar{a}_i, \infty)$ for each country i. Here, $1/\bar{a}_i$ is a lower bound on firm productivity in country i.[20] In addition, a higher k corresponds to a thicker right-tail in the distribution of productivity levels.[21] This distributional assumption yields convenient expressions for G_i and V_i that are polynomials in a:

$$G_i(a) = \left(\frac{a}{\bar{a}_i}\right)^k \tag{3.1}$$

$$V_i(a) = \frac{k}{k-\varepsilon+1}\left(\frac{a^{k-\varepsilon+1}}{\bar{a}_i^k}\right) \tag{3.2}$$

Helpman et al. (2004) show that if the underlying productivity distribution is Pareto with shape parameter k, then the distribution of observed firm sales will be Pareto with shape $k-\varepsilon+1$.[22] Using European firm-level data, they establish the goodness of fit of this parametric distribution for firm sales, while always obtaining estimates of the shape parameter, $k-\varepsilon+1$, that are significantly greater than 0 across manufacturing industries. This empirical evidence motivates the assumption: $k > \varepsilon - 1$. In essence, this requires that the distribution of firm productivities places a sufficiently large mass on high productivity levels.

[20] One might presume that $1/\bar{a}_s < 1/\bar{a}_n$, so that the Southern manufacturing sector has a lower average productivity level. In practice, though, we will not need this assumption for the proofs. We will however require that $\bar{a}_s$ and $\bar{a}_n$ both be sufficiently large, so that the cut-off values, a_S, a_D, a_{XN}, a_{XS}, and a_I, all lie within the interior of the support of the relevant distributions they are drawn from.

[21] It is easy to check that our proofs do not require the shape parameter k to be identical in both West and South, but we have set k as such for simplicity.

[22] This distribution of firm sales is equal to $V_i(a)$ up to a multiplicative constant.

3.1 Impact on industry cut-offs and market demand levels

We now formally demonstrate how an improvement in Southern financial development systematically shifts the productivity cut-offs that sort firms, as well as the aggregate demand levels that these firms face in each market. This bears direct implications for the spatial distribution of MNC affiliate sales, as we will show further below. Observe first that the equilibrium in Southern manufactures is determined solely by (2.15) and (2.17), which pins down A_{ss} and a_S. Totally differentiating these two equations yields:

Lemma 1: $\frac{da_S}{d\eta} > 0$ and $\frac{dA_{ss}}{d\eta} < 0$.

Proof. See Appendix 7.1. ■

Intuitively, a rising cost of default in South alleviates the moral hazard problem, and hence more Southern firms gain access to financial credit. This lowers the productivity cut-off, $a_S^{1-\varepsilon}$, for entry into the local market, as shown in the lower panel of Figure 3. However, the free-entry condition (2.17) requires the expected profitability of a Southern firm to remain constant, which implies that the average level of home demand faced by each Southern firm, A_{ss}, must subsequently fall.

Since Western manufactures are substitutes in consumption in South, these changes in Southern financial development spill over on the structure of the West's manufacturing sector. Specifically, the productivity cut-offs and aggregate demand shifts faced by Western firms are given by:

Lemma 2: (i) $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} > \frac{1}{a_D}\frac{da_D}{d\eta} > 0$; (ii) $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} < \frac{1}{a_I}\frac{da_I}{d\eta} < 0$; (iii) $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta} > 0$; and (iv) $\frac{dA_{sw}}{d\eta} < 0$.

Proof. See Appendix 7.2. ■

While the formal proof of Lemma 2 is fairly extended, the key shifts are very intuitive and are illustrated in the upper panel of Figure 3. The increase in competition in the Southern market decreases South's demand for each Western differentiated variety. This lowers A_{sw}, and correspondingly raises the productivity bars, $a_{XS}^{1-\varepsilon}$ and $a_I^{1-\varepsilon}$, for Western firms seeking to penetrate South, either by exporting or horizontal FDI. However, since the fixed cost of entry, f_{En}, remains constant, the free-entry condition (2.16) implies that total profits from sales in the Northern markets (West and East) must increase. The increase in Southern financial development thus biases West's firms towards serving the developed country markets, as the productivity cut-offs, $a_D^{1-\varepsilon}$ and $a_{XN}^{1-\varepsilon}$, both fall, while the aggregate demand levels in West and East, A_{ww} and A_{ew}, both rise. The parameter assumption, $\varepsilon > \phi$, plays a subtle role that allows this intuition to run through: The output of a given Southern firm must be a closer substitute for other Southern manufacturing varieties than are manufactures from the North, so that Northern varieties are more easily displaced from South's consumption basket with the entry of more competing Southern firms.

Note, moreover, that the proportional shift in the $a_{XN}^{1-\varepsilon}$ cut-off is larger than that of the $a_D^{1-\varepsilon}$ cut-off: Being closer to the $a_{XS}^{1-\varepsilon}$ and $a_I^{1-\varepsilon}$ cut-offs, Western firms with productivity levels around $a_{XN}^{1-\varepsilon}$ are more directly affected by the contraction in Southern demand. Similarly, the $a_{XS}^{1-\varepsilon}$ cut-off increases proportionally more than the a_I cut-off because the most productive Western firms (with $a^{1-\varepsilon} > a_I^{1-\varepsilon}$) are insulated to some extent from the negative demand shock in the South, given that they continue to serve the Northern markets (where demand levels have risen) while enjoying production costs savings in the low-wage South.

3.2 The spatial distribution of sales: Firm-level predictions

These shifts in the productivity cut-offs and market demand levels allow us to sign the impact of Southern financial development on various sales quantities. Within our set-up, we define several quantities of interest that describe the spatial distribution of affiliate sales. For a given affiliate in South with productivity $1/a$, sales to the local market are simply given by: $HORI(a) \equiv (1-\alpha)A_{sw}\left(\frac{a\omega}{\alpha}\right)^{1-\varepsilon}$. We shall refer to these as horizontal sales, since they allow the MNC to avoid transport costs while servicing the Southern market. Export-platform sales to third-country destinations (East) are defined as: $PLAT(a) \equiv (1-\alpha)A_{ew}\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon}$. Last but not least, sales back to the Western home market (which we label as vertical sales) are given by: $VERT(a) \equiv (1-\alpha)A_{ww}\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon}$. These sales back to the home market capture vertical FDI in the sense that the production process has been fragmented across borders: Headquarter inputs, as embodied in f_I, are provided in the Western headquarters, while production and assembly occurs in South, taking advantage of lower factor costs there. Naturally, total sales of the affiliate are: $TOT(a) = HORI(a) + PLAT(a) + VERT(a)$.

Applying these definitions, we obtain:

$$\frac{HORI(a)}{TOT(a)} = \left(1+\tau^{1-\varepsilon}\left(\frac{A_{ew}}{A_{sw}}+\frac{A_{ww}}{A_{sw}}\right)\right)^{-1} \tag{3.3}$$

$$\frac{PLAT(a)}{TOT(a)} = \left(1+\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ew}}+\frac{A_{ww}}{A_{ew}}\right)^{-1} \tag{3.4}$$

$$\frac{VERT(a)}{TOT(a)} = \left(1+\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ww}}+\frac{A_{ew}}{A_{ww}}\right)^{-1} \tag{3.5}$$

which are three ratios that describe the breakdown of affiliate sales by destination.

We can now state the following result regarding the spatial distribution of MNC sales:

Proposition 1 [Firm-level predictions]: *Consider a Western firm with productivity* $1/a$*, where* $a^{1-\varepsilon} > a_I^{1-\varepsilon}$*, so that this firm is a multinational that operates a production affiliate in South. Suppose* *that South undergoes a small improvement in financial development, after which this Western firm still remains a multinational. In response to this increase in* η*:*

(i) Horizontal affiliate sales to South, $HORI(a)$*, decrease, while both export-platform sales to East,* $PLAT(a)$*, and vertical sales back to West,* $VERT(a)$*, increase; and*

(ii) $\frac{HORI(a)}{TOT(a)}$*, decreases, while both* $\frac{PLAT(a)}{TOT(a)}$ *and* $\frac{VERT(a)}{TOT(a)}$*, increase.*

Proof. See Appendix 7.3. ■

The intuition behind this proposition builds on the logic behind Lemma 2. The changes in sales levels, $HORI(a)$, $PLAT(a)$, and $VERT(a)$, are driven by changes in the demand levels, A_{sw}, A_{ew}, and A_{ww}, in the markets that the MNC is servicing. When credit constraints in South are eased, the demand in South for Western goods drops due to the increased competition from local firms. Hence, horizontal sales into South, as well as the share of these horizontal sales in total sales, both decline. At the same time, demand levels in East and West rise in equilibrium, which impels the multinational towards servicing the developed Northern markets, prompting an increase in platform and vertical sales (both in absolute levels and in shares relative to total sales). Indeed, the model further predicts that the increase in each MNC's export-platform sales exceeds that in its sales back to West:

Lemma 3: (i) $\frac{d}{d\eta}PLAT(a) > \frac{d}{d\eta}VERT(a) > 0$; and (ii) $\frac{d}{d\eta}\frac{PLAT(a)}{TOT(a)} > \frac{d}{d\eta}\frac{VERT(a)}{TOT(a)} > 0$.

Proof. See Appendix 7.4. ■

Platform sales increase more than vertical sales for a simple reason: The MNC faces tougher competition in its own home market than it does in East's market, due to the presence of a margin of purely domestic Western firms (whose productivity draws satisfy $a^{1-\varepsilon} \in (a_D^{1-\varepsilon}, a_{XN}^{1-\varepsilon})$) that supply close substitutes in the Western market. Once again, this effect depends on the assumption that varieties from the same country are closer substitutes for one another than varieties from different countries ($\varepsilon > \phi$).

3.3 The spatial distribution of sales: Aggregate predictions

Apart from firm-level predictions, our model also allows us to deduce the effect of host country financial development on aggregate sales quantities. For this, we define the aggregate horizontal, platform and vertical sales of Western MNCs by:

$$HORI \equiv N_n \int_0^{a_I} HORI(a)dG_n(a) = N_n(1-\alpha)A_{sw}\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon} V_n(a_I) \tag{3.6}$$

$$PLAT \equiv N_n \int_0^{a_I} PLAT(a)dG_n(a) = N_n(1-\alpha)A_{ww}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} V_n(a_I) \tag{3.7}$$

$$VERT \equiv N_n \int_0^{a_I} VERT(a)dG_n(a) = N_n(1-\alpha)A_{ww}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} V_n(a_I) \tag{3.8}$$

where we have integrated over the measure of Western firms with labor input coefficient $a < a_I$, that are productive enough to go multinational. (The Pareto distributional assumption for firm productivities is convenient for this purpose, as it delivers neat expressions for these aggregate sales quantities.)

To analyze the impact of Southern financial development on aggregate sales, it is useful first to sign the effect of improvements in η on the measure of Western firms:

Lemma 4: $\frac{dN_n}{d\eta} < 0$.

Proof. See Appendix 7.5. ■

This result is very much consistent with the competition effect we have been highlighting: The easing of credit constraints in South and the subsequent entry of more competitor firms in the local market reduces the *ex ante* expected profits of Western firms. As a result, the measure of Western firms also contracts.

We can now state the following proposition on the impact of Southern financial development on aggregate sales:

Proposition 2 [Aggregate predictions]: *Consider sales aggregated over all Western MNCs with a production affiliate in South. In response to an improvement in financial development in South:*

(i) $HORI$, $PLAT$, *and* $VERT$ *all decrease; and*

(ii) $\frac{HORI}{TOT}$ *decreases, while both* $\frac{PLAT}{TOT}$ *and* $\frac{VERT}{TOT}$ *increase.*

Proof. See Appendix 7.6. ■

The intuition behind part (ii) of the proposition – how the spatial distribution of aggregate affiliate sales varies with η – is essentially the same as that underlying the effect of η on an individual MNC's sales shares, as outlined in Proposition 1. An improvement in financial development in South that increases competition in that market leads Western firms to direct their sales effort away from South, towards the developed Northern markets instead.

