NBER WORKING PAPER SERIES

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Working Paper 20046
http://www.nber.org/papers/w20046

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 2014

We thank Pol Antràs, Bruce Blonigen, Elhanan Helpman, Beata Javorcik, Catherine Mann, Marc Melitz, Daniel Trefler, Jonathan Vogel, David Weinstein, Daniel Xu, Stephen Yeaple and Bill Zeile for their valuable feedback. Thanks also to audiences at Georgetown, Harvard, LMU Munich, Toronto, the World Bank, Chinese University of Hong Kong, the 2008 CESifo-NORFACE Seminar, the 2009 Asia Pacific Trade Seminars, the 2009 Midwest International Economics Group Meeting, the 2012 AEA Annual Meeting, the 2013 West Coast Trade Workshop, the 2013 Princeton IES Workshop, the 2013 NBER ITI Summer Institute and the 2013 Brandeis Summer Workshop. We acknowledge C. Fritz Foley and Stanley Watt, who contributed to earlier versions of this paper. The statistical analysis was conducted at the Bureau of Economic Analysis, U.S. Department of Commerce, under arrangements that maintain legal confidentiality requirements. The views expressed are those of the authors and do not reflect official positions of the U.S. Department of Commerce. We have no relevant sources of funding to disclose. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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NBER Working Paper No. 20046
April 2014
JEL No. F12,F23,F36,G20

ABSTRACT

We provide evidence that host-country financial development affects the global operations of multinational firms. Financially advanced economies attract more affiliates of U.S. multinationals. Financially developed host countries also feature higher aggregate affiliate sales to the local market, the United States and third-country destinations. By contrast, individual affiliates in such hosts sell more to the United States and other markets, but less locally. Yet, the share of local sales in total affiliate sales falls with host-country financial development both at the affiliate and aggregate levels, while the shares of U.S. and third-country sales increase. These results are amplified in sectors that depend more on the financial system for external capital. We rationalize these empirical patterns with a three-country model of multinational activity under imperfect financial markets. The data are consistent with two effects of financial development highlighted by the model: 1) a competition effect that reduces affiliates' local revenues due to increased domestic firm entry; and 2) a financing effect that encourages affiliate entry by easing borrowing constraints in the host country.

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1 Introduction

Multinational corporations (MNCs) manage complex global operations, basing offshore affiliates in multiple countries and serving multiple markets from each location. As multinationals not only strongly influence patterns of international trade, but also channel technology transfer, capital flows and job creation across borders, it remains a policy priority to understand what forces shape their activity. This is of particular concern for developing countries seeking to attract foreign direct investment (FDI).

The prior literature has identified horizontal, vertical and export-platform motives for multinational activity, which are reflected in part by affiliate sales to the host country, parent country and third-country destinations, respectively.[1] However, evidence indicates that multinationals do not conform to this strict categorization and instead display features of all three motives: The average offshore affiliate of a U.S. multinational sells 75% of its output in the host economy, ships 7% back to the United States, and exports the remaining 18% to other markets (see Table 1).[2] In this paper, we isolate systematic empirical patterns in MNC operations and affiliate sales across countries. We show that host-country financial development influences multinationals' choices over affiliate entry and sales destinations, as resource-constrained foreign and domestic firms compete in the presence of financial frictions.

We establish four empirical regularities using detailed data from the Bureau of Economic Analysis (BEA) on U.S. multinational firms during 1989-2009. First, countries with high levels of financial development attract more subsidiaries from the United States. Second, stronger financial institutions in the host country raise aggregate affiliate sales to the local market, to the United States and to third-country destinations. At the level of the individual affiliate, by contrast, exports to the United States and other markets are increased, but local sales are reduced. Third, the share of affiliates' local sales in total sales declines with host-country financial development, while the shares of return sales to the United States and export-platform sales to other countries rise; these patterns hold both in the aggregate and at the affiliate level. Finally, the share of affiliate sales to third-country markets responds (weakly) more to local financial conditions than the share of return sales to the United States.

We demonstrate that these empirical regularities are consistent with a three-country model in which heterogeneous firms face imperfect capital markets. In the model, the world comprises two identical economies in the North ("West" and "East") and a lower-wage third country ("South"). Similar to Helpman et al. (2004) and Grossman et al. (2006), each firm draws a productivity level upon entry and subsequently chooses where to manufacture and market its goods. Sufficiently productive Northern firms both sell at home and export abroad, while the most efficient Northern firms base a production plant in South and use it to serve all three markets as a multinational company.

[1] See Markusen (1984), Brainard (1997), Markusen and Venables (2000), and Helpman et al. (2004) on horizontal FDI; Helpman (1984), Hummels et al. (2001), Hanson et al. (2001, 2005), and Yeaple (2003a) on vertical FDI; Hanson et al. (2001) and Ekholm et al. (2007) on export-platform FDI; and Blonigen (2005) for a survey.

[2] This is consistent with the breakdown of sales reported in Ramondo et al. (2012) for U.S. multinationals abroad. Baldwin and Okubo (2012) find a similar pattern for Japanese multinationals, where platform sales reach a slightly higher 25%.

Financial institutions shape the pattern of multinational activity because firms require external finance to fund their fixed costs of operation. To build intuition, we first consider a baseline model in which Southern firms have limited access to capital due to imperfect credit markets, but Northern firms are unconstrained. In this setting, financial development in South encourages entry by domestic firms, reducing the competitiveness of foreign multinationals in the host market. For each individual affiliate, local sales to South therefore decline, while exports to other destinations rise, both in levels and as shares of the affiliate's total sales (*competition effect*). We then extend the model to include financially-constrained Northern firms that rely in part on the host-country capital market. While still lowering local demand for each individual affiliate's output, Southern financial development now has an additional effect: It attracts more foreign multinationals and thus increases the *aggregate* levels of multinational sales to all three destinations (*financing effect*). In a second extension, we accommodate differential adjustments in subsidiaries' platform and return sales to the United States by introducing a *home-bias effect* in consumption.

The model guides our empirical analysis of U.S. multinational firms' global activity across countries with different levels of financial development. The BEA surveys include detailed information on offshore affiliates' location and sales by destination, enabling us to evaluate the effects of financial development along multiple dimensions of multinational activity as prescribed by the model. This allows us to confirm that the data are strongly consistent with the competition and financing effects described above, while also exhibiting some features consistent with the home-bias effect. We also show in our model that the ratio of private credit to GDP in a host country increases monotonically in its financial development, and we therefore use this as the primary explanatory variable in our empirical analysis. Finally, our estimation approach incorporates an extensive set of control variables as indicated by the model.

The data reveal economically significant effects of host-country financial development on multinational activity. Our results imply that improving a country's financial conditions by one standard deviation is associated with (on average) a 10.6% increase in the number of foreign affiliates, and a 17.4% expansion in aggregate affiliate sales. As sales adjust differentially across markets, however, the share of affiliate sales remaining in the local market falls by 2.5 percentage-points, while the shares of exports to the United States and to third-country destinations rise by 1 and 1.5 percentage-points respectively.

To address the possible presence of unobserved country characteristics correlated with financing conditions, as well as reverse causality, we introduce cross-industry variation in external finance dependence, which determines sensitivity to credit availability but less so to general institutional or economic development (Rajan and Zingales 1998). We find that MNC activity in financially more vulnerable sectors indeed responds systematically more to financial development along each dimension predicted by the model: Increases in the number of foreign affiliates and aggregate affiliate sales are respectively 4.3% and 10.2% higher in the industry at the 75$^{\text{th}}$ percentile by external finance dependence relative to the industry at the 25$^{\text{th}}$ percentile. We also present additional results at the affiliate level that use parent firm fixed effects to control for unobserved firm characteristics that may influence production location and sales decisions. We show robust support for our empirical findings using this approach too.

This paper contributes to a growing literature studying the impact of financial frictions on firm operations. Existing evidence indicates that financial development improves aggregate growth by increasing entry by credit-constrained firms, as well as encouraging technology adoption and expansion along the intensive margin (King and Levine 1993, Rajan and Zingales 1998, Beck 2003, Beck et al. 2005, Aghion et al. 2007, Hsu et al. 2014). Financial reform also raises firms' export participation and aggregate export volumes (Manova 2008, Amiti and Weinstein 2011, Manova 2013), with effects concentrated among small firms and in sectors relatively reliant on external capital. We incorporate these insights into our model of financial market imperfections, and consider their implications for the competitive environment and multinational firms' activity across countries with different levels of financial development.

We also extend a separate line of research on the role of host-country financial conditions for FDI. While frictions in external capital markets may limit foreign affiliate expansion to some extent, multinationals are known to circumvent constraints by employing internal capital markets (Feinberg and Phillips 2004, Desai et al. 2004). As a result, foreign subsidiaries are less credit-constrained and more responsive to growth opportunities than other firms (Desai et al. 2008, Manova et al. 2011). These advantages may encourage vertical integration with suppliers located in financially less-developed countries (Bustos 2007, Antràs et al. 2009, Carluccio and Fally 2012).[3] We build on these earlier papers by considering not only MNCs' financing practices, but also their affiliate entry and sales decisions.[4]

Our paper adds to recent studies examining multinational firms' complex global strategies. Rather than focusing on purely horizontal, vertical or export-platform FDI modes, this literature aims to instead develop theories that accommodate hybrid motives and deliver predictions for trade flows and multinational activity that can be evaluated empirically (Yeaple 2003a,b, Markusen and Venables 2007, Ramondo and Rodriguez-Clare 2012, Arkolakis et al. 2012, Tintelnot 2012, Irarrazabal et al. 2013). Our work indirectly speaks to the relative importance of these three FDI motives: One interpretation of our findings is that, *ceteris paribus*, stronger financial institutions in the host country reduce the incentives to pursue FDI for horizontal motives, and instead favor vertical and export-platform motives.

Finally, the competition effect we highlight relates to prior work on the interaction between foreign affiliates and domestic firms in FDI host countries. Multinationals may crowd out local producers by raising competition (Aitken and Harrison 1999, De Backer and Sleuwaegen 2003), but they can also generate productivity spillovers and nudge indigenous companies to remove X-inefficiencies, especially

[3] See however Buch et al. (2009) who argue that financially-constrained firms are less likely to choose horizontal FDI over direct exporting because of the higher associated fixed costs.

[4] Our analysis also contributes to research on the impact of broader institutional frictions on FDI. While we focus on financial frictions, other recent studies have emphasized the effects of contractual imperfections, investor protection laws and intellectual property rights on multinational activity (Antràs 2003, Branstetter et al. 2006, Bénassy-Quéré et al. 2007, Bernard et al. 2010, Antràs and Chor 2013, Bilir 2013). Similar to Antràs and Caballero (2009), our approach emphasizes the equilibrium interaction between FDI and trade flows in the presence of financial frictions.

when local financial markets are strong (Alfaro et al. 2004, Javorcik and Spatareanu 2009, Arnold et al. 2011). While these papers explore the impact of FDI on the host economy, we instead evaluate the effects of local financial development and increased competition by domestic firms on foreign multinationals.

The rest of the paper proceeds as follows. Section 2 sets up the baseline model, while Section 3 develops the two extensions. Section 4 outlines our estimation strategy and Section 5 describes the data. Sections 6 and 7 report our empirical results. The last section concludes.

2 A Baseline Model of FDI with Host-Country Credit Constraints

We develop a three-country model with heterogeneous firms to analyze how host-country financial conditions affect the entry and sales decisions of MNC affiliates. The model setup is stylized so as to highlight the theoretical results that correspond to our empirical analysis below. We first build a baseline model in which only Southern firms are exposed to credit constraints in order to isolate the *competition effect*. In Section 3.1, we extend this setup by requiring multinationals to finance affiliate operations in part using capital raised in the host country; this reveals the *financing effect*. We then discuss in Section 3.2 how the model can accommodate differential responses in affiliates' return and platform sales.

2.1 The basic environment

Consider a world with two symmetric countries in the developed North ("West" and "East") and a low-wage country ("South"). There are two sectors in each country, one producing a homogeneous good and the other featuring a continuum of differentiated varieties. Labor is the only factor. The homogeneous good is produced under constant returns to scale. This good is freely tradable across borders, and thus serves as the global numeraire. In each country, the labor force is sufficiently large so that a strictly positive amount of the homogeneous good is produced in equilibrium; this pins down the nominal wage as the marginal product of labor in this sector. However, South is assumed to be less productive in the homogeneous good sector than the Northern countries: While $1/\omega$ workers are needed to make each unit of the numeraire in South (where $\omega < 1$), only one worker is required in the North. This normalizes the nominal wage in West and East to 1, with the wage in South being ω.

The utility function of a representative consumer from the developed North (subscript $n = e, w$, for East and West respectively) is given by:

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

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

$$U_s = y_s^{1-\mu} \left(\sum_{j \in \{e,w,s\}} \int_{\Omega_{sj}} x_{sj}(a)^{\alpha} \, dG_j(a) \right)^{\frac{\mu}{\alpha}}, \quad 0 < \alpha, \, \mu < 1. \tag{2.2}$$

Utility in country i ($i \in \{e, w, s\}$) is thus a Cobb-Douglas aggregate over consumption of the homogeneous good (y_i) and differentiated varieties ($x_{ij}(a)$), where the expenditure share of the latter is equal to μ. The sub-utility derived from differentiated varieties is in turn a Dixit-Stiglitz aggregate, with $\varepsilon = \frac{1}{1-\alpha} > 1$ being the constant elasticity of substitution. For now, we assume this elasticity to be the same regardless of varieties' country of origin, but we discuss in Section 3.2 a more flexible specification in which varieties from the same country are closer substitutes than varieties from different countries. We let $x_{ij}(a)$ denote the quantity of a country-j differentiated variety that is consumed in country i. Each differentiated variety is produced by a separate firm and indexed by a, the labor requirement per unit output; $1/a$ is thus the productivity level of the firm. 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 in country j.

We define Ω_{ij} to be the set of country-j differentiated varieties consumed in i. When $i \neq j$, this set consists of all varieties exported by country j's firms to i, as well as varieties produced and sold locally in i by country j's multinational affiliates if FDI takes place. Analogously, when $i = j$, Ω_{ii} is the union of all indigenous varieties produced domestically, and all varieties produced by country i's multinational affiliates abroad that are then exported back to the home market. Notice that South demands varieties from all three countries.[5] In contrast, Southern varieties do not enter the North's utility function, for example because these varieties do not cater to developed-country tastes, or alternatively because Southern firms face prohibitively high fixed costs when attempting to penetrate Northern markets. This simplifying assumption allows us to examine the Southern differentiated varieties industry without having to include feedback effects from Northern demand for South's goods.

Maximizing (2.1) and (2.2) subject to the standard budget constraints implies the familiar iso-elastic demand functions for each variety: $x_{ij} = A_{ij} p_{ij}(a)^{-\varepsilon}$, where $p_{ij}(a)$ denotes the price of the country-j variety in country i. Given the symmetry between West and East, the expressions for aggregate demand, A_{ij}, in country i for varieties from j are:

$$A_{ww} = A_{ee} = A_{ew} = A_{we} = \frac{\mu E_n}{P_{ww}^{1-\varepsilon} + P_{we}^{1-\varepsilon}}, \quad \text{and} \tag{2.3}$$

$$A_{sw} = A_{se} = A_{ss} = \frac{\mu E_s}{P_{ss}^{1-\varepsilon} + 2P_{sw}^{1-\varepsilon}}, \tag{2.4}$$

where $P_{ij}^{1-\varepsilon} = \int_{\Omega_{ij}} p_{ij}(a)^{1-\varepsilon} \, dG_j(a)$ is the ideal price index of varieties from j faced by country i. Note that the above equations make use of the fact that $P_{ww}^{1-\varepsilon} = P_{ee}^{1-\varepsilon}$, $P_{ew}^{1-\varepsilon} = P_{we}^{1-\varepsilon}$ and $P_{sw}^{1-\varepsilon} = P_{se}^{1-\varepsilon}$. Here, E_i is the total expenditure of consumers in i, where $E_w = E_e = E_n$. These aggregate expenditure levels are exogenous and equal to the nominal wage times the size of the workforce in each country.

[5] Prior three-country models, such as Yeaple (2003a), Grossman et al. (2006) and Ekholm et al. (2007), have often 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. In our model, however, Southern demand for Northern varieties is crucial for changes in the level of competitiveness in the Southern market to affect the Northern multinationals' behavior.

2.2 The differentiated varieties industry

A. Firms in the financially unconstrained North

Without loss of generality, we describe the structure of the differentiated varieties sector in West; the situation in East is entirely symmetric.[6] Each entrant firm in West obtains its unit cost draw, a, and then decides whether to commence production or exit. 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 this as the recurring cost of operating a production plant in West or of headquarter services such as managerial expertise. At the start of each period, firms require external financing to pay f_D upfront. For simplicity, we assume that firms cannot use retained earnings from previous periods because management has no control rights over these revenues and must transfer them as dividends or profits to the firm's owners. Firms thus borrow for each period's fixed costs at a (gross) interest rate of $R > 1$, which is set exogenously in an international capital market that we do not model explicitly. However, there are no frictions to borrowing activity in the developed North.

Firms charge a constant markup over marginal costs, so that the home price for a Western variety is $p_{ww}(a) = \frac{a}{\alpha}$. Individual producers take the aggregate demand levels in each country as given. Profits from sales in the domestic market are equal to revenues minus variable and fixed costs, and are given by:

$$\pi_D(a) = (1-\alpha)A_{ww}\left(\frac{a}{\alpha}\right)^{1-\varepsilon} - Rf_D. \tag{2.5}$$

The export decision: Firms that are sufficiently productive 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 includes the cost of maintaining an overseas distribution network. Exporting also entails an iceberg transport cost that raises prices by a multiplicative factor, $\tau > 1$. The Western firm's profits from exporting to East and South are thus respectively:

$$\pi_{XN}(a) = (1-\alpha)A_{ew}\left(\frac{\tau a}{\alpha}\right)^{1-\varepsilon} - Rf_X, \quad \text{and} \tag{2.6}$$

$$\pi_{XS}(a) = (1-\alpha)A_{sw}\left(\frac{\tau a}{\alpha}\right)^{1-\varepsilon} - Rf_X. \tag{2.7}$$

The FDI decision: Alternatively, Northern firms that are sufficiently productive can choose to become multinationals. This allows the firm to locate production closer to the host-country market (saving on shipping costs), as well as to lower its wage bill if it locates in South. However, establishing an affiliate abroad requires a high per-period fixed cost equal to f_I units of Northern labor. In this baseline setting, we assume Northern firms do not seek host-country financing for their offshore affiliates, as they are able to tap fully into the North's financial institutions for all their credit needs.

A Western MNC thus faces a wide array of options. Apart from servicing the host-country market, the firm may also choose to use its foreign affiliate as an export platform to a third country or even back

[6] The corresponding equations for East can be obtained by replacing the subscript 'w' with 'e', and vice versa.

to its home (Western) market. We assume that such exporting to each market would incur both the above-mentioned export fixed cost, f_X, as well as the same iceberg transport cost, τ. This clearly raises a large number of combinatorial possibilities for the export-versus-FDI decision over the three markets. To keep the analysis tractable, we therefore adopt the approach of focusing on a case that allows us to economize on the number of relevant productivity cutoffs. In particular, we examine the case where: (i) Western firms that are sufficiently productive conduct FDI only in the low-wage South and not in East; and (ii) a Western firm that establishes a plant in South uses that plant as its global production center serving all three countries. Below, we show that two conditions, namely $\tau\omega < 1$ and $f_X < f_D < f_I$, suffice to ensure that this is the optimal strategy for Western MNCs. Intuitively, the Southern wage after adjusting for transport costs ($\tau\omega$) and the fixed cost of exporting (f_X) must both be low, if MNCs are to decide to use South as their global production center.

Consider first a Western firm that already operates a multinational affiliate in South. It is then automatically more profitable to use this 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 $\tau\omega < 1 < \tau$ and $f_X < f_I$ (bearing in mind that $1-\varepsilon < 0$). In particular, this rules out the possibility of the MNC establishing affiliates in both South and East.

Next, conditional on setting up a Southern affiliate, we can further deduce that it is optimal to use this affiliate to supply even the firm's home 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 than to incur the higher fixed cost and wages of production at home.

It remains to check that the optimal decision for a Western firm that becomes a multinational is to locate its overseas affiliate in South, rather than in East. For this, we compare the total profits from servicing all three countries out of an affiliate in South against the profits from setting up an affiliate in East instead:

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

Note that if FDI is undertaken in East, the home market (West) can be supplied either through domestic production or 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 production mode. It is straightforward to check that the above inequality holds when $\tau\omega < 1$, $\omega < 1$, $\omega < \tau$ and $f_X < f_D$. It is thus not optimal for a Western firm to conduct FDI in 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 firm's global production center to South, with only headquarter activities being retained in West. Under these parameter assumptions, and taking into account revenues from all three markets, profits from FDI in South for a firm with productivity $1/a$ are therefore:

$$\pi_I(a) = (1-\alpha)A_{sw}\left(\frac{a\omega}{\alpha}\right)^{1-\varepsilon} + (1-\alpha)(A_{ww} + A_{ew})\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} - R(f_I + 2f_X). \tag{2.8}$$

Note that under FDI, the fixed cost of operating a production plant in West (f_D) is no longer incurred.

Patterns of production: Each firm's productivity level determines where it manufactures and in which markets it sells its goods. Firms produce at home for the domestic market if profits from (2.5) are positive. Solving $\pi_D(a) = 0$, this pins down a zero-profit value, a_D, which is the maximum labor input coefficient at which domestic production is profitable. Similarly, setting $\pi_{XN}(a) = 0$ yields a cutoff level, a_{XN}, below which exporting to East is profitable. Solving $\pi_{XS}(a) = 0$ delivers the analogous cutoff, a_{XS}, for exporting to South. These three thresholds are given by:

$$a_D^{1-\varepsilon} = \frac{Rf_D}{(1-\alpha)A_{ww}(1/\alpha)^{1-\varepsilon}}, \tag{2.9}$$

$$a_{XN}^{1-\varepsilon} = \frac{Rf_X}{(1-\alpha)A_{ew}(\tau/\alpha)^{1-\varepsilon}}, \quad \text{and} \tag{2.10}$$

$$a_{XS}^{1-\varepsilon} = \frac{Rf_X}{(1-\alpha)A_{sw}(\tau/\alpha)^{1-\varepsilon}}. \tag{2.11}$$

There is a fourth cutoff, a_I, that delineates when FDI is feasible. Becoming a multinational 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:

$$a_I^{1-\varepsilon} = \frac{R(f_I - f_D)}{(1-\alpha)[A_{ww}((\frac{\tau\omega}{\alpha})^{1-\varepsilon} - (\frac{1}{\alpha})^{1-\varepsilon}) + A_{ew}((\frac{\tau\omega}{\alpha})^{1-\varepsilon} - (\frac{\tau}{\alpha})^{1-\varepsilon}) + A_{sw}((\frac{\omega}{\alpha})^{1-\varepsilon} - (\frac{\tau}{\alpha})^{1-\varepsilon})]}. \tag{2.12}$$

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 assume that $0 < a_D^{1-\varepsilon} < a_{XN}^{1-\varepsilon} < a_{XS}^{1-\varepsilon} < a_I^{1-\varepsilon}$. This describes a natural sorting of Western firms to the various production modes in the spirit of Helpman et al. (2004), and in line with prior evidence that successively more productive firms are able to first export to foreign markets and eventually undertake FDI. The upper panel of Figure 1 illustrates this sorting pattern using $a^{1-\varepsilon}$ as a proxy for firm productivity. The least efficient firms with $a^{1-\varepsilon} < a_D^{1-\varepsilon}$ have labor input requirements that are too high and exit the industry upon observing their productivity draw. Firms with productivity levels between $a_D^{1-\varepsilon}$ and $a_{XN}^{1-\varepsilon}$ supply only the domestic Western market. Using the cutoff expressions in (2.9) and (2.10), the assumption that $a_D^{1-\varepsilon} < a_{XN}^{1-\varepsilon}$ reduces to $\tau^{\varepsilon-1}\left(\frac{f_X}{A_{ew}}\right) > \frac{f_D}{A_{ww}}$, so that export costs must be sufficiently bigger than the fixed cost of domestic production (normalizing by demand levels).[7] 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, but not to South; based on (2.10) and (2.11), this simply requires that market demand for Western varieties be greater in East than in South, $A_{ew} > A_{sw}$. Firms with $a_{XS}^{1-\varepsilon} < a^{1-\varepsilon} < a_I^{1-\varepsilon}$ can further export to the smaller Southern market.[8] Finally, the most productive firms with $a^{1-\varepsilon} > a_I^{1-\varepsilon}$ 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 productive enough (upper panel). 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 located in South, from where they service all three markets (lower panel).

B. Firms in the credit-constrained South

The structure of South's differentiated varieties sector is simpler, with Southern firms producing only for domestic consumption. The per-period fixed cost of domestic production is f_S units of Southern labor, and we assume 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. Following Aghion et al. (2005), we model this moral hazard problem by assuming that firms lose a fraction $\eta \in [0, 1]$ of their appropriable profits if they choose to default. For simplicity, we take these appropriable profits to be the revenues of the firm less the variable costs that it must pay to its production workers. Thus, while it is tempting to default to avoid loan repayment, this is a costly option. The parameter η can be viewed as the pecuniary cost of actions taken to hide the firm's financial resources from lenders. We therefore interpret η as capturing the degree of financial development in South: When credit institutions are stronger, η is higher and it is more costly for firms to hide their profits and assets. A Southern firm with input coefficient a would default if and only if the associated profit loss is smaller than the cost of repaying the loan:

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

The above condition yields a productivity threshold above which firms have access to credit:

$$a_S^{1-\varepsilon} = \frac{1}{\eta}\frac{Rf_S\omega}{(1-\alpha)A_{ss}(\omega/\alpha)^{1-\varepsilon}}. \tag{2.13}$$

We assume that lenders can observe a, and hence only Southern firms with $a^{1-\varepsilon} > a_S^{1-\varepsilon}$ are able to commence production. When $\eta = 1$, $a_S^{1-\varepsilon}$ is the cutoff for domestic entry that would prevail in the

[7] Under the utility specification in (2.1) and (2.2) with a single elasticity of substitution, we have $A_{ww} = A_{ew}$, so this condition simplifies further to $\tau^{\varepsilon-1}f_X > f_D$. Note that this is not inconsistent with the earlier requirement that $f_X < f_D$.

[8] 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.

absence of credit market imperfections. When $\eta < 1$, however, the productivity cutoff is higher, as illustrated in the lower panel of Figure 1. This is because some firms with productivity below $a_S^{1-\varepsilon}$ would earn positive profits following entry, but are prevented from doing so because they are unable to credibly commit to repaying their loans. As η increases toward 1, this distortion from credit constraints vanishes.

C. Industry equilibrium

We now close the model by specifying the conditions that govern firm entry in each country. For this, it is convenient to define $V_i(a) = \int_0^a \tilde{a}^{1-\varepsilon} dG_i(\tilde{a})$, since this expression will show up repeatedly.