As for part (i), observe from (3.6)-(3.8) that η affects these aggregate quantities through three channels: (i) the productivity cut-off for FDI, $a_I^{1-\varepsilon}$; (ii) the measure of Western firms, N_n; and (iii) the demand levels in the respective markets, A_{sw}, A_{ew}, and A_{ww}. The first two channels capture the extensive margin of sales, since these operate through the entry or exit of Western MNCs, while the third channel reflects the intensive margin that operates through changes in the sales of individual MNCs. We know that the effect of improved Southern financial development on the extensive margin is to unambiguously lower all three sales quantities ($HORI$, $PLAT$, and $VERT$): A higher η raises the productivity bar for entry into South as an MNC, so that $V_N(a_I)$ drops (Lemma 2). It also induces a contraction in the measure of Western firms, so that N_n drops (Lemma 4). In the case of horizontal sales, this negative effect on the extensive margin is reinforced by the simultaneous decrease in A_{sw}, so that $HORI$ falls. It turns out that the decline on the extensive margin also dominates any potential increases on the intensive margin from A_{ew} and A_{ww}, so that both $PLAT$ and $VERT$ also fall unambiguously.[23]

4 Empirical Results: Host Country Financial Development and MNC Sales

We turn now to the supporting empirical evidence on the role that host country financial development plays in determining the spatial distribution of MNC affiliate sales. Based on our model from the previous section, we should expect to see that in FDI host countries with more mature credit environments, MNC sales would be oriented away from serving the local host market, towards serving third-country and the home country markets instead. Thus, host country financial development should be negatively correlated with the share of local sales in total sales, while being positively correlated with the shares of platform sales and sales to the MNC's home market. In what follows, we show that the recent experience of US multinationals is broadly consistent with these predictions.

4.1 Data description

The information that we use on US multinational activity is from the Bureau of Economic Analysis (BEA) Survey of US Direct Investment Abroad. This is a very rich dataset, including financial and operating data of all US multinational parent firms and their affiliates abroad. All foreign business enterprises in which a US national holds at least a 10% ownership share are included in the sample,

[23] The dominant role of the extensive margin bears a parallel with Chaney (2005). In a model with heterogenous firms, Chaney shows that the elasticity of substitution between varieties magnifies the impact of trade barriers on trade flows on the intensive margin, but dampens this relationship between distance and trade on the extensive margin. Of note, Chaney establishes both theoretically and empirically that the effect on the extensive margin dominates that on the intensive margin.

and response to the survey is required by law. In our empirical work, we restrict ourselves to the subset of majority-owned non-bank affiliates of non-bank US parents. While the BEA makes a fair amount of aggregate summary statistics available on its website, the firm-level data can only be accessed by US citizens at the BEA's premises (subject to BEA approval) due to confidentiality reasons.

The BEA conducts benchmark surveys every five years (most recently, in 2004), which in principle capture the entire universe of US foreign affiliate activity. In non-benchmark years, only affiliates with sales larger than a predetermined cut-off are required to report, resulting in a sample that is biased towards larger firms. To derive comparable summary statistics, the BEA imputes data for the smaller firms in non-benchmark years. In our affiliate-level regressions, we will work with the annual data from 1989-1998, using only those observations that the BEA micro data indicates to be original survey information (namely, excluding all imputed data in non-benchmark years). This constrains us to an unbalanced panel of affiliates, but our results on the impact of host country financial development nevertheless hold when we restrict our regressions to benchmark survey years only, in which the sample is more comprehensive.[24]

The BEA survey includes a question that solicits detailed information on each foreign affiliate's "sales or gross operating revenues, excluding sales taxes". In addition to reporting total affiliate sales, the survey requests a breakdown of these sales into: (i) local sales (in the host country market); (ii) sales to the US; and (iii) sales to other countries. We use these as our baseline measures of horizontal sales ($HORI(a)$), vertical sales ($VERT(a)$) and export-platform sales ($PLAT(a)$) respectively. When divided by total affiliate sales, $TOT(a)$, these variables summarize the spatial distribution of each MNC's sales destinations. The BEA survey further requests the breakdown within each of these three categories into sales to other affiliates of the US reporting firm and sales to unaffiliated customers, a distinction which we will use later to provide alternative measures of horizontal, vertical, and platform sales as a robustness check.

Table 1 provides basic descriptive statistics for each of these sales variables for the benchmark years, 1989 and 1994. Of note, the spatial distribution patterns of US foreign affiliate sales appear to have been fairly stable between these two benchmark years. Sales to the local host market took up by far the largest share, being slightly over 70% of total affiliate sales in both benchmark years. Platform sales accounted for about 20% of affiliate sales, with sales back to the US taking up just under 10%.

Turning to the right-hand variables for our regression analysis, we use Beck et al.'s (2000) data on private credit extended by banks and other financial intermediaries, normalized by country GDP, as

[24] We restrict ourselves for now to the pre-1999 data, as the BEA (together with all US government agencies) switched from the US Standard Industrial Classification (SIC) to the North American Industry Classification System (NAICS) in 1999. We have yet to fully resolve the concordance issues between these two classification systems.

our measure of host country financial development. The availability of credit is particularly relevant in our context, since it speaks directly to the accessibility of financial capital, and hence to the ease of entry for host country firms in their domestic market.

As additional control variables, we include both the real GDP and real GDP per capita of the host country, taken from the Penn World Tables, Version 6.1. Real GDP serves as a control for the host's market size, which clearly has the potential to shift the propensity of MNC affiliates to serve the local market. On the other hand, real GDP per capita can be viewed as a proxy for local factor costs. We also use the rule of law index from La Porta et al. (1998), as a further control for host country conditions that could affect the security of inward FDI. To capture the issue of proximity and trade costs, we use the great circle formula distance between the major population centers of the US and each host country, taken from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).[25] Given the recent attention paid to the role of regional trade agreements (RTAs) in reducing tariff barriers among member countries, we also include a set of 10 RTA dummy variables based on Rose (2004); these are respectively equal to 1 if the host country is a signatory to the following RTAs in the given year: EEC/EC, US-Israel, Canada-US (the precursor of NAFTA), CARICOM, PATCRA, ANZ-CERTA, CACM, SPARTECA, ASEAN, and Mercosur.

4.2 Empirical results

We proceed to test the effect of host country financial development on the spatial distribution of US foreign affiliate sales, focusing on the share of horizontal, platform and vertical sales in total sales as our key dependent variables. We present first the affiliate-level evidence, using the BEA survey data from 1989-1998. Columns (1)-(3) of Table 2 display the baseline regressions where the left-hand side variable is respectively: (1) the share of sales to the local market in total affiliate sales; (2) the share of sales to third-country markets in total sales; and (3) the share of US sales in total sales. All regressions include year fixed effects to control for possible time trends, as well as industry fixed effects to absorb any unobserved systematic differences across industries. We report robust standard errors clustered by host country, to account for possible correlated shocks that might affect all affiliates in the same country.

The effect of financial development identified in these regressions is consistent with the firm-level predictions in Proposition 1 regarding $\frac{HORI(a)}{TOT(a)}$, $\frac{PLAT(a)}{TOT(a)}$, and $\frac{VERT(a)}{TOT(a)}$. Column (1) confirms that *ceteris paribus*, more mature levels of financial development are associated with a lower share of affiliate sales to the local market (coefficient = -0.106, significant at the 1% level), implying a decreased propensity towards the horizontal motive for FDI. Conversely, the share of affiliate sales

[25] http://www.cepii.fr/anglaisgraph/bdd/distances.htm

to third country markets increases (Column (2), coefficient = 0.109, significant at the 1% level), suggesting an increased propensity towards export-platform FDI. To gauge the implied quantitative impact, consider an improvement in financial development from the 25th-percentile country (Private credit over GDP = 0.13, in the year 1989) to the 75th-percentile country (Private credit over GDP = 0.51). Such an increase in the availability of private credit in the FDI host country would lower US foreign affiliates' share of local sales in total sales by 0.040 on average (from an initial mean level of 0.716), while raising the third-country sales share by 0.041 (from an initial mean level of 0.197). This represents a fairly sizeable re-orientation in sales destinations when viewed from the perspective of the export-platform sales share, which would increase by about 20%.

With regards to the share of return sales to the US, although our theory predicts a positive correlation, we estimate a coefficient on the host's level of financial development that is statistically indistinguishable from zero (with a negative point estimate). This evidence is nevertheless consistent with Lemma 3, which predicts that the impact of host country financial development on platform sales should be larger in magnitude than that on vertical sales: The coefficient of "Private Credit over GDP" in Column (2) is larger than that in Column (3), with the difference being statistically significant at the 1% level. Although the panel that we use from 1989-1998 is unbalanced due to BEA sampling procedures in non-benchmark years, we also find very similar results regarding the effect of host country financial development on the shares of local, third-country, and US sales when running separate regressions on each of the benchmark years, 1989 and 1994 (regressions available upon request).

The signs we obtain on several other control variables are also consistent with the underlying intuition of our model. Of note, higher levels of host country real GDP are associated with a larger share of local sales in affiliate's total sales, as well as a smaller share of both third-country sales and sales back to the US. We interpret this as a market size effect that raises the propensity towards horizontal FDI, while steering affiliates away from servicing third-country markets or the home economy (the US). Separately, notice that distance from the US tends to raise the local sales share. This is consistent with the familiar intuition behind the proximity-concentration tradeoff that higher transport costs (proxied here by a longer distance) make horizontal FDI a more profitable option for servicing foreign markets. However, distance tends to deter US parent firms from using the foreign affiliate as a base for servicing the home market, as evidenced by the negative coefficient (significant at the 10% level) on log distance in Column (3). While all regressions include a full set of RTA dummies, we have displayed only the coefficient of the EEC/EC (European Economic Community / European Community) RTA, which is of particular interest. A by-product of the move towards European economic integration has been the rise of several smaller European countries (most prominently, Ireland) as manufacturing bases from which MNCs service the large European market (Ekholm et al. 2003, Navaretti and Venables 2004). Our regressions appear to pick up on this phenomenon, identifying a positive and significant effect of EEC/EC membership on the export-platform share of affiliate sales (with a consequent decrease in the shares of both horizontal and vertical sales).

The remainder of Table 2 explores the use of alternative measures of horizontal, platform, and vertical sales, that draw on the distinction between sales to affiliated and unaffiliated customers. Taking affiliated sales as a proxy for transactions within the boundaries of the US parent firm, we use US sales to affiliated entities as a second measure of vertical sales, to capture that component of MNC activity that arises from the fragmentation of production processes within the firm to take advantage of cross-border factor price differentials. On the other hand, we use unaffiliated local sales and unaffiliated sales to third countries as alternatives to capture horizontal and platform sales respectively, the presumption here being that excluding intra-firm transactions helps provide a better gauge of sales to consumers in each set of markets. Reassuringly, Columns (4)-(6) confirm that our findings are left broadly unchanged when we adopt these alternative dependent variables. The availability of private credit in the host country continues to have a negative and significant effect on the share of sales to local unaffiliated customers (Column (4)). There is also a positive and significant effect on the share to third-country unaffiliated customers (Column (5)), although the magnitude of this coefficient drops by about a half compared to the corresponding baseline regression in Column (2). The point estimate for the effect on affiliated US sales is now positive, but this remains statistically indistinguishable from zero (Column (6)).

Table 3 undertakes several robustness tests using the same trio of dependent variables as in our baseline specifications (Table 2, Columns (1)-(3)). One potentially important category of omitted variables pertains to unobserved parent firm characteristics. When controlling for these with parent fixed effects in Table 3, Columns (1)-(3), we continue to obtain results that are very similar to the baseline: Once again, host countries with a better credit environment witness lower shares of local sales, but higher shares of sales to third-countries. While the effect on US sales is not statistically significant, this coefficient is nevertheless smaller than the estimated effect of host country financial development on platform sales. Columns (4)-(6) include an even more extensive set of fixed effects, these being at the affiliate level. This subjects the data to a very stringent test (there being only at most ten observations per affiliate in our panel), and the results we obtain are weaker, with the effects of financial development being much smaller and no longer significant, although still of the predicted sign.

How then does the data measure up when we test it against the aggregate predictions of our model? Table 4 presents the results obtained using sales quantities summed up to the country level;

for example, the dependent variable in Column (1) is total affiliate sales in the host's market divided by these affiliates' total sales to all markets. We include only the two benchmark years (1989 and 1994) in these regressions, given the concerns we have mentioned over the reliability of deduced aggregates for non-benchmark years. Our specifications again include year fixed effects, with standard errors clustered by host country.

Columns (1)-(3) of Table 4 confirm that the effects of host country financial development are also manifest in the aggregate data. This is despite the much smaller number of observations in these regressions, as well as the fact that we are also controlling for both real GDP and real GDP per capita, which are already highly correlated with financial development.[26] In particular, we find that "Private Credit over GDP" exerts a negative effect on the aggregate share of horizontal sales (coefficient = −0.499, significant at the 1% level), while tending to raise that of third-country platform sales (coefficient = 0.270, significant at the 5% level). As with the affiliate-level evidence, we do not find a significant effect on the share of sales returning to the US; the point estimate remains positive and smaller in magnitude than the corresponding effect in Column (2) on third-country sales (although the difference in these two coefficients is now not statistically significant at conventional levels, due to the larger standard errors obtained in these country-level regressions). Note also that the EEC/EC dummy behaves as before, with membership in this common market tending to raise the propensity for platform FDI, with the share of horizontal sales falling as a consequence. The results are slightly weaker when we adopt the alternative sales measures in Columns (4)-(6) as our dependent variables: We still find a negative effect of host country financial development on horizontal FDI, as measured by the share of sales to unaffiliated local customers. The effects on both the share of unaffiliated third-country sales and the share of affiliated US sales are positive, though not statistically significant.

In sum, the recent experience of US multinationals confirms that in host countries where private credit is more readily available, MNC affiliates are oriented less towards sales to the local market, and more towards using the foreign plant as a base for sales to other markets. This provides supporting evidence consistent with the competition effect highlighted in our model, that a more competitive host market decreases the propensity towards horizontal FDI, and raises that towards export-platform FDI and (to a lesser extent) vertical FDI.

[26]The partial correlation between "Private Credit over GDP" and log real GDP in 1989 for the countries in our aggregate data is 0.33 (significant at the 5% level). The corresponding correlation between "Private Credit over GDP" and log real GDP per capita in 1989 is 0.67 (significant at the 1% level).

5 Conclusion

This paper contributes to the growing literature examining how conditions in FDI host countries affect the structure of multinational activity. We uncover several novel effects of financial development in the FDI-receiving country, using comprehensive affiliate-level data on US multinational activity abroad. In host countries where secure sources of external credit are more readily accessed, MNC affiliates exhibit a lower share of sales to the local market, while channelling a larger share towards sales to third-country markets. Better host country financial development thus appears to reduce the horizontal component of FDI, while raising the export-platform motive for going multinational.

We posit and formalize a competition effect to explain this link between financial development and the spatial distribution of MNC sales. An improvement in credit conditions in the FDI host country ("South") would facilitate the entry of more Southern manufacturing firms into the local market. Northern varieties thus face more competition in the Southern market, and this prompts Northern MNCs based in South to shift their sales away from the local market, and channel them towards the third-country and parent country markets instead. In highlighting this mechanism, we have abstracted from the potential influence of host country credit markets on the capital structure of Northern affiliates. These effects on the financing decisions of MNC affiliates are clearly important, and have indeed been the focus of prior work (Feinberg and Phillips 2004, Antràs et al. 2007). Nevertheless, we hope this paper will call attention to the role of Southern financial development in providing credit access to Southern firms as well, which in turn can impact the sales decisions and activities of Northern MNCs.

There remains much scope for research which we hope to pursue in future work. While we have focused here exclusively on MNC activity, we hope to explore how host country financial development might also affect decisions regarding whether to service the host country market via exports or FDI, as well as whether to service the third-country market via direct exports from the home country or export-platform FDI. It would also be interesting to empirically distinguish between the effects of host country financial development on the intensive and extensive margins of MNC sales.

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7 Appendix (Details of Proofs)

7.1 Proof of Lemma 1

Proof. Taking logarithms of (2.15) and (2.17), and totally differentiating, one obtains:

$$(\varepsilon-1)\frac{da_S}{a_S}=\frac{d\eta}{\eta}+\frac{dA_{ss}}{A_{ss}},\quad \text{and}$$

$$a_S^{\varepsilon-1}V_s(a_S)\frac{dA_{ss}}{A_{ss}}+[a_S^{\varepsilon-1}V_s'(a_S)-\eta G_s'(a_S)]da_S=0$$

Note that the expression for the cut-off, $a_S^{1-\varepsilon}$, from (2.15) has been used in deriving the second equation above. Solving these two equations simultaneously yields:

$$\frac{da_S}{d\eta}=\frac{1}{\eta}\frac{a_S^{\varepsilon-1}V_s(a_S)}{(\varepsilon-1)a_S^{\varepsilon-2}V_s(a_S)+[a_S^{\varepsilon-1}V_s'(a_S)-\eta G_s'(a_S)]}>0,\quad \text{and}$$

$$\frac{dA_{ss}}{d\eta}=-\frac{1}{\eta}\frac{a_S^{\varepsilon-1}V_s'(a_S)-\eta G_s'(a_S)}{(\varepsilon-1)a_S^{\varepsilon-2}V_s(a_S)+[a_S^{\varepsilon-1}V_s'(a_S)-\eta G_s'(a_S)]}<0$$

These last two inequalities follow from the fact that $\varepsilon>1$ and

$$a_S^{\varepsilon-1}V_s'(a_S)-\eta G_s'(a_S)=(1-\eta)G_s'(a_S)>0$$

for all $\eta\in(0,1)$, since $a_S^{\varepsilon-1}V_s'(a_S)=G_s'(a_S)$ by applying Liebnitz's rule to the definition of $V_s(\cdot)$, and $G_s'(a)>0$ for all $a\in(0,\bar{a}_s)$. ■

7.2 Proof of Lemma 2

Proof. The proof of this lemma is long, so it is useful to provide a heuristic description of how this proof proceeds. In essence, we will take the remaining 13 equations that define the Western industry equilibrium – (2.3)-(2.6), (2.11)-(2.14), (2.18)-(2.21), and (2.16) – and log-differentiate them. We then reduce the resulting system of equations to a set of 4 equations in the 4 unknowns, $\frac{da_D}{a_D}$, $\frac{da_{XN}}{a_{XN}}$, $\frac{da_{XS}}{a_{XS}}$, and $\frac{da_I}{a_I}$. From this, we can pinpoint the comparative statics with respect to η for the Western industry cut-offs, and hence for the other endogenous variables as well.

First, log-differentiating (2.11), (2.12) and (2.13) yields:

$$(\varepsilon-1)\frac{da_D}{a_D}=\frac{dA_{ww}}{A_{ww}}\tag{7.1}$$

$$(\varepsilon-1)\frac{da_{XN}}{a_{XN}}=\frac{dA_{ew}}{A_{ew}}\tag{7.2}$$

$$(\varepsilon-1)\frac{da_{XS}}{a_{XS}}=\frac{dA_{sw}}{A_{sw}}\tag{7.3}$$

Since $\varepsilon>1$, this implies that: $sign(\frac{da_D}{d\eta})=sign(\frac{dA_{ww}}{d\eta})$, $sign(\frac{da_{XN}}{d\eta})=sign(\frac{dA_{ew}}{d\eta})$, and $sign(\frac{da_{XS}}{d\eta})=sign(\frac{dA_{sw}}{d\eta})$.

Similarly, log-differentiating (2.14) yields:

$$\frac{da_I}{a_I}=\frac{A_{ww}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{1}{\alpha}\right)^{1-\varepsilon}\right)\frac{dA_{ww}}{A_{ww}}+A_{ew}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)\frac{dA_{ew}}{A_{ew}}+A_{sw}\left(\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)\frac{dA_{sw}}{A_{sw}}}{(\varepsilon-1)\left[A_{ww}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{1}{\alpha}\right)^{1-\varepsilon}\right)+A_{ew}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)+A_{sw}\left(\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)\right]}$$

Replacing $\frac{dA_{ww}}{A_{ww}}$, $\frac{dA_{ew}}{A_{ew}}$, and $\frac{dA_{sw}}{A_{sw}}$ by the expressions in (7.1)-(7.3), and simplifying extensively leads to:

$$\frac{da_I}{a_I}=\frac{\rho_1(1-\Delta_1)\frac{da_D}{a_D}+(1-\rho_1)(1-\Delta_2)\frac{da_{XN}}{a_{XN}}+\frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)\frac{da_{XS}}{a_{XS}}}{\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2)+\frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)} \tag{7.4}$$

where we define:

$$\rho_1 = \frac{P_{ww}^{1-\phi}}{P_{ww}^{1-\phi}+P_{ew}^{1-\phi}} \tag{7.5}$$

$$\rho_2 = \frac{P_{ss}^{1-\phi}}{P_{ss}^{1-\phi}+2P_{sw}^{1-\phi}} \tag{7.6}$$

$$\Delta_1 = \frac{\left(\frac{1}{\alpha}\right)^{1-\varepsilon}V_n(a_D)}{\left(\frac{1}{\alpha}\right)^{1-\varepsilon}V_n(a_D)+((\frac{\tau\omega}{\alpha})^{1-\varepsilon}-\left(\frac{1}{\alpha}\right)^{1-\varepsilon})V_n(a_I)} \tag{7.7}$$

$$\Delta_2 = \frac{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n(a_{XN})}{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n(a_{XN})+((\frac{\tau\omega}{\alpha})^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon})V_n(a_I)} \tag{7.8}$$

$$\Delta_3 = \frac{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n(a_{XS})}{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n(a_{XS})+((\frac{\omega}{\alpha})^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon})V_n(a_I)} \tag{7.9}$$

Observe that: $\rho_1, \rho_2, \Delta_1, \Delta_2, \Delta_3 \in (0,1)$. Moreover, using the above definitions of Δ_1, Δ_2, and Δ_3, one can show that:

$$sign\{\Delta_1-\Delta_2\} \;=\; sign\{((\tau\omega)^{1-\varepsilon}-\tau^{1-\varepsilon})V_N(a_D)-\tau^{1-\varepsilon}((\tau\omega)^{1-\varepsilon}-1)V_N(a_{XN})\} \;>\; 0$$

This inequality follows from the following facts: $V_N(a_D) > V_N(a_{XN}) > 0$ (since $a_D > a_{XN}$), and $(\tau\omega)^{1-\varepsilon}-\tau^{1-\varepsilon} > \tau^{1-\varepsilon}((\tau\omega)^{1-\varepsilon}-1) > 0$. In an analogous fashion, we have:

$$sign\{\Delta_2-\Delta_3\} \;=\; sign\{\tau^{1-\varepsilon}(\omega^{1-\varepsilon}-\tau^{1-\varepsilon})V_N(a_{XN})-\tau^{1-\varepsilon}((\tau\omega)^{1-\varepsilon}-\tau^{1-\varepsilon})V_N(a_{XS})\} \;>\; 0$$

This last expression is again positive since: $V_N(a_{XN}) > V_N(a_{XS}) > 0$ (because $a_{XN} > a_{XS}$), and $\omega^{1-\varepsilon}-\tau^{1-\varepsilon} > (\tau\omega)^{1-\varepsilon}-\tau^{1-\varepsilon} > 0$. It therefore follows that $1 > \Delta_1 > \Delta_2 > \Delta_3 > 0$. These are useful properties to bear in mind in the algebra that follows.