Prospective entrants in country i's differentiated varieties sector incur an upfront entry cost equal to f_{Ei} units of country i labor. This is a once-off cost that firms pay before they can obtain their productivity draw.[9] On the exit side, firms face an exogenous probability, $\delta \in (0,1)$, of "dying" and leaving the industry in each period. For an equilibrium with a constant measure of firms in each country, the cost of entry must equal expected profits. Using the profit functions (2.5)-(2.8) and the cutoffs (2.9)-(2.12), and integrating the expressions for expected profits over the distribution $G_i(a)$, one can write down the free-entry conditions for Northern and Southern firms as:

$$\begin{aligned}
\delta f_{En} &= (1-\alpha)A_{ww}\left(\frac{1}{\alpha}\right)^{1-\varepsilon}(V_n(a_D)-V_n(a_I)) - Rf_D(G_n(a_D)-G_n(a_I)) \\
&\quad +(1-\alpha)A_{ew}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XN})-V_n(a_I)) - Rf_X(G_n(a_{XN})-G_n(a_I)) \\
&\quad +(1-\alpha)A_{sw}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XS})-V_n(a_I)) - Rf_X(G_n(a_{XS})-G_n(a_I)) \\
&\quad +(1-\alpha)\left(A_{ww}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} + A_{ew}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} + A_{sw}\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}\right)V_n(a_I) - R(f_I+2f_X)G_n(a_I), \quad \text{and}
\end{aligned} \tag{2.14}$$

$$\delta f_{Es}\omega = (1-\alpha)A_{ss}\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}V_s(a_S) - Rf_S\omega G_s(a_S). \tag{2.15}$$

Finally, we denote the measure of firms in country i's differentiated varieties sector by N_i.[10] The definition of the ideal price index then implies:

$$P_{ww}^{1-\varepsilon} = N_n\left[\left(\frac{1}{\alpha}\right)^{1-\varepsilon}(V_n(a_D)-V_n(a_I)) + \left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}V_n(a_I)\right], \tag{2.16}$$

$$P_{ew}^{1-\varepsilon} = N_n\left[\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XN})-V_n(a_I)) + \left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}V_n(a_I)\right], \tag{2.17}$$

$$P_{sw}^{1-\varepsilon} = N_n\left[\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XS})-V_n(a_I)) + \left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}V_n(a_I)\right], \quad \text{and} \tag{2.18}$$

$$P_{ss}^{1-\varepsilon} = N_s\left[\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}V_s(a_S)\right]. \tag{2.19}$$

[9] Our results are robust to subjecting the fixed cost of entry in South, f_{Es}, to borrowing constraints too. Intuitively, an improvement in financial development in South would still spur more entry by Southern firms, which would work in the same direction as the effects in our baseline model.

[10] Following Melitz (2003), for N_i to be constant, the expected mass of successful entrants, N_i^{ent}, needs to equal the mass of firms that dies exogenously in each period, namely: $N_i^{ent} = \delta N_i$, for $i = n, s$.

The equilibrium of the model is thus pinned down by the system of equations (2.3)-(2.4) and (2.9)-(2.19) 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 are able to derive comparative statics results that directly inform our empirical analysis.

In what follows, it is convenient to explicitly parameterize the technology distribution in the differentiated varieties sector. As is common in this literature, we assume that productivity $1/a$ follows a Pareto distribution with shape parameter k and support $[1/\bar{a}_i, \infty)$ for each country i.[11] The associated expressions for G_i and V_i are thus: $G_i(a) = \left(\frac{a}{\bar{a}_i}\right)^k$ and $V_i(a) = \frac{k}{k-\varepsilon+1}\left(\frac{a^{k-\varepsilon+1}}{\bar{a}_i^k}\right)$. Helpman et al. (2004) have shown that if the underlying productivity distribution is Pareto with shape parameter k, then the distribution of observed firm sales is Pareto with shape parameter $k - \varepsilon + 1$. We therefore assume that $k > \varepsilon - 1$, which is necessary to deliver a finite variance for the distribution of firm sales.

2.3 The competition effect of host-country financial development

We are now in a position to derive the effects of financial conditions in the host country on multinational activity there. Specifically, we use our model to determine how changes in η affect both the shares and levels of MNC affiliate sales emanating from South that are destined respectively for the local, third- and home-country markets. This in turn depends on how η affects the various productivity cutoffs. Since MNC affiliates do not seek financing directly from South in this baseline model, this isolates the effect that arises from the interactions between Northern and Southern firms in South's goods market alone. We thus label this the *competition effect*.

A. Impact on industry cutoffs and market demand levels

We first establish how an improvement in Southern financial development systematically shifts the productivity cutoffs and aggregate demand levels in each market. Note that equations (2.13) and (2.15) pin down A_{ss} and a_S for the industry equilibrium in South. By totally differentiating these two equations, we obtain:

Lemma 1: *(i)* $\frac{da_S}{d\eta} > 0$; *and (ii)* $\frac{dA_{ss}}{d\eta} < 0$.

We relegate all detailed proofs to the Appendix, and focus instead on conveying the intuition here. When η rises, the higher cost of default in South helps to alleviate the moral hazard problem, and hence more Southern firms gain access to credit. This lowers the productivity cutoff, $a_S^{1-\varepsilon}$, for entry into the Southern differentiated varieties sector, as illustrated in the bottom panel of Figure 3a. However, the free-entry condition (2.15) requires that the expected profitability of a Southern firm remain constant. Average demand for each Southern product, A_{ss}, must subsequently fall.

[11] We require that $\bar{a}_s$ and $\bar{a}_n$ both be sufficiently large, so that all relevant cutoffs lie within the interior of the support of the distributions that they are drawn from. Also, our proofs do not require the same shape parameter in West and South, but we have assumed this to simplify notation.

Since Northern and Southern varieties are substitutes in consumption in South, the entry of more domestic firms in South naturally affects the differentiated varieties sector in each Northern country. The consequent effects on the productivity cutoffs and demand levels relevant to Western firms are described in the following lemma; by symmetry, these comparative statics also apply to the Eastern industry:

Lemma 2: *When MNCs do not require host-country financing, (i)* $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} < \frac{1}{a_I}\frac{da_I}{d\eta} < 0$*; (ii)* $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} = \frac{1}{a_D}\frac{da_D}{d\eta} > 0$*; (iii)* $\frac{dA_{sw}}{d\eta} < 0$*; and (iv)* $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} = \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta} > 0$.

The key shifts in Lemma 2 are illustrated in the upper panel of Figure 3a. Intuitively, an improvement in host-country financial development leads to the entry of more Southern varieties, and the resulting tougher competition decreases South's demand for each Western variety, A_{sw}. This raises the productivity cutoffs, $a_{XS}^{1-\varepsilon}$ and $a_I^{1-\varepsilon}$, for Western firms seeking to penetrate the Southern market either through exports or FDI. However, since the fixed cost of entry, f_{En}, remains constant, the free-entry condition (2.14) implies that total profits from sales in the Northern markets (West and East) must increase. This tilts West's firms toward serving the developed country markets: The productivity cutoffs, $a_D^{1-\varepsilon}$ and $a_{XN}^{1-\varepsilon}$, both fall, while aggregate demand levels in West and East, A_{ww} and A_{ew}, both rise.[12]

B. Impact on multinational affiliate sales

These shifts in the productivity cutoffs and aggregate demand levels in turn allow us to sign the impact of host-country financial development on affiliate sales. We first define several sales variables of interest that are observable in the data, and which are also illustrated in the lower panel of Figure 2. For a given MNC affiliate in South with productivity $1/a$, its sales to the local market are: $HOR(a) \equiv A_{sw}\left(\frac{a\omega}{\alpha}\right)^{1-\varepsilon}$. We refer to these as horizontal sales, since they allow the multinational to avoid transport costs while servicing the Southern market. Export-platform sales to third-country destinations (in our case, East) are defined as: $PLA(a) \equiv A_{ew}\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon}$. Finally, return sales back to the Western home market are: $RET(a) \equiv A_{ww}\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon}$. The affiliate's total sales are: $TOT(a) \equiv HOR(a) + PLA(a) + RET(a)$.

Integrating these firm-level sales over the measure of Western multinationals (with $a^{1-\varepsilon} > a_I^{1-\varepsilon}$) delivers the following expressions for the aggregate levels of horizontal, platform and return sales respectively:

$$HOR \equiv N_n \int_0^{a_I} HOR(a)dG_n(a) = N_n A_{sw}\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon} V_n(a_I), \tag{2.20}$$

$$PLA \equiv N_n \int_0^{a_I} PLA(a)dG_n(a) = N_n A_{ew}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} V_n(a_I), \quad \text{and} \tag{2.21}$$

$$RET \equiv N_n \int_0^{a_I} RET(a)dG_n(a) = N_n A_{ww}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} V_n(a_I). \tag{2.22}$$

The measure of multinational firms is in turn given by: $N_n \int_0^{a_I} dG_n(a) = N_n G_n(a_I)$. Using these defini-

[12] That the proportional shifts in the $a_D^{1-\varepsilon}$ and $a_{XN}^{1-\varepsilon}$ cutoffs, and hence also in A_{ww} and A_{ew}, are equal is a feature that is relaxed in the extension in Section 3.2.

tions, we construct three sales shares that describe the breakdown of affiliate sales by destination:

$$\frac{HOR(a)}{TOT(a)} = \frac{HOR}{TOT} = \left(1 + \tau^{1-\varepsilon}\frac{A_{ew}}{A_{sw}} + \tau^{1-\varepsilon}\frac{A_{ww}}{A_{sw}}\right)^{-1}, \tag{2.23}$$

$$\frac{PLA(a)}{TOT(a)} = \frac{PLA}{TOT} = \left(1 + \tau^{\varepsilon-1}\frac{A_{sw}}{A_{ew}} + \frac{A_{ww}}{A_{ew}}\right)^{-1}, \quad \text{and} \tag{2.24}$$

$$\frac{RET(a)}{TOT(a)} = \frac{RET}{TOT} = \left(1 + \tau^{\varepsilon-1}\frac{A_{sw}}{A_{ww}} + \frac{A_{ew}}{A_{ww}}\right)^{-1}. \tag{2.25}$$

We have a convenient property here that the respective sales shares at the individual affiliate level and at the aggregate level are algebraically identical. These shares moreover depend crucially on the pairwise ratios of the aggregate demand levels for Northern varieties across the three different markets.

We can now state a key result regarding the effect of host-country financial development on the above measures of multinational activity.[13]

Proposition 1 *When MNCs do not require host-country financing, in response to a small improvement in financial development, η, in South:*

(i) $HOR(a)$ decreases, while both $PLA(a)$ and $RET(a)$ increase;

(ii) $\frac{HOR(a)}{TOT(a)} = \frac{HOR}{TOT}$ decreases, while both $\frac{PLA(a)}{TOT(a)} = \frac{PLA}{TOT}$ and $\frac{RET(a)}{TOT(a)} = \frac{RET}{TOT}$ increase; and

(iii) N_n, $N_nG_n(a_I)$, HOR, PLA and RET all decrease.

The intuition behind this proposition builds directly on the logic of Lemma 2. When credit constraints in South are eased, the demand in South for Western goods drops due to the competition effect following the entry of more local firms. For each affiliate, this leads horizontal sales to South, as well as their share in total sales, to both decline. At the same time, demand levels in East and West rise in equilibrium, so that each affiliate re-directs its sales toward the developed North. This prompts an increase in platform and return sales, both in absolute levels and relative to total sales.

As for part (iii) of the proposition, the competition effect lowers the *ex ante* expected profits of Western firms. This leads to a decrease in both the measure of these firms, N_n, and the measure of multinationals, $N_nG_n(a_I)$. To see how this subsequently affects aggregate sales levels, we refer back to equations (2.20)-(2.22). On the extensive margin, a higher η lowers HOR, PLA and RET, by reducing N_n and raising the productivity cutoff for FDI so that $V_N(a_I)$ drops; both of these shifts reflect the exit of Western MNCs from South. In the case of horizontal sales, this negative effect on the extensive margin is reinforced by the reduction in A_{sw}, and HOR clearly falls. As for platform and return sales, the decline on the extensive margin dominates the increases on the intensive margin from A_{ew} and A_{ww}, so that both PLA and RET fall unambiguously as well. These predictions in part (iii), however, depend on the assumptions concerning affiliate financing practices. We address this issue next.

[13] Note that all results regarding individual affiliate-level sales variables pertain to firms that remain multinationals after the underlying small change in η.

3 Enriching the baseline model

3.1 The financing effect

Thus far, we have considered a baseline setting in which Northern firms are unconstrained in their ability to raise outside financing. In this subsection, we examine what happens when we relax this assumption, by instead requiring that Northern multinationals also seek local financing in South to (partially) service the fixed cost of their FDI. Such host-country financing is important in practice. For example, Feinberg and Phillips (2004) report that between 1983-1996, close to two-thirds of the debt of U.S. multinational affiliates abroad was raised locally.[14] Such local borrowing introduces an additional channel through which host-country financial development may affect multinational activity, by alleviating the credit constraints that affiliates face.

We retain the previous setup of our three-country world, but now introduce local financing. We do so by adopting a specific formulation of the firm's moral hazard problem that both maintains tractability and facilitates comparison with the baseline model. What will be important for our results is the idea that credit constraints in South raise the productivity threshold for Northern firms to undertake FDI.

We assume that FDI in South is now perceived by Northern financiers as risky, so that the latter are not willing to extend credit for the entire fixed cost of FDI, f_I. For example, fixed assets in a Southern production plant are not viewed as fully collateralizable, due to either expropriation risk or difficulties in enforcing cross-border claims on assets. For simplicity, we suppose that Northern financiers still lend an amount f_D at the (unconstrained) interest rate R to each Western MNC, this being what they would have been willing to offer had the firm instead located production at home. The shortfall $f_I - f_D$ must be obtained from South's imperfect financial institutions. To focus on the fixed cost of FDI, we also assume that all export fixed costs, f_X, are covered by Northern financiers, for example because goods shipments can be used as collateral once a sales contract exists.

It remains to specify what affects multinationals' repayment incentives for their local borrowing in South. As in Section 2.2.B, default on one's Southern debt obligations incurs a cost equal to a fraction $\eta \in [0, 1]$ of appropriable profits. For convenience, we assume that an MNC's appropriable profits equal its total affiliate sales minus variable costs, less the corresponding operating profits that the firm would have obtained had it instead manufactured at home. The latter are operating profits that the firm would be able to guarantee itself as an outside option by moving production back home, and so are arguably less appropriable from the perspective of Southern creditors seeking to enforce a debt contract.[15] With this specification, a multinational with productivity $a^{1-\varepsilon}$ would default on its Southern loan if:

$$\eta(1-\alpha)\left[A_{ww}\left(\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{a}{\alpha}\right)^{1-\varepsilon}\right) + A_{ew}\left(\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{\tau a}{\alpha}\right)^{1-\varepsilon}\right) + A_{sw}\left(\left(\frac{a\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{\tau a}{\alpha}\right)^{1-\varepsilon}\right)\right] < R(f_I - f_D),$$

[14] See their Table 1. Funding from U.S. parent firms accounted for an additional 16% of affiliates' debt.

[15] While there are alternative ways of defining what constitutes appropriable profits, our general insights would hold so long as the productivity cutoff for FDI by Northern firms is higher the more severe financial constraints in South are.

namely when the cost of default on the left-hand side is less than the cost of repaying creditors. Setting the above as an equality and rearranging, one obtains a modified FDI cutoff, $\tilde{a}_I^{1-\varepsilon}$, given by:

$$\tilde{a}_I^{1-\varepsilon} = \frac{1}{\eta} a_I^{1-\varepsilon}, \tag{3.1}$$

where $a_I^{1-\varepsilon}$ is the FDI cutoff from the baseline model defined in (2.12). Northern firms with $a^{1-\varepsilon} > \tilde{a}_I^{1-\varepsilon}$ are sufficiently productive to commit to repay their Southern lenders, and are thus able to raise the necessary funds to undertake FDI. Since $\eta \in [0,1]$, credit market imperfections in the host country thus (weakly) raise the productivity cutoff that Northern firms need to clear before FDI becomes feasible.[16]

The above formulation preserves much of the structure of our baseline model. The equilibrium in the presence of host-country financing is now pinned down by equations (2.3)-(2.4) and (2.9)-(2.19), but with one difference as (3.1) replaces (2.12) as the expression for the FDI cutoff.

A. Impact on industry cutoffs and market demand levels

We proceed as before to explore how a small change in host-country financial development affects equilibrium outcomes, starting first with the impact on the industry cutoffs. Note that equations (2.13) and (2.15) still pin down the equilibrium for South's differentiated varieties industry, so that Lemma 1 continues to hold in this extended model with host-country financing. An increase in η once again facilitates entry by more Southern firms, so that the competition effect is still operative. What is more interesting is the further effects that this has on the Northern industry, as described by:

Lemma 3: *When MNC affiliates require host-country financing, (i)* $\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} > 0$*; (ii)* $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} < 0$*; (iii)* $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} = \frac{1}{a_D}\frac{da_D}{d\eta} > \frac{1}{a_{XS}}\frac{da_{XS}}{d\eta}$*; (iv)* $\frac{1}{A_{sw}}\frac{dA_{sw}}{d\eta} < 0$*; and (v)* $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} = \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta} > \frac{1}{A_{sw}}\frac{dA_{sw}}{d\eta}$*.*

Compared with Lemma 2, a key difference is that an improvement in host-country financial development now leads instead to a *leftward* shift in the FDI cutoff, $\tilde{a}_I^{1-\varepsilon}$, as illustrated in Figure 3b. This occurs because an increase in η has a *financing effect* that makes credit accessible and FDI feasible for a larger margin of Northern firms. Despite the introduction of this new effect, we can nevertheless still show that $\frac{da_{XS}}{d\eta} < 0$ and $\frac{dA_{sw}}{d\eta} < 0$: Overall, the Southern market does become more competitive, not just because of the entry of more local firms, but also because there are now more MNC affiliates present there. The productivity cutoff for Northern firms to start exporting to South, $a_{XS}^{1-\varepsilon}$, thus shifts to the right, while the market demand level faced by each Northern firm in South falls. As for $a_D^{1-\varepsilon}$ and $a_{XN}^{1-\varepsilon}$, the model is now sufficiently rich that the direction of change of these two cutoffs is in general dependent on parameter values.[17] We can nevertheless show that the impact on a_D and a_{XN} is less negative than that

[16] We therefore continue to maintain our working assumption on the order of the Northern productivity cutoffs in equilibrium, namely: $0 < a_D^{1-\varepsilon} < a_{XN}^{1-\varepsilon} < a_{XS}^{1-\varepsilon} < \tilde{a}_I^{1-\varepsilon}$.

[17] For example, setting $R = 1.07$, $\varepsilon = 3.8$, $L_n = L_s = 1$, $f_D = 0.2$, $f_X = 0.15$, $f_I = 4$, $f_S = 0.1$, $f_{En} = f_{Es} = 1$, $\tau = 1.4$, $\omega = 0.6$, $\bar{a}_N = \bar{a}_S = 25$, $k = 4$, $\delta = 0.1$, $\mu = 0.5$ and $\eta = 0.5$ delivers an equilibrium with the desired sorting pattern of the productivity cutoffs ($a_D = 13.42$, $a_{XN} = 10.62$, $a_{XS} = 6.30$ and $\tilde{a}_I = 5.25$), in which we also have:

on a_{XS}, which in turn allows us to compare the proportional changes in A_{ww}, A_{ew} and A_{sw}. Intuitively, the response of the $a_D^{1-\varepsilon}$ and $a_{XN}^{1-\varepsilon}$ cutoffs is muted compared to that of $a_{XS}^{1-\varepsilon}$, as the former two cutoffs correspond to Northern firms that are less directly affected by the degree of competition in South.

B. Impact on multinational affiliate sales

What does the above imply for the pattern of affiliate sales? By inspecting (2.23)-(2.25) and applying Lemma 3, one can see that the relative shifts in A_{ww}, A_{ew} and A_{sw} induced by an improvement in η once again lead to a decrease in the horizontal sales share, $\frac{HOR(a)}{TOT(a)}$, as well as an increase in the platform and return sales shares, $\frac{PLA(a)}{TOT(a)}$ and $\frac{RET(a)}{TOT(a)}$. These responses are aligned with the baseline model and indicative of the competition effect. While the increase in η lowers the horizontal sales levels, $HOR(a)$, of individual affiliates, we do not have a similarly sharp prediction for the effects on $PLA(a)$ and $RET(a)$, as we cannot sign the direction of change of A_{ew} and A_{ww} explicitly in this extension.

More importantly, the financing effect alters the behavior of aggregate multinational activity from the baseline model in Section 2. An improvement in host-country financial development now facilitates the entry of more MNC affiliates into South, as indicated by the leftward shift in the $\tilde{a}_I^{1-\varepsilon}$ cutoff described in Lemma 3. We show in the Appendix that this increase in multinational activity on the extensive margin can be large enough to dominate any shifts in the respective market demand levels, A_{sw}, A_{ew} and A_{ww}, in the expressions for HOR, PLA and RET in (2.20)-(2.22), so that the net effect is an increase in all three aggregate sales levels. In particular, this will always turn out to be the case when the initial level of financial development in the host country is sufficiently high. This stands in direct contrast to the earlier predictions in part (iii) of Proposition 1 of the baseline model; there, with only the competition effect operative, an increase in η could only result in the exit of Northern MNCs on the extensive margin and hence a decline in the aggregate measures of multinational activity.

We summarize our results in the presence of host-country borrowing as follows:

Proposition 2 *When MNC affiliates require host-country financing, in response to a small improvement in financial development, η, in South:*

(i) $HOR(a)$ decreases, while the effects on both $PLA(a)$ and $RET(a)$ are ambiguous;

(ii) $\frac{HOR(a)}{TOT(a)} = \frac{HOR}{TOT}$ decreases, while both $\frac{PLA(a)}{TOT(a)} = \frac{PLA}{TOT}$ and $\frac{RET(a)}{TOT(a)} = \frac{RET}{TOT}$ increase; and

(iii) if the initial level of host-country financial development is sufficiently high, $N_n G_n(\tilde{a}_I)$, HOR, PLA and RET all increase.

The sufficient condition specified in part (iii) of this proposition warrants some discussion. Intuitively, when the initial level of η is high, improvements in host-country financial development trigger a modest

$\frac{1}{a_D}\frac{da_D}{d\eta} = \frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} = -4.34 < 0$. However, when we raise ω to 0.8 and lower τ to 1.2 (holding the other parameter values constant), we obtain $a_D = 13.57$, $a_{XN} = 12.53$, $a_{XS} = 10.87$, $\tilde{a}_I = 4.27$, and $\frac{1}{a_D}\frac{da_D}{d\eta} = \frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} = 0.83 > 0$. The Matlab code for computing the equilibrium is available on request.

amount of entry by Southern firms, as the initial distortion imposed by financial frictions is small. The decline in Southern demand, A_{sw}, experienced by each Northern firm will in turn be small, and will in particular be insufficient to counteract the tendency for more Northern multinationals to locate in South as credit becomes more accessible. In short, in this setting the competition effect is dominated by the financing effect, and aggregate levels of multinational activity increase. This sufficient condition is moreover very mild in practice. In footnote 17, we have already provided an example of a valid parametrization of our model with $\eta = 0.5$ (much below the upper bound of 1), in which $N_n G_n(\tilde{a}_I)$, HOR, PLA and RET all rise with small increases in η.[18] Our extensive quantitative explorations indicate that η needs to be low *and* one of the other parameters has to lie far outside of conventional ranges in order to generate a numerical counter-example in which part (iii) of Proposition 2 does not hold. (We discuss one such counter-example in more detail in the Appendix proof.)

3.2 The home-bias effect

In both versions of the model that we have presented so far, platform and return sales respond identically to host-country financial development. However, an empirically relevant possibility is that affiliates' return and platform sales adjust differentially to improvements in host-country credit conditions. While there are various ways to achieve this from a modeling perspective, we do so by introducing home bias in consumer preferences that preserves much of the underlying symmetry of our model.

For our purposes, it is convenient to revert back to the baseline model of Section 2 in which affiliates do not require host-country financing. While we had previously assumed a single elasticity of substitution in the differentiated varieties sector, we now modify the utility functions to:

$$U_n = y_n^{1-\mu} \left[\sum_{j \in \{e,w\}} \left(\int_{\Omega_{nj}} x_{nj}(a)^{\alpha} \, dG_j(a) \right)^{\frac{\beta}{\alpha}} \right]^{\frac{\mu}{\beta}}, \text{ and} \tag{3.2}$$

$$U_s = y_s^{1-\mu} \left[\sum_{j \in \{e,w,s\}} \left(\int_{\Omega_{sj}} x_{sj}(a)^{\alpha} \, dG_j(a) \right)^{\frac{\beta}{\alpha}} \right]^{\frac{\mu}{\beta}}, \tag{3.3}$$

for Northern and Southern consumers respectively. In contrast to (2.1) and (2.2), the sub-utility derived from differentiated varieties is now a two-tiered CES function, with $\varepsilon = \frac{1}{1-\alpha}$ being the elasticity of substitution for varieties from the same country, and $\phi = \frac{1}{1-\beta}$ being the corresponding elasticity for varieties from different countries. We assume that $0 < \beta < \alpha < 1$, which translates into a home-bias assumption, as varieties from the same country are then closer substitutes than varieties drawn from different countries ($\varepsilon > \phi > 1$).

Under this richer utility specification, an improvement in Southern financial development once again spurs entry on the part of domestic firms, so that Lemma 1 continues to hold. Likewise, the competition effect impacts the Northern industry in the way that Lemma 2 describes, but with a key modification:

[18] For the first parametrization in footnote 17, we get: $\frac{d}{d\eta} N_n G_n(\tilde{a}_I) = 0.57$, $\frac{d}{d\eta} HOR = 0.72$ and $\frac{d}{d\eta} PLA = \frac{d}{d\eta} RET = 2.06$.

One can show that $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} > \frac{1}{a_D}\frac{da_D}{d\eta} > 0$, and that $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta} > 0$; in other words, the proportional decrease in the $a_{XN}^{1-\varepsilon}$ cutoff is now strictly larger than that for the $a_D^{1-\varepsilon}$ cutoff. In the online Supplemental Appendix to this paper, we prove that Proposition 1 remains true in its entirety, but the home-bias assumption delivers a further prediction: The rise in the MNC's export-platform sales now exceeds that of its return sales back to West:

Proposition 3 *With home bias in consumer preferences, (i)* $\frac{d}{d\eta}PLA(a) > \frac{d}{d\eta}RET(a)$*; (ii)* $\frac{d}{d\eta}\frac{PLA(a)}{TOT(a)} = \frac{d}{d\eta}\frac{PLA}{TOT} > \frac{d}{d\eta}\frac{RET(a)}{TOT(a)} = \frac{d}{d\eta}\frac{RET}{TOT}$*; and (iii)* $\frac{d}{d\eta}PLA > \frac{d}{d\eta}RET$*.*

Platform sales rise more than return sales for a simple reason: A Western MNC faces tougher competition in its own home market than in East. This occurs because Western varieties are closer substitutes in consumption for the MNC's goods than Eastern varieties, and a margin of Western firms (with productivity $a_D^{1-\varepsilon} < a^{1-\varepsilon} < a_{XN}^{1-\varepsilon}$) sell only at home but not in East.

4 Empirical Strategy

The model developed in Sections 2 and 3 delivers specific predictions for the effects of host-country financial conditions on multinational activity. To establish whether these predictions are consistent with observed patterns in the data, we design an estimation framework that is directly guided by the model.

4.1 Baseline Estimating Equation

We evaluate the influence of host-country financial institutions on multinational activity using the following baseline specification:

$$MNC_{ikt} = \alpha + \beta\, FD_{it} + \Gamma X_{it} + \varphi_k + \varphi_t + \epsilon_{ikt}, \tag{4.1}$$

where MNC_{ikt} characterizes the activity of U.S.-based multinational firms in host country i and sector k during year t, and FD_{it} is the financial development of country i in year t. The main coefficient of interest, β, captures the impact of host-country financial conditions on multinational activity.

Following Propositions 1-3, we estimate equation (4.1) with three sets of outcome variables, MNC_{ikt}: 1) the number of foreign affiliates, $N_nG_n(a_{Iikt})$; 2) aggregate affiliate sales to each destination market, HOR_{ikt}, PLA_{ikt} and RET_{ikt}, and across all markets, TOT_{ikt}; and 3) the share of aggregate affiliate sales to each destination, $\frac{HOR_{ikt}}{TOT_{ikt}}$, $\frac{PLA_{ikt}}{TOT_{ikt}}$ and $\frac{RET_{ikt}}{TOT_{ikt}}$. We assess the model's implications for individual firms with a firm-level version of (4.1) using two additional sets of outcomes: 4) affiliate-level sales by destination, $HOR_{ikt}(a)$, $PLA_{ikt}(a)$ and $RET_{ikt}(a)$, and across all markets, $TOT_{ikt}(a)$; and 5) the share of affiliate-level sales to each destination, $\frac{HOR_{ikt}(a)}{TOT_{ikt}(a)}$, $\frac{PLA_{ikt}(a)}{TOT_{ikt}(a)}$ and $\frac{RET_{ikt}(a)}{TOT_{ikt}(a)}$.