We now differentiate the free-entry condition for West, (2.16), and collect terms to obtain the following equation:

$$
\begin{aligned}
0 \quad = \quad & \left[(1-\alpha)A_{ww}\left(\left(\frac{1}{\alpha}\right)^{1-\varepsilon}V_n(a_D)+\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{1}{\alpha}\right)^{1-\varepsilon}\right)V_n(a_I)\right)\right]\frac{dA_{ww}}{A_{ww}}\ldots \\
& \ldots+\left[(1-\alpha)A_{ew}\left(\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n(a_{XN})+\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)V_n(a_I)\right)\right]\frac{dA_{ew}}{A_{ew}}\ldots \\
& \ldots+\left[(1-\alpha)A_{sw}\left(\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n(a_{XS})+\left(\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)V_n(a_I)\right)\right]\frac{dA_{sw}}{A_{sw}}\ldots \\
& \ldots+\left[(1-\alpha)A_{ww}\left(\frac{1}{\alpha}\right)^{1-\varepsilon}V_n'(a_D)-Rf_DG_n'(a_D)\right]da_D\ldots \\
& \ldots+\left[(1-\alpha)A_{ew}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n'(a_{XN})-Rf_XG_n'(a_{XN})\right]da_{XN}\ldots \\
& \ldots+\left[(1-\alpha)A_{sw}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n'(a_{XS})-Rf_XG_n'(a_{XS})\right]da_{XS}\ldots \\
& \ldots+\left[(1-\alpha)\left(A_{ww}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{1}{\alpha}\right)^{1-\varepsilon}\right)+A_{ew}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)\right.\right.\ldots \\
& \left.\left.\ldots+A_{sw}\left(\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)V_n'(a_I)\right)-R(f_I-f_D)G_n'(a_I)\right]da_I
\end{aligned}
$$

Focus first on the term involving da_D on the right-hand side. By substituting the expression for a_D from (2.11), and applying the fact that $a^{\varepsilon-1}V_n'(a)=G_n'(a)$ for all $a\in(0,\bar{a}_n)$, one can show that the coefficient of da_D reduces to 0. An analogous argument implies that the coefficients of da_{XN}, da_{XS}, and da_I are all identically equal to 0. Turning to the terms involving $\frac{dA_{ww}}{A_{ww}}$, $\frac{dA_{ew}}{A_{ew}}$, and $\frac{dA_{sw}}{A_{sw}}$, one can now apply the definitions in (7.5)-(7.6) to simplify the derivative of this free-entry equation to:

$$
\begin{aligned}
0 \quad &= \quad \rho_1\frac{dA_{ww}}{A_{ww}}+(1-\rho_1)\frac{dA_{ew}}{A_{ew}}+\frac{1-\rho_2}{2}\frac{E_s}{E_n}\frac{dA_{sw}}{A_{sw}} \\
&= \quad \rho_1\frac{da_D}{a_D}+(1-\rho_1)\frac{da_{XN}}{a_{XN}}+\frac{1-\rho_2}{2}\frac{E_s}{E_n}\frac{da_{XS}}{a_{XS}} \qquad (7.10)
\end{aligned}
$$

where the last line follows from a quick substitution from (7.1)-(7.3). Intuitively, the free-entry condition requires that a rise in demand in any one market for the Western MNC's goods must be balanced by a decline in demand from at least one other market. By implication, the three cut-offs a_D, a_{XN} and a_{XS} cannot all move in the same direction.

We move on to log-differentiate the market demand expressions in (2.3)-(2.6):

$$
\frac{dA_{ww}}{A_{ww}} = \left((1-\rho_1)\frac{1-\phi}{1-\varepsilon}-1\right)\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}}-(1-\rho_1)\frac{1-\phi}{1-\varepsilon}\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}} \qquad (7.11)
$$

$$
\frac{dA_{ew}}{A_{ew}} = \left(\rho_1\frac{1-\phi}{1-\varepsilon}-1\right)\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}}-\rho_1\frac{1-\phi}{1-\varepsilon}\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}} \qquad (7.12)
$$

$$
\frac{dA_{sw}}{A_{sw}} = \left(\rho_2\frac{1-\phi}{1-\varepsilon}-1\right)\frac{dP_{sw}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}}-\rho_2\frac{1-\phi}{1-\varepsilon}\frac{dP_{ss}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}} \qquad (7.13)
$$

$$
\frac{dA_{ss}}{A_{ss}} = \left((1-\rho_2)\frac{1-\phi}{1-\varepsilon}-1\right)\frac{dP_{ss}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}}-(1-\rho_2)\frac{1-\phi}{1-\varepsilon}\frac{dP_{sw}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}} \qquad (7.14)
$$

Meanwhile, log-differentiating the ideal price indices (2.18)-(2.20) gives us:

$$\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}} = \frac{dN_n}{N_n} + (k-\varepsilon+1)\left(\Delta_1 \frac{da_D}{a_D} + (1-\Delta_1)\frac{da_I}{a_I}\right) \tag{7.15}$$

$$\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}} = \frac{dN_n}{N_n} + (k-\varepsilon+1)\left(\Delta_2 \frac{da_{XN}}{a_{XN}} + (1-\Delta_2)\frac{da_I}{a_I}\right) \tag{7.16}$$

$$\frac{dP_{sw}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}} = \frac{dN_n}{N_n} + (k-\varepsilon+1)\left(\Delta_3 \frac{da_{XS}}{a_{XS}} + (1-\Delta_3)\frac{da_I}{a_I}\right) \tag{7.17}$$

where we have applied the fact that: $\frac{aV_n(a)}{V_n'(a)} = k-\varepsilon+1$, for the Pareto distribution to obtain these last three equations.[27]

Using Cramer's Rule, we now invert (7.13) and (7.14) to obtain:

$$\frac{dP_{sw}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}} = \left(\rho_2 \frac{1-\phi}{\varepsilon-\phi} - 1\right)\frac{dA_{sw}}{A_{sw}} - \rho_2 \frac{1-\phi}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}} \tag{7.18}$$

$$\frac{dP_{ss}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}} = \left((1-\rho_2)\frac{1-\phi}{\varepsilon-\phi} - 1\right)\frac{dA_{ss}}{A_{ss}} - (1-\rho_2)\frac{1-\phi}{\varepsilon-\phi}\frac{dA_{sw}}{A_{sw}} \tag{7.19}$$

Setting (7.17) equal to (7.18) implies that:

$$\frac{dN_n}{N_n} = -\rho_2\frac{1-\phi}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}} + \left[(\varepsilon-1)\left(\rho_2\frac{1-\phi}{\varepsilon-\phi} - 1\right) - (k-\varepsilon+1)\Delta_3\right]\frac{da_{XS}}{a_{XS}} - (k-\varepsilon+1)(1-\Delta_3)\frac{da_I}{a_I} \tag{7.20}$$

We now plug this expression for $\frac{dN_n}{N_n}$ into (7.15) and (7.16), and substitute the subsequent expressions for $\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}}$ from (7.15) and $\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}}$ from (7.16) into (7.11) and (7.12). Finally, replacing $\frac{dA_{ww}}{A_{ww}}$ and $\frac{dA_{ew}}{A_{ew}}$ with the equivalent expressions in terms of $\frac{da_D}{a_D}$ and $\frac{da_{XN}}{a_{XN}}$ from (7.1) and (7.2) respectively, one obtains (after some re-arrangement):

$$\begin{aligned}
-\frac{\rho_2}{k-\varepsilon+1}\frac{1-\phi}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}} &= \left[\left((1-\rho_1)\frac{1-\phi}{1-\varepsilon} - 1\right)\Delta_1 - \frac{\varepsilon-1}{k-\varepsilon+1}\right]\frac{da_D}{a_D} - (1-\rho_1)\frac{1-\phi}{1-\varepsilon}\Delta_2\frac{da_{XN}}{a_{XN}}\dots \\
&\dots - \left[\frac{\varepsilon-1}{k-\varepsilon+1}\left(\rho_2\frac{1-\phi}{\varepsilon-\phi} - 1\right) - \Delta_3\right]\frac{da_{XS}}{a_{XS}}\dots \\
&\dots + \left[(\Delta_1-\Delta_3) - (\Delta_1-\Delta_2)(1-\rho_1)\frac{1-\phi}{1-\varepsilon}\right]\frac{da_I}{a_I}
\end{aligned} \tag{7.21}$$

$$\begin{aligned}
-\frac{\rho_2}{k-\varepsilon+1}\frac{1-\phi}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}} &= -\rho_1\frac{1-\phi}{1-\varepsilon}\Delta_1\frac{da_D}{a_D} + \left[\left(\rho_1\frac{1-\phi}{1-\varepsilon} - 1\right)\Delta_2 - \frac{\varepsilon-1}{k-\varepsilon+1}\right]\frac{da_{XN}}{a_{XN}}\dots \\
&\dots - \left[\frac{\varepsilon-1}{k-\varepsilon+1}\left(\rho_2\frac{1-\phi}{1-\varepsilon} - 1\right) - \Delta_3\right]\frac{da_{XS}}{a_{XS}}\dots \\
&\dots + \left[(\Delta_2-\Delta_3) - (\Delta_1-\Delta_2)\rho_1\frac{1-\phi}{1-\varepsilon}\right]\frac{da_I}{a_I}
\end{aligned} \tag{7.22}$$

Equations (7.4), (7.10), (7.21), and (7.22) give us four equations in the four unknowns, $\frac{da_D}{a_D}$, $\frac{da_{XN}}{a_{XN}}$, $\frac{da_{XS}}{a_{XS}}$, and $\frac{da_I}{a_I}$. To pin down the comparative statics explicitly, note that subtracting (7.22) from

[27] Note that we have not explicitly differentiated (2.21) for $P_{ss}^{1-\varepsilon}$. This equation only plays a role in pinning down the sign of $\frac{dN_s}{N_s}$, which is of secondary interest to our exercise.

(7.21) implies:

$$\frac{da_I}{a_I} = \frac{1}{\Delta_1 - \Delta_2}\left[\left(\Delta_1 + \frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\frac{da_D}{d_D} - \left(\Delta_2 + \frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\frac{da_{XN}}{d_{XN}}\right] \tag{7.23}$$

Meanwhile, eliminating $\frac{da_{XS}}{a_{XS}}$ from (7.4) and (7.10) delivers:

$$\frac{da_I}{a_I} = \frac{\rho_1(\Delta_3 - \Delta_1)\frac{da_D}{a_D} + (1-\rho_1)(\Delta_3 - \Delta_2)\frac{da_{XN}}{a_{XN}}}{\rho_1(1-\Delta_1) + (1-\rho_1)(1-\Delta_2) + \frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)} \tag{7.24}$$

For convenience, let us define: $\Delta_d = \rho_1(1-\Delta_1) + (1-\rho_1)(1-\Delta_2) + \frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)$, which is the denominator in (7.24). Note that $\Delta_d > 0$, since $\rho_1, \rho_2, \Delta_1, \Delta_2, \Delta_3 \in (0,1)$.

Then, setting (7.23) equal to (7.24) and re-arranging, one obtains:

$$\begin{aligned} 0 \;=\; & \left[-\rho_1(\Delta_1 - \Delta_3)(\Delta_1 - \Delta_2) - \Delta_d\left(\Delta_1 + \frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\right]\frac{da_D}{a_D}\ldots \\ & \ldots + \left[-(1-\rho_1)(\Delta_2 - \Delta_3)(\Delta_1 - \Delta_2) + \Delta_d\left(\Delta_2 + \frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\right]\frac{da_{XN}}{a_{XN}} \end{aligned} \tag{7.25}$$

Since $\Delta_1 - \Delta_2, \Delta_2 - \Delta_3, \Delta_d > 0$ and $\rho_1 \in (0,1)$, it follows that the coefficient of $\frac{da_D}{a_D}$ in (7.25) is negative. Moreover, using the definition of Δ_d, it is easy to see that the coefficient of $\frac{da_{XN}}{a_{XN}}$ is strictly greater than: $-(1-\rho_1)(\Delta_2 - \Delta_3)(\Delta_1 - \Delta_2) + (1-\rho_1)(1-\Delta_2)\Delta_2$, which in turn is positive, since: $1 - \Delta_2 > \Delta_1 - \Delta_2$, and $\Delta_2 > \Delta_2 - \Delta_3$. Thus, the coefficient of $\frac{da_{XN}}{a_{XN}}$ in (7.25) is positive. Since the linear combination in (7.25) is equal to 0, it follows that $sign(\frac{da_{XN}}{d\eta}) = sign(\frac{da_D}{d\eta})$.

We require one more equation in $\frac{da_D}{a_D}$ and $\frac{da_{XN}}{a_{XN}}$ in order to pin down their common sign. For this, substitute the expression for $\frac{da_I}{a_I}$ from (7.24) and the expression for $\frac{da_{XS}}{a_{XS}}$ from (7.10) into (7.21) to obtain:

$$\begin{aligned} -\frac{\rho_2}{k-\varepsilon+1}\frac{1-\phi}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}} \;=\; & \left[\frac{2\rho_1}{1-\rho_2}\frac{E_n}{E_s}\left(\frac{\varepsilon-1}{k-\varepsilon+1}\left(\rho_2\frac{1-\phi}{\varepsilon-\phi} - 1\right) - \Delta_3\right)\ldots\right. \\ & \ldots - \left((\Delta_1 - \Delta_3) - (\Delta_1 - \Delta_2)(1-\rho_1)\frac{1-\phi}{1-\varepsilon}\right)\frac{\rho_1(\Delta_1 - \Delta_3)}{\Delta_d}\ldots \\ & \left.\ldots + \left((1-\rho_1)\frac{1-\phi}{1-\varepsilon} - 1\right)\Delta_1 - \frac{\varepsilon-1}{k-\varepsilon+1}\right] \times \frac{da_D}{a_D}\ldots \\ & \ldots + \left[\frac{2(1-\rho_1)}{1-\rho_2}\frac{E_n}{E_s}\left(\frac{\varepsilon-1}{k-\varepsilon+1}\left(\rho_2\frac{1-\phi}{\varepsilon-\phi} - 1\right) - \Delta_3\right)\ldots\right. \\ & \ldots - \left((\Delta_1 - \Delta_3) - (\Delta_1 - \Delta_2)(1-\rho_1)\frac{1-\phi}{1-\varepsilon}\right)\frac{(1-\rho_1)(\Delta_2 - \Delta_3)}{\Delta_d}\ldots \\ & \left.\ldots - (1-\rho_1)\frac{1-\phi}{1-\varepsilon}\Delta_2\right] \times \frac{da_{XN}}{a_{XN}} \end{aligned} \tag{7.26}$$

Note that $(\Delta_1 - \Delta_3) - (\Delta_1 - \Delta_2)(1-\rho_1)\frac{1-\phi}{1-\varepsilon} > 0$, since: $\Delta_1 - \Delta_2 < \Delta_1 - \Delta_3$; $1 - \rho_1 \in (0,1)$; and $\frac{1-\phi}{1-\varepsilon} \in (0,1)$ (because $\varepsilon > \phi > 1$). It is then straightforward to see that both the coefficients of $\frac{da_D}{a_D}$

and $\frac{da_{XN}}{a_{XN}}$ in (7.26) are negative. From Lemma 1, $\frac{dA_{ss}}{d\eta} < 0$, so that the left-hand side of (7.26) is negative. It follows that $sign(\frac{da_{XN}}{d\eta}) = sign(\frac{da_D}{d\eta}) > 0$.

Re-arranging (7.25) now implies that:

$$\frac{\frac{1}{a_D}\frac{da_D}{d\eta}}{\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}} = \frac{-(1-\rho_1)(\Delta_2-\Delta_3)(\Delta_1-\Delta_2)+\Delta_d\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\right)}{\rho_1(\Delta_1-\Delta_3)(\Delta_1-\Delta_2)+\Delta_d\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\right)} \tag{7.27}$$

It is easy to verify that the numerator of (7.27) is smaller than its denominator; in particular, this follows as a consequence of $\Delta_d > 0$ and $\Delta_1 > \Delta_2$. Since we have just shown that $\frac{da_D}{d\eta}$ and $\frac{da_{XN}}{d\eta}$ are both positive, it follows that $\frac{1}{a_D}\frac{da_D}{d\eta}/\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} \in (0,1)$, so that: $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} > \frac{1}{a_D}\frac{da_D}{d\eta} > 0$, as claimed by part (i) of Lemma 2.

Part (iii) of the lemma follows immediately from (7.11) and (7.12), since the percentage changes in a_D and a_{XN} are respectively proportional to the percentage changes in A_{ww} and A_{ew} (with multiplicative factor equal to $\varepsilon - 1 > 0$).

As for part (ii) of the lemma, observe that (7.10) implies:

$$\frac{da_{XS}}{a_{XS}} = -\frac{2}{1-\rho_2}\frac{E_n}{E_s}\left(\rho_1\frac{da_D}{a_D} + (1-\rho_1)\frac{da_{XN}}{a_{XN}}\right) < 0 \tag{7.28}$$

At the same time, it is clear from (7.24) that $\frac{da_I}{a_I} < 0$. Furthermore, subtracting (7.28) from (7.24) yields:

$$\frac{da_I}{a_I} - \frac{da_{XS}}{a_{XS}} = \left(-\frac{\Delta_1-\Delta_3}{\Delta_d} + \frac{2}{1-\rho_2}\frac{E_n}{E_s}\right)\rho_1\frac{da_D}{a_D} + \left(-\frac{\Delta_2-\Delta_3}{\Delta_d} + \frac{2}{1-\rho_2}\frac{E_n}{E_s}\right)(1-\rho_1)\frac{da_{XN}}{a_{XN}}$$

One can now check directly that: $\frac{2}{1-\rho_2}\frac{E_n}{E_s}\Delta_d > 1-\Delta_3 > \Delta_1-\Delta_3, \Delta_2-\Delta_3$. The coefficients of $\frac{da_D}{a_D}$ and $\frac{da_{XN}}{a_{XN}}$ from this last equation are thus both positive, from which we can conclude that: $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} < \frac{1}{a_I}\frac{da_I}{d\eta} < 0$.

Finally, part (iv) of the lemma follows from the fact that $\frac{da_{XS}}{a_{XS}}$ and $\frac{dA_{sw}}{A_{sw}}$ share the same sign (from (7.3)). ■

7.3 Proof of Proposition 1

Proof. For any given level of firm productivity $1/a$, the definitions of $HORI(a)$, $PLAT(a)$, and $VERT(a)$ imply that the effect of Southern financial development on these sales quantities is pinned down respectively by the derivatives of A_{sw}, A_{ew}, and A_{ww} with respect to η. It follows from Lemma 2 that when Southern financial development improves, $HORI(a)$ falls (since $\frac{dA_{sw}}{d\eta} < 0$), $PLAT(a)$ increases (since $\frac{dA_{ew}}{d\eta} > 0$), and $VERT(a)$ increases (since $\frac{dA_{ww}}{d\eta} > 0$).

Moreover, (3.3) implies that the share of horizontal sales in total affiliate sales, $\frac{HORI(a)}{TOT(a)}$, falls when financial development in South improves, since both $\frac{A_{ww}}{A_{sw}}$ and $\frac{A_{ew}}{A_{sw}}$ increase with η. On the other hand, both $\frac{A_{sw}}{A_{ew}}$ and $\frac{A_{ww}}{A_{ew}}$ are decreasing in η. (That $\frac{d}{d\eta}\frac{A_{ww}}{A_{ew}} < 0$ follows from the fact that $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta} > 0$.) From the definition in (3.4), this implies that $\frac{d}{d\eta}\frac{PLAT(a)}{TOT(a)} > 0$.

It remains to show that $\frac{d}{d\eta}\frac{VERT(a)}{TOT(a)} > 0$ as well, by far the trickiest of these comparative statics to sign. For this, it suffices to show that $\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ww}} + \frac{A_{ew}}{A_{ww}}$ decreases with η (based on the definition in (3.5)). Note that:

$$\begin{aligned}
\frac{d}{d\eta}\ln\left(\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ww}} + \frac{A_{ew}}{A_{ww}}\right) \quad &\propto \quad \tau^{\varepsilon-1}A_{sw}\left(\frac{1}{A_{sw}}\frac{dA_{sw}}{d\eta} - \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right) + A_{ew}\left(\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} - \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right) \\
&\propto \quad \tau^{\varepsilon-1}\frac{A_{sw}}{A_{ew}}\left(\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} - \frac{1}{a_D}\frac{da_D}{d\eta}\right) + \left(\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} - \frac{1}{a_D}\frac{da_D}{d\eta}\right)
\end{aligned}$$

where '$\propto$' denotes equality up to a positive multiplicative term. (In the last step above, we have used (7.1)-(7.3) to replace the derivatives of the aggregate demand levels with the derivatives of the industry cut-offs.) We now replace $\frac{da_{XS}}{d\eta}$ using the expression in (7.28). Also, recalling the definitions from (2.4), (2.3), (7.5) and (7.6), one can rewrite: $\frac{A_{ew}}{A_{ww}} = \frac{E_s}{E_n}\frac{1-\rho_2}{2(1-\rho_1)}\frac{P_{ew}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}}$. Performing these substitutions and re-arranging, one obtains:

$$\begin{aligned}
\frac{d}{d\eta}\ln\left(\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ww}} + \frac{A_{ew}}{A_{ww}}\right) \quad &\propto \quad -\left[1 + \tau^{\varepsilon-1}\frac{P_{ew}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}}\left(\frac{E_s}{E_n}\frac{1-\rho_2}{2(1-\rho_1)} + \frac{\rho_1}{1-\rho_1}\right)\right]\frac{1}{a_D}\frac{da_D}{d\eta}\dots \\
&\dots + \left[1 - \tau^{\varepsilon-1}\frac{P_{ew}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}}\right]\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} \qquad (7.29)
\end{aligned}$$

In this last equation, the coefficient of $\frac{1}{a_D}\frac{da_D}{d\eta}$ is clearly negative (since $\rho_1, \rho_2 \in (0,1)$). As for the coefficient of $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}$, using the expressions for $P_{ew}^{1-\varepsilon}$ and $P_{sw}^{1-\varepsilon}$ from (2.19) and (2.20), we have:

$$\begin{aligned}
1 - \tau^{\varepsilon-1}\frac{P_{ew}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}} \quad &= \quad 1 - \tau^{\varepsilon-1}\left[\frac{\tau^{1-\varepsilon}V_N(a_{XN}) + ((\tau\omega)^{1-\varepsilon} - \tau^{1-\varepsilon})V_N(a_I)}{\tau^{1-\varepsilon}V_N(a_{XS}) + (\omega^{1-\varepsilon} - \tau^{1-\varepsilon})V_N(a_I)}\right] \\
&= \quad \frac{\tau^{1-\varepsilon}(V_N(a_{XS}) - V_N(a_I)) - (V_N(a_{XN}) - V_N(a_I))}{\tau^{1-\varepsilon}V_N(a_{XS}) + (\omega^{1-\varepsilon} - \tau^{1-\varepsilon})V_N(a_I)} \\
&< \quad \frac{(\tau^{1-\varepsilon} - 1)(V_N(a_{XN}) - V_N(a_I))}{\tau^{1-\varepsilon}V_N(a_{XS}) + (\omega^{1-\varepsilon} - \tau^{1-\varepsilon})V_N(a_I)} \\
&< \quad 0
\end{aligned}$$