Propositions 1-3 imply distinct effects of host-country financial development on multinational activity across the above outcome variables. These depend on the potential mechanisms highlighted by the theory: the competition effect, the financing effect and the home-bias effect. To determine how consistent the data are with these mechanisms, we examine the extent to which the estimated coefficient for β in (4.1) is aligned with Propositions 1-3 both in sign and relative magnitude for each outcome MNC_{ikt}. To keep things clear in our discussion below, we label the coefficient β for regressions involving multinationals' horizontal, platform and return sales as β_{HOR}, β_{PLA} and β_{RET}, respectively.

First, the competition effect arises as host-country financial development induces entry by domestic firms. Propositions 1 and 2 indicate that the resulting increase in local competition reduces affiliate-level sales revenues earned in the host country $HOR(a)_{ikt}$, consistent with $\beta_{HOR} < 0$. Furthermore, financial development in South lowers the share of affiliate-level and aggregate sales to the host market, $\frac{HOR_{ikt}(a)}{TOT_{ikt}(a)}$ and $\frac{HOR_{ikt}}{TOT_{ikt}}$, while raising the share of export sales to the parent country and to third-country destinations, $\frac{RET_{ikt}(a)}{TOT_{ikt}(a)}$, $\frac{RET_{ikt}}{TOT_{ikt}}$, $\frac{PLA_{ikt}(a)}{TOT_{ikt}(a)}$ and $\frac{PLA_{ikt}}{TOT_{ikt}}$. These latter effects are consistent with $\beta_{HOR} < 0$, $\beta_{PLA} > 0$ and $\beta_{RET} > 0$ for the affiliate-level and aggregate sales shares.[19]

Second, the financing effect implies that host-country financial development raises the aggregate level of multinational activity, as Northern firms can access more capital in the host country when credit conditions there improve. According to Proposition 2, the number of offshore affiliates, $N_n G_n(a_{Iikt})$, and aggregate affiliate sales to each destination, HOR_{ikt}, PLA_{ikt}, RET_{ikt} and TOT_{ikt}, are therefore all positively related to financial development in i. Finding $\beta > 0$ for each of these outcome variables would therefore be consistent with Proposition 2 and indicative of the financing effect. By contrast, Proposition 1 would predict $\beta < 0$ in these regressions if the financing effect is not present.

Finally, we briefly discuss the extent to which the data are consistent with Proposition 3. We compare the impact of host-country financial development on sales to third-country destinations with the impact on sales to the United States; finding a larger coefficient on platform sales ($\beta_{PLA} > \beta_{RET}$) would be consistent with the home-bias effect in Section 3.2.

The baseline specification (4.1) includes a number of important controls. Host-country covariates X_{it} reflect local characteristics other than FD_{it} that affect multinational activity in the model. These include aggregate expenditure, E_S; wages, ω; fixed entry, production and FDI costs, f_{ES}, f_S and f_I; and trade costs, f_X and τ. Since our empirical analysis focuses on the global activity of U.S.-based firms, all relevant characteristics of the parent country are subsumed by year fixed effects, φ_t, which also account for temporal changes in general determinants of offshoring such as macroeconomic conditions. Finally, the industry fixed effects, φ_k, absorb cross-sector differences in aggregate expenditure shares, μ, and demand elasticities, ε and ϕ, as well as in production, exporting and FDI costs. The error term ϵ_{ikt} captures any residual factors that shape MNCs' global operations. We cluster standard errors by host country in all reported results, to allow for correlated shocks across observations at the country level.

[19] The affiliate-level and aggregate sales shares sum to 1 by definition. Accordingly, the coefficients on any given right-hand side variable must and do sum to 0 across the specifications for the three sales shares. However, each regression still delivers independent information, namely whether the effect of financial development on each outcome is significantly different from 0. There are no efficiency gains from estimating the three equations simultaneously as seemingly unrelated regressions, since each includes the same set of explanatory variables and is run on the same set of observations.

4.2 Second Estimating Equation

In equation (4.1), β is identified from the variation in financial institutions across host countries and over time. The X_{it} controls absorb the effects of country characteristics that affect multinational activity and may be correlated with financial development. Under the assumption that all such covariates are included in X_{it}, β isolates the independent effect of FD_{it} on MNC_{ikt} and is not subject to omitted variable bias. Separately, reverse causality is less likely to be an empirical concern given the range of dependent variables MNC_{ikt} we consider: Even should FD_{it} respond to aggregate multinational activity $N_nG_n(a_{Iikt})$ and TOT_{ikt}, it is less clear how the shares of affiliate sales by destination market would affect FD_{it}. Moreover, host-country financial development is plausibly exogenous from the perspective of an individual U.S. multinational affiliate.

Nevertheless, a realistic concern is that countries strengthen financial institutions while implementing broader institutional or economic reforms that also affect multinational firms. If the latter changes are unobserved, estimates of β may reflect the influence of both financial development and these omitted country characteristics.[20] To isolate the causal effect of financial development on multinational activity in the presence of such characteristics, we therefore introduce a second estimating equation that incorporates cross-industry variation in sensitivity to financial development:

$$MNC_{ikt} = \alpha + \beta\, FD_{it} + \gamma\, FD_{it} \times EFD_k + \Gamma X_{it} + \varphi_k + \varphi_t + \epsilon_{ikt}. \tag{4.2}$$

Here, EFD_k identifies the external finance dependence of sector k, and the coefficients β and γ jointly capture the impact of FD_{it} on MNC_{ikt}. Following Rajan and Zingales (1998), this approach builds on the premise that technological differences across industries generate differential requirements for outside capital. Firms in sectors with high external finance dependence tend to face high upfront costs, which impose liquidity constraints and raise the need for outside funding. Our theoretical model can be readily extended to reflect this dimension of industry heterogeneity, by featuring $K > 1$ differentiated-varieties sectors with different fixed entry costs for Southern firms, f_S. This can be done by generalizing the utility functions in (2.1) and (2.2) to be Cobb-Douglas over the consumption of the homogeneous good and the CES aggregates for the K differentiated-varieties sectors. We show in the Appendix that the effects of host-country financial development on multinational activity are systematically larger for industries that are more dependent on external finance.

We thus expect the coefficients β and γ to share the same predicted sign across all outcome variables. Importantly, γ has a clear interpretation even in the presence of omitted country characteristics. In addition, in Section 7.4, we report results from estimating (4.2) with country-year fixed effects φ_{it}, in which γ isolates the effect of financial development separately from the effects of both observed and unobserved country-year covariates.

[20] Note however that X_{it} will include GDP per capita and rule of law, alleviating concerns that β captures the effect of overall economic development and broader institutional reforms rather than the effect of financial development.

We view equations (4.1) and (4.2) as providing complementary evidence. Specification (4.1) estimates the impact of FD_{it} on the average sector in an economy. This is relevant for aggregate welfare, but potentially more subject to estimation biases. Specification (4.2) by contrast offers cleaner identification in view of potential omitted variables and reverse causality, but is less relevant to welfare since it reflects only differential (i.e. reallocation) effects across sectors.

5 Data Description

Implementing the empirical framework in Section 4 requires measures of multinational activity, host-country financial institutions, and sectors' external finance dependence. We describe the data we employ for these measures below.

5.1 U.S. Multinational Activity

We construct the dependent variables, MNC_{ikt}, in specifications (4.1) and (4.2) using firm-level data on the global operations of U.S.-based multinationals from the Bureau of Economic Analysis (BEA). The BEA Survey of U.S. Direct Investment Abroad provides information on U.S. parent firms and their foreign affiliates on an annual basis during our sample period, 1989-2009. The data are most comprehensive in scope and coverage in benchmark years, which include 1989, 1994, 1999, 2004 and 2009.[21,22] By contrast, participation in non-benchmark year surveys is subject to size thresholds that vary over time. We therefore compute aggregate outcome variables for benchmark years only, but study the entire panel in affiliate-level regressions.[23]

An important element of this dataset is its detailed record of U.S. multinationals' affiliate sales. In addition to each subsidiary's total revenues, $TOT(a)$, the BEA reports: 1) local sales in the host country, $HOR(a)$, 2) exports to the United States, $RET(a)$, and 3) exports to other destinations, $PLA(a)$.[24] We use these as direct measures of horizontal, return and export-platform sales, as well as to calculate sales shares. Because we observe the primary industry affiliation of each parent company, we are also able to compute aggregate outcomes MNC_{ikt} by host country and year for 220 NAICS 4-digit industries.

Table 1 summarizes multinational activity in the data. In aggregate, the total revenues of U.S. multinational affiliates amount to $561 million in the average country-industry-year triplet. The typ-

[21] Data coverage is nearly complete: In a typical benchmark year, the survey covers over 99% of affiliate activity by total assets, total sales and total U.S. FDI. In case of missing survey responses, the BEA may report imputed values; these are flagged and we exclude them from the analysis.

[22] Any U.S. person having direct or indirect ownership or control of ten percent or more of the voting securities of an incorporated foreign business enterprise or an equivalent interest in an unincorporated foreign business enterprise at any time during a benchmark fiscal year is considered to have a foreign affiliate. However, for very small affiliates that do not own another affiliate, parents are exempt from reporting with the standard survey form. Foreign affiliates are required to report separately unless they are in both the same country and three-digit industry. Each affiliate is considered to be incorporated where its physical assets are located.

[23] We have verified that the affiliate-level results also hold in the sample restricted to benchmark years.

[24] Affiliate sales by destination are observed only for majority-owned affiliates. We therefore restrict the sample to affiliates for which the U.S. parent firm has direct or indirect ownership or control of more than 50 percent of the voting securities.

ical affiliate sells primarily to its local market (75%), while earning a smaller share of revenues from exports to the United States (7%) and to third countries (18%). This composition varies substantially across affiliates and years: The standard deviations around these three means are 36%, 20% and 31%, respectively. Subsidiaries selling only in a single market capture 22% of global MNC sales, while affiliates serving all three destinations contribute over 52%. Multinational firms also locate production facilities across a broad set of countries. In 2009 for example, 1,892 parent companies operated 14,804 affiliates in 142 countries. In an average year, 1,465 U.S. parents manage 4.18 foreign affiliates, with some large corporations maintaining more subsidiaries (standard deviation: 9.78).

5.2 Host-Country Financial Development

Our theoretical framework provides guidance regarding an appropriate measure of host-country financial development, even though η itself is not directly observed. In the model, financial development in South attracts entry by new domestic firms (and multinational affiliates if they borrow locally). We formally establish in the Appendix that the ratio of aggregate credit-financed fixed costs to GDP in South is increasing in the parameter η, both in the baseline model and in the extension with host-country financing. A model-consistent proxy for η is therefore the amount of total host-country bank credit extended to the private sector as a share of host-country GDP. We use this variable from Beck et al. (2009) as our primary measure of financial development. It is an outcome-based measure that captures the actual availability of external capital in an economy, and also implicitly reflects the extent to which local institutions support formal lending activity and enforce financial contracts.

Financial development varies significantly across the 95 host countries and 21 years in our sample (Table 1, Appendix Table 1). The mean value of FD_{it} in the panel is 0.51, with a standard deviation of 0.44. Notice that the cross-sectional dispersion of FD_{it} exceeds its time-series variation: While the standard deviation of private credit across countries was 0.62 in 2009, it was only 0.15 for the average economy over the 1989-2009 period. We consider several alternative measures for financial development in Section 7.1.

5.3 Sectors' External Finance Dependence

Sectors' external finance dependence, EFD_k, is measured following Rajan and Zingales (1998). We calculate EFD_k as the share of capital expenditures not financed with internal cash flows from operations using data on all publicly-listed U.S. companies in sector k from Compustat.[25] This aims to capture industries' inherent need for outside capital given technologically-determined cash flow and investment structures. There is significant variation in observed external finance dependence across the 220 industries in the sample (mean: 0.42, standard deviation: 2.74).

[25] We first compute the external finance dependence ratio for each firm over the 1996-2005 period. We calculate EFD_k as the median such ratio across all firms in sector k; sectors with fewer than ten firms were dropped.

Constructing EFD_k with U.S. data has three distinct advantages. First, the United States has a well-developed financial system; companies' observed behavior thus plausibly approximates optimal financing practices. Second, sectors' financial sensitivity is not measured endogenously with respect to host-country financial conditions. Finally, estimating γ in (4.2) requires only that the true rank-ordering of sectors' external finance dependence remain relatively stable across countries. The level of EFD_k may therefore differ across countries without impacting the interpretation of γ, although measurement error could bias our results downwards.

6 Main Results

6.1 Affiliate Presence and Number of Multinational Affiliates

We first examine how the financial environment of the host country affects the number of U.S. multinational affiliates. Columns 1 and 6 of Table 2 provide estimates of equations (4.1) and (4.2), in which MNC_{ikt} is an indicator equal to one if at least one foreign subsidiary is active in country i and sector k during year t.[26] Economies with strong financial institutions are significantly more likely to attract multinational activity. Moreover, the effect of financial development is systematically stronger in industries more reliant on external finance. We report OLS regressions in Table 2, but the results are nearly identical if we instead adopt a probit specification. We observe similar patterns in Columns 2 and 7, where the dependent variable is the log number of affiliates in country i and industry k during year t. This outcome corresponds to the measure of foreign subsidiaries in our model, $N_n G_n(a_{Iikt})$. Conditional on multinational presence, financially advanced countries host more affiliates, particularly in financially more dependent sectors.

These results are aligned with the predictions of part (iii) of Proposition 2, and are thus consistent with the presence of the financing effect. They are also both statistically and economically significant. A one-standard-deviation increase in private credit generates (on average) a 10.6% increase in the number of MNC subsidiaries. This impact is 4.3% higher in the industry at the 75$^{\text{th}}$ percentile by external finance dependence relative to the industry at the 25$^{\text{th}}$ percentile. While all foreign affiliates sell locally, to their home country and to third-country destinations in the model, in the data some instead supply only one or two of these markets. Columns 3-5 and 8-10 nevertheless confirm empirically that FD_{it} has a similar positive association with the number of subsidiaries that sell to each of these three destinations.

6.2 Level of Aggregate Multinational Affiliate Sales

We next evaluate the impact of host-country credit conditions on the scale of MNC operations at the aggregate level. In Table 3, we estimate (4.1) and (4.2) defining MNC_{ikt} to be the combined log revenues

[26] The regression sample in Columns 1 and 6 includes all country-sector-year triplets that host at least one MNC affiliate in at least one year in the panel. In all other columns, the sample includes all country-sector-year triplets with a positive number of MNC affiliates.

TOT_{ikt} of all foreign affiliates in country i and industry k during year t. We also consider log aggregate sales separately by destination, HOR_{ikt}, PLA_{ikt} and RET_{ikt}.[27]

The results suggest that the local financing mechanism is active: Consistent with part (iii) of Proposition 2, aggregate MNC sales increase in local financial development, both in total and to each market. The economic magnitudes of these relationships are substantial. A one-standard-deviation improvement in FD_{it} expands global affiliate revenues by 17.4% in the average industry (Column 4). These effects are magnified in financially dependent sectors, with an additional differential increase of 10.2% between the 75$^{\text{th}}$ and 25$^{\text{th}}$ percentile industries based on EFD_k (Column 8). Breaking down these aggregate revenues by destination, we also observe positive coefficients for local sales, third-country platform sales and return sales to the United States. While the level effect of FD_{it} is precisely estimated only for return and total sales, the interaction terms are highly significant across all four sales measures.

6.3 Composition of Aggregate Multinational Affiliate Sales

We also assess the influence of host-country financial development on the composition of aggregate MNC sales across destinations. According to part (ii) of Propositions 1 and 2, subsidiaries become more export-oriented following financial reform in South, selling a smaller share of their output to the local market as competition there intensifies. Importantly, this theoretical result holds whether or not multinationals rely on local credit for their operations. Table 4 provides corresponding estimates.

The three dependent variables in Table 4 capture the fraction of aggregate affiliate sales destined for the local market, $\frac{HOR_{ikt}}{TOT_{ikt}}$, the United States, $\frac{RET_{ikt}}{TOT_{ikt}}$, and third countries, $\frac{PLA_{ikt}}{TOT_{ikt}}$. We find evidence strongly consistent with the competition channel emphasized in the model: MNC subsidiaries direct a smaller share of their sales to the local economy when it has mature credit markets, while sending a larger share to the United States and to third countries. These patterns are more pronounced in financially more vulnerable sectors (Columns 4-6). To determine the economic significance of these effects, consider a host nation where access to capital improves from the 10$^{\text{th}}$ to the 90$^{\text{th}}$ percentile in the sample. This change would be associated with a decline in the share of horizontal sales by 5.4 percentage-points in the typical industry, with the impact 1.9 percentage-points bigger for a sector at the 90$^{\text{th}}$ percentile by external finance dependence relative to a sector at the 10$^{\text{th}}$ percentile. The corresponding increase in the shares of platform and return sales to the U.S. would be 3.2 and 2.2 percentage-points on average. Our point estimates further indicate differences between return and platform sales in line with the home-bias mechanism described in Proposition 3 (i.e. $\beta_{PLA} > \beta_{RET}$), although the difference in magnitude between these coefficients is not always statistically significant.

[27]The sum of the reported local, U.S. and third-country sales falls short of the total sales recorded for a handful of affiliates. To ensure that the sales shares described below sum to one across sales destinations, we calculate total sales by summing the three sales components and use this sum in our analysis. All results are robust to instead using the raw data.

6.4 Level of Individual Affiliate Sales

Beyond aggregate outcomes, our model has implications for affiliate-level sales that can be examined directly in the data. Specifically, part (i) of Propositions 1 and 2 imply that subsidiaries in financially more advanced hosts sell less locally due to the competition mechanism. In the absence of the financing effect, such subsidiaries also sell more to the United States and to third countries (Proposition 1). With local financing, these two export flows still move in the same direction, but the sign becomes theoretically ambiguous (Proposition 2).

The results in Table 5 are consistent with these implications of the competition effect. At the affiliate level, log local sales, $HOR_{ikt}(a)$, decrease significantly in host-country financial development. By contrast, log sales to the United States, $RET_{ikt}(a)$, and to third-country destinations, $PLA_{ikt}(a)$, both rise with FD_{it}, for a combined impact on log total sales, $TOT_{ikt}(a)$, that is indistinguishable from zero. These effects become larger in financially more sensitive industries. It is also instructive to compare the pattern of response in affiliate-level sales in Table 5 against that for aggregate sales in Table 3. The difference between these two tables in the signs of the coefficients for horizontal and total sales (Columns 1, 4, 5 and 8), as well as the evidence for the extensive margin of FDI in Table 2, together suggest that the data are consistent with the presence of both the financing and the competition effects.

6.5 Composition of Individual Affiliate Sales

Finally, we study the shares of affiliate-level sales across destinations in view of part (ii) of Propositions 1 and 2. In Table 6, we estimate (4.1) and (4.2) setting the dependent variable to be the share of subsidiary revenues earned in the host country, $\frac{HOR_{ikt}(a)}{TOT_{ikt}(a)}$, in the United States, $\frac{RET_{ikt}(a)}{TOT_{ikt}(a)}$, and in third markets, $\frac{PLA_{ikt}(a)}{TOT_{ikt}(a)}$. The results are strongly consistent with the competition channel in the model: Affiliates based in financially more advanced countries sell a smaller fraction of output locally compared with affiliates in financially less developed economies. By contrast, affiliates export a higher proportion of output to third-country destinations and to the United States, with platform sales responding slightly more than return sales. These patterns are amplified in sectors with higher requirements for external capital. In terms of economic magnitudes, the point estimates in these affiliate-level regressions are slightly smaller than those from using the aggregate sales shares in Table 4, but typically not statistically different. This is in line with the implication from our model that the affiliate-level and aggregate sales shares are equal.

6.6 Control Variables

The results above obtain in the presence of an extensive set of controls, X_{it}. We briefly discuss now the estimated effects that we find for these controls. Across Tables 2-6, we document a pervasive role for host-country aggregate demand, E_{it}, as measured by GDP from the Penn World Tables (PWT) Version 7.0. Large economies attract more multinational activity (Tables 2, 3 and 5) and capture a bigger share of foreign affiliates' sales (Tables 4 and 6). This is consistent with a market-size effect that raises the propensity for horizontal FDI. We proxy wages in the recipient country, ω_{it}, by its log GDP per capita from the PWT. We also indirectly account for the cost of other input factors in production outside our model by controlling for the stocks of physical and human capital per worker.[28] We record positive coefficients for income per capita in the sales level regressions (Table 3), but little role for factor endowments. Of note, controlling for GDP per capita helps ensure that we identify the impact of financial development separately from that of overall economic development.

We allow fixed and variable trade costs, f_{Xit} and τ_{it}, to differ for trade between the U.S. and host country i, and between i and other destinations. We control for the former with i's log bilateral distance to the United States (from CEPII) and a set of 11 time-varying dummy variables for regional trade agreements (RTAs) between the U.S. and i such as NAFTA. For the latter, we use indicators for i's membership in 8 major multilateral agreements such as the E.U.[29] The estimates suggest that distance to the United States deters the level of multinational activity (Tables 2 and 3), but has only a limited impact on the composition of MNC sales (Table 4). Although we do not report these in full, the RTA coefficients tend to conform to expected patterns. For example, we find a positive and significant effect of E.U. membership on the export-platform share of affiliate revenues, with a consequent decrease in the shares of both horizontal and return sales. By contrast, affiliates located in NAFTA member countries report a significantly higher share of return sales to the U.S.

Host-country FDI costs, f_{Iit}, are captured using two measures: the average corporate tax rate faced by foreign firms, computed using BEA data on observed tax incidence, and a rule of law index from the *International Country Risk Guide* which helps capture the security of foreign direct investments. Consistent with profit-shifting motives, we do see that multinationals appear more likely to direct sales away from host countries with high corporate taxes towards the United States instead. Similarly, rule of law tends to be positively correlated with the share of local sales, but negatively associated with export sales shares.

Finally, year fixed effects, φ_t, implicitly account for the fixed cost of firm entry in the United States, f_{ENt}. To the extent that the fixed costs of firm entry and production in South are a function of local factor costs and market size, our measures for ω_{it} and E_{it} also reflect f_{ESit} and f_{Sit}. The size of all third-country markets potentially served by an affiliate in i, E_{-it}, is indirectly measured by the combination of i's own GDP and year fixed effects that subsume global and U.S. GDP.

[28] We construct these covariates following the methodology of Hall and Jones (1999). For physical capital, we applied the perpetual inventory method to data from the PWT, setting the initial capital stock equal to $I_0/(g+d)$, where I_0 is investment in the initial year, g is the average growth rate of investment over the first ten years, and $d = 0.06$ is the assumed depreciation rate. For human capital, this was calculated as the average years of schooling from Barro and Lee (2010), weighted by the Mincerian returns to education function adopted by Hall and Jones (1999).

[29] The United States participates in 11 RTAs: US-Israel, NAFTA, US-Jordan, US-Singapore, US-Chile, US-Australia, US-Morocco, CAFTA-DR (Dominican Republic-Central America), US-Bahrain, US-Peru, US-Oman. The multilateral trade agreements included are: GATT/WTO, EU = European Union, EFTA = European Free Trade Area, CARICOM = Caribbean Community, CACM = Central American Common Market, ASEAN = Association of Southeast Asian Nations, ASEAN-China, Mercosur. All information on membership in trade agreements is from Rose (2004), augmented with direct reference to the World Trade Organization's website.

7 Alternative Specifications and Robustness

The results described in Section 6 are robust to a wide set of alternative specifications. In the interest of space, we present in this section additional evidence for aggregate and affiliate-level sales shares only, as the theoretical predictions for these outcome variables are most robust across the model specifications in Propositions 1-3. Corresponding sensitivity analyses for affiliate presence and sales levels are available upon request.

7.1 Alternative Measures and Additional Controls

We first demonstrate in Table 7 that the results are robust to alternative measures of host-country financial development. As a broader measure of access to debt financing, we use credit by both banks and other financial institutions as a share of GDP (Beck et al. 2009). Since equity financing provides an alternative source of capital, we also study stock market capitalization, defined as the total value of publicly-listed shares normalized by GDP (Beck et al. 2009). Finally, we exploit a binary variable equal to one in all years after a country has undergone various financial reforms deemed necessary for a well-functioning financial system (Abiad et al. 2010). We find similar results using each measure.

In Appendix Table 2, we address the fact that many affiliates report zero activity in one of the three sales categories. Specifically, we verify that our results are robust to tobit estimation. We have also confirmed that our findings are not driven by the behavior of small firms contributing little to overall multinational activity. We record comparable coefficients in Appendix Table 3 when we adopt weighted least squares estimation with log total affiliate sales as weights.

Table 8 further shows that our results are robust to introducing three additional controls. These serve as alternative proxies for variables included in X_{it}. To capture the export-platform potential of country i, we construct the log average GDP of all destinations excluding i and the United States, weighted by the inverse bilateral distance from i (à la Blonigen et al. 2007). In terms of our model, this measure of export-platform potential combines elements of both the size of third-country markets (E_{-it}) and the cost of serving them from an affiliate in i (f_{Xit} and τ_{it}). We find that affiliates in hosts with greater export-platform potential indeed sell a smaller share of output locally and a larger share to third countries, with no corresponding effect on the share of return sales to the United States.

We also exploit information on barriers to establishing a new business in host nation i from the World Bank *Doing Business Report*. We use the first principal component of the log nominal cost (scaled by GDP per capita), the log number of procedures and the log number of days required to establish a new business in i as an additional control.[30] These directly measure the cost of domestic firm entry in South (f_{Sit}), and are plausibly also correlated with the fixed cost of FDI (f_{Iit}). Similarly, we include the first principal component of the log nominal cost per shipping container, the log number of procedures and

[30]These data are available for a subset of the countries in our sample starting in 2003. We use the average 2003-2009 value for each country in our regressions for the full 1989-2009 panel of BEA data.

the log number of days involved in exporting from country i.[31] This provides another proxy for the fixed and variable trade costs (f_{Xit} and τ_{it}) incurred by affiliates located in i when selling to other markets. We find no evidence that these bureaucratic barriers shape the composition of MNC sales.

7.2 Alternative Explanations: Entry Barriers and Export Finance

Economies with advanced financial markets tend also to have low barriers to firm entry. The composition of multinationals' affiliate sales across destinations may therefore respond to competition affiliates face from domestic producers due to these low entry costs. While still consistent with the idea that competition in the host-country consumer market determines the nature of FDI activity, such an effect would be unrelated to credit conditions. The results in Table 8 indicate that this alternative mechanism is unlikely to explain our findings, since we control directly for entry costs with the cost of doing business.[32]

Separately, the prior literature has documented that firms' export activity is more dependent on external capital than is production for the domestic market (Manova 2013). Moreover, our estimates above (as well as Desai et al. 2004) suggest that multinationals rely in part on host-country capital to finance foreign operations. Should financial development in the host improve access to capital, affiliates may be not only more likely to enter, but also more export-intensive conditional on entry. Importantly, this would result from the higher sensitivity of exporting to financial frictions, rather than from the competition effect *per se*.

Beyond the robust evidence we presented in Table 8 when conditioning on export costs from each host country, we further consider the export-finance mechanism by controlling for multinationals' affiliate-level financing practices in equations (4.1) and (4.2). Specifically, the BEA records each subsidiary's total current liabilities and long-term debt, as well as the fraction of this debt held by the U.S. parent firm, host-country persons, or other entities. Should the credit environment in the host country determine affiliates' export intensity purely through the export-finance mechanism described above, controlling for affiliate financing practices should eliminate the significance of coefficients β and γ. Table 9, however, indicates that the effect of financial development on the composition of affiliate sales across markets remains qualitatively the same when we control for the fraction of local borrowing.[33]

7.3 Unobserved Firm Heterogeneity

A potentially important category of omitted variables pertains to unobserved parent-firm characteristics. In the model, this heterogeneity arises from differences in firm productivity draws, but multinationals might in reality differ along other dimensions that affect production and sales decisions (e.g. managerial

[31]These data are available for a subset of the countries in our sample starting in 2006. We use the average 2006-2009 value for each country in our regressions for the full 1989-2009 panel of BEA data.

[32]This is in the spirit of Nunn and Trefler (2013) who advocate for distinguishing between the effects of entry costs and financial development in explaining country export patterns.

[33]We have verified that these results are robust to controlling instead for affiliates' total leverage (scaled by total assets) or the share of loans provided by the parent company. The sample size in Table 9 is substantially reduced because only affiliates above a minimum size threshold report their financing practices.

practices, labor skill, R&D intensity, financial health). Such unobservable efficiency or product-appeal advantages in specific markets may influence the composition of firm sales across destinations.

To accommodate this possibility, we add parent firm fixed effects to our baseline specification in Table 10. The role of financial development is now identified primarily from the variation in credit conditions across the affiliates of the same multinational that are based in different countries. We continue to observe coefficients for the main effect of FD_{it} that are consistent with the earlier Table 6 results, although only the effect on the local sales share is significant at the 10% level, while that for the platform and return sales shares is marginally insignificant (Columns 1-3). Nevertheless, we obtain strongly significant results for all three sales shares when examining the differential effect across sectors with different degrees of external financing needs (Columns 4-6).[34] In other words, a given multinational tends to orient its affiliates in financially advanced economies towards return sales and export-platform activities. By contrast, it uses subsidiaries in financially less developed host countries to serve the local market to a greater degree.

7.4 Cross-Section vs Time-Series Variation

We conclude by exploring the relative importance of the cross-country and time-series variation in financial development for observed FDI patterns. In Table 11, we add host-country fixed effects to baseline specifications (4.1) and (4.2). For the average sector, we find that this leads to imprecise estimates for the effects on local and third-country sales shares, while the effect on the U.S. sales share remains consistent with the model (Columns 1-3). Nevertheless, when we further take into account the cross-sector variation in external finance dependence, we uncover large and significant impacts of FD_{it} on all three sales shares that are in line with the competition effect (Columns 4-6). Moreover, the interaction terms retain their signs and significance when we include both industry dummies and country-year fixed effects (Columns 7-9), where the latter subsume the main effect of FD_{it}.[35]

These findings suggest that financial market imperfections explain the pattern of multinational activity across countries and sectors, as well as across sectors within a country over time or within a country-year pair. Improvements in a host country's credit conditions thus appear associated with reallocations in the composition of affiliate sales across industries, with the direct effect on the average industry being more moderate. The latter may, however, also be substantial if financial reforms are more dramatic than those typically seen in the data. This caveat is warranted since our identification power hinges on the much larger variance in FD_{it} across countries, compared to the average within-country experience (Appendix Table 1).

[34] We obtain similar results when restricting the sample to parent firms with five or more affiliates.

[35] We have also verified that consistent patterns obtain in the cross-section of countries within a given benchmark year, as well as if we isolate the pure time-series dimension with country fixed effects but no time dummies.

8 Conclusion

This paper contributes to the literature examining how conditions in recipient countries affect multinational activity. Using comprehensive data on U.S. multinational activity abroad, we uncover several novel effects of financial development in the host economy. Financially advanced countries attract more MNC subsidiaries. Strong financial institutions in the host country also raise aggregate affiliate sales to the local market, to the United States and to third-country destinations. For individual affiliates, however, exports to the United States and to other markets are increased, but local sales are reduced. Yet both in the aggregate and at the affiliate levels, the share of local sales in total affiliate sales falls with host-country financial development, while the shares of U.S. and third-country sales increase.

We develop a model of multinational activity under imperfect financial markets that explains these empirical regularities. The data are consistent with two effects of financial development highlighted by the model: 1) a *competition effect* in which increased domestic firm entry stiffens competition, reducing affiliates' local revenues; and 2) a *financing effect* that encourages MNC entry by easing borrowing constraints in the host country. These effects point to important factors governing multinational firms' global operations, and have policy implications for developing countries seeking to attract FDI as a means to technology transfer and foreign capital inflows.

There remains much scope for further research on multinational activity in the presence of imperfect financial markets. While we have focused on the effects of local credit conditions on FDI patterns, more work is needed to understand how foreign affiliates and domestic firms interact in capital markets. Our findings also suggest that the state of the financial system in different countries might affect the organizational and operational structure of global supply chains. A promising direction for future work is to examine the effects of local economic conditions and financial policy on multinational firm behavior, taking into account these firms' global affiliate networks.

9 References

Abiad, Abdul, Enrica Detragiache, and Thierry Tressel, (2010), "A New Database of Financial Reforms," *IMF Staff Papers* 57(2): 281-302.

Aghion, Philippe, Thibault Fally, and Stefano Scarpetta, (2007), "Credit Constraints as a Barrier to the Entry and Post-Entry Growth of Firms," *Economic Policy* 22(52): 731-779.

Aghion, Philippe, Peter Howitt, and David Mayer-Foulkes, (2005), "The Effect of Financial Development on Convergence: Theory and Evidence," *Quarterly Journal of Economics* 120(1): 173-222.

Aitken, Brian J., and Ann E. Harrison, (1999), "Do Domestic Firms Benefit from Foreign Direct Investment? Evidence from Venezuela," *American Economic Review* 89(3): 605-618.

Alfaro, Laura, Areendam Chanda, Sebnem Kalemli-Ozcan, and Selin Sayek, (2004),"FDI and Economic Growth: The Role of Local Financial Markets," *Journal of International Economics* 64(1): 89-112.

Amiti, Mary, and David Weinstein, (2011), "Exports and Financial Shocks," *Quarterly Journal of Economics* 126(4): 1841-1877.

Antràs, Pol, (2003), "Firms, Contracts, and Trade Structure," *Quarterly Journal of Economics* 118(4): 1375-1418.

Antràs, Pol, and Ricardo Caballero, (2009), "Trade and Capital Flows: A Financial Frictions Perspective," *Journal of Political Economy* 117(4): 701-744.

Antras, Pol, and Davin Chor, (2013), "Organizing the Global Value Chain," *Econometrica* 81(6): 2127-2204.

Antràs, Pol, Mihir Desai, and C. Fritz Foley, (2009), "Multinational Firms, FDI Flows and Imperfect Capital Markets," *Quarterly Journal of Economics* 124(3): 1171-1219.

Arkolakis, Costas, Natalia Ramondo, Andrés Rodríguez-Clare, and Stephen Yeaple, (2013), "Innovation and Production in the Global Economy," NBER Working Paper #18972.

Arnold, Jens M., Beata S. Javorcik, and Aaditya Mattoo, (2011), "Does Services Liberalization Benefit Manufacturing Firms? Evidence from the Czech Republic," *Journal of International Economics* 85(1): 136-146.

Baldwin, Richard, and Toshihiro Okubo, (2012), "Networked FDI: Sales and Sourcing Patterns of Japanese Foreign Affiliates," NBER Working Paper #18083.

Barro, Robert, and Jong-Wha Lee, (2010), "A New Data Set of Educational Attainment in the World, 1950-2010," NBER Working Paper #15902.

Beck, Thorsten, (2003), "Financial Dependence and International Trade," *Review of International Economics* 11(2): 296-316.

Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine, (2009), "Financial Institutions and Markets across Countries and over Time – Data and Analysis," World Bank Policy Research Working Paper #4943.

Beck, Thorsten, Asli Demirgüç-Kunt, and Vojislav Maksimovic, (2005), "Financial and Legal Constraints to Firm Growth: Does Size Matter?" *Journal of Finance* 60(1): 137-177.

Bénassy-Quéré, Agnès, Maylis Coupet, Thierry Mayer, (2007), "Institutional Determinants of Foreign Direct Investment," *World Economy* 30(5): 764-782.

Bernard, Andrew, J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott, (2010), "Intrafirm Trade and Product Contractibility," *American Economic Review: Papers and Proceedings* 100(2): 444-448.

Bilir, L. Kamran, (2013), "Patent Laws, Product Lifecycle Lengths, and Multinational Activity," *American Economic Review*, forthcoming.

Blonigen, Bruce A., (2005), "A Review of the Empirical Literature on FDI Determinants," *Atlantic Economic Journal* 33(4): 383-403.

Blonigen, Bruce A., Ronald B. Davies, Glen R. Waddell, and Helen Naughton, (2007), "FDI in Space: Spatial Autoregressive Relationships in Foreign Direct Investment," *European Economic Review* 51(5): 1303-1325.

Brainard, S. Lael, (1997), "An Empirical Assessment of the Proximity-Concentration Trade-off Between Multinational Sales and Trade," *American Economic Review* 87(4): 520-544.

Branstetter, Lee, Raymond Fisman, and C. Fritz Foley, (2006), "Do Stronger Intellectual Property Rights Increase International Technology Transfer? Empirical Evidence from U.S. Firm-Level Panel Data," *Quarterly Journal of Economics* 121(1): 321-349.

Buch, Claudia, Iris Kesternich, Alexander Lipponer, and Monika Schnitzer, (2009), "Financial Constraints and the Margins of FDI," CEPR Discussion Paper 7444.

Bustos, Paula, (2007), "FDI as a Source of Finance in Imperfect Capital Markets: Firm-Level Evidence from Argentina," Pompeu Fabra University - CREI mimeo.

Carluccio, Juan, and Thibault Fally, (2012), "Global Sourcing under Imperfect Capital Markets," *Review of Economics and Statistics* 94(3): 740-763.

De Backer, Koen, and Leo Sleuwaegen, (2003), "Does Foreign Direct Investment Crowd Out Domestic Entrepreneurship?" *Review of Industrial Organization* 22(1): 67-84.

Desai, Mihir A., C. Fritz Foley, and Kristin J. Forbes, (2008), "Financial Constraints and Growth: Multinational and Local Firm Responses to Currency Depreciations," *Review of Financial Studies* 21(6): 2857-2888.

Desai, Mihir A., C. Fritz Foley, and James R. Hines Jr., (2004), "A Multinational Perspective on Capital Structure Choice and Internal Capital Markets," *Journal of Finance* 59(6): 2451-2487.

Ekholm, Karolina, Rikard Forslid, and James R. Markusen, (2007), "Export-Platform Foreign Direct Investment," *Journal of the European Economic Association* 5(4): 776-795.

Feinberg, Susan, and Gordon Phillips, (2004), "Growth, Capital Market Development and Competition for Resources within MNCs," NBER Working Paper #9252.

Grossman, Gene, Elhanan Helpman, and Adam Szeidl, (2006), "Optimal Integration Strategies for the Multinational Firm," *Journal of International Economics* 70(1): 216-238.

Hall, Robert, and Charles Jones, (1999), "Why Do Some Countries Produce So Much More Output Per Worker Than Others?" *Quarterly Journal of Economics* 114(1): 83-116.

Hanson, Gordon, Raymond Mataloni, and Matthew Slaughter, (2001), "Expansion Strategies of U.S. Multinational Firms," in Dani Rodrik and Susan Collins, eds., *Brookings Trade Forum*, 2001: 245-282.

Hanson, Gordon, Raymond Mataloni, and Matthew Slaughter, (2005), "Vertical Production Networks in Multinational Firms," *Review of Economics and Statistics* 87(4): 664-678.

Helpman, Elhanan, (1984), "A Simple Theory of International Trade with Multinational Corporations," *Journal of Political Economy* 92(3): 451-471.

Helpman, Elhanan, Marc J. Melitz, and Stephen R. Yeaple, (2004), "Exports Versus FDI with Heterogeneous Firms," *American Economic Review* 94(1): 300-316.

Hsu, Po-Hsuan, Xuan Tian, and Yan Xu, (2014), "Financial Development and Innovation: Cross-Country Evidence," *Journal of Financial Economics* 112(1): 116-135.

Hummels, David, Jun Ishii, and Kei-Mu Yi, (2001), "The Nature and Growth of Vertical Specialization in World Trade," *Journal of International Economics* 54(1): 75-96.

Irarrazabal, Alfonso, Andreas Moxnes, and Luca David Opromolla, (2013), "The Margins of Multinational Production and the Role of Intra-firm Trade," *Journal of Political Economy* 121(1): 74-126.

Javorcik, Beata S., and Mariana Spatareanu, (2009), "Tough Love: Do Czech Suppliers Learn from Their Relationships with Multinationals?" *Scandinavian Journal of Economics* 111(4): 811-833.

King, Robert, and Ross Levine, (1993), "Finance and Growth: Schumpeter Might Be Right," *Quarterly Journal of Economics* 108(3): 717-737.

Manova, Kalina, (2008), "Credit Constraints, Equity Market Liberalizations and International Trade," *Journal of International Economics* 76(1): 33-47.

Manova, Kalina, (2013), "Credit Constraints, Heterogeneous Firms, and International Trade", *Review of Economic Studies* 80(2): 711-744.

Manova, Kalina, Shang-Jin Wei, and Zhiwei Zhang (2011), "Firms Exports and Multinational Activity under Credit Constraints," NBER Working Paper #16905.

Markusen, James R., (1984), "Multinationals, Multi-Plant Economies, and the Gains from Trade," *Journal of International Economics* 16(3-4): 205-226.

Markusen, James R., and Anthony Venables, (2000), "The Theory of Endowment, Intra-industry and Multi-national Trade," *Journal of International Economics* 52(2): 209-234.

Markusen, James R., and Anthony Venables, (2007), "Interacting Factor Endowments and Trade Costs: A Multi-Country, Multi-Good Approach to Trade Theory," *Journal of International Economics* 73(2): 333-354.

Melitz, Marc J., (2003), "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica* 71(6): 1695-1725.

Nunn, Nathan and Daniel Trefler (2013). "Domestic Institutions as a Source of Comparative Advantage." NBER Working Paper #18851.

Rajan, Raghuram, and Luigi Zingales, (1998), "Financial Dependence and Growth," *American Economic Review* 88(3): 559-586.

Ramondo, Natalia, Veronica Rappoport, and Kim Ruhl, (2012), "Horizontal versus Vertical FDI: Revisiting Evidence about U.S. Multinationals," mimeo.

Ramondo, Natalia, and Andrés Rodríguez-Clare, (2013), "Trade, Multinational Production, and the Gains from Openness," *Journal of Political Economy* 121(2): 273-322.

Rose, Andrew, (2004), "Do We Really Know that the WTO Increases Trade?" *American Economic Review* 94(1): 98-114.

Tintelnot, Felix, (2012), "Global Production with Export Platforms," Penn State mimeo.

Yeaple, Stephen R., (2003a), "The Role of Skill Endowments in the Structure of U.S. Outward Foreign Direct Investment," *Review of Economics and Statistics* 85(3): 726-734.

Yeaple, Stephen R., (2003b), "The Complex Integration Strategies of Multinationals and Cross Country Dependencies in the Structure of Foreign Direct Investment," *Journal of International Economics* 60(2): 293-314.

Appendix

Proof of Lemma 1. Log-differentiating (2.13) and (2.15), one obtains:

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

To derive the second equation above, we used the fact that $(1-\alpha)A_{ss}(\omega/\alpha)^{1-\varepsilon}=(1/\eta)a_S^{\varepsilon-1}Rf_S\omega$, which holds from the expression for $a_S^{1-\varepsilon}$ in (2.13). Solving these two equations simultaneously yields:

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

Applying Leibniz's rule to $V_s(a_S)=\int_0^{a_S}\tilde{a}^{1-\varepsilon}dG_s(\tilde{a})$, we have: $a_S^{\varepsilon-1}V_s'(a_S)=G_s'(a_S)$. Hence, $a_S^{\varepsilon-1}V_s'(a_S)-\eta G_s'(a_S)=(1-\eta)G_s'(a_S)>0$, since $\eta\in(0,1)$ and $G_s'(a)>0$. Since $\varepsilon>1$, it follows that $\frac{da_S}{d\eta}>0$ and $\frac{dA_{ss}}{d\eta}<0$.

While the above proof holds for any cdf $G_s(a)$, it is straightforward to show for the case of the Pareto distribution, $G_s(a)=(a/\bar{a}_s)^k$, that the above derivatives can be written more simply as:

$$\frac{da_S}{d\eta} = \frac{a_S}{\eta}\frac{1-\rho_S}{\varepsilon-1}, \quad \text{and} \tag{9.1}$$
$$\frac{dA_{ss}}{d\eta} = -\frac{A_{ss}}{\eta}\rho_S. \tag{9.2}$$

Here, ρ_S is a constant that depends only on parameter values: $\rho_S\equiv\frac{(1-\eta)\frac{k-\varepsilon+1}{\varepsilon-1}}{1+(1-\eta)\frac{k-\varepsilon+1}{\varepsilon-1}}\in(0,1)$. These are convenient expressions that we use frequently in the rest of the proofs. ■

Proof of Lemma 2. We take the remaining equations that define the industry equilibrium in West – (2.3)-(2.4), (2.9)-(2.12), (2.14) and (2.16)-(2.19) – and differentiate them. First, log-differentiating (2.9)-(2.11) yields:

$$(\varepsilon-1)\frac{da_D}{a_D} = \frac{dA_{ww}}{A_{ww}}, \tag{9.3}$$
$$(\varepsilon-1)\frac{da_{XN}}{a_{XN}} = \frac{dA_{ew}}{A_{ew}}, \quad \text{and} \tag{9.4}$$
$$(\varepsilon-1)\frac{da_{XS}}{a_{XS}} = \frac{dA_{sw}}{A_{sw}}. \tag{9.5}$$

Since $A_{sw}=A_{ss}$, it immediately follows from (9.2) and (9.5) that $\frac{dA_{sw}}{d\eta}=\frac{dA_{ss}}{d\eta}<0$, and hence that:

$$\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta}=-\frac{1}{\eta}\frac{\rho_S}{\varepsilon-1}<0. \tag{9.6}$$

This establishes part (iii) of the lemma.

We next differentiate the free-entry condition for West, (2.14):

$$
\begin{aligned}
0 \;=\; & \left[(1-\alpha)A_{ww}\left(\left(\frac{1}{\alpha}\right)^{1-\varepsilon}V_n(a_D)+\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{1}{\alpha}\right)^{1-\varepsilon}\right)V_n(a_I)\right)\right]\frac{dA_{ww}}{A_{ww}} \\
& +\left[(1-\alpha)A_{ew}\left(\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n(a_{XN})+\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)V_n(a_I)\right)\right]\frac{dA_{ew}}{A_{ew}} \\
& +\left[(1-\alpha)A_{sw}\left(\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n(a_{XS})+\left(\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)V_n(a_I)\right)\right]\frac{dA_{sw}}{A_{sw}} \\
& +\left[(1-\alpha)A_{ww}\left(\frac{1}{\alpha}\right)^{1-\varepsilon}V_n'(a_D)-Rf_DG_n'(a_D)\right]da_D \\
& +\left[(1-\alpha)A_{ew}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n'(a_{XN})-Rf_XG_n'(a_{XN})\right]da_{XN} \\
& +\left[(1-\alpha)A_{sw}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}V_n'(a_{XS})-Rf_XG_n'(a_{XS})\right]da_{XS} \\
& +\Bigg[(1-\alpha)\Bigg(A_{ww}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{1}{\alpha}\right)^{1-\varepsilon}\right)+A_{ew}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right) \\
& +A_{sw}\left(\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}-\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)\Bigg)V_n'(a_I)-R(f_I-f_D)G_n'(a_I)\Bigg]da_I. \qquad (9.7)
\end{aligned}
$$

Focus first on the term involving da_D on the right-hand side of (9.7). We make use of the fact that: (i) $(1-\alpha)A_{ww}(1/\alpha)^{1-\varepsilon}=a_D^{\varepsilon-1}Rf_D$, which comes from equation (2.9); and (ii) $a^{\varepsilon-1}V_n'(a)=G_n'(a)$ for all $a\in(0,\bar{a}_n)$, which holds from Leibniz's Rule. With these, one can show that the coefficient of da_D in (9.7) reduces to 0. An analogous argument implies that the coefficients of da_{XN}, da_{XS} and da_I are all also 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 use the expressions for the price indices in (2.16)-(2.18) to re-write (9.7) as:

$$\rho_1\frac{dA_{ww}}{A_{ww}}+(1-\rho_1)\frac{dA_{ew}}{A_{ew}}+\frac{1-\rho_2}{2}\frac{E_s}{E_n}\frac{dA_{sw}}{A_{sw}}=0,$$

where we define: $\rho_1=\frac{P_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}+P_{ew}^{1-\varepsilon}}$ and $\rho_2=\frac{P_{ss}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}+2P_{sw}^{1-\varepsilon}}$. Note that $\rho_1,\rho_2\in(0,1)$. A quick substitution from (9.3)-(9.5) then implies:

$$\rho_1\frac{da_D}{a_D}+(1-\rho_1)\frac{da_{XN}}{a_{XN}}+\frac{1-\rho_2}{2}\frac{E_s}{E_n}\frac{da_{XS}}{a_{XS}}=0. \qquad (9.8)$$

Intuitively, the free-entry condition requires that a rise in demand in any one market for the Western firm's goods must be balanced by a decline in demand from at least one other market. Since $A_{ww}=A_{ew}$, we have $\frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}=\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta}$, and hence from (9.3) and (9.4), we have $\frac{1}{a_D}\frac{da_D}{d\eta}=\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}$. Substituting this and the expression for $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta}$ from (9.6) into (9.8), we obtain:

$$\frac{1}{a_D}\frac{da_D}{d\eta}=\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}=\frac{1}{\eta}\frac{E_s}{E_n}\frac{1-\rho_2}{2}\frac{\rho_S}{\varepsilon-1}>0. \qquad (9.9)$$

It follows from (9.3) and (9.4) that: $\frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}=\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta}>0$. This establishes parts (ii) and (iv) of the lemma.

Finally, we turn to part (i) in the statement of Lemma 2. Log-differentiating (2.12) yields:

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

We replace $\frac{dA_{ww}}{A_{ww}}$, $\frac{dA_{ew}}{A_{ew}}$ and $\frac{dA_{sw}}{A_{sw}}$ using (9.3)-(9.5). Making use also of the expressions: (i) for A_{ww}, A_{ew} and A_{sw} from (2.3)-(2.4); and (ii) for $P_{ww}^{1-\varepsilon}$, $P_{ew}^{1-\varepsilon}$ and $P_{sw}^{1-\varepsilon}$ from (2.16)-(2.18); and simplifying extensively, one can show that:

$$\frac{da_I}{a_I} = \frac{\rho_1(1-\Delta_1)\frac{da_D}{a_D} + (1-\rho_1)(1-\Delta_2)\frac{da_{XN}}{a_{XN}} + \frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)\frac{da_{XS}}{a_{XS}}}{\rho_1(1-\Delta_1) + (1-\rho_1)(1-\Delta_2) + \frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)}, \tag{9.10}$$

where we define:

$$\begin{aligned}
\Delta_1 &= \frac{\left(\frac{1}{\alpha}\right)^{1-\varepsilon} V_n(a_D)}{\left(\frac{1}{\alpha}\right)^{1-\varepsilon} V_n(a_D) + (\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{1}{\alpha}\right)^{1-\varepsilon})V_n(a_I)}, \\
\Delta_2 &= \frac{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon} V_n(a_{XN})}{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon} V_n(a_{XN}) + (\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{\tau}{\alpha}\right)^{1-\varepsilon})V_n(a_I)}, \quad \text{and} \\
\Delta_3 &= \frac{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon} V_n(a_{XS})}{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon} V_n(a_{XS}) + (\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{\tau}{\alpha}\right)^{1-\varepsilon})V_n(a_I)}.
\end{aligned}$$

Thus, $\frac{da_I}{a_I}$ is a weighted average of $\frac{da_D}{a_D}$, $\frac{da_{XN}}{a_{XN}}$ and $\frac{da_{XS}}{a_{XS}}$. Note that $\Delta_1, \Delta_2, \Delta_3 \in (0,1)$. Moreover, using the above definitions, we have: $sign\{\Delta_1 - \Delta_2\} = sign\{(\omega^{1-\varepsilon}-1)V_N(a_D) - ((\tau\omega)^{1-\varepsilon}-1)V_N(a_{XN})\} > 0$. This inequality holds as: $V_N(a_D) > V_N(a_{XN}) > 0$ (since $a_D > a_{XN}$), and $\omega^{1-\varepsilon} - 1 > (\tau\omega)^{1-\varepsilon} - 1 > 0$. Analogously, we have: $sign\{\Delta_2 - \Delta_3\} = sign\{(\omega^{1-\varepsilon} - \tau^{1-\varepsilon})V_N(a_{XN}) - ((\tau\omega)^{1-\varepsilon} - \tau^{1-\varepsilon})V_N(a_{XS})\} > 0$. This is again positive as: $V_N(a_{XN}) > V_N(a_{XS}) > 0$ (since $a_{XN} > a_{XS}$), and $\omega^{1-\varepsilon} - \tau^{1-\varepsilon} > (\tau\omega)^{1-\varepsilon} - \tau^{1-\varepsilon} > 0$. In sum, we have: $1 > \Delta_1 > \Delta_2 > \Delta_3 > 0$. We further define: $\Delta_d = \rho_1(1-\Delta_1) + (1-\rho_1)(1-\Delta_2) + \frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3) > 0$, which is the denominator in (9.10). We now substitute into (9.10) the expressions for $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta}$, $\frac{1}{a_D}\frac{da_D}{d\eta}$ and $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}$ from (9.6) and (9.9). After simplifying, one obtains:

$$\frac{1}{a_I}\frac{da_I}{d\eta} = \frac{1}{\eta}\frac{1}{\Delta_d}\frac{E_s}{E_n}\frac{1-\rho_2}{2}\frac{\rho_S}{\varepsilon-1}\left[\Delta_3 - \rho_1\Delta_1 - (1-\rho_1)\Delta_2\right] < 0. \tag{9.11}$$

That this last expression is negative follow from the fact that $\rho_1, \rho_2, \Delta_1, \Delta_2, \Delta_3 \in (0,1)$, and that $\Delta_1 > \Delta_2 > \Delta_3$. Moreover, (9.6) and (9.11) imply:

$$\begin{aligned}
\frac{1}{a_I}\frac{da_I}{d\eta} - \frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} &= \frac{1}{\eta}\frac{1}{\Delta_d}\frac{\rho_S}{\varepsilon-1}\left[\frac{E_s}{E_n}\frac{1-\rho_2}{2}(\Delta_3 - 1) + \Delta_d\right] \\
&= \frac{1}{\eta}\frac{1}{\Delta_d}\frac{\rho_S}{\varepsilon-1}\left[\rho_1(1-\Delta_1) + (1-\rho_1)(1-\Delta_2)\right] \\
&> 0.
\end{aligned}$$

Thus, $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} < \frac{1}{a_I}\frac{da_I}{d\eta} < 0$, which completes the proof of the lemma. ■

Proof of Proposition 1. The definitions of $HOR(a)$, $PLA(a)$ and $RET(a)$ indicate that the effects of Southern financial development on these individual affiliate sales levels are pinned down respectively by the derivatives of A_{sw}, A_{ew} and A_{ww} with respect to η. Lemma 2 then implies that when η improves, $HOR(a)$ falls (since $\frac{dA_{sw}}{d\eta} < 0$), $PLA(a)$ increases (since $\frac{dA_{ew}}{d\eta} > 0$), and $RET(a)$ increases (since $\frac{dA_{ww}}{d\eta} > 0$). This establishes part (i) of the proposition.

For part (ii), from (2.23), one can see that $\frac{d}{d\eta}\frac{HOR(a)}{TOT(a)} < 0$, since both $\frac{A_{ww}}{A_{sw}}$ and $\frac{A_{ew}}{A_{sw}}$ increase with η. On the other hand, from (2.24) and (2.25), we have $\frac{d}{d\eta}\frac{PLA(a)}{TOT(a)} = \frac{d}{d\eta}\frac{RET(a)}{TOT(a)} > 0$, since $\frac{A_{sw}}{A_{ew}}$ is decreasing in η and $\frac{A_{ww}}{A_{ew}} = 1$.