The second-to-last step relies on the fact that $V_N(a_{XN}) > V_N(a_{XS})$ (since $a_{XN} > a_{XS}$), while the last step follows from the parameter condition $\tau > 1$. The coefficient of $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}$ is thus negative. Since $\frac{da_D}{d\eta}, \frac{da_{XN}}{d\eta} > 0$, it follows from (7.29) that $\frac{d}{d\eta}\ln\left(\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ww}} + \frac{A_{ew}}{A_{ww}}\right) < 0$. Hence, $\frac{VERT(a)}{TOT(a)}$ increases with η. ■

7.4 Proof of Lemma 3

Proof. For (i), based on the definition of $PLAT(a)$ and $VERT(a)$, we have:

$$\begin{aligned}\frac{d}{d\eta}(PLAT(a) - VERT(a)) &= (1-\alpha)\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon}\left(\frac{dA_{ew}}{d\eta} - \frac{dA_{ww}}{d\eta}\right) \\ &= (1-\alpha)\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} A_{ww}\left(\frac{A_{ew}}{A_{ww}}\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} - \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right)\end{aligned}$$

where we have used (7.1) and (7.2) in substituting for the derivatives of the demand levels with respect to η.

The expressions for A_{ew} and A_{ww} from (2.4) and (2.3) imply that:

$$\frac{A_{ew}}{A_{ww}} = \left[\frac{V_N(a_D) + ((\tau\omega)^{1-\varepsilon} - 1)V_N(a_I)}{\tau^{1-\varepsilon}V_N(a_{XN}) + ((\tau\omega)^{1-\varepsilon} - \tau^{1-\varepsilon})V_N(a_I)}\right]^{\frac{\varepsilon-\phi}{\varepsilon-1}} \tag{7.30}$$

Now, observe that:

$$\begin{aligned}& [V_N(a_D) + ((\tau\omega)^{1-\varepsilon} - 1)V_N(a_I)] - [\tau^{1-\varepsilon}V_N(a_{XN}) + ((\tau\omega)^{1-\varepsilon} - \tau^{1-\varepsilon})V_N(a_I)] \\ = \;& (V_N(a_D) - V_N(a_I)) - \tau^{1-\varepsilon}(V_N(a_{XN}) - V_N(a_I)) \\ > \;& (V_N(a_{XN}) - V_N(a_I)) - \tau^{1-\varepsilon}(V_N(a_{XN}) - V_N(a_I)) \\ > \;& 0\end{aligned}$$

where the second-to-last step above uses the fact that $V_N(a_D) > V_N(a_{XN})$ (since $a_D > a_{XN}$), while the last step relies on the condition: $1 > \tau^{1-\varepsilon} > 0$. Thus, the fraction in square brackets in (7.30) is greater than 1. Since $\frac{\varepsilon-\phi}{\varepsilon-1} > 0$, this implies that: $\frac{A_{ew}}{A_{ww}} > 1$.

It follows that:

$$\begin{aligned}\frac{d}{d\eta}(PLAT(a) - VERT(a)) &> (1-\alpha)\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} A_{ww}\left(\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} - \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right) \\ &> 0\end{aligned}$$

since $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}$ from Lemma 2. This establishes part (i) of Lemma 3.

As for part (ii), applying the quotient rule to the expressions for $\frac{PLAT(a)}{TOT(a)}$ and $\frac{VERT(a)}{TOT(a)}$ from (3.4) and (3.5) respectively, one obtains after some simplification:

$$\begin{aligned}\frac{d}{d\eta}\left[\frac{PLAT(a)}{TOT(a)} - \frac{VERT(a)}{TOT(a)}\right] &\propto -A_{ew}\left(\tau^{\varepsilon-1}\frac{dA_{sw}}{d\eta} + \frac{dA_{ww}}{d\eta}\right) + (\tau^{\varepsilon-1}A_{sw} + A_{ww})\frac{dA_{ew}}{d\eta}\ldots \\ &\quad \ldots + A_{ww}\left(\tau^{\varepsilon-1}\frac{dA_{sw}}{d\eta} + \frac{dA_{ew}}{d\eta}\right) - (\tau^{\varepsilon-1}A_{sw} + A_{ew})\frac{dA_{ww}}{d\eta} \\ &= \tau^{\varepsilon-1}A_{sw}A_{ww}\left(1 - \frac{A_{ew}}{A_{ww}}\right)\frac{1}{A_{sw}}\frac{dA_{sw}}{d\eta} + 2A_{ew}A_{ww}\left(\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta}\ldots\right. \\ &\quad \left.\ldots - \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right) + \tau^{\varepsilon-1}A_{sw}A_{ww}\left(\frac{A_{ew}}{A_{ww}}\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} - \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right) \\ &> 0\end{aligned}$$

where this last inequality hinges on: $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta} > 0 > \frac{1}{A_{sw}}\frac{dA_{sw}}{d\eta}$ (from Lemma 2), and $\frac{A_{ew}}{A_{ww}} > 1$ (as shown above for part (i) of this lemma). Thus, in response to a given change in η, platform sales as a share of total sales increase by a larger magnitude than vertical sales as a share of total sales. ■

7.5 Proof of Lemma 4

Proof. To show that $\frac{dN_n}{d\eta} < 0$, we solve for $\frac{dN_n}{N_n}$ from (7.16). To this end, note that (7.11) and (7.12) imply that:

$$\begin{aligned}\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}} &= \rho_1 \frac{1-\phi}{\varepsilon-\phi}\left(\frac{dA_{ew}}{A_{ew}} - \frac{dA_{ww}}{A_{ww}}\right) - \frac{dA_{ew}}{A_{ew}} \\ &= (\varepsilon-1)\left[\rho_1 \frac{1-\phi}{\varepsilon-\phi}\left(\frac{da_{XN}}{a_{XN}} - \frac{da_D}{a_D}\right) - \frac{da_{XN}}{a_{XN}}\right] \end{aligned} \tag{7.31}$$

(In particular, this means that: $\frac{1}{P_{ew}^{1-\varepsilon}}\frac{dP_{ew}^{1-\varepsilon}}{d\eta} < 0$, since $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} > \frac{1}{a_D}\frac{da_D}{d\eta} > 0$ by Lemma 2, and $\varepsilon > \phi > 1$.) Substituting from (7.31) into (7.16), replacing $\frac{da_I}{a_I}$ with the expression from (7.23), and re-arranging yields:

$$\begin{aligned}\frac{1}{k-\varepsilon+1}\frac{dN_n}{N_n} &= \left[\left(\rho_1\frac{1-\phi}{\varepsilon-\phi}-1\right)\frac{\varepsilon-1}{k-\varepsilon+1} - \Delta_2 + \frac{1-\Delta_2}{\Delta_1-\Delta_2}\left(\Delta_2 + \frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\right]\frac{da_{XN}}{a_{XN}}\dots \\ &\quad \dots - \left[\rho_1\frac{1-\phi}{\varepsilon-\phi}\frac{\varepsilon-1}{k-\varepsilon+1} + \frac{1-\Delta_2}{\Delta_1-\Delta_2}\left(\Delta_1 + \frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\right]\frac{da_D}{a_D}\end{aligned} \tag{7.32}$$

To determine the sign of $\frac{dN_n}{N_n}$, divide the right-hand side of (7.32) by $\frac{da_{XN}}{a_{XN}}$, and substitute in the expression for $\frac{da_D}{a_D}/\frac{da_{XN}}{d_{XN}}$ from (7.27). After simplifying and collecting terms extensively, one can show that $\frac{dN_n}{N_n}$ is equal up to a positive multiplicative term to:

$$\begin{aligned}&-\left(\frac{\varepsilon-1}{k-\varepsilon+1}+\Delta_2\right)\left[\Delta_d\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)+\rho_1(\Delta_1-\Delta_2)(\Delta_1-\Delta_3)\right]\dots \\ &\quad \dots + \rho_1\frac{\varepsilon-1}{k-\varepsilon+1}\frac{1-\phi}{\varepsilon-\phi}(\Delta_1-\Delta_2)\left[\rho_1(\Delta_1-\Delta_3)+(1-\rho_1)(\Delta_2-\Delta_3)+\Delta_d\right]\dots \\ &\quad \dots + (1-\Delta_2)\left[\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\right)\rho_1(\Delta_1-\Delta_3)+\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\right)(1-\rho_1)(\Delta_2-\Delta_3)\right] \\ <\; &-\left(\frac{\varepsilon-1}{k-\varepsilon+1}+\Delta_2\right)\times \\ &\quad \left[(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)+\rho_1(\Delta_1-\Delta_2)(\Delta_1-\Delta_3)\right]\dots \\ &\quad \dots + \rho_1\frac{\varepsilon-1}{k-\varepsilon+1}\frac{1-\phi}{\varepsilon-\phi}(\Delta_1-\Delta_2)(1-\Delta_3)\dots \\ &\quad \dots + (1-\Delta_2)\left[\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\right)\rho_1(\Delta_1-\Delta_3)+\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\right)(1-\rho_1)(\Delta_2-\Delta_3)\right]\end{aligned} \tag{7.33}$$

where the inequality comes from applying: $\Delta_d > \rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2)$ and simplifying.

We now collect all the terms in (7.33) in which $\frac{\varepsilon-1}{k-\varepsilon+1}$ does not appear:

$$
\begin{aligned}
& -\Delta_2[(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))\Delta_1+\rho_1(\Delta_1-\Delta_2)(\Delta_1-\Delta_3)\ldots \\
& \quad \ldots+(1-\Delta_2)[\Delta_2\rho_1(\Delta_1-\Delta_3)+\Delta_1(1-\rho_1)(\Delta_2-\Delta_3)] \\
= \; & -\rho_1\Delta_2\Delta_3(1-\Delta_1)-(1-\rho_1)\Delta_1\Delta_3(1-\Delta_2) \\
< \; & 0
\end{aligned}
$$

This term is negative, since $\rho_1, \Delta_1, \Delta_2, \Delta_3 \in (0,1)$.