For part (iii), we first need an expression for $\frac{1}{N_n}\frac{dN_n}{d\eta}$. Start by log-differentiating (2.3):

$$\frac{dA_{ww}}{A_{ww}} = -\rho_1 \frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}} - (1-\rho_1)\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}}. \tag{9.12}$$

Equations (2.16) and (2.17) in turn provide us with the log-derivatives of the two price indices that appear on the right-hand side of (9.12):

$$\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}} = \frac{dN_n}{N_n} + (k-\varepsilon+1)\left(\Delta_1 \frac{da_D}{a_D} + (1-\Delta_1)\frac{da_I}{a_I}\right), \quad \text{and} \tag{9.13}$$

$$\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}} = \frac{dN_n}{N_n} + (k-\varepsilon+1)\left(\Delta_2 \frac{da_{XN}}{a_{XN}} + (1-\Delta_2)\frac{da_I}{a_I}\right). \tag{9.14}$$

We now substitute: (i) from (9.13) and (9.14) into (9.12); (ii) from (9.3) into the left-hand side of (9.12); and (iii) the expressions for $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta}$, $\frac{1}{a_D}\frac{da_D}{d\eta}$ and $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}$ from (9.6) and (9.9) into (9.12). After some algebra, this yields:

$$\begin{aligned}\frac{1}{N_n}\frac{dN_n}{d\eta} &= \frac{1}{\eta}\frac{1}{\Delta_d}\frac{E_s}{E_n}\frac{1-\rho_2}{2}\frac{\rho_S}{\varepsilon-1}\Big[-(\varepsilon-1)\Delta_d \\ &\quad -(k-\varepsilon+1)\left(\Delta_3(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2)) + \frac{E_s}{E_n}\frac{1-\rho_2}{2}(1-\Delta_3)(\rho_1\Delta_1+(1-\rho_1)\Delta_2\right)\Big] \\ &< 0.\end{aligned}$$

Note that we make use here of the fact that $k-\varepsilon+1>0$. As a_I also decreases in response to an increase in η, it follows that an improvement in Southern financial development decreases both the measure of Northern firms, N_n, and the "number" of multinationals, $N_nG_n(a_I)$. The further effect that this has on aggregate platform sales in (2.21) can be computed from:

$$\begin{aligned}\frac{d}{d\eta}\ln PLA &= \frac{1}{N_n}\frac{dN_n}{d\eta} + (\varepsilon-1)\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} + (k-\varepsilon+1)\frac{1}{a_I}\frac{da_I}{d\eta} \\ &= \frac{1}{\eta}\frac{1}{\Delta_d}\frac{E_s}{E_n}\frac{1-\rho_2}{2}\frac{\rho_S}{\varepsilon-1}(k-\varepsilon+1)\Big[(\Delta_3-\rho_1\Delta_1-(1-\rho_1)\Delta_2) \\ &\quad -\left(\Delta_3(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2)) + \frac{E_s}{E_n}\frac{1-\rho_2}{2}(1-\Delta_3)(\rho_1\Delta_1+(1-\rho_1)\Delta_2\right)\Big] \\ &< 0,\end{aligned}$$

where recall from equation (9.11) that $\Delta_3-\rho_1\Delta_1-(1-\rho_1)\Delta_2$ is indeed negative. Looking back at the definitions in (2.20)-(2.22), and making use of parts (iii) and (iv) of Lemma 2, we then have: $\frac{d}{d\eta}\ln PLA = \frac{d}{d\eta}\ln RET > \frac{d}{d\eta}\ln HOR$. Hence, the aggregate sales levels HOR, PLA and RET all decrease in response to an improvement in η. ■

Proof of Lemma 3. First, observe that the equilibrium for South's differentiated varieties industry is still determined by (2.13) and (2.15) as in the baseline model. Thus, Lemma 1 holds and the expressions for $\frac{da_S}{d\eta}$ and $\frac{dA_{ss}}{d\eta}$ from (9.1) and (9.2) still apply. As for the Northern industry, only two equations are affected relative to the baseline model when we differentiate the equilibrium system. The first of these is the equation obtained from log-differentiating the new FDI cutoff, (3.1):

$$\Delta_d \frac{d\tilde{a}_I}{\tilde{a}_I} = \frac{\Delta_d}{\varepsilon - 1}\frac{d\eta}{\eta} + \rho_1(1-\Delta_1)\frac{da_D}{a_D} + (1-\rho_1)(1-\Delta_2)\frac{da_{XN}}{a_{XN}} + \frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)\frac{da_{XS}}{a_{XS}}. \tag{9.15}$$

The additional term, $\frac{\Delta_d}{\varepsilon-1}\frac{d\eta}{\eta}$, on the right-hand side captures the direct effect that Southern financial development has in alleviating the credit constraints faced by Northern firms. The second equation that is affected is the free-entry condition. In the manipulation of (9.7), we now need to bear in mind that the coefficient of the term in $d\tilde{a}_I$ is no longer equal to 0. This is because:

$$\begin{aligned} &(1-\alpha)\left[A_{ww}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{1}{\alpha}\right)^{1-\varepsilon}\right) + A_{ew}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right) + A_{sw}\left(\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right)\right] V_n'(\tilde{a}_I) \\ &\quad -R(f_I - f_D)G_n'(\tilde{a}_I) \\ = \;& (1-\alpha)(1-\eta)\left[A_{ww}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{1}{\alpha}\right)^{1-\varepsilon}\right) + A_{ew}\left(\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}\right) + A_{sw}\left(\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}\right)\right] V_n'(\tilde{a}_I) \end{aligned}$$

where the last step follows from using the definition of $\tilde{a}_I^{1-\varepsilon}$ from (3.1) to substitute out for $R(f_I - f_D)$, as well as from using Leibniz's rule to replace $G_n'(\tilde{a}_I)$ with $\tilde{a}_I^{\varepsilon-1}V_n'(\tilde{a}_I)$. We now follow analogous algebraic steps as in the proof of Lemma 2, in particular, substituting in the definitions of the price indices (2.16)-2.18), as well as the definitions of ρ_1 and Δ_d. This allows us to rewrite the derivative of the free-entry condition as:

$$\rho_1\frac{da_D}{a_D} + (1-\rho_1)\frac{da_{XN}}{a_{XN}} + \frac{1-\rho_2}{2}\frac{E_s}{E_n}\frac{da_{XS}}{a_{XS}} + (1-\eta)\frac{k-\varepsilon+1}{\varepsilon-1}\Delta_d\frac{d\tilde{a}_I}{\tilde{a}_I} = 0. \tag{9.16}$$

Since the expression for $a_{XS}^{1-\varepsilon}$ in (2.11) remains unchanged, one can quickly see from the proof of Lemma 2 that we still have $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} = -\frac{1}{\eta}\frac{\rho_S}{\varepsilon-1}$ as in equation (9.6). Likewise, the same argument in the proof of Lemma 2 implies that $\frac{1}{a_D}\frac{da_D}{d\eta} = \frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}$. Substituting these two properties into (9.15) and (9.16), this leaves us with a system of two linear equations in the two unknowns, $\frac{1}{a_D}\frac{da_D}{d\eta}$ and $\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}$. Solving these two equations simultaneously then yields:

$$\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} = \frac{1}{\eta}\frac{1-\rho_T}{\varepsilon-1}\left[1 - \rho_S\frac{E_s}{E_n}\frac{1-\rho_2}{2}\frac{\rho_1\Delta_1 + (1-\rho_1)\Delta_2 - \Delta_3}{\Delta_d}\right] \tag{9.17}$$

$$\frac{1}{a_D}\frac{da_D}{d\eta} = \frac{1}{\eta}\left[-\rho_T + \frac{E_s}{E_n}\frac{1-\rho_2}{2}(1-\rho_T)\left(\rho_S - (1-\rho_S)(1-\eta)\frac{k-\varepsilon+1}{\varepsilon-1}(1-\Delta_3)\right)\right] \tag{9.18}$$

where ρ_T is defined by: $\rho_T \equiv \frac{(1-\eta)\frac{k-\varepsilon+1}{\varepsilon-1}(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))}{1+(1-\eta)\frac{k-\varepsilon+1}{\varepsilon-1}(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))} \in (0,1)$.

Examining (9.17), note that: (i) $\rho_1\Delta_1 + (1-\rho_1)\Delta_2 - \Delta_3 > 0$, since $\Delta_1, \Delta_2 > \Delta_3$; and (ii) $\frac{E_s}{E_n}\frac{1-\rho_2}{2}(\rho_1\Delta_1 + (1-\rho_1)\Delta_2 - \Delta_3) < \frac{E_s}{E_n}\frac{1-\rho_2}{2}(1-\Delta_3) < \Delta_d$, since $\Delta_1, \Delta_2 < 1$. These two facts in turn imply that: $\frac{E_s}{E_n}\frac{1-\rho_2}{2}\frac{\rho_1\Delta_1+(1-\rho_1)\Delta_2-\Delta_3}{\Delta_d} \in (0,1)$. Since we also have $\rho_S \in (0,1)$, it follows from (9.17) that $\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} > 0$, as claimed in part (i) of Lemma 3. We have also already seen that: $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} = -\frac{1}{\eta}\frac{\rho_S}{\varepsilon-1} < 0$, which is part (ii) of the lemma.

As for (9.18), the sign of $\frac{1}{a_D}\frac{da_D}{d\eta} = \frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}$ is in principle ambiguous: The two numerical examples in footnote 17 illustrate that this derivative can indeed be either positive or negative. We can nevertheless evaluate the following:

$$\frac{1}{a_D}\frac{da_D}{d\eta} - \frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} = \frac{1}{\eta}\left[\rho_S - \rho_T + \frac{E_s}{E_n}\frac{1-\rho_2}{2}(1-\Delta_3)\rho_S(1-\rho_T)\Delta_3\right]. \tag{9.19}$$

Using the definitions of ρ_S and ρ_T, we have: $\rho_S - \rho_T = \rho_S(1-\rho_T)\left[1-\rho_1(1-\Delta_1)-(1-\rho_1)(1-\Delta_2)\right] > 0$, since: $\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2) < \rho_1 + (1-\rho_1) = 1$, and $\rho_S, \rho_T \in (0,1)$. Inspecting (9.19), we have $\frac{1}{a_D}\frac{da_D}{d\eta} - \frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} > 0$, which establishes part (iii) of Lemma 3. As for parts (iv) and (v) of the lemma, these follow immediately from applying (9.3)-(9.5). ■

Proof of Proposition 2. As in the proof of Proposition 1, $\frac{d}{d\eta}HOR(a)$, $\frac{d}{d\eta}PLA(a)$ and $\frac{d}{d\eta}RET(a)$ respectively inherit the signs of $\frac{dA_{sw}}{d\eta}$, $\frac{dA_{ew}}{d\eta}$ and $\frac{dA_{ww}}{d\eta}$. Lemma 3 then implies that $\frac{dA_{sw}}{d\eta} > 0$, but also that $\frac{dA_{ew}}{d\eta}$ and $\frac{dA_{ww}}{d\eta}$ cannot be conclusively signed. This establishes part (i) of this proposition.

Furthermore, part (v) of Lemma 3 implies that $\frac{A_{ww}}{A_{sw}}$ and $\frac{A_{ew}}{A_{sw}}$ are both increasing in η. Referring back to the definitions of the sales shares in (2.23)-(2.25), we immediately have $\frac{d}{d\eta}\frac{HOR(a)}{TOT(a)} < 0$ and $\frac{d}{d\eta}\frac{PLA(a)}{TOT(a)} = \frac{d}{d\eta}\frac{RET(a)}{TOT(a)} > 0$. This pins down part (ii) of the proposition.

For part (iii), we first write down the derivatives of the aggregate variables of interest. Observe that the expressions for the log-derivatives of A_{ww}, $P_{ww}^{1-\varepsilon}$ and $P_{ew}^{1-\varepsilon}$ in equations (9.12)-(9.14) remain valid in the model with host-country financing. Eliminating $\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}}$ and $\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}}$ from these equations and using (9.3), we have:

$$\begin{aligned}\frac{1}{N_n}\frac{dN_n}{d\eta} \quad = \quad & -(\varepsilon-1)\frac{da_D}{a_D} - (k-\varepsilon+1)\left[\rho_1\left(\Delta_1\frac{1}{a_D}\frac{da_D}{d\eta} + (1-\Delta_1)\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}\right)\right. \\ & \left. +(1-\rho_1)\left(\Delta_2\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} + (1-\Delta_2)\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}\right)\right].\end{aligned} \tag{9.20}$$

In turn, how the number of multinationals, $N_nG_n(\tilde{a}_I)$, responds to η is given by: $\frac{d}{d\eta}\log N_nG_n(\tilde{a}_I) = \frac{1}{N_n}\frac{dN_n}{d\eta} + \frac{G_n'(\tilde{a}_I)\tilde{a}_I}{G_n(\tilde{a}_I)}\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} = \frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}$, where $\frac{G_n'(a)a}{G_n(a)} = k$ for the Pareto distribution. Using (9.20), together with the fact that $\frac{1}{a_D}\frac{da_D}{d\eta} = \frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}$, this yields:

$$\begin{aligned}\frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} \quad = \quad & \left[-(\varepsilon-1)-(k-\varepsilon+1)\left(\rho_1\Delta_1+(1-\rho_1)\Delta_2\right)\right]\frac{1}{a_D}\frac{da_D}{d\eta} \\ & +\left[k-(k-\varepsilon+1)\left(\rho(1-\Delta_1)+(1-\rho_1)(1-\Delta_2)\right)\right]\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} \\ = \quad & \left[(\varepsilon-1)+(k-\varepsilon+1)\left(\rho_1\Delta_1+(1-\rho_1)\Delta_2\right)\right]\left(\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} - \frac{1}{a_D}\frac{da_D}{d\eta}\right).\end{aligned} \tag{9.21}$$

Note that it is straightforward to verify that: $(\varepsilon-1)+(k-\varepsilon+1)\left(\rho_1\Delta_1+(1-\rho_1)\Delta_2\right) = k-(k-\varepsilon+1)\left(\rho(1-\Delta_1)+(1-\rho_1)(1-\Delta_2)\right) > 0$. It thus suffices to determine the sign of $\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} - \frac{1}{a_D}\frac{da_D}{d\eta}$. For this, substitute in the expressions for these derivatives from (9.17) and (9.18). Some algebra leads to:

$$\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} - \frac{1}{a_D}\frac{da_D}{d\eta} = \frac{1}{\eta}\frac{1}{\varepsilon-1}\left[1-\rho_S(1-\rho_T)\frac{\frac{E_s}{E_n}\frac{1-\rho_2}{2}(1-\Delta_3)}{\Delta_d}\left(\rho_1\Delta_1+(1-\rho_1)\Delta_2+\frac{E_s}{E_n}\frac{1-\rho_2}{2}\Delta_3\right)\right]. \tag{9.22}$$

As for the effect on aggregate horizontal sales, we differentiate (2.20) with respect to η. Making use of (9.5), we have:

$$
\begin{aligned}
\frac{d}{d\eta}\ln HOR &= \frac{1}{N_n}\frac{dN_n}{d\eta} + (\varepsilon-1)\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} + (k-\varepsilon+1)\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} \\
&= \frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} - (\varepsilon-1)\left(\frac{1}{a_D}\frac{da_D}{d\eta} - \frac{1}{a_{XS}}\frac{da_{XS}}{d\eta}\right) - (\varepsilon-1)\left(\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} - \frac{1}{a_D}\frac{da_D}{d\eta}\right) \\
&= \frac{1}{\eta}\left[1-\rho_S(1-\rho_T)\frac{\frac{E_s}{E_n}\frac{1-\rho_2}{2}(1-\Delta_3)}{\Delta_d}\left(\rho_1\Delta_1 + (1-\rho_1)\Delta_2 + \frac{E_s}{E_n}\frac{1-\rho_2}{2}\Delta_3\right)\right. \\
&\qquad \left. -\rho_S(1-\rho_T)\frac{\rho_1\Delta_1+(1-\rho_1)\Delta_2+\frac{E_s}{E_n}\frac{1-\rho_2}{2}\Delta_3}{\frac{k-\varepsilon+1}{\varepsilon-1}(\rho_1\Delta_1+(1-\rho_1)\Delta_2)}\right]. \qquad (9.23)
\end{aligned}
$$

Note that in the penultimate step, we substituted in for $\frac{1}{N_n}\frac{dN_n}{d\eta}+k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}$ using (9.21), for $\frac{1}{a_D}\frac{da_D}{d\eta}-\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta}$ using (9.19), for $\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}-\frac{1}{a_D}\frac{da_D}{d\eta}$ using (9.22), and then simplified extensively.

Likewise, differentiating (2.21) with respect to η and using (9.3), we have:

$$
\begin{aligned}
\frac{d}{d\eta}\ln PLA = \frac{d}{d\eta}\ln RET &= \frac{1}{N_n}\frac{dN_n}{d\eta} + (\varepsilon-1)\frac{1}{a_D}\frac{da_D}{d\eta} + (k-\varepsilon+1)\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} \\
&= \frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} - (\varepsilon-1)\left(\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} - \frac{1}{a_D}\frac{da_D}{d\eta}\right) \\
&= (k-\varepsilon+1)\left(\rho_1\Delta_1+(1-\rho_1)\Delta_2\right)\left(\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} - \frac{1}{a_D}\frac{da_D}{d\eta}\right). \qquad (9.24)
\end{aligned}
$$

Once again, we have made use of the expression for $\frac{1}{N_n}\frac{dN_n}{d\eta}+k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}$ in (9.21) to arrive at (9.24). In particular, observe from (9.21) and (9.24) that the measure of multinationals, aggregate platform sales and aggregate return sales all move in the same direction when η changes.

It remains for us to analyze the sign of the derivatives in (9.21), (9.23) and (9.24). Recall the definition: $\rho_S \equiv \frac{(1-\eta)\frac{k-\varepsilon+1}{\varepsilon-1}}{1+(1-\eta)\frac{k-\varepsilon+1}{\varepsilon-1}}$. When $\eta=1$, we thus have $\rho_S=0$, in which case it quickly follows from (9.22) that $\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}-\frac{1}{a_D}\frac{da_D}{d\eta}>0$, and hence that $\frac{d}{d\eta}\ln N_nG_n(a_I)$, $\frac{d}{d\eta}\ln PLA$, $\frac{d}{d\eta}\ln RET>0$. Moreover, inspecting (9.23), we would also have $\frac{d}{d\eta}\ln HOR>0$. By continuity, it follows that $\frac{d}{d\eta}\ln N_nG_n(a_I)$, $\frac{d}{d\eta}\ln HOR$, $\frac{d}{d\eta}\ln PLA$ and $\frac{d}{d\eta}\ln RET$ must all be positive in a neighborhood of η, so that $N_nG_n(a_I)$, HOR, PLA and RET are increasing in host-country financial development if the initial level of η is sufficiently high. This establishes part (iii) of the proposition.

It is useful to point out here that some form of a sufficient condition is indeed required in the statement of part (iii) of the proposition. Examining the expression for $\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}-\frac{1}{a_D}\frac{da_D}{d\eta}$ in (9.22) more closely, one can see that $\rho_S, 1-\rho_T, \frac{E_s}{E_n}\frac{1-\rho_2}{2}(1-\Delta_3)/\Delta_d \in (0,1)$, but that we cannot explicitly bound $\rho_1\Delta_1+(1-\rho_1)\Delta_2+\frac{E_s}{E_n}\frac{1-\rho_2}{2}\Delta_3$ between 0 and 1, even though $\Delta_1,\Delta_2,\Delta_3\in(0,1)$. That said, it is actually not easy to find parameter values for which $N_nG_n(a_I)$, HOR, PLA or RET end up decreasing in η, even when we set the initial level of η to be very small. As an example, consider the set of parameter values: $R=1.07$, $\varepsilon=3.8$, $L_n=L_s=1$, $f_D=0.2$, $f_X=0.15$, $f_S=0.1$, $f_{En}=f_{Es}=1$, $\tau=1.3$, $\omega=0.7$, $\bar{a}_N=\bar{a}_S=25$, $k=4$, $\delta=0.1$, $\mu=0.5$ and $\eta=0.01$. While this features a low η, it turns out that it is also necessary to set the remaining parameter f_I to be very high to generate a counter-example to part (iii) of the proposition. In particular, when $f_I=1000$, we have an equilibrium with $a_D=14.41$, $a_{XN}=12.28$, $a_{XS}=12.23$ and $\tilde{a}_I=0.20$, in which $\frac{d}{d\eta}HOR=-0.89<0$. This value of f_I is of course exceedingly large relative to the other fixed cost parameters. But attempting to reduce the value of f_I to 100 results in an equilibrium in which the order of two of the cutoffs gets reversed, specifically $a_{XN} = 12.18$ and $a_{XS} = 12.23$. ■

Cross-industry heterogeneity. Our aim is to show that the effects of host-country financial development in our model will hold particularly for industries that have a higher financing requirement, as captured by f_S. Under the assumption that firm productivities within each industry follow a Pareto distribution, we have from (9.1) and (9.2) that $sign\left(\frac{d^2a_S}{d\eta df_S}\right) = sign\left(\frac{da_S}{df_S}\right)$ and $sign\left(\frac{d^2A_{ss}}{d\eta df_S}\right) = -sign\left(\frac{dA_{ss}}{df_S}\right)$. To pin down the signs of these derivatives with respect to f_S, we totally differentiate (2.13) and (2.15) to obtain:

$$
\begin{aligned}
(\varepsilon-1)\frac{da_S}{a_S} &= -\frac{df_S}{f_S} + \frac{dA_{ss}}{A_{ss}}, \quad \text{and} \\
0 &= a_S^{\varepsilon-1}V_s(a_S)\frac{dA_{ss}}{A_{ss}} + \left(a_S^{\varepsilon-1}V_s'(a_S) - \eta G_s'(a_S)\right)da_S - \eta G_s(a_S)\frac{df_S}{f_S} \\
&= a_S^{\varepsilon-1}V_s(a_S)\frac{dA_{ss}}{A_{ss}} + (1-\eta)a_S G_s'(a_S)\frac{da_S}{a_S} - \eta G_s(a_S)\frac{df_S}{f_S}.
\end{aligned}
$$

Note that we have applied Leibniz's rule to the definition of $V_s(a_S)$, as in the proof of Lemma 1, in the last step above. Solving these two equations simultaneously yields:

$$
\begin{aligned}
\frac{1}{a_S}\frac{da_S}{df_S} &= -\frac{1}{f_S}\frac{a_S^{\varepsilon-1}V_s(a_S) - \eta G_s(a_S)}{(\varepsilon-1)a_S^{\varepsilon-1}V_s(a_S) + (1-\eta)a_S G_s'(a_S)}, \quad \text{and} \\
\frac{1}{A_{ss}}\frac{dA_{ss}}{df_S} &= \frac{1}{f_S}\left[1 - \frac{(\varepsilon-1)a_S^{\varepsilon-1}V_s(a_S) - (\varepsilon-1)\eta G_s(a_S)}{(\varepsilon-1)a_S^{\varepsilon-1}V_s(a_S) + (1-\eta)a_S G_s'(a_S)}\right].
\end{aligned}
$$

Looking at the numerator on the right-hand side of the above expression for $\frac{1}{a_S}\frac{da_S}{df_S}$, observe that: $a_S^{\varepsilon-1}V_s(a_S) = a_S^{\varepsilon-1}\int_0^{a_S} a^{1-\varepsilon}G_s'(a)da = a_S^{\varepsilon-1}\left[a_S^{1-\varepsilon}G_s(a_S) - \int_0^{a_S}(1-\varepsilon)a^{-\varepsilon}G_s(a)da\right] > \eta G_s(a_S)$, which implies that $\frac{1}{a_S}\frac{da_S}{df_S} < 0$. Next, from the equation for $\frac{1}{A_{ss}}\frac{dA_{ss}}{df_S}$, we have: $0 < (\varepsilon-1)a_S^{\varepsilon-1}V_s(a_S) - (\varepsilon-1)\eta G_s(a_S) < (\varepsilon-1)a_S^{\varepsilon-1}V_s(a_S) + (1-\eta)a_S G_s'(a_S)$, which in turn means that $\frac{1}{A_{ss}}\frac{dA_{ss}}{df_S} > 0$.

We can thus conclude that $\frac{d^2a_S}{d\eta df_S} < 0$ and $\frac{d^2A_{ss}}{d\eta df_S} < 0$. In particular, the fact that $\frac{d^2A_{ss}}{d\eta df_S}$ inherits the same negative sign as $\frac{dA_{ss}}{d\eta}$ is crucial, as it also means that $sign\left(\frac{d^2A_{sw}}{d\eta df_S}\right) = sign\left(\frac{dA_{sw}}{d\eta}\right)$. The effects of host-country financial development on the market demand levels, and hence the respective sales shares in (2.23)-(2.25), are therefore stronger in industries with a higher f_S. ■

The relationship between private credit and η. Consider first the baseline model where MNCs do not require host-country financing. The model counterpart of our empirical measure of private credit over GDP is: $N_s G(a_S) f_S \omega/(\omega L)$, this being the total amount borrowed by domestic firms, divided by the total labor income in South. Since f_S, ω, and L are fixed, our task is to show that $N_s G_s(a_S)$, the "number" of successful entrants in the Southern industry, is increasing in η.

First, log-differentiate the ideal price index, $P_{ss}^{1-\varepsilon}$, given by (2.19):

$$
\frac{1}{N_s}\frac{dN_s}{d\eta} = \frac{1}{P_{ss}^{1-\varepsilon}}\frac{dP_{ss}^{1-\varepsilon}}{d\eta} - (k-\varepsilon+1)\frac{1}{a_S}\frac{da_S}{d\eta}. \tag{9.25}
$$

We therefore have: $\frac{d}{d\eta}\log N_sG_s(a_S) = \frac{1}{N_s}\frac{dN_S}{d\eta} + \frac{G_s'(a_S)a_S}{G_s(a_S)}\frac{1}{a_S}\frac{da_S}{d\eta} = \frac{1}{N_s}\frac{dN_S}{d\eta} + k\frac{1}{a_S}\frac{da_S}{d\eta} = \frac{1}{P_{ss}^{1-\varepsilon}}\frac{dP_{ss}^{1-\varepsilon}}{d\eta} + (\varepsilon - 1)\frac{1}{a_S}\frac{da_S}{d\eta}$, where we have made use of (9.25) to obtain the last expression. We have seen from Lemma 1 that $\frac{da_S}{d\eta} > 0$. As $\varepsilon > 1$, it will thus suffice to show that $\frac{1}{P_{ss}^{1-\varepsilon}}\frac{dP_{ss}^{1-\varepsilon}}{d\eta} > 0$, in order to conclude that $\frac{d}{d\eta}\log N_sG_s(a_S) > 0$.

For this, we log-differentiate (2.4) to obtain: $\frac{dA_{sw}}{A_{sw}} = -\rho_2\frac{dP_{ss}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}} - (1-\rho_2)\frac{dP_{sw}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}}$. Substituting in the expression for $\frac{dA_{sw}}{A_{sw}}$ from (9.5) into this last equation, and rearranging, gives:

$$\rho_2\frac{1}{P_{ss}^{1-\varepsilon}}\frac{dP_{ss}^{1-\varepsilon}}{d\eta} = -(\varepsilon-1)\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} - (1-\rho_2)\frac{1}{P_{sw}^{1-\varepsilon}}\frac{dP_{sw}^{1-\varepsilon}}{d\eta}. \tag{9.26}$$

Now, log-differentiating (2.18) yields:

$$\frac{1}{P_{sw}^{1-\varepsilon}}\frac{dP_{sw}^{1-\varepsilon}}{d\eta} = \frac{1}{N_n}\frac{dN_n}{d\eta} + (k-\varepsilon+1)\left(\Delta_3\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} + (1-\Delta_3)\frac{1}{a_I}\frac{da_I}{d\eta}\right). \tag{9.27}$$

Since $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} < 0$ and $\frac{1}{a_I}\frac{da_I}{d\eta} < 0$ from Lemma 2, and $\frac{1}{N_n}\frac{dN_n}{d\eta} < 0$ from Proposition 1, it follows that: $\frac{1}{P_{sw}^{1-\varepsilon}}\frac{dP_{sw}^{1-\varepsilon}}{d\eta} < 0$. From (9.26), we immediately have: $\frac{1}{P_{ss}^{1-\varepsilon}}\frac{dP_{ss}^{1-\varepsilon}}{d\eta} > 0$, so that $\frac{d}{d\eta}\log N_sG_s(a_S) > 0$, and we indeed have total private credit extended in the South increasing with η in our baseline model.

As for the extension with local borrowing by MNCs, the private credit to GDP ratio in South is now given instead by: $[2N_nG_n(\tilde{a}_I)(f_I - f_D) + N_sG_s(a_S)f_S\omega]/(\omega L)$, where the numerator takes into account total lending to multinational affiliates from both East and West, as well as to Southern domestic firms. Under the sufficient condition assumed for part (iii) of Proposition 3 – that the initial level of host-country financial development be sufficiently high – we have already seen that the "number" of multinational affiliates $N_nG(\tilde{a}_I)$ will be increasing in η. We now show that when the initial level of η is sufficiently high, this increase in $2N_nG_n(\tilde{a}_I)$ will dominate any movements in $N_sG_s(a_S)$ in the numerator of the private credit to GDP ratio.

Log-differentiating the expression for the private credit to GDP ratio, we get:

$$\begin{aligned}
& \frac{2\left(\frac{dN_n}{d\eta}G_n(\tilde{a}_I) + N_nG_n'(\tilde{a}_I)\frac{d\tilde{a}_I}{d\eta}\right)(f_I - f_D) + \left(\frac{dN_s}{d\eta}G_s(a_S) + N_sG_s'(a_S)\frac{da_S}{d\eta}\right)f_S\omega}{2N_nG_n(\tilde{a}_I)(f_I-f_D) + N_sG_s(a_S)f_S\omega} \\
= & \frac{2N_nG_n(\tilde{a}_I)(f_I-f_D)\left(\frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}\right) + N_sG_s(a_S)f_S\omega\left(\frac{1}{N_s}\frac{dN_s}{d\eta} + k\frac{1}{a_S}\frac{da_S}{d\eta}\right)}{2N_nG_n(\tilde{a}_I)(f_I-f_D) + N_sG_s(a_S)f_S\omega} \\
\propto & \left(\frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}\right) + \frac{N_sG_s(a_S)f_S\omega}{2N_nG_n(\tilde{a}_I)(f_I-f_D)}\left(\frac{1}{N_s}\frac{dN_s}{d\eta} + k\frac{1}{a_S}\frac{da_S}{d\eta}\right),
\end{aligned} \tag{9.28}$$

where '$\propto$' denotes equality up to a positive multiplicative term. We thus focus on pinning down the sign of (9.28) in the neighborhood of $\eta = 1$. Using (9.21) and (9.22), and setting $\eta = 1$, we have: $\frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} = 1 + \frac{k-\varepsilon+1}{\varepsilon-1}(\rho_1\Delta_1 + (1-\rho_1)\Delta_2)$. Next, since (2.4), (2.18) and (2.19) are unchanged in the extension with host-country financing, equations (9.25), (9.26) and (9.27) remain valid, so that:

$$\begin{aligned}
\frac{1}{N_s}\frac{dN_s}{d\eta} + k\frac{1}{a_S}\frac{da_S}{d\eta} &= -\frac{\varepsilon-1}{\rho_2}\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} - \frac{1-\rho_2}{\rho_2}\frac{1}{P_{sw}^{1-\varepsilon}}\frac{dP_{sw}^{1-\varepsilon}}{d\eta} + (\varepsilon-1)\frac{1}{a_S}\frac{da_S}{d\eta} \\
&= -\frac{\varepsilon-1}{\rho_2}\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} + (\varepsilon-1)\frac{1}{a_S}\frac{da_S}{d\eta} \\
&\quad -\frac{1-\rho_2}{\rho_2}\left(\frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta} + (k-\varepsilon+1)\left(\Delta_3\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} + (1-\Delta_3)\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}\right) - k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}\right).
\end{aligned}$$

We now make use of the following properties: (i) $\frac{1-\rho_2}{\rho_2} = \frac{2P_{sw}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}}$ from the definition of ρ_2; (ii) $\frac{1}{a_S}\frac{da_S}{d\eta} = \frac{1}{\eta}\frac{1-\rho_S}{\varepsilon-1}$ from (9.1); (iii) $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} = -\frac{1}{\eta}\frac{\rho_S}{\varepsilon-1}$ from the proof of Lemma 3; (iv) the expression for $\frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}$ in (9.21); and (v) the expression for $\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}$ in (9.17). Evaluating these at $\eta = 1$ and following some algebra, one obtains: $\frac{1}{N_s}\frac{dN_s}{d\eta} + k\frac{1}{a_S}\frac{da_S}{d\eta} = 1 - \frac{2P_{sw}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}}\frac{k-\varepsilon+1}{\varepsilon-1}\left(\rho_1\Delta_1 + (1-\rho_1)\Delta_2 - \Delta_3\right)$. We further use the expressions for the ideal price indices in (2.18) and (2.19) to simplify the following:

$$\begin{aligned}
\frac{N_s G_s(a_S) f_S \omega}{2N_n G_n(\tilde{a}_I)(f_I - f_D)}\frac{2P_{sw}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}} &= \frac{(G_s(a_S)/V_s(a_S)) f_S\omega}{(G_n(\tilde{a}_I)/V_n(\tilde{a}_I))(f_I - f_D)}\frac{1}{1-\Delta_3}\frac{\omega^{1-\varepsilon} - \tau^{1-\varepsilon}}{\omega^{1-\varepsilon}} \\
&= \frac{f_S\omega/a_S^{1-\varepsilon}}{(f_I - f_D)/\tilde{a}_I^{1-\varepsilon}}\frac{1}{1-\Delta_3}\frac{\omega^{1-\varepsilon} - \tau^{1-\varepsilon}}{\omega^{1-\varepsilon}} \\
&= \frac{A_{ss}(\omega^{1-\varepsilon} - \tau^{1-\varepsilon})}{A_{ww}((\tau\omega)^{1-\varepsilon} - 1) + A_{ew}((\tau\omega)^{1-\varepsilon} - \tau^{1-\varepsilon}) + A_{sw}(\omega^{1-\varepsilon} - \tau^{1-\varepsilon})}\frac{1}{1-\Delta_3},
\end{aligned}$$

where we have substituted in the expressions for $a_S^{1-\varepsilon}$ in (2.13) and $\tilde{a}_I^{1-\varepsilon}$ in (3.1) for this last step. Since $A_{ss} = A_{sw}$, we thus have: $\frac{N_s G_s(a_S) f_S\omega}{2N_n G_n(\tilde{a}_I)(f_I - f_D)}\frac{2P_{sw}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}} < \frac{1}{1-\Delta_3}$.

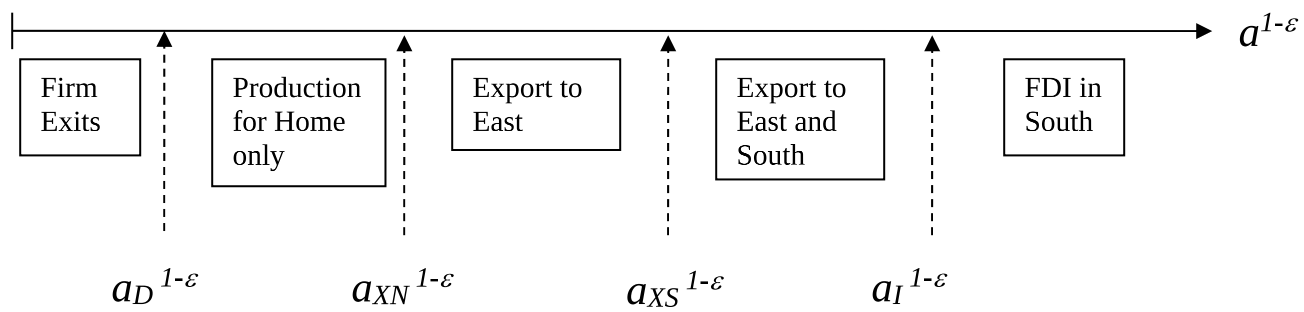
Applying the above properties to (9.28), we find that evaluated at $\eta = 1$:

$$\begin{aligned}
&\left(\frac{1}{N_n}\frac{dN_n}{d\eta} + k\frac{1}{\tilde{a}_I}\frac{d\tilde{a}_I}{d\eta}\right) + \frac{N_s G_s(a_S) f_S\omega}{2N_n G_n(\tilde{a}_I)(f_I - f_D)}\left(\frac{1}{N_s}\frac{dN_s}{d\eta} + k\frac{1}{a_S}\frac{da_S}{d\eta}\right) \\
= \;& 1 + \frac{k-\varepsilon+1}{\varepsilon-1}\left(\rho_1\Delta_1 + (1-\rho_1)\Delta_2\right) + \frac{N_s G_s(a_S) f_S\omega}{2N_n G_n(\tilde{a}_I)(f_I - f_D)}\left(1 - \frac{2P_{sw}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}}\frac{k-\varepsilon+1}{\varepsilon-1}\left(\rho_1\Delta_1 + (1-\rho_1)\Delta_2 - \Delta_3\right)\right) \\
> \;& \frac{k-\varepsilon+1}{\varepsilon-1}\left(\rho_1\Delta_1 + (1-\rho_1)\Delta_2\right) - \frac{1}{1-\Delta_3}\frac{k-\varepsilon+1}{\varepsilon-1}\left(\rho_1\Delta_1 + (1-\rho_1)\Delta_2 - \Delta_3\right) \\
\propto \;& \left(\rho_1\Delta_1 + (1-\rho_1)\Delta_2\right)(1-\Delta_3) - \left(\rho_1\Delta_1 + (1-\rho_1)\Delta_2 - \Delta_3\right) \\
= \;& \Delta_3\left(1 - \rho_1\Delta_1 - (1-\rho_1)\Delta_2\right).
\end{aligned}$$

But this last expression is clearly positive, since $\Delta_1, \Delta_2 \in (0,1)$. By a continuity argument, this allows us to conclude that $[2N_n G_n(\tilde{a}_I)(f_I - f_D) + N_s G_s(a_S) f_S\omega]/(\omega L)$ is increasing in η when the initial level of η is sufficiently high. ■

Figure 1
Productivity Cutoffs and Industry Structure

In West:



In South:

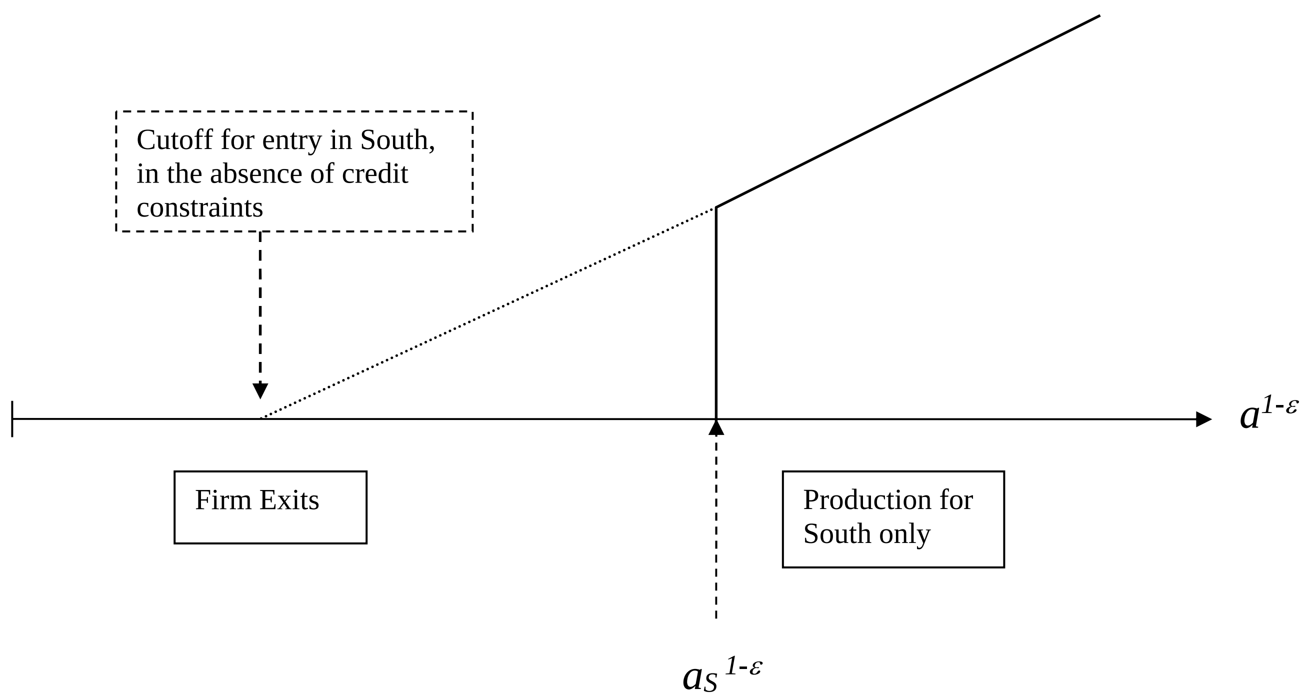
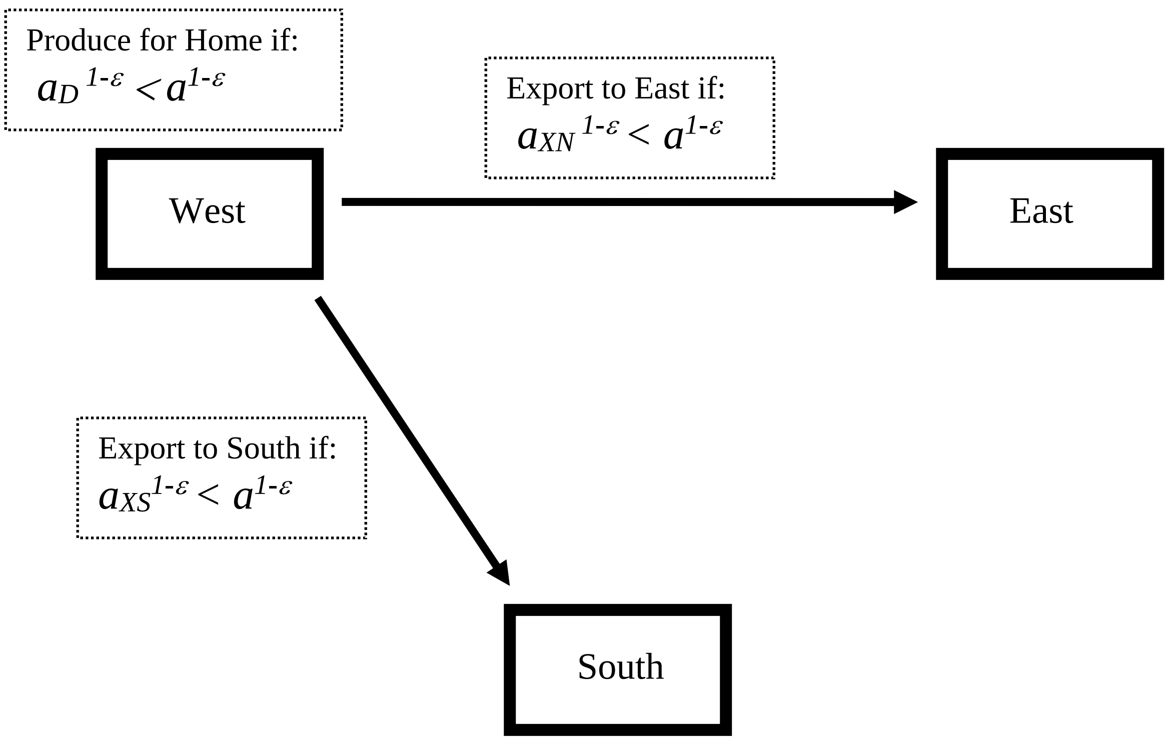


Figure 2
Modes of Operation (illustrated for Western firms)

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



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

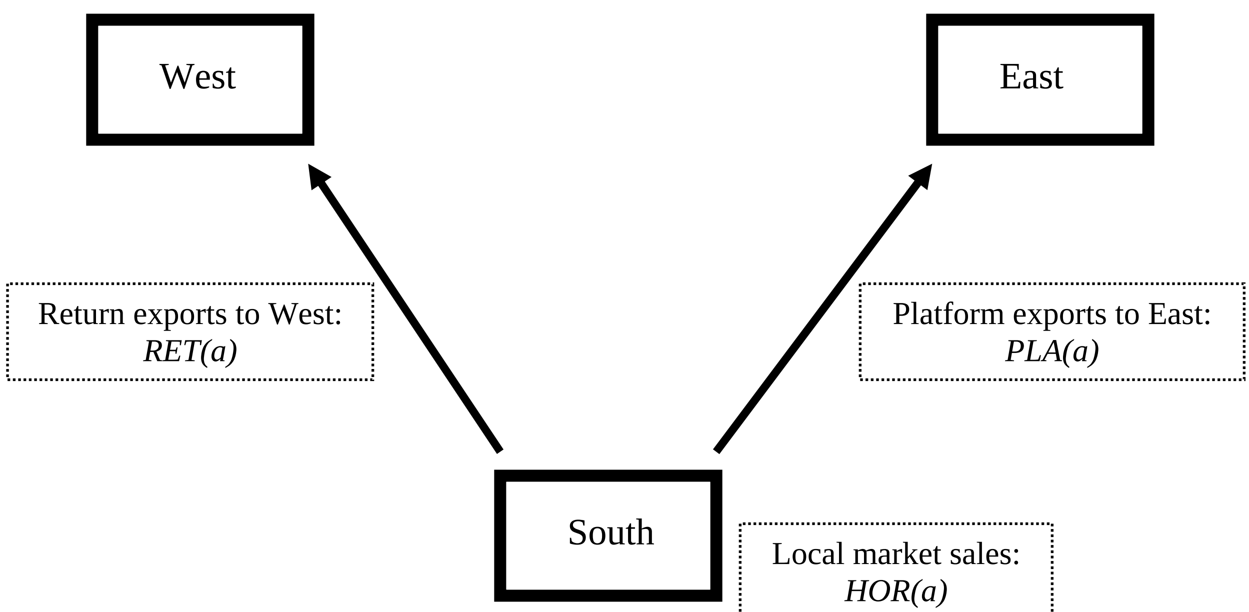
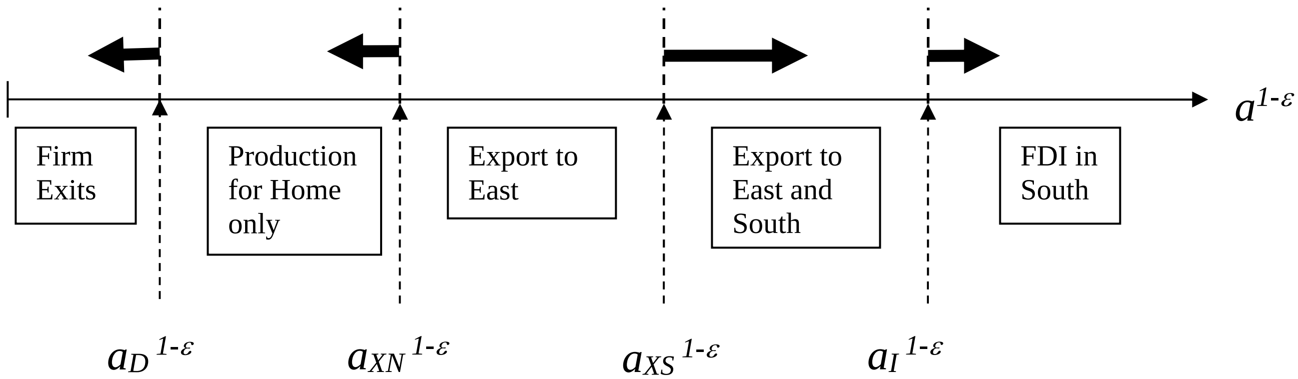


Figure 3a
Response of Cutoffs to an Improvement in Southern Financial Development: Baseline Model

In West:



In South:

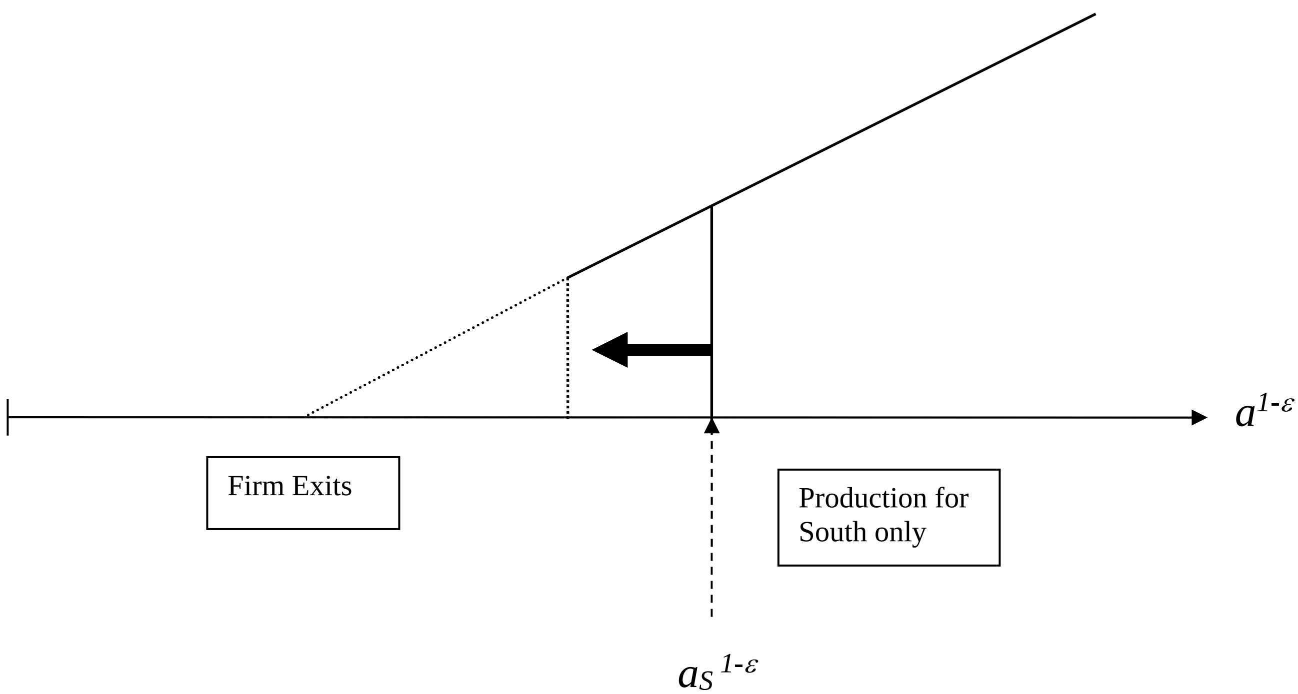


Figure 3b
Response of Cutoffs to an Improvement in Southern Financial Development: With Host-Country Borrowing by MNCs

In West:

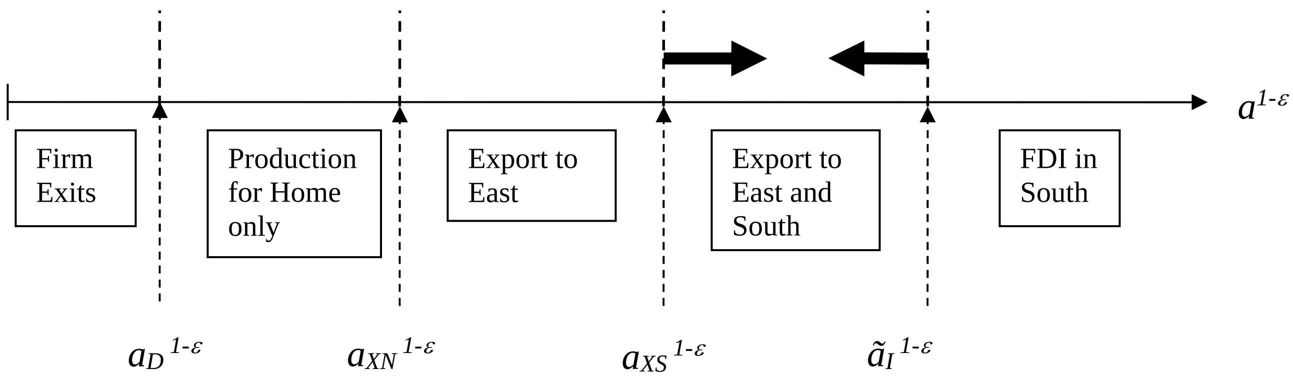


Table 1: Summary Statistics

	N	Mean	Standard Deviation
Country-Industry-Year Level			
Total Affiliate Sales (thousand USD)	17,811	561,256	2,450,158
Local Affiliate Sales (thousand USD)	17,811	363,112	1,502,995
3rd country Affiliate Sales (thousand USD)	17,811	147,074	1,009,672
US Affiliate Sales (thousand USD)	17,811	51,070	626,707
Local / Total sales	17,811	0.78	0.32
3rd country / Total sales	17,811	0.16	0.27
US / Total sales	17,811	0.06	0.17
Number of Affiliates	17,811	4.08	6.56
Affiliate-Year Level			
Total Affiliate Sales (thousand USD)	227,089	192,812	845,844
Local Affiliate Sales (thousand USD)	227,089	121,663	532,596
3rd country Affiliate Sales (thousand USD)	227,089	52,490	421,167
US Affiliate Sales (thousand USD)	227,089	18,659	228,768
Local / Total sales	227,089	0.75	0.36
3rd country / Total sales	227,089	0.18	0.31
US / Total sales	227,089	0.07	0.20
Industry Level			
External Finance Dependence	220	0.42	2.74
Country-Year Level			
Private Credit / GDP	1,794	0.51	0.44
Private Credit (bank & other) / GDP	1,800	0.55	0.46
Stock Market Capitalization / GDP	1,442	0.56	0.68
Financial Reform Indicator	1,114	14.56	4.66
Log GDP	1,923	25.27	1.63
Log GDP per Capita	1,923	8.98	1.19
Log Distance	1,923	8.90	0.53
Corporate Tax Rate	1,923	0.18	0.15
Log K/L	1,855	10.73	1.25
Log H/L	1,882	0.84	0.25
General			
Number of Parent Companies per Year	21	1,465	304
Number of Affiliates per Parent-Year	4,724	4.18	9.78

This table summarizes multinational activity, host-country institutions, and industry characteristics across 95 countries and 220 industries in 1989-2009. External finance dependence follows the methodology of Rajan and Zingales (1998). Financial development measures are from Beck et al. (2009) and Abiad et al. (2010). GDP and GDP per capita are from the Penn World Tables, Version 7.0. Log distance between the United States and each host country is from CEPII and is time invariant. Log physical and human capital per worker (K/L and H/L) are based on the Penn World Tables and Barro and Lee (2010). All other variables are from the Bureau of Economic Analysis Survey of U.S. Direct Investment Abroad. The corporate tax rate is constructed using information on the actual tax incidence of US multinational affiliates observed in the BEA data.

Table 2: Number of Multinational Affiliates

Dependent variable:	Indicator N > 0	Log N	Log N, local sales	Log N, 3rd ctry sales	Log N, US sales	Indicator N > 0	Log N	Log N, local sales	Log N, 3rd ctry sales	Log N, US sales
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Fin Development	0.101 (3.11)***	0.220 (2.28)**	0.191 (2.01)**	0.130 (1.53)	0.149 (2.00)**	0.122 (3.19)***	0.223 (2.19)**	0.191 (1.90)*	0.117 (1.23)	0.129 (1.51)
Fin Development x Ext Fin Dependence						0.007 (2.62)**	0.039 (3.90)***	0.033 (2.92)***	0.036 (3.09)***	0.038 (4.23)***
Log GDP	0.073 (7.93)***	0.272 (7.37)***	0.279 (7.64)***	0.227 (6.29)***	0.214 (6.07)***	0.093 (8.93)***	0.306 (7.67)***	0.314 (7.84)***	0.260 (6.54)***	0.258 (6.55)***
Log GDP per capita	0.080 (1.69)*	0.589 (2.89)***	0.605 (2.94)***	0.599 (2.92)***	0.512 (2.30)**	0.090 (1.60)	0.620 (2.69)***	0.653 (2.82)***	0.615 (2.58)**	0.547 (2.02)**
Log Distance to US	-0.090 (-2.63)***	-0.125 (-2.33)**	-0.127 (-2.40)**	-0.024 (-0.60)	-0.153 (-3.38)***	-0.102 (-2.61)**	-0.121 (-2.14)*	-0.128 (-2.37)**	-0.043 (-1.00)	-0.186 (-3.63)***
Controls	K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE									
# Obs	78,916	15,531	14,991	8,845	6,896	41,630	10,435	10,109	6,565	5,049
R^2	0.44	0.53	0.53	0.47	0.44	0.48	0.56	0.56	0.50	0.47

* p<0.10, ** p<0.05, *** p<0.01. This table reports OLS estimates of equations (4.1) and (4.2). The unit of observation is the country-sector-year triplet and the sample includes all benchmark years during 1989-2009. The dependent variable in columns 1 and 6 is a binary indicator equal to 1 if there is at least one US multinational affiliate present. The dependent variables in columns 2-5 and 7-10 are the log number of US multinational affiliates that are present, present and selling locally, present and exporting to third countries, or present and exporting to the United States. Financial Development is measured by the ratio of private credit to GDP. All regressions control for K/L, H/L, Rule of Law, corporate Tax Rate, and Regional Trade Agreement (RTA) dummies. Rule of Law is from the International Country Risk Guide. The RTA dummies are from Rose (2004) and WTO. All other variables are as described in Table 1. All regressions also include industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Table 3: Level of Multinational Affiliate Sales, Aggregate Level

Dependent variable:	Local sales	3rd ctry sales	US sales	Total sales	Local sales	3rd ctry sales	US sales	Total sales
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fin Development	0.233	0.376	0.756	0.350	0.148	0.403	0.684	0.298
	(1.49)	(1.51)	(3.20)***	(2.30)**	(0.95)	(1.50)	(2.61)**	(1.92)*
Fin Development x Ext Fin Dependence					0.058	0.103	0.188	0.089
					(2.70)***	(4.16)***	(6.47)***	(4.78)***
Log GDP	0.716	0.337	0.324	0.601	0.769	0.387	0.419	0.646
	(10.33)**	(3.58)***	(3.54)***	(9.02)***	(11.18)**	(3.99)***	(4.46)***	(9.69)***
Log GDP per capita	1.120	1.520	1.240	1.046	1.275	1.335	1.116	1.058
	(2.96)***	(3.16)***	(2.41)**	(2.87)***	(3.03)***	(2.57)**	(2.01)**	(2.60)**
Log Distance	-0.265	0.169	-0.508	-0.259	-0.278	0.152	-0.531	-0.233
	(-2.71)***	(1.22)	(-3.34)***	(-2.93)***	(-2.90)***	(1.14)	(-2.90)***	(-2.52)**
Controls	K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE							
# Obs	14,991	8,845	6,896	15,531	10,109	6,565	5,049	10,435
R^2	0.44	0.33	0.26	0.42	0.47	0.35	0.28	0.45

* p<0.10, ** p<0.05, *** p<0.01. This table reports OLS estimates of equations (4.1) and (4.2). The unit of observation is the country-sector-year triplet and the sample includes all benchmark years during 1989-2009. The dependent variables are the log of local sales, 3rd-country sales, US sales, and total sales by all US multinational affiliates. All regressions include the full set of controls described in Table 2, as well as industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Table 4: Composition of Multinational Affiliate Sales, Aggregate Level

Dependent variable:	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales
	(1)	(2)	(3)	(4)	(5)	(6)
Fin Development	-0.057	0.033	0.023	-0.058	0.037	0.021
	(-2.81)***	(1.88)*	(3.53)***	(-2.87)***	(1.99)**	(3.27)***
Fin Development x Ext Fin Dependence				-0.013	0.010	0.003
				(-3.67)***	(3.02)***	(2.28)**
Log GDP	0.033	-0.027	-0.007	0.035	-0.030	-0.005
	(4.50)***	(-4.31)***	(-2.97)***	(4.15)***	(-4.27)***	(-2.05)**
Log GDP per capita	-0.005	0.012	-0.008	0.028	-0.011	-0.017
	(-0.14)	(0.37)	(-0.58)	(0.70)	(-0.31)	(-1.28)
Log Distance	-0.011	0.020	-0.009	-0.017	0.025	-0.008
	(-0.70)	(1.98)*	(-0.95)	(-1.05)	(2.10)**	(-0.96)
Controls	K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE					
# Obs	15,531	15,531	15,531	10,435	10,435	10,435
R^2	0.22	0.23	0.13	0.24	0.24	0.15

* p<0.10, ** p<0.05, *** p<0.01. This table reports OLS estimates of equations (4.1) and (4.2). The unit of observation is the country-sector-year triplet and the sample includes all benchmark years during 1989-2009. The dependent variables are the ratio of local sales, 3rd-country sales and US sales to total sales, after the numerator and the denominator have been summed across all US multinational affiliates. All regressions include the full set of controls described in Table 2, as well as industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Table 5: Level of Multinational Affiliate Sales, Affiliate Level

Dependent variable:	Local sales	3rd ctry sales	US sales	Total sales	Local sales	3rd ctry sales	US sales	Total sales
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fin Development	-0.153	0.237	0.470	-0.033	-0.231	0.215	0.419	-0.092
	(-2.27)**	(1.84)*	(2.95)***	(-0.64)	(-3.13)***	(1.58)	(2.51)**	(-1.69)*
Fin Development x Ext Fin Dependence					-0.001	0.044	0.126	0.014
					(-0.07)	(2.69)***	(4.35)***	(1.38)
Log GDP	0.301	-0.088	-0.080	0.143	0.363	-0.100	-0.073	0.181
	(7.66)***	(-1.46)	(-1.21)	(4.96)***	(9.45)***	(-1.67)*	(-1.07)	(7.51)***
Log GDP per capita	0.048	0.520	0.421	-0.017	0.122	0.445	0.180	-0.014
	(0.29)	(1.86)*	(1.41)	(-0.11)	(0.78)	(1.56)	(0.58)	(-0.11)
Log Distance	-0.149	0.189	-0.184	-0.087	-0.141	0.144	-0.224	-0.077
	(-3.73)***	(1.71)*	(-1.56)	(-2.35)**	(-3.42)***	(1.21)	(-1.63)	(-2.65)***
Controls	K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE							
# Obs	198,154	103,908	71,160	215,173	148,575	85,349	58,439	161,423
R^2	0.12	0.18	0.16	0.11	0.13	0.18	0.16	0.11

* p<0.10, ** p<0.05, *** p<0.01. This table reports OLS estimates of equations (4.1) and (4.2). The unit of observation is the affiliate-year and the sample includes all years during 1989-2009. The dependent variables are the log of local sales, 3rd-country sales, US sales, and total sales of each US multinational affiliate. All regressions include the full set of controls described in Table 2, as well as industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Table 6: Composition of Multinational Affiliate Sales, Affiliate Level

Dependent variable:	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales
	(1)	(2)	(3)	(4)	(5)	(6)
Fin Development	-0.047 (-2.46)**	0.030 (1.86)*	0.018 (2.20)**	-0.040 (-1.90)*	0.030 (1.69)*	0.010 (1.10)
Fin Development x Ext Fin Dependence				-0.007 (-3.87)***	0.004 (2.39)**	0.003 (1.98)*
Log GDP	0.048 (5.35)***	-0.041 (-5.78)***	-0.008 (-2.52)**	0.050 (5.13)***	-0.044 (-5.68)***	-0.006 (-2.03)**
Log GDP per capita	-0.013 (-0.35)	0.001 (0.03)	0.013 (1.11)	0.007 (0.17)	-0.011 (-0.31)	0.004 (0.39)
Log Distance	-0.021 (-1.38)	0.015 (1.45)	0.006 (0.56)	-0.014 (-0.82)	0.010 (0.77)	0.004 (0.32)
Controls	K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE					
# Obs	215,178	215,178	215,178	161,427	161,427	161,427
R^2	0.14	0.16	0.08	0.15	0.17	0.10

* p<0.10, ** p<0.05, *** p<0.01. This table reports OLS estimates of equations (4.1) and (4.2). The unit of observation is the affiliate-year and the sample includes all years during 1989-2009. The dependent variables are the ratio of local sales, 3rd-country sales and US sales to total sales for each US multinational affiliate. All regressions include the full set of controls described in Table 2, as well as industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Table 7: Alternative Measures of Financial Development, Aggregate Level

Dependent variable:	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Private credit by banks and other financial institutions / GDP						
Fin Development	-0.056	0.036	0.020	-0.059	0.041	0.018
	(-2.63)***	(1.94)*	(2.80)***	(-2.71)***	(2.09)**	(2.49)**
Fin Development x Ext Fin Dependence				-0.013	0.010	0.003
				(-3.65)***	(3.01)***	(2.13)**
Controls	GDP, GDP per capita, Distance, K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE					
# Obs	15,673	15,673	15,673	10,530	10,530	10,530
R^2	0.22	0.23	0.13	0.24	0.24	0.15
Panel B: Stock market capitalization / GDP						
Fin Development	-0.038	0.024	0.014	-0.037	0.027	0.011
	(-2.64)***	(2.02)**	(3.17)***	(-2.67)***	(2.29)**	(2.61)**
Fin Development x Ext Fin Dependence				-0.009	0.008	0.002
				(-5.41)***	(4.04)***	(2.45)**
Controls	GDP, GDP per capita, Distance, K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE					
# Obs	15,480	15,480	15,480	10,476	10,476	10,476
R^2	0.22	0.24	0.13	0.24	0.25	0.16
Panel C: Financial reform indicator						
Fin Development	-0.006	0.006	0.001	-0.006	0.006	-0.000
	(-2.10)**	(2.41)**	(0.42)	(-1.95)*	(2.31)**	(-0.11)
Fin Development x Ext Fin Dependence				-0.001	0.001	0.001
				(-3.24)***	(2.02)**	(3.46)***
Controls	GDP, GDP per capita, Distance, K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE					
# Obs	13,323	13,323	13,323	8,985	8,985	8,985
R^2	0.22	0.23	0.14	0.23	0.24	0.15

* p<0.10, ** p<0.05, *** p<0.01. This table replicates Table 4 using three alternative measures of financial development: the ratio of private credit by banks and other financial institutions to GDP and the ratio of stock market capitalization to GDP from Beck et al. (2009), and an indicator variable equal to 1 in all years after a country undergoes financial reform from Abiad et al. (2010). All regressions include the full set of controls described in Table 2, as well as industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Table 8: Cost of Entry, Cost of Exporting and
Export Platform Potential in Host Country, Aggregate Level

Dependent variable:	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales
	(1)	(2)	(3)	(4)	(5)	(6)
Fin Development	-0.056	0.031	0.025	-0.060	0.036	0.024
	(-3.50)***	(2.28)**	(3.99)***	(-4.04)***	(2.90)***	(3.75)***
Fin Development x Ext Fin Dependence				-0.014	0.010	0.003
				(-3.73)***	(3.15)***	(2.19)**
Entry Cost	0.006	-0.004	-0.002	0.010	-0.007	-0.004
	(0.62)	(-0.51)	(-0.69)	(0.99)	(-0.76)	(-1.40)
Export Cost	-0.022	0.031	-0.008	-0.035	0.041	-0.006
	(-0.81)	(1.25)	(-0.95)	(-1.24)	(1.69)	(-0.62)
Export Platform Potential	-0.111	0.112	-0.000	-0.120	0.126	-0.006
	(-4.16)***	(5.49)***	(-0.02)	(-4.47)***	(6.17)***	(-0.59)
Controls	GDP, GDP per capita, Distance, K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE					
# Obs	15,182	15,182	15,182	10,190	10,190	10,190
R^2	0.23	0.25	0.13	0.26	0.27	0.15

* p<0.10, ** p<0.05, *** p<0.01. This table replicates Table 4 adding three more controls: indices for the cost of firm entry in the host country and for the cost of exporting from the host country constructed from the World Bank Doing Business Report, as well as a measure of the host country's export-platform potential calculated using GDP and bilateral distance data from the Penn World Table and CEPII respectively. All regressions include the full set of controls described in Table 2, as well as industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Table 9: Use of Host-Country Financing, Affiliate Level

Dependent variable:	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales
	(1)	(2)	(3)	(4)	(5)	(6)
Fin Development	-0.061	0.039	0.022	-0.054	0.038	0.017
	(-2.63)**	(1.82)*	(2.81)***	(-2.13)**	(1.56)	(2.27)**
Fin Development x Ext Fin Dependence				-0.008	0.005	0.002
				(-3.13)***	(2.23)**	(1.37)
Lagged Share of Local Financing	0.103	-0.084	-0.019	0.084	-0.073	-0.010
	(4.42)***	(-4.11)***	(-2.71)***	(3.78)***	(-3.69)***	(-1.46)
Controls	GDP, GDP per capita, Distance, K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE					
# observations	22,199	22,199	22,199	16,566	16,566	16,566
R-squared	0.18	0.19	0.11	0.18	0.19	0.13

* p<0.10, ** p<0.05, *** p<0.01. This table replicates Table 6 adding one more control: the lagged share of affiliate financing raised in the host country from the BEA data. Only benchmark years in 1989-2009 are included. All regressions include the full set of controls described in Table 2, as well as industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Table 10: Parent-Firm Fixed Effects, Affiliate Level

Dependent variable:	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales
	(1)	(2)	(3)	(4)	(5)	(6)
Fin Development	-0.033	0.023	0.010	-0.026	0.022	0.004
	(-1.94)*	(1.56)	(1.59)	(-1.44)	(1.39)	(0.58)
Fin Development x Ext Fin Dependence				-0.009	0.006	0.003
				(-5.03)***	(3.65)***	(1.99)**
Controls	GDP, GDP per capita, Distance, K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Parent Firm FE, Year FE					
# observations	215,181	215,181	215,181	161,427	161,427	161,427
R-squared	0.27	0.27	0.24	0.28	0.27	0.24

* p<0.10, ** p<0.05, *** p<0.01. This table replicates Table 6 with parent firm and year fixed effects in place of industry and year fixed effects. All regressions include the full set of controls described in Table 2. T-statistics based on robust standard errors clustered by country appear in parentheses.

Table 11: Cross Section vs. Time Series: Country Fixed Effects, Aggregate Level

Dependent variable:	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fin Development	0.005	-0.015	0.010	0.014	-0.020	0.006			
	(0.38)	(-1.21)	(2.04)**	(0.94)	(-1.45)	(1.24)			
Fin Development x Ext Fin Dependence				-0.012	0.009	0.003	-0.011	0.009	0.003
				(-3.46)***	(2.85)***	(2.08)**	(-3.19)***	(2.61)***	(1.87)*
Controls	Country FE, Industry FE, Year FE			Country FE, Industry FE, Year FE			Country-Year FE, Industry FE		
	GDP, GDP per capita, Distance, K/L, H/L, Rule of Law, Tax Rate, RTA Dummies								
# Obs	15,531	15,531	15,531	10,435	10,435	10,435	11,392	11,392	11,392
R^2	0.27	0.29	0.16	0.30	0.31	0.18	0.32	0.33	0.20

* p<0.10, ** p<0.05, *** p<0.01. This table replicates Table 4 adding country fixed effects to the industry and year fixed effects in columns 1-6, and including country-year fixed effects and industry fixed effects in columns 7-9. All regressions include the full set of controls described in Table 2. T-statistics based on robust standard errors clustered by country appear in parentheses.

Appendix Table 1: Host-Country Financial Development

Country	Mean	St Dev	Country	Mean	St Dev	Country	Mean	St Dev
Algeria	0.15	0.16	Guatemala	0.21	0.08	Peru	0.17	0.08
Argentina	0.16	0.05	Guyana	0.43	0.08	Philippines	0.29	0.10
Australia	0.82	0.23	Haiti	0.13	0.02	Poland	0.25	0.09
Austria	0.99	0.10	Honduras	0.35	0.10	Portugal	1.05	0.45
Bahrain	0.41	0.07	Hong Kong	1.43	0.14	Qatar	0.29	0.04
Bangladesh	0.28	0.06	Hungary	0.38	0.14	Russia	0.19	0.12
Belgium	0.71	0.18	Iceland	0.88	0.76	Saudi Arabia	0.26	0.07
Bolivia	0.41	0.13	India	0.30	0.09	Senegal	0.20	0.04
Botswana	0.14	0.04	Indonesia	0.33	0.13	Singapore	0.92	0.12
Brazil	0.35	0.08	Iran	0.21	0.04	Slovakia	0.41	0.07
Bulgaria	0.34	0.22	Ireland	1.01	0.59	Slovenia	0.44	0.22
Cameroon	0.12	0.07	Israel	0.71	0.14	South Africa	0.63	0.10
Canada	0.96	0.24	Italy	0.71	0.18	Spain	1.05	0.42
Chile	0.55	0.12	Jamaica	0.22	0.05	Sri Lanka	0.23	0.08
Colombia	0.30	0.07	Japan	1.49	0.41	Sudan	0.04	0.02
Congo	0.06	0.05	Jordan	0.71	0.12	Sweden	0.69	0.35
Costa Rica	0.22	0.12	Kenya	0.22	0.02	Switzerland	1.61	0.07
Cote D'Ivoire	0.20	0.09	Kuwait	0.47	0.19	Syria	0.09	0.01
Croatia	0.61	0.13	Luxembourg	1.24	0.47	Tanzania	0.09	0.05
Cyprus	1.42	0.36	Malawi	0.07	0.02	Thailand	1.03	0.28
Czech Republic	0.49	0.14	Malaysia	1.09	0.22	Trinidad & Tobago	0.30	0.03
Denmark	0.97	0.70	Malta	0.97	0.15	Tunisia	0.54	0.04
Dominican Rep	0.21	0.05	Mexico	0.19	0.06	Turkey	0.17	0.07
Ecuador	0.23	0.06	Morocco	0.43	0.17	Uganda	0.05	0.02
Egypt	0.38	0.12	Netherlands	1.24	0.43	United Kingdom	1.31	0.30
El Salvador	0.35	0.09	New Zealand	1.05	0.25	Uruguay	0.32	0.15
Finland	0.69	0.14	Norway	0.64	0.09	Venezuela	0.13	0.07
France	0.91	0.09	Oman	0.34	0.04	Vietnam	0.51	0.28
Gabon	0.11	0.04	Pakistan	0.24	0.02	Yemen	0.06	0.01
Germany	1.05	0.10	Panama	0.69	0.18	Zambia	0.07	0.03
Ghana	0.08	0.04	Papua New Guinea	0.18	0.05			
Greece	0.50	0.24	Paraguay	0.22	0.05			
Panel Variation:	0.51	0.44						

This table summarizes the variation in financial development in the panel. Financial development is measured by private credit normalized by GDP. Lebanon is further included in our sample in Table 7, Panel B, where financial development is measured instead by stock market capitalization normalized by GDP.

Appendix Table 2: Tobit, Aggregate Level

Dependent variable:	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales
	(1)	(2)	(3)	(4)	(5)	(6)
Fin Development	-0.058	0.057	0.060	-0.060	0.055	0.052
	(-2.88)***	(2.15)**	(3.42)***	(-2.92)***	(2.11)**	(3.37)***
Fin Development x Ext Fin Dependence				-0.013	0.008	0.007
				(-3.71)***	(2.13)**	(2.95)***
Controls	GDP, GDP per capita, Distance, K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE					
# observations	15,531	15,531	15,531	10,435	10,435	10,435
R-squared	0.37	0.30	0.27	0.42	0.31	0.38

* p<0.10, ** p<0.05, *** p<0.01. This table replicates Table 4 but applies Tobit instead of OLS estimation. All regressions include the full set of controls described in Table 2, as well as industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Appendix Table 3: Weighted Least Squares, Affiliate Level

Dependent variable:	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales	Local sales / Total sales	3rd ctry sales / Total sales	US sales / Total sales
	(1)	(2)	(3)	(4)	(5)	(6)
Fin Development	-0.051	0.032	0.019	-0.046	0.034	0.012
	(-2.56)**	(1.89)*	(2.40)**	(-2.10)**	(1.80)*	(1.34)
Fin Development x Ext Fin Dependence				-0.008	0.004	0.004
				(-3.86)***	(2.39)**	(2.06)**
Controls	GDP, GDP per capita, Distance, K/L, H/L, Rule of Law, Tax Rate, RTA Dummies, Industry FE, Year FE					
# observations	210,852	210,852	210,852	159,137	159,137	159,137
R-squared	0.16	0.18	0.09	0.16	0.18	0.11

* p<0.10, ** p<0.05, *** p<0.01. This table replicates Table 6 but applies Weighted Least Squares instead of OLS estimation, using log total affiliate sales as weights. All regressions include the full set of controls described in Table 2, as well as industry and year fixed effects. T-statistics based on robust standard errors clustered by country appear in parentheses.

Host-Country Financial Development and Multinational Activity: Supplementary Appendix

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April 2, 2014

Abstract

In this Supplementary Appendix, we provide detailed derivations for the extension of our model in Section 3.2 of the main paper that incorporates home-bias in consumption. In particular, we establish that Proposition 1 in our baseline model continues to apply in this extension, and also provide the proof of Proposition 3.

A Incorporating home-bias in consumption

Model Setup. Recall that we now modify the respective utility functions in North and South to:

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

$$U_s = y_s^{1-\mu}\left[\sum_{j\in\{e,w,s\}}\left(\int_{\Omega_{sj}} x_{sj}(a)^{\alpha}\, dG_j(a)\right)^{\frac{\beta}{\alpha}}\right]^{\frac{\mu}{\beta}}, \tag{A.2}$$

where $0 < \beta < \alpha < 1$. We denote the elasticity of substitution for varieties from the same country by $\varepsilon = \frac{1}{1-\alpha}$, and the elasticity of substitution for varieties from different countries by $\phi = \frac{1}{1-\beta}$. Note that $\varepsilon > \phi > 1$, which captures the idea that varieties from the same country are closer substitutes than varieties drawn from different countries.

Maximizing (A.1) and (A.2) subject to the standard budget constraints, one obtains that demand in country i for a variety from country j is: $x_{ij}(a) = A_{ij}p_{ij}(a)^{-\varepsilon}$, where the aggregate market demand levels are now given

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by:

$$A_{ww} = A_{ee} = \frac{\mu E_n P_{ww}^{\varepsilon-\phi}}{P_{ww}^{1-\phi} + P_{ew}^{1-\phi}}, \tag{A.3}$$

$$A_{ew} = A_{we} = \frac{\mu E_n P_{ew}^{\varepsilon-\phi}}{P_{ww}^{1-\phi} + P_{ew}^{1-\phi}}, \tag{A.4}$$

$$A_{sw} = A_{se} = \frac{\mu E_s P_{sw}^{\varepsilon-\phi}}{P_{ss}^{1-\phi} + 2P_{sw}^{1-\phi}}, \quad \text{and} \tag{A.5}$$

$$A_{ss} = \frac{\mu E_s P_{ss}^{\varepsilon-\phi}}{P_{ss}^{1-\phi} + 2P_{sw}^{1-\phi}}. \tag{A.6}$$

In contrast to the baseline model, we no longer have $A_{ww} = A_{ew}$ and $A_{sw} = A_{ss}$. This is precisely due to the introduction of the additional elasticity of substitution, ϕ. In particular, when $\varepsilon = \phi$, the above collapses back to the demand expressions from our baseline model.

The rest of the equations for the equilibrium system remain the same as in the baseline model. For completeness, we reproduce them below:

$$a_D^{1-\varepsilon} = \frac{Rf_D}{(1-\alpha)A_{ww}(1/\alpha)^{1-\varepsilon}} \tag{A.7}$$

$$a_{XN}^{1-\varepsilon} = \frac{Rf_X}{(1-\alpha)A_{ew}(\tau/\alpha)^{1-\varepsilon}} \tag{A.8}$$

$$a_{XS}^{1-\varepsilon} = \frac{Rf_X}{(1-\alpha)A_{sw}(\tau/\alpha)^{1-\varepsilon}} \tag{A.9}$$

$$a_I^{1-\varepsilon} = \frac{R(f_I - f_D)}{(1-\alpha)[A_{ww}((\frac{\tau\omega}{\alpha})^{1-\varepsilon} - (\frac{1}{\alpha})^{1-\varepsilon}) + A_{ew}((\frac{\tau\omega}{\alpha})^{1-\varepsilon} - (\frac{\tau}{\alpha})^{1-\varepsilon}) + A_{sw}((\frac{\omega}{\alpha})^{1-\varepsilon} - (\frac{\tau}{\alpha})^{1-\varepsilon})]} \tag{A.10}$$

$$a_S^{1-\varepsilon} = \frac{1}{\eta}\frac{Rf_S\omega}{(1-\alpha)A_{ss}(\omega/\alpha)^{1-\varepsilon}} \tag{A.11}$$

$$\begin{aligned} \delta f_{En} = {} & (1-\alpha)A_{ww}\left(\frac{1}{\alpha}\right)^{1-\varepsilon}(V_n(a_D) - V_n(a_I)) - Rf_D(G_n(a_D) - G_n(a_I)) \\ & +(1-\alpha)A_{ew}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XN}) - V_n(a_I)) - Rf_X(G_n(a_{XN}) - G_n(a_I)) \\ & +(1-\alpha)A_{sw}\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XS}) - V_n(a_I)) - Rf_X(G_n(a_{XS}) - G_n(a_I)) \\ & +(1-\alpha)\left(A_{ww}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} + A_{ew}\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} + A_{sw}\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}\right)V_n(a_I) - R(f_I + 2f_X)G_n(a_I) \end{aligned} \tag{A.12}$$

$$\delta f_{Es}\omega = (1-\alpha)A_{ss}\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}V_s(a_S) - Rf_S\omega G_s(a_S) \tag{A.13}$$

$$P_{ww}^{1-\varepsilon} = N_n\left[\left(\frac{1}{\alpha}\right)^{1-\varepsilon}(V_n(a_D) - V_n(a_I)) + \left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}V_n(a_I)\right] \tag{A.14}$$

$$P_{ew}^{1-\varepsilon} = N_n\left[\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XN}) - V_n(a_I)) + \left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon}V_n(a_I)\right] \tag{A.15}$$

$$P_{sw}^{1-\varepsilon} = N_n\left[\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon}(V_n(a_{XS}) - V_n(a_I)) + \left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}V_n(a_I)\right] \tag{A.16}$$

$$P_{ss}^{1-\varepsilon} = N_s\left[\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon}V_s(a_S)\right] \tag{A.17}$$

The equilibrium is thus pinned down by the 15 equations (A.3)-(A.17) in the 15 endogeneous variables: 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}.

Proposition 1 continues to hold. It is clear that (A.11) and (A.13) once again pin down the equilibrium for the Southern differentiated varieties industry. Since these equations are unchanged from the baseline model, this means that Lemma 1 holds, namely that $\frac{da_S}{d\eta} > 0$ and $\frac{dA_{ss}}{d\eta} < 0$.

We next show that a modified version of Lemma 2 now describes the subsequent impact on the Northern industry equilibrium:

Lemma 2A: *In the extended model with home-bias in consumption, (i)* $\frac{1}{a_{XS}}\frac{da_{XS}}{d\eta} < \frac{1}{a_I}\frac{da_I}{d\eta} < 0$; *(ii)* $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta} > \frac{1}{a_D}\frac{da_D}{d\eta} > 0$; *(iii)* $\frac{dA_{sw}}{d\eta} < 0$; *and (iv)* $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta} > 0$.

In response to a small increase in η, we now have the proportional shift in the a_{XN} cutoff exceeding that in the a_D cutoff, and hence the proportional increase in A_{ew} exceeding that in A_{ww}.

We proceed to prove this modified lemma. To provide a heuristic roadmap, we will take the remaining 13 equations that define the Western industry equilibrium – (A.3)-(A.5), (A.7)-(A.10), (A.12), and (A.14)-(A.17) – and log-differentiate them. We then reduce the resulting system 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 determine the comparative statics with respect to η for the Western industry cutoffs, and hence for the other endogenous variables as well.

First, log-differentiating (A.7), (A.8) and (A.9) yields:

$$(\varepsilon-1)\frac{da_D}{a_D} = \frac{dA_{ww}}{A_{ww}}, \tag{A.18}$$

$$(\varepsilon-1)\frac{da_{XN}}{a_{XN}} = \frac{dA_{ew}}{A_{ew}}, \quad \text{and} \tag{A.19}$$

$$(\varepsilon-1)\frac{da_{XS}}{a_{XS}} = \frac{dA_{sw}}{A_{sw}}. \tag{A.20}$$

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

Similarly, log-differentiating (A.10) yields:

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

We replace $\frac{dA_{ww}}{A_{ww}}$, $\frac{dA_{ew}}{A_{ew}}$ and $\frac{dA_{sw}}{A_{sw}}$ by the expressions in (A.18)-(A.20). Making use also of the expressions for A_{ww}, A_{ew} and A_{sw} from (A.3)-(A.5), and for $P_{ww}^{1-\varepsilon}$, $P_{ew}^{1-\varepsilon}$ and $P_{sw}^{1-\varepsilon}$ from (A.14)-(A.16), and simplifying extensively, one can show that:

$$\frac{da_I}{a_I} = \frac{\rho_1(1-\Delta_1)\frac{da_D}{a_D} + (1-\rho_1)(1-\Delta_2)\frac{da_{XN}}{a_{XN}} + \frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)\frac{da_{XS}}{a_{XS}}}{\rho_1(1-\Delta_1) + (1-\rho_1)(1-\Delta_2) + \frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)}, \tag{A.21}$$

where we now define: $\rho_1 = \frac{P_{ww}^{1-\phi}}{P_{ww}^{1-\phi}+P_{ew}^{1-\phi}}$ and $\rho_2 = \frac{P_{ss}^{1-\phi}}{P_{ss}^{1-\phi}+2P_{sw}^{1-\phi}}$. Note that in contrast to the baseline model, the definitions of ρ_1 and ρ_2 now involve ϕ, instead of ε. We nevertheless still have $\rho_1, \rho_2 \in (0,1)$. Recall also the following definitions, which we retain from the baseline model:

$$\Delta_1 = \frac{\left(\frac{1}{\alpha}\right)^{1-\varepsilon} V_n(a_D)}{\left(\frac{1}{\alpha}\right)^{1-\varepsilon} V_n(a_D) + (\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{1}{\alpha}\right)^{1-\varepsilon})V_n(a_I)}, \tag{A.22}$$

$$\Delta_2 = \frac{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon} V_n(a_{XN})}{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon} V_n(a_{XN}) + (\left(\frac{\tau\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{\tau}{\alpha}\right)^{1-\varepsilon})V_n(a_I)}, \quad \text{and} \tag{A.23}$$

$$\Delta_3 = \frac{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon} V_n(a_{XS})}{\left(\frac{\tau}{\alpha}\right)^{1-\varepsilon} V_n(a_{XS}) + (\left(\frac{\omega}{\alpha}\right)^{1-\varepsilon} - \left(\frac{\tau}{\alpha}\right)^{1-\varepsilon})V_n(a_I)}. \tag{A.24}$$

Note that in the proof of Lemma 2 in the main paper, we showed that $1 > \Delta_1 > \Delta_2 > \Delta_3 > 0$.

Next, we differentiate the free-entry condition for West, (A.12). Following the algebraic manipulations used in the proof of Lemma 2 in the main paper, we once again obtain:

$$\rho_1 \frac{da_D}{a_D} + (1-\rho_1)\frac{da_{XN}}{a_{XN}} + \frac{1-\rho_2}{2}\frac{E_s}{E_n}\frac{da_{XS}}{a_{XS}} = 0. \quad \text{(A.25)}$$

A quick implication is that the three cutoffs 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 (A.3)-(A.6):

$$\frac{dA_{ww}}{A_{ww}} = \left((1-\rho_1)\frac{\phi-1}{\varepsilon-1} - 1\right)\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}} - (1-\rho_1)\frac{\phi-1}{\varepsilon-1}\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}}, \quad \text{(A.26)}$$

$$\frac{dA_{ew}}{A_{ew}} = \left(\rho_1\frac{\phi-1}{\varepsilon-1} - 1\right)\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}} - \rho_1\frac{\phi-1}{\varepsilon-1}\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}}, \quad \text{(A.27)}$$

$$\frac{dA_{sw}}{A_{sw}} = \left(\rho_2\frac{\phi-1}{\varepsilon-1} - 1\right)\frac{dP_{sw}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}} - \rho_2\frac{\phi-1}{\varepsilon-1}\frac{dP_{ss}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}}, \quad \text{and} \quad \text{(A.28)}$$

$$\frac{dA_{ss}}{A_{ss}} = \left((1-\rho_2)\frac{\phi-1}{\varepsilon-1} - 1\right)\frac{dP_{ss}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}} - (1-\rho_2)\frac{\phi-1}{\varepsilon-1}\frac{dP_{sw}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}}. \quad \text{(A.29)}$$

Meanwhile, log-differentiating the ideal price indices (A.14)-(A.16) gives us:

$$\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}} = \frac{dN_n}{N_n} + (k-\varepsilon+1)\left(\Delta_1\frac{da_D}{a_D} + (1-\Delta_1)\frac{da_I}{a_I}\right), \quad \text{(A.30)}$$

$$\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}} = \frac{dN_n}{N_n} + (k-\varepsilon+1)\left(\Delta_2\frac{da_{XN}}{a_{XN}} + (1-\Delta_2)\frac{da_I}{a_I}\right), \quad \text{and} \quad \text{(A.31)}$$

$$\frac{dP_{sw}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}} = \frac{dN_n}{N_n} + (k-\varepsilon+1)\left(\Delta_3\frac{da_{XS}}{a_{XS}} + (1-\Delta_3)\frac{da_I}{a_I}\right), \quad \text{(A.32)}$$

where we have made use of the fact that $\frac{aV_n'(a)}{V_n(a)} = k-\varepsilon+1$ for the Pareto distribution.

Using Cramer's Rule, we now invert (A.28) and (A.29) to obtain:

$$\frac{dP_{sw}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}} = \left(-\rho_2\frac{\phi-1}{\varepsilon-\phi} - 1\right)\frac{dA_{sw}}{A_{sw}} + \rho_2\frac{\phi-1}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}}, \quad \text{and} \quad \text{(A.33)}$$

$$\frac{dP_{ss}^{1-\varepsilon}}{P_{ss}^{1-\varepsilon}} = \left(-(1-\rho_2)\frac{\phi-1}{\varepsilon-\phi} - 1\right)\frac{dA_{ss}}{A_{ss}} + (1-\rho_2)\frac{\phi-1}{\varepsilon-\phi}\frac{dA_{sw}}{A_{sw}}. \quad \text{(A.34)}$$

Setting (A.32) equal to (A.33) then implies:

$$\frac{dN_n}{N_n} = \rho_2\frac{\phi-1}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}} - \left[(\varepsilon-1)\left(\rho_2\frac{\phi-1}{\varepsilon-\phi}+1\right) + (k-\varepsilon+1)\Delta_3\right]\frac{da_{XS}}{a_{XS}} - (k-\varepsilon+1)(1-\Delta_3)\frac{da_I}{a_I}. \quad \text{(A.35)}$$

We now plug this expression for $\frac{dN_n}{N_n}$ into (A.30) and (A.31), and substitute the subsequent expressions for $\frac{dP_{ww}^{1-\varepsilon}}{P_{ww}^{1-\varepsilon}}$ and $\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}}$ into (A.26) and (A.27). Finally, replacing $\frac{dA_{ww}}{A_{ww}}$ and $\frac{dA_{ew}}{A_{ew}}$ with the expressions in terms of $\frac{da_D}{a_D}$ and $\frac{da_{XN}}{a_{XN}}$ from (A.18) and (A.19) respectively, one obtains after some rearrangement:

$$\frac{\rho_2}{k-\varepsilon+1}\frac{\phi-1}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}} = \left[\left((1-\rho_1)\frac{\phi-1}{\varepsilon-1}-1\right)\Delta_1-\frac{\varepsilon-1}{k-\varepsilon+1}\right]\frac{da_D}{a_D}-(1-\rho_1)\frac{\phi-1}{\varepsilon-1}\Delta_2\frac{da_{XN}}{a_{XN}} + \left[\frac{\varepsilon-1}{k-\varepsilon+1}\left(\rho_2\frac{\phi-1}{\varepsilon-\phi}+1\right)+\Delta_3\right]\frac{da_{XS}}{a_{XS}} + \left[(\Delta_1-\Delta_3)-(\Delta_1-\Delta_2)(1-\rho_1)\frac{\phi-1}{\varepsilon-1}\right]\frac{da_I}{a_I}, \quad \text{and} \tag{A.36}$$

$$\frac{\rho_2}{k-\varepsilon+1}\frac{\phi-1}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}} = -\rho_1\frac{\phi-1}{\varepsilon-1}\Delta_1\frac{da_D}{a_D}+\left[\left(\rho_1\frac{\phi-1}{\varepsilon-1}-1\right)\Delta_2-\frac{\varepsilon-1}{k-\varepsilon+1}\right]\frac{da_{XN}}{a_{XN}} + \left[\frac{\varepsilon-1}{k-\varepsilon+1}\left(\rho_2\frac{\phi-1}{\varepsilon-\phi}+1\right)+\Delta_3\right]\frac{da_{XS}}{a_{XS}} + \left[(\Delta_2-\Delta_3)+(\Delta_1-\Delta_2)\rho_1\frac{\phi-1}{\varepsilon-1}\right]\frac{da_I}{a_I}. \tag{A.37}$$

(A.21), (A.25), (A.36), and (A.37) 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 equating (A.37) and (A.36) implies:

$$\frac{da_I}{a_I} = \frac{1}{\Delta_1-\Delta_2}\left[\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\frac{da_D}{d_D}-\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\frac{da_{XN}}{d_{XN}}\right]. \tag{A.38}$$

Meanwhile, using (A.25) to eliminate $\frac{da_{XS}}{a_{XS}}$ from (A.21) delivers:

$$\frac{da_I}{a_I} = -\frac{\rho_1(\Delta_1-\Delta_3)\frac{da_D}{a_D}+(1-\rho_1)(\Delta_2-\Delta_3)\frac{da_{XN}}{a_{XN}}}{\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2)+\frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3)}. \tag{A.39}$$

For convenience, let us define: $\Delta_d = \rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2)+\frac{1-\rho_2}{2}\frac{E_s}{E_n}(1-\Delta_3) > 0$, which is the denominator in (A.39). Then, setting (A.38) equal to (A.39) and rearranging, one obtains:

$$0 = \left[\rho_1(\Delta_1-\Delta_3)(\Delta_1-\Delta_2)+\Delta_d\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\right]\frac{da_D}{a_D} + \left[(1-\rho_1)(\Delta_2-\Delta_3)(\Delta_1-\Delta_2)-\Delta_d\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\right]\frac{da_{XN}}{a_{XN}}. \tag{A.40}$$

Since $\Delta_1-\Delta_2, \Delta_1-\Delta_3 > 0$, it follows that the coefficient of $\frac{da_D}{a_D}$ in (A.40) is positive. Moreover, using the definition of Δ_d, one can see that the coefficient of $\frac{da_{XN}}{a_{XN}}$ is strictly smaller than: $(1-\rho_1)(\Delta_2-\Delta_3)(\Delta_1-\Delta_2)-(1-\rho_1)(1-\Delta_2)\Delta_2$, which itself is already negative, since: $1-\Delta_2 > \Delta_1-\Delta_2 > 0$, and $\Delta_2 > \Delta_2-\Delta_3 > 0$. Thus, the coefficient of $\frac{da_{XN}}{a_{XN}}$ in (A.40) is negative. Since the linear combination in (A.40) is equal to 0, it follows that $sign(\frac{da_D}{d\eta}) = sign(\frac{da_{XN}}{d\eta})$.

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 (A.39) and that for $\frac{da_{XS}}{a_{XS}}$ from (A.25) into (A.36) to obtain:

$$\frac{\rho_2}{k-\varepsilon+1}\frac{\phi-1}{\varepsilon-\phi}\frac{dA_{ss}}{A_{ss}} = \left[\left((1-\rho_1)\frac{\phi-1}{\varepsilon-1}-1\right)\Delta_1-\frac{2\rho_1}{1-\rho_2}\frac{E_n}{E_s}\left(\frac{\varepsilon-1}{k-\varepsilon+1}\left(\rho_2\frac{\phi-1}{\varepsilon-\phi}+1\right)+\Delta_3\right) -\frac{\varepsilon-1}{k-\varepsilon+1}-\left((\Delta_1-\Delta_3)-(\Delta_1-\Delta_2)(1-\rho_1)\frac{\phi-1}{\varepsilon-1}\right)\frac{\rho_1(\Delta_1-\Delta_3)}{\Delta_d}\right]\frac{da_D}{a_D} + \left[-(1-\rho_1)\frac{\phi-1}{\varepsilon-1}\Delta_2-\frac{2(1-\rho_1)}{1-\rho_2}\frac{E_n}{E_s}\left(\frac{\varepsilon-1}{k-\varepsilon+1}\left(\rho_2\frac{\phi-1}{\varepsilon-\phi}+1\right)+\Delta_3\right) -\left((\Delta_1-\Delta_3)-(\Delta_1-\Delta_2)(1-\rho_1)\frac{\phi-1}{\varepsilon-1}\right)\frac{(1-\rho_1)(\Delta_2-\Delta_3)}{\Delta_d}\right]\frac{da_{XN}}{a_{XN}}. \tag{A.41}$$

Note that $(\Delta_1-\Delta_3)-(\Delta_1-\Delta_2)(1-\rho_1)\frac{\phi-1}{\varepsilon-1} > 0$, since: $\Delta_1-\Delta_3 > \Delta_1-\Delta_2 > 0$, $1-\rho_1 \in (0,1)$, and $\frac{\phi-1}{\varepsilon-1} \in (0,1)$. These conditions also imply that: $(1-\rho_1)\frac{\phi-1}{\varepsilon-1}-1 < 0$. It is then straightforward to see that the coefficients of both $\frac{da_D}{a_D}$ and $\frac{da_{XN}}{a_{XN}}$ in (A.41) are negative. From Lemma 1, recall that $\frac{dA_{ss}}{d\eta} < 0$. It follows then from (A.41) that $sign(\frac{da_D}{d\eta}) = sign(\frac{da_{XN}}{d\eta}) > 0$.

Rearranging (A.40) now implies:

$$\frac{\frac{1}{a_D}\frac{da_D}{d\eta}}{\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}} = \frac{-(1-\rho_1)(\Delta_2-\Delta_3)(\Delta_1-\Delta_2)+\Delta_d\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)}{\rho_1(\Delta_1-\Delta_3)(\Delta_1-\Delta_2)+\Delta_d\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)}. \tag{A.42}$$

It is easy to verify that the numerator of (A.42) is positive but smaller than the denominator; in particular, this is a consequence of $\Delta_1 > \Delta_2$. 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 stated in part (i) of Lemma 2A. Part (iii) of the lemma then holds immediately from (A.18) and (A.19).

As for part (ii) of the lemma, observe that (A.25) implies:

$$\frac{da_{XS}}{a_{XS}} = -\frac{2}{1-\rho_2}\frac{E_n}{E_s}\left(\rho_1\frac{da_D}{a_D}+(1-\rho_1)\frac{da_{XN}}{a_{XN}}\right) < 0. \tag{A.43}$$

At the same time, it is clear from (A.39) that $\frac{da_I}{a_I} < 0$. Now, subtracting (A.43) from (A.39) yields:

$$\frac{da_I}{a_I} - \frac{da_{XS}}{a_{XS}} = \left(-\frac{\Delta_1-\Delta_3}{\Delta_d}+\frac{2}{1-\rho_2}\frac{E_n}{E_s}\right)\rho_1\frac{da_D}{a_D} + \left(-\frac{\Delta_2-\Delta_3}{\Delta_d}+\frac{2}{1-\rho_2}\frac{E_n}{E_s}\right)(1-\rho_1)\frac{da_{XN}}{a_{XN}}. \tag{A.44}$$

One can 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) follows from the fact that $\frac{da_{XS}}{a_{XS}}$ and $\frac{dA_{sw}}{A_{sw}}$ share the same sign (from (A.20)). This concludes the proof of Lemma 2A.

We now proceed to establish that Proposition 1 continues to apply in the extended model with home-bias in the utility specification. Recall from the definitions of $HOR(a)$, $PLA(a)$ and $RET(a)$ in the main paper that the effects of η on these firm-level sales values are pinned down respectively by the derivatives of A_{sw}, A_{ew} and A_{ww} with respect to η. Lemma 2A then implies that when Southern financial development improves, $HOR(a)$ falls (since $\frac{dA_{sw}}{d\eta} < 0$), $PLA(a)$ increases (since $\frac{dA_{ew}}{d\eta} > 0$), and $RET(a)$ increases (since $\frac{dA_{ww}}{d\eta} > 0$). This establishes part (i) of the proposition.

Next, recall the expressions for the sales shares by destination listed in equations (2.23)-(2.25) in the main paper. One can see that $\frac{d}{d\eta}\frac{HORI(a)}{TOT(a)} < 0$, since both $\frac{A_{ww}}{A_{sw}}$ and $\frac{A_{ew}}{A_{sw}}$ increase with η. On the other hand, we have $\frac{d}{d\eta}\frac{PLAT(a)}{TOT(a)} > 0$, since 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 $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta} > 0$.) It remains to show that $\frac{d}{d\eta}\frac{RET(a)}{TOT(a)} > 0$ as well. From equation (2.25), it suffices to show that $\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ww}} + \frac{A_{ew}}{A_{ww}}$ decreases with η:

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

where '$\propto$' denotes equality up to a positive multiplicative term. (Note that we have used (A.18)-(A.20) in the last step above.) We now replace $\frac{da_{XS}}{d\eta}$ using the expression in (A.43). Also, based on the definitions from (A.3) and (A.4), one can show that: $\frac{A_{sw}}{A_{ew}} = \frac{E_s}{E_n}\frac{1-\rho_2}{2(1-\rho_1)}\frac{P_{ew}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}}$. Performing these substitutions and rearranging, we obtain:

$$\frac{d}{d\eta}\left(\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ww}}+\frac{A_{ew}}{A_{ww}}\right) \propto -\left[1+\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ew}}\left(\frac{E_n}{E_s}\frac{2\rho_1}{1-\rho_2}+1\right)\right]\frac{1}{a_D}\frac{da_D}{d\eta}+\left[1-\tau^{\varepsilon-1}\frac{P_{ew}^{1-\varepsilon}}{P_{sw}^{1-\varepsilon}}\right]\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}.$$

In this last equation, the coefficient of $\frac{1}{a_D}\frac{da_D}{d\eta}$ is clearly negative. 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 (A.15) and (A.16), we have:

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

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 $\tau^{1-\varepsilon} < 1$ and $V_N(a_{XN}) > V_N(a_I)$ (since $a_{XN} > a_I$). The coefficient of $\frac{1}{a_{XN}}\frac{da_{XN}}{d\eta}$ is thus negative as well. Since $\frac{da_D}{d\eta}, \frac{da_{XN}}{d\eta} > 0$, this implies: $\frac{d}{d\eta}\left(\tau^{\varepsilon-1}\frac{A_{sw}}{A_{ww}}+\frac{A_{ew}}{A_{ww}}\right) < 0$. Hence, $\frac{RET(a)}{TOT(a)}$ increases with η.

It remains for us to prove part (iii) of the proposition, which contains the implications of host-country financial development for the various aggregate measures of multinational activity. To pin down the effect on N_n, we solve for $\frac{dN_n}{N_n}$ from (A.31). First, applying Cramer's Rule to (A.26) and (A.27), we have:

$$\frac{dP_{ew}^{1-\varepsilon}}{P_{ew}^{1-\varepsilon}} = \rho_1\frac{\phi-1}{\varepsilon-\phi}\left(\frac{dA_{ww}}{A_{ww}}-\frac{dA_{ew}}{A_{ew}}\right)-\frac{dA_{ew}}{A_{ew}} = (\varepsilon-1)\left[\rho_1\frac{\phi-1}{\varepsilon-\phi}\left(\frac{da_D}{a_D}-\frac{da_{XN}}{a_{XN}}\right)-\frac{da_{XN}}{a_{XN}}\right]. \qquad \text{(A.45)}$$

Substituting from (A.45) into (A.31), replacing $\frac{da_I}{a_I}$ with the expression from (A.38), and rearranging yields:

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

To determine the sign of $\frac{dN_n}{N_n}$, divide the right-hand side of the above by $\frac{da_{XN}}{a_{XN}}$, and substitute in the expression for $\frac{da_D}{a_D}/\frac{da_{XN}}{d_{XN}}$ from (A.42). After some algebra, one can show that $sign(\frac{dN_n}{d\eta})$ is given by the sign of:

$$\begin{aligned}
& -\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\right)\left[\Delta_d\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)+\rho_1(\Delta_1-\Delta_2)(\Delta_1-\Delta_3)\right] \\
& -\rho_1\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\phi-1}{\varepsilon-\phi}(\Delta_1-\Delta_2)\left[\rho_1(\Delta_1-\Delta_3)+(1-\rho_1)(\Delta_2-\Delta_3)+\Delta_d\right] \\
& +(1-\Delta_2)\left[\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\rho_1(\Delta_1-\Delta_3)+\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)(1-\rho_1)(\Delta_2-\Delta_3)\right] \\
< & -\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\right)\left[(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)+\rho_1(\Delta_1-\Delta_2)(\Delta_1-\Delta_3)\right] \\
& -\rho_1\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\phi-1}{\varepsilon-\phi}(\Delta_1-\Delta_2)(1-\Delta_3) \\
& +(1-\Delta_2)\left[\left(\Delta_2+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)\rho_1(\Delta_1-\Delta_3)+\left(\Delta_1+\frac{\varepsilon-1}{k-\varepsilon+1}\frac{\varepsilon-1}{\varepsilon-\phi}\right)(1-\rho_1)(\Delta_2-\Delta_3)\right], \qquad \text{(A.46)}
\end{aligned}$$

where the inequality comes from applying: $\Delta_d > \rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2)$. We now collect all the terms in (A.46) in which $\frac{\varepsilon-1}{k-\varepsilon+1}$ does not appear. These are:

$$\begin{aligned}
& -\Delta_2\left[(\rho_1(1-\Delta_1)+(1-\rho_1)(1-\Delta_2))\Delta_1+\rho_1(\Delta_1-\Delta_2)(\Delta_1-\Delta_3)\right]+(1-\Delta_2)\left[\Delta_2\rho_1(\Delta_1-\Delta_3)+\Delta_1(1-\rho_1)(\Delta_2-\Delta_3)\right] \\
= & -\Delta_3\left[\rho_1\Delta_2(1-\Delta_1)+(1-\rho_1)\Delta_1(1-\Delta_2)\right] \\
< & \ 0.
\end{aligned}$$

This term is negative, since $\rho_1, \Delta_1, \Delta_2, \Delta_3 \in (0,1)$. Similarly, we collect the remaining terms in (A.46), all of which involve $\frac{\varepsilon-1}{k-\varepsilon+1}$, as follows:

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

since $\frac{\varepsilon-1}{k-\varepsilon+1}>0$. This completes the proof that $\frac{dN_n}{d\eta}<0$. As $\frac{da_I}{d\eta}$ is also negative, we thus have $\frac{1}{N_n}\frac{dN_n}{d\eta}+k\frac{1}{a_I}\frac{da_I}{d\eta}<0$, so that $\frac{d}{d\eta}\log N_nG_n(a_I)<0$.

Finally, we derive the effects of changes in η on the aggregate sales variables defined in equations (2.20)-(2.22) in the main paper. 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, we have just seen that N_n decreases in η. To show that HOR, PLA and RET all decline in η, it therefore suffices to prove that PLA 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 (2.21), we have:

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

To get from the first line above to the second, we have used the expression for $\frac{dN_n}{d\eta}$ from (A.31), and substituted for $\frac{dP_{ew}^{1-\varepsilon}}{d\eta}$ using (A.45). We have also used (A.18) and (A.19) 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 $\frac{d}{d\eta}\ln(PLA)<0$ 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 $\phi-1>0$ and $k-\varepsilon+1>0$. Thus, when η increases, the contraction in the extensive margin 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}. This concludes our proof that Proposition 1 continues to hold in the extended model with home-bias in consumption. ■

Proof of Proposition 3. For part (i) of the proposition, from the definitions of $PLA(a)$ and $RET(a)$, we have:

$$
\frac{d}{d\eta}(PLA(a)-RET(a))=(1-\alpha)\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon}A_{ww}\left(\frac{A_{ew}}{A_{ww}}\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta}-\frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right).
$$

We show first that $\frac{A_{ew}}{A_{ww}}>1$. From (A.3) and (A.4), we have:

$$
\frac{A_{ew}}{A_{ww}}=\left[\frac{V_N(a_D)+((\tau\omega)^{1-\varepsilon}-1)V_N(a_I)}{\tau^{1-\varepsilon}V_N(a_{XN})+((\tau\omega)^{1-\varepsilon}-\tau^{1-\varepsilon})V_N(a_I)}\right]^{\frac{\varepsilon-\phi}{\varepsilon-1}}. \tag{A.47}
$$

Observe that:

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

where the second-to-last step uses the fact that $V_N(a_D) > V_N(a_{XN})$ (since $a_D > a_{XN}$), while the final step holds because $\tau^{1-\varepsilon} < 1$. Since the exponent, $\frac{\varepsilon-\phi}{\varepsilon-1}$, is positive (as $\varepsilon > \phi > 1$), it follows that $\frac{A_{ew}}{A_{ww}} > 1$, as claimed. We thus have:

$$\frac{d}{d\eta}(PLA(a) - RET(a)) \;>\; (1-\alpha)\left(\frac{\tau a\omega}{\alpha}\right)^{1-\varepsilon} A_{ww}\left(\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} - \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right) \;>\; 0,$$

since $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}$ from Lemma 2A.

For part (ii) of the proposition, applying the quotient rule to the expressions for $\frac{PLA(a)}{TOT(a)}$ and $\frac{RET(a)}{TOT(a)}$ from (2.24) and (2.25) respectively, one obtains after some simplification that:

$$\begin{aligned}
\frac{d}{d\eta}\left[\frac{PLA(a)}{TOT(a)} - \frac{RET(a)}{TOT(a)}\right] \;\propto\;& \tau^{\varepsilon-1}\frac{A_{sw}}{A_{ew}}\left(1 - \frac{A_{ew}}{A_{ww}}\right)\frac{1}{A_{sw}}\frac{dA_{sw}}{d\eta} + 2\left(\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} - \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right) \\
& + \tau^{\varepsilon-1}\frac{A_{sw}}{A_{ew}}\left(\frac{A_{ew}}{A_{ww}}\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} - \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta}\right) \\
>\;& 0,
\end{aligned}$$

where the last inequality follows from: $\frac{1}{A_{ew}}\frac{dA_{ew}}{d\eta} > \frac{1}{A_{ww}}\frac{dA_{ww}}{d\eta} > 0 > \frac{1}{A_{sw}}\frac{dA_{sw}}{d\eta}$ (Lemma 2A), and $\frac{A_{ew}}{A_{ww}} > 1$.

Finally, part (iii) of the proposition can be established using the definitions for PLA and RET in equations (2.21) and (2.22), and following analogous steps to the proof used for part (i) above. ■