Similarly, we collect the remaining terms in (7.33), all of which involve $\frac{\varepsilon-1}{k-\varepsilon+1}$:

$$
\begin{aligned}
& -\frac{\varepsilon-1}{k-\varepsilon+1}\left[(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)+\rho_1(\Delta_1-\Delta_2)(\Delta_1-\Delta_3)\ldots\right. \\
& \quad \ldots+\Delta_2(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))\frac{\varepsilon-1}{\varepsilon-\phi}\ldots \\
& \quad \left.\ldots-\frac{1-\phi}{\varepsilon-\phi}\rho_1(\Delta_1-\Delta_2)(1-\Delta_3)-\frac{\varepsilon-1}{\varepsilon-\phi}(1-\Delta_2)(\rho_1(\Delta_1-\Delta_3)+(1-\rho_1)(\Delta_2-\Delta_3))\right] \\
< \; & -\frac{\varepsilon-1}{k-\varepsilon+1}\left[(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))\Delta_1+\rho_1(\Delta_1-\Delta_2)(\Delta_1-\Delta_3)\ldots\right. \\
& \quad \ldots+\Delta_2(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))\frac{\varepsilon-1}{\varepsilon-\phi}\ldots \\
& \quad \left.\ldots-\frac{1-\phi}{\varepsilon-\phi}\rho_1(\Delta_1-\Delta_2)(1-\Delta_3)-\frac{\varepsilon-1}{\varepsilon-\phi}(1-\Delta_2)(\rho_1(\Delta_1-\Delta_3)+(1-\rho_1)(\Delta_2-\Delta_3))\right] \\
= \; & -\frac{\varepsilon-1}{k-\varepsilon+1}\left[\rho_1(1-\Delta_1)\Delta_2+(1-\rho_1)\Delta_1(1-\Delta_2)+\frac{\varepsilon-1}{\varepsilon-\phi}\Delta_3(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))\right] \\
< \; & 0
\end{aligned}
$$

since $\frac{\varepsilon-1}{k-\varepsilon+1} > 0$. We have thus successfully verified that $\frac{dN_n}{d\eta} < 0$, so an improvement in financial development in South leads to a contraction in the measure of Western firms.

It is worth noting that a proof analogous to that presented here can be used to show that $\frac{d(N_n A_{ww})}{d\eta} < 0$. Likewise, $\frac{d(N_n A_{sw})}{d\eta} < 0$ since both N_n and A_{sw} are decreasing in η. However, the sign of $\frac{d(N_n A_{ew})}{d\eta}$ cannot be pinned down explicitly. Recall that Lemma 2 states that in response to an increase in η, the proportional increase in A_{ew} is larger than that of A_{ww}. It turns out that this larger increase in A_{ew} may more than outweigh the decline in N_n, so that the overall effect on $N_n A_{ew}$ is indeterminate. ■

7.6 Proof of Proposition 2

Proof. Since $V_n(a)$ is an increasing function for all $a \in (0, \bar{a}_n)$, an improvement in η leads to a decrease in a_I and hence in $V_n(a_I)$ also. Lemma 4 has also established that N_n decreases in η. Therefore, to show that $HORI$, $PLAT$, and $VERT$ all decline in η, it suffices to prove that $PLAT$ is declining in η, since $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}, \frac{1}{A_{sw}}\frac{dA_{sw}}{d\eta}$.

From the expression for $PLAT$ in (3.7), we have:

$$\begin{aligned}
\frac{d}{d\eta}\ln(PLAT) &= \frac{1}{N_n}\frac{dN_n}{d\eta} + \frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} + \frac{V_N'(a_I)a_I}{V_N(a_I)}\frac{1}{a_I}\frac{da_I}{d\eta} \\
&= (\varepsilon-1)\left[\left(-1+\rho_1\frac{1-\phi}{1-\varepsilon}\right)\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} - \rho_1\frac{1-\phi}{1-\varepsilon}\frac{1}{a_D}\frac{da_D}{d\eta}\right]\ldots \\
&\quad \ldots-(k-\varepsilon+1)\left(\Delta_2\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}+(1-\Delta_2)\frac{1}{a_I}\frac{da_I}{d\eta}\right)\ldots \\
&\quad \ldots+(\varepsilon-1)\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}+(k-\varepsilon+1)\frac{1}{a_I}\frac{da_I}{d\eta} \\
&= (\varepsilon-1)\rho_1\frac{1-\phi}{\varepsilon-\phi}\left(\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}-\frac{1}{a_D}\frac{da_D}{d\eta}\right)-(k-\varepsilon+1)\Delta_2\left(\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}-\frac{1}{a_I}\frac{da_I}{d\eta}\right) \\
&< 0
\end{aligned}$$

To get from the first line above to the expression on the second line, we have used the expression for $\frac{dN_n}{d\eta}$ from (7.16), and substituted for $\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}}$ using (7.31). We have also used (7.1) and (7.2) to substitute for $\frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}$ and $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta}$ wherever these terms appear. Finally, we have used the fact that $\frac{V_N'(a_I)a_I}{V_N(a_I)} = k-\varepsilon+1$ for the Pareto distribution. The last step establishing that $\frac{d}{d\eta}\ln(PLAT) < 0$ follows from $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} > \frac{1}{a_D}\frac{da_D}{d\eta} > \frac{1}{a_I}\frac{da_I}{d\eta}$, bearing in mind that $1-\phi < 0$ and $k-\varepsilon+1 > 0$. Thus, when η increases, the contraction in the extensive margin of sales captured by the fall in N_n and $V_N(a_I)$ is larger in magnitude than the increase in sales on the intensive margin due to the rise in the demand level, A_{ew}.

Turning to part (ii) of the proposition, note from (3.6)-(3.8) that the expressions for the aggregate horizontal, platform and vertical shares are algebraically identical to (3.3)-(3.5), the corresponding expressions for individual MNCs. From the proof of Proposition 1, this means that $\frac{HORI}{TOT}$ falls, while both $\frac{PLAT}{TOT}$ and $\frac{VERT}{TOT}$ rise, when η increases. ■

Table 1
Summary Statistics
(Affiliate-level variables, Benchmark survey years only)

	Mean	Std. Dev.
Year: 1989		
No. of obs. = 6248		
Local / Total sales	0.716	0.348
3rd-country / Total sales	0.197	0.291
US / Total sales	0.087	0.223
Unaff Local / Total sales	0.678	0.369
Unaff 3rd-country / Total sales	0.117	0.227
Aff US / Total sales	0.069	0.200
Year: 1994		
No. of obs. = 6316		
Local / Total sales	0.704	0.354
3rd-country / Total sales	0.206	0.297
US / Total sales	0.091	0.223
Unaff Local / Total sales	0.660	0.377
Unaff 3rd-country / Total sales	0.115	0.226
Aff US / Total sales	0.071	0.200

Notes: Based on the BEA Survey of US Direct Investment Abroad.

Table 2
Determinants of the Spatial Distribution of MNC Sales
(Affiliate-level evidence, 1989-1998)

Dependent var.:	$\frac{Local}{Total\ sales}$	$\frac{3rd\ ctry}{Total\ sales}$	$\frac{US}{Total\ sales}$	$\frac{Unaff\ Local}{Total\ sales}$	$\frac{Unaff\ 3rd\ ctry}{Total\ sales}$	$\frac{Aff\ US}{Total\ sales}$
	(1)	(2)	(3)	(4)	(5)	(6)
Private Credit	−0.106***	0.109***	−0.002	−0.118***	0.051**	0.004
over GDP	(0.031)	(0.024)	(0.015)	(0.035)	(0.020)	(0.015)
Log Real GDP	0.106***	−0.092***	−0.014***	0.104***	−0.037***	−0.012***
	(0.018)	(0.017)	(0.005)	(0.019)	(0.006)	(0.004)
Log Real GDP	−0.020	0.003	0.017	−0.029	0.010	0.011
per capita	(0.043)	(0.030)	(0.022)	(0.045)	(0.024)	(0.021)
Log Distance	0.081*	−0.014	−0.067*	0.076	−0.004	−0.072**
	(0.047)	(0.018)	(0.035)	(0.050)	(0.011)	(0.033)
Rule of Law	0.004	0.005	−0.009	0.007	0.007	−0.012
	(0.016)	(0.012)	(0.007)	(0.018)	(0.007)	(0.008)
EEC/EC Dummy	−0.161***	0.194***	−0.033**	−0.151***	0.086***	−0.023*
	(0.037)	(0.032)	(0.016)	(0.040)	(0.019)	(0.013)
Number of obs.	40708	40708	40708	40708	40708	40708
R^2	0.22	0.26	0.22	0.20	0.17	0.18

Notes: Robust standard errors, clustered by host country, are reported in parentheses; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. All specifications include year fixed effects, industry fixed effects, as well as a full set of RTA dummies (only the coefficient on the EEC/EC dummy is reported).

Table 3
Determinants of the Spatial Distribution of MNC Sales
(Affiliate-level evidence, 1989-1998; Additional specifications)

Dependent var.:	$\frac{Local}{Total\ sales}$	$\frac{3rd\ ctry}{Total\ sales}$	$\frac{US}{Total\ sales}$	$\frac{Local}{Total\ sales}$	$\frac{3rd\ ctry}{Total\ sales}$	$\frac{US}{Total\ sales}$
	(1)	(2)	(3)	(4)	(5)	(6)
Private Credit	−0.107***	0.104***	0.004	−0.014	0.005	0.009
over GDP	(0.028)	(0.022)	(0.012)	(0.016)	(0.014)	(0.007)
Log Real GDP	0.101***	−0.090***	−0.010***	−0.041	0.042	0.000
	(0.017)	(0.015)	(0.004)	(0.041)	(0.045)	(0.035)
Log Real GDP	−0.017	0.001	0.016	0.206***	−0.174***	−0.032
per capita	(0.036)	(0.027)	(0.016)	(0.059)	(0.053)	(0.057)
Log Distance	0.081**	−0.017	−0.064***	1.789***	−1.628***	−0.161
	(0.031)	(0.016)	(0.019)	(0.402)	(0.410)	(0.346)
Rule of Law	0.000	0.009	−0.009*	−0.032	0.019	0.012
	(0.014)	(0.010)	(0.005)	(0.044)	(0.047)	(0.034)
EEC/EC Dummy	−0.157***	0.178***	−0.021*	−0.001	0.011	−0.009**
	(0.033)	(0.030)	(0.011)	(0.019)	(0.020)	(0.005)
Number of obs.	40708	40708	40708	40708	40708	40708
Within R^2	0.16	0.23	0.14	0.01	0.01	0.01
Parent fixed effects	Yes	Yes	Yes	No	No	No
Affiliate fixed effects	No	No	No	Yes	Yes	Yes

Notes: Robust standard errors, clustered by host country, are reported in parentheses; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. All specifications include year fixed effects, industry fixed effects, as well as a full set of RTA dummies (only the coefficient on the EEC/EC dummy is reported).

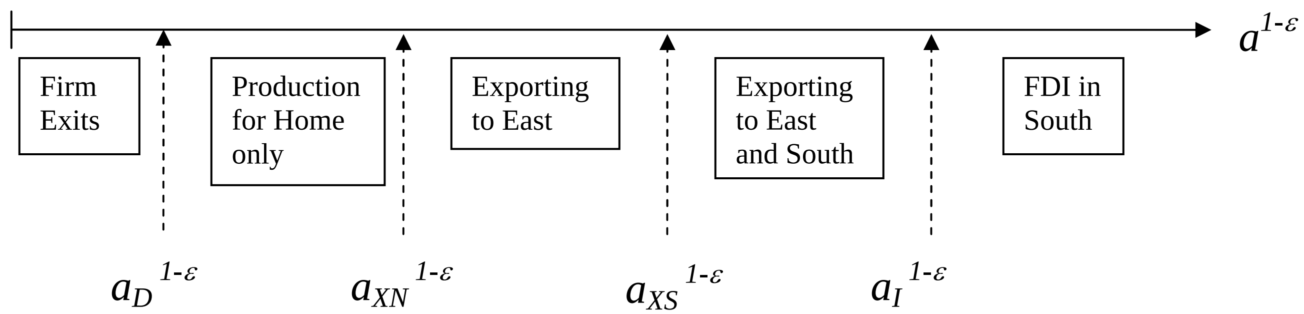
Table 4
Determinants of the Spatial Distribution of MNC Sales
(Aggregate evidence, 1989 & 1994)

Dependent var.:	$\frac{Local}{Total\ sales}$	$\frac{3rd\ ctry}{Total\ sales}$	$\frac{US}{Total\ sales}$	$\frac{Unaff\ Local}{Total\ sales}$	$\frac{Unaff\ 3rd\ ctry}{Total\ sales}$	$\frac{Aff\ US}{Total\ sales}$
	(1)	(2)	(3)	(4)	(5)	(6)
Private Credit	−0.499***	0.270**	0.123	−0.504***	0.150	0.107
over GDP	(0.127)	(0.112)	(0.100)	(0.130)	(0.101)	(0.100)
Log Real GDP	0.138***	−0.070**	−0.048*	0.135***	−0.033	−0.042*
	(0.036)	(0.031)	(0.024)	(0.039)	(0.020)	(0.024)
Log Real GDP	0.204***	−0.044	−0.189**	0.197**	−0.023	−0.191**
per capita	(0.072)	(0.045)	(0.090)	(0.076)	(0.028)	(0.091)
Log Distance	−0.041	0.034	0.010	−0.043	0.012	0.010
	(0.065)	(0.039)	(0.059)	(0.070)	(0.032)	(0.056)
Rule of Law	0.005	0.003	0.025*	0.005	0.003	0.026*
	(0.023)	(0.017)	(0.013)	(0.026)	(0.012)	(0.013)
EEC/EC Dummy	−0.202**	0.162**	0.013	−0.177*	0.003	0.023
	(0.076)	(0.073)	(0.055)	(0.092)	(0.037)	(0.053)
Number of obs.	61	54	58	63	59	58
R^2	0.57	0.57	0.58	0.54	0.35	0.56

Notes: Robust standard errors, clustered by host country, are reported in parentheses; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. All specifications include year fixed effects, as well as a full set of RTA dummies (only the coefficient on the EEC/EC dummy is reported).

Figure 1
Productivity Cut-offs and Industry Structure

In West:



In South:

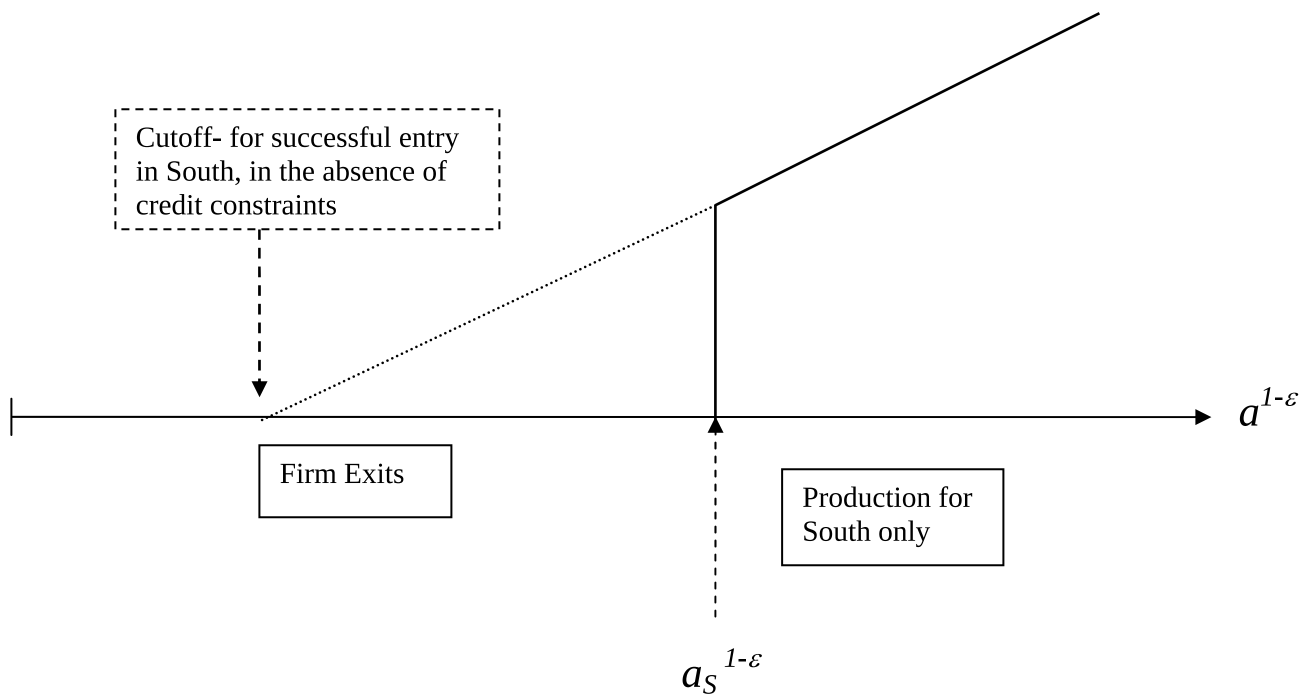


Figure 2a
Modes of Organization and Destination Markets
(for firms in West)

If $a^{1-\varepsilon} < a_I^{\,1-\varepsilon}$ (No FDI):

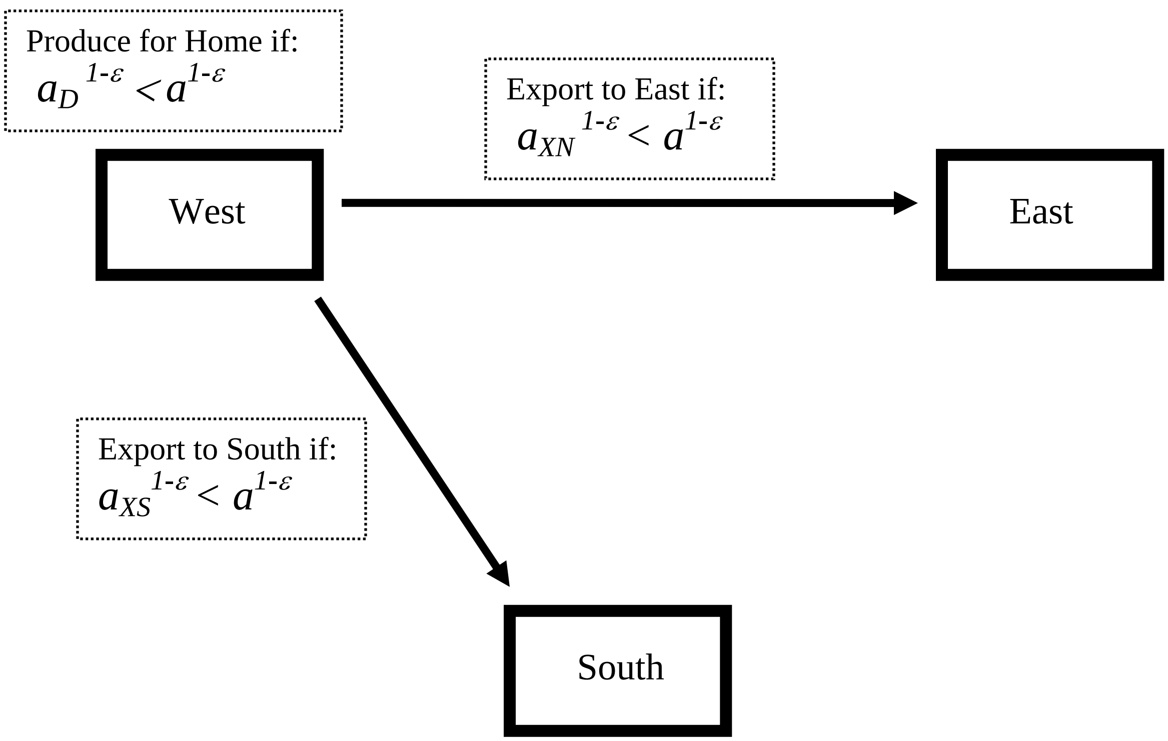


Figure 2b
Modes of Organization and Destination Markets
(for firms in West)

If $a^{1-\varepsilon} > a_I^{1-\varepsilon}$ (FDI in South):

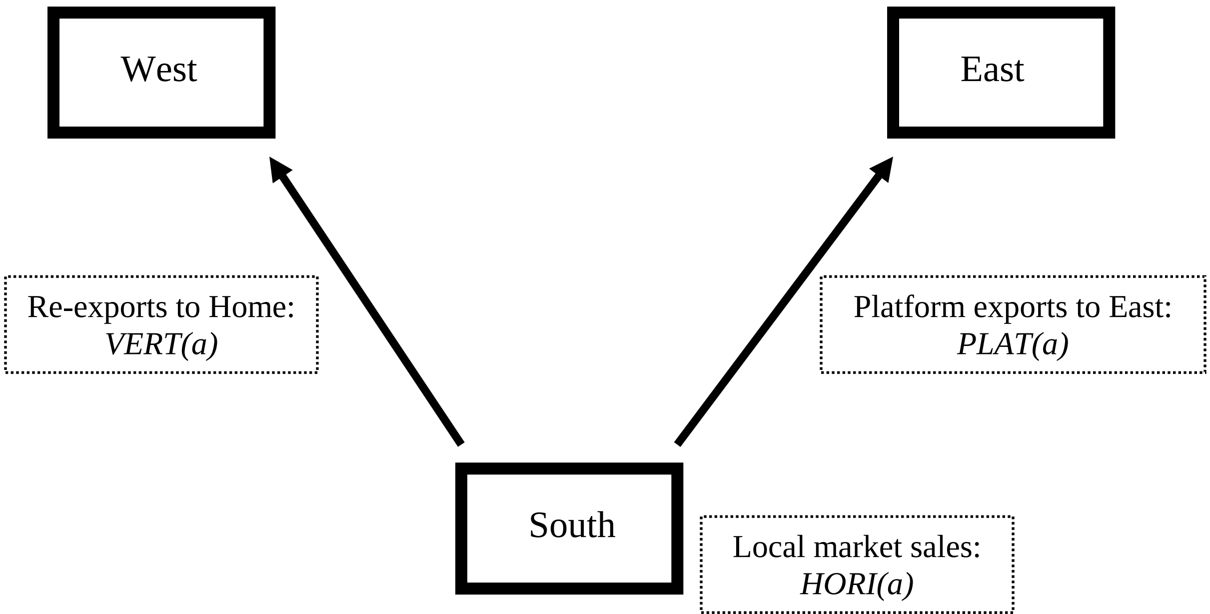
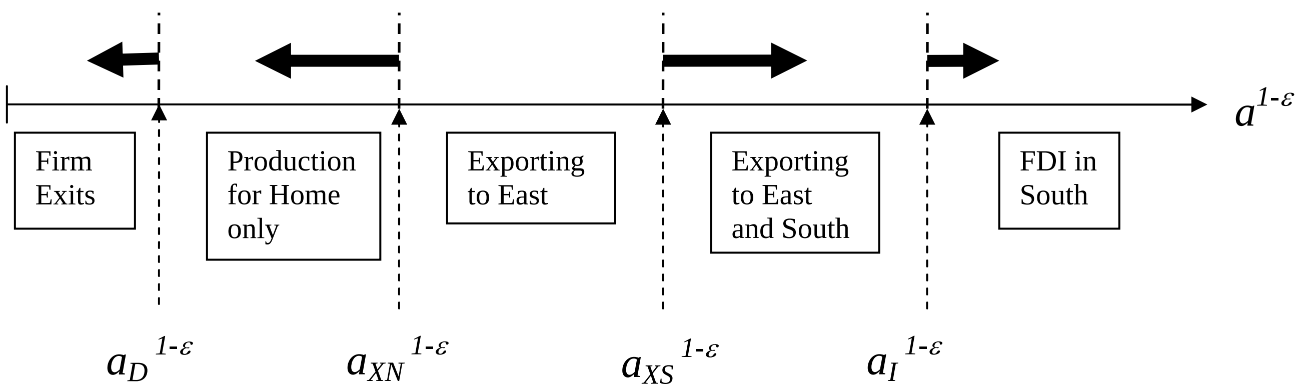


Figure 3
Response of Productivity Cut-offs and Industry Structure to an Improvement in Southern Financial Development

In West:



In South: