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Firm Reputation and Vertical FDI

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Abstract

This paper investigates a production firm's choice for FDI if this can involve reputational risk. I develop a theoretical model in which investments in a foreign production location can yield negative reactions from consumers. The results suggest that if reputational risk is equal among firms, the likelihood of a firm sorting into FDI increases in its productivity. Meanwhile, the sorting pattern changes if more productive firms experience more reputational risk. The sorting pattern into FDI then shows an inverse U-shape in productivity. Finally, I show that outsourcing can be an attractive strategy for firms not productive enough and firms too productive for FDI: although outsourcing involves a loss in firm productivity, it also requires less fixed investments and comes with less reputational risk than FDI.

Keywords: *Foreign Direct Investment, Reputation, Corporate Social Responsibility*

Contents

1 Introduction

In 2013, one of South Asia's largest industrial accidents took place when an eight-story garment factory in Bangladesh collapsed (The Economist, 2013). Not only the Bangladeshi government was held responsible for the accident, but also several large multinational firms such as Primark. These multinationals were accused of exploiting poorly paid workers and caring too little about their safety (Nauta, 2018).

From a theoretical perspective, it is not surprising that firms want to locate their manufacturing facilities in developing countries. Developing countries often have a large pool of cheap labor, attracting firms that engage in resource-seeking foreign direct investment (FDI) (Dunning, 2000). Moreover, the observation that mainly large multinationals were accused of exploiting low-wage workers is also in line with theoretical predictions on FDI. Existing models predict that the larger, more productive firms in the market are expected to benefit most from keeping marginal costs low by entering low-wage production locations (Antràs & Yeaple, 2014; Grossman, Helpman, & Szeidl, 2006).

A missing factor in these theoretical models is that especially large and productive firms could experience significant reputational damage after they are exposed of using an unethical production process. As illustrated above, the large multinationals involved in Bangladesh's industrial accident received elaborate negative media coverage. Moreover, Udayasankar (2008) and Green and Peloza (2014) suggest that the largest firms in the market might have the strongest incentive to show prosocial behavior, as these firms experience a strong degree of external pressure to do so. This raises the question of which types of firms are likely to produce through FDI if this involves reputational risk. On the one hand, larger firms might thus experience more negative reactions from consumers if they are exposed of socially irresponsible behavior at foreign production locations. On the other hand, existing models on FDI predict that larger firms benefit more from entering low-wage production locations than smaller firms.

Investigating this question not only adds to the literature on vertical FDI but could also have important implications for local authorities and international organizations that promote, for example, occupational safety and environmental standards. It could be relevant for these organizations to know whether reputational damage could induce certain firms to make more ethical

decisions in their value chain. Moreover, knowing which types of firms would be most affected by reputational risk is even more interesting.

In order to investigate which firms sort into vertical FDI when reputational risk is involved, I develop an extension to the model of Antràs and Yeaple (2014). More specifically, I assume that consumers dislike unethical behavior of firms. In addition, I consider the possibility for firms to choose between FDI and outsourcing when entering a foreign country.

Solving the model yields three main findings. First, the sorting pattern into production locations is unaffected compared to the literature as long as firms face a homogenous reputational risk. I also find that the firms that produce using FDI are on the upper part of the productivity spectrum, while the firms that opt for domestic production are in the middle of this spectrum. Second, I show that the sorting pattern into production locations changes if reputational risk grows in firm productivity. In this case, the sorting pattern into FDI exhibits an inverse U-shape. This implies that some relatively productive firms still engage in FDI but the most productive firms will not. This result is driven by the assumption that the benefit of FDI, low marginal costs, and the cost of FDI, reputational risk, grow in firm productivity. As the growth rate of these two is not identical, a critical point emerges. After this critical point, the cost outweighs the benefit. As a result, the probability of firms choosing FDI shows an inverse U-shape in productivity. Third, introducing the option to outsource production increases the number of firms operating in the foreign country. In contrast to the existing literature, I find that these outsourcing firms do not need to be less productive than those that opt for FDI. The intuition behind this result is that outsourcing involves relatively low fixed costs and limited reputational risks. Especially the latter consequence could be relevant for the more productive firms.

The remainder of this paper is structured as follows. In the next section, I present an overview of the relevant literature on FDI, firm reputation, and corporate social responsibility. Section 3 gives an outline of the baseline model. Section 4 presents the results of this baseline model. Section 5 considers how the results from the baseline model change if reputational damage grows in firm productivity. Section 6 studies how outsourcing could affect the sorting pattern into production modes. The paper ends with a conclusion and discussion.

2 Literature Review

2.1 OLI Framework

A wide range of papers has been written to investigate the determinants of FDI. Faeth (2009) presents an overview of nine models attempting to explain FDI. One of these models is the eclectic paradigm or OLI framework, as developed by Dunning (1980, 2000). This framework describes three advantages that increase firms' likelihood of engaging in FDI. These include an ownership-specific advantage, a locational advantage, and an internalization advantage. Ownership-specific advantages refer to assets that a firm possesses but its competitors do not. Examples of these ownership advantages include proprietary technology or a good reputation (Antràs & Yeaple, 2014). Locational advantages in a foreign country exist when it is more profitable for a firm to exploit assets in that specific country than in the home country. Finally, an internalization advantage exists when a firm benefits from performing an activity in-house rather than licensing the right to a third party.

While these advantages can thus influence whether a firm engages in FDI, the exact effect of each advantage can differ between firms. That is, the impact of these three advantages on a firm is highly context-specific (Dunning, 2000). The economic and political situation in the home and foreign country, the industry, and firm-specific characteristics can, for example, influence how a firm responds to each advantage. Another important contextual factor is a firm's motive behind FDI. The literature describes four motives for FDI: market seeking, resource seeking, efficiency seeking, and strategic asset seeking (Dunning, 1998). The first motive refers to FDI designed to satisfy a foreign country's region or market. The second type, resource-seeking FDI, can be used to exploit natural resources in a foreign country. These natural resources include raw materials and unskilled labor. The third motive refers to promoting efficiency by improving, for example, the division of labor. Finally, strategic asset seeking is used to improve the competitive advantage by protecting or improving ownership-specific advantages. As certain motives might be more important for particular firms, significant differences in FDI can emerge between firms.

2.2 Theoretical Models on FDI

Firm Heterogeneity and Multinational Activity

Clearly, the Neoclassical models do not exploit the context-specific heterogeneity to explain multinational activities. In contrast, the models of the new-new trade theory do integrate this heterogeneity in their general equilibrium frameworks (Antràs & Yeaple, 2014). More specifically, these models have explained why, given cost differences between countries, not all firms operate affiliates in low-wage countries to perform labor-intensive activities (Krugman, Obstfeld, & Melitz, 2015). The models of the new trade theory provided an important starting point in the development of the new-new trade theory. These models provided a framework in which product differentiation and imperfect competition could explain trade. For instance, Dixit and Stiglitz (1977) describe a market with monopolistic competition and show that consumers prefer variety by modeling preferences using a CES utility function. Krugman (1979, 1980) uses a simplified version of this model to show that economies of scale can induce trade, even in the absence of differences in taste, technology, or factor endowments between countries.

These new trade theory models have been extended in various ways to explain FDI flows. Helpman (1984) applies the model of Dixit and Stiglitz (1977) to explain why certain firms become multinationals. Helpman's paper shows that firms can become multinationals to exploit cross-country differences in factor prices by shifting activities to the cheapest locations. Melitz (2003) extends the model of Krugman (1980) by introducing differences in firm productivity. By introducing this firm heterogeneity, the author could explain why only a fraction of firms export their products: only the most productive firms find it profitable to enter the export market.

Using Helpman (1984) as a starting point, Antràs and Yeaple (2014) have developed a theoretical model to explain vertical FDI flows. The difference between the two models is that in the model of Antràs and Yeaple (2014), cross-country differences in factor prices emerge due to different technologies. The analysis of Helpman (1984) relies on differences in relative factor endowments across countries. In addition, the model of Antràs and Yeaple (2014) also incorporates firm heterogeneity, comparable to Melitz (2003). The results of their paper are also similar to the results of Melitz (2003): only the most productive firms within an industry find it profitable to engage in FDI. The intuition behind this result is as follows. Firms can locate the labor-intensive

activities of their supply chain in a foreign country. The main benefit of operating in this foreign affiliate is that the wages in the foreign country are lower than in the home country. As a result, the marginal costs of production are lower if firms open a foreign affiliate than when they perform all production in the home country. The main cost of vertical FDI is that opening a foreign plant comes with additional fixed costs. The benefits will outweigh the costs if the firm has a sufficient level of production and sales. Consequently, a sorting pattern emerges in which only the most productive firms find it profitable to engage in FDI.

Outsourcing versus FDI

In explaining why firms might choose to produce in a foreign country rather than produce in the home country, the literature has also paid attention to why firms might prefer FDI over outsourcing. There are multiple theoretical models that aim to capture this internalization decision. Helpman (2006) presents an overview of several of these models. A returning element in these models is that incomplete contracts between final good producers and input suppliers can explain why some firms might prefer FDI over outsourcing. For example, Antras and Helpman (2004) combine the incomplete contracts approach with input intensity and firm heterogeneity to explain the sorting pattern of firms into specific organizational forms. A primary result of the paper is that in headquarter-intensive sectors, the most productive firms opt for FDI. In addition, they also find that firms that exit the market are the least productive. Hence, outsourcing firms are expected to be in the middle of the productivity spectrum.

Moreover, Helpman (2006) also highlights papers that discuss the negative consequence of incomplete contracts. Among these is the paper of Acemoglu, Antràs, and Helpman (2007), which describes that incomplete contracts can result in a productivity loss. The result is driven by the assumption that less sophisticated technologies are less productive than their more sophisticated counterparts. As contract incompleteness leads to firms choosing less sophisticated production technologies, firms lose productivity when outsourcing production.

2.3 Firm Reputation and FDI

While the OLI framework incorporates the role of firm reputation in deciding to engage in FDI, this is not necessarily the case for the theoretical models described above. That is, firm reputation can be seen as an ownership advantage, as it can give firms a competitive advantage

(Faeth, 2009). In addition, firms can have an internalization advantage if it is more efficient for a firm to perform activities in-house than licensing them to protect its reputation. The theoretical models described in Section 2.2 do not explicitly mention firm reputation as a determinant for FDI: multinational activity is predominantly explained by cross-country differences. Important to note is that these models could implicitly incorporate some form of firm reputation: reputation could provide firms some market power or cost advantage, which could then explain firm heterogeneity (Antràs & Yeaple, 2014).

However, neither the eclectic paradigm nor the theoretical models acknowledge that FDI could harm a firm's reputation. Meantime, anecdotal evidence does suggest that there are cases in which operating in developing countries could harm a firm's reputation. As illustrated in the introduction, multinational firms were held accountable for the industrial accident in Bangladesh. Another example relates to firms that (used to) have part of their supply chain in Xinjiang. As there is global outrage over the crimes committed against the Uyghur population, many firms fear boycotts if exposed of their connection to production locations or strategic partnerships with Chinese companies from that region (The Economist, 2022; Kelly, 2020). Finally, many companies have pulled back from selling in Russia as a response to its invasion of Ukraine. While moral reasons could drive this behavior, it is plausible that the desire to mitigate reputational damage also plays an essential role (Buchanan Pitrelli, 2022). The case of L'Occitane illustrates this. While the cosmetics brand initially planned on continuing business in Russia, it decided to close its Russian shops after consumers criticized its decision and called for a boycott (Corp, 2022).

Overall, the anecdotal evidence suggests that there are cases in which FDI can give firms a bad reputation. The financial literature has broadly investigated whether a bad reputation could be negative for a firm's financial performance. Klassen and McLaughlin (1996) find that the stock market rewards firms that have won an award for their environmental performance. Meantime, firms that were involved in environmental crises are found to have significant negative returns. Capelle-Blancard and Laguna (2010) find similar evidence. Their paper analyzes stock market returns after industrial accidents in chemical plants and refineries. The authors find that the stock market instantly reacts negatively after an accident. The size of these short-term losses grows in the severity of the accident. In the long-term, stocks of firms involved in accidents in-

volving human harm or pollution were negatively affected. Finally, Krüger (2015) also finds that investors respond strongly negatively to news about a firm's social responsibility. The negative reaction is particularly extreme to negative news about communities and the environment.

2.4 Corporate Social Responsibility

The examples above show that firms might avoid certain countries or regions to prevent involvement in scandals or adverse situations. This behavior could be driven by efforts in corporate social responsibility (CSR), which implies that firms take into account the impact of their value chain on societal outcomes.[1] Several theories can explain why firms might engage in CSR. The theory that is the most closely related to the examples from Section 2.3 is the theory of delegated philanthropy. This vision implies that stakeholders, such as consumers, demand corporations engage in philanthropy on their behalf (Bénabou & Tirole, 2010). These stakeholders are thus willing to sacrifice money to reach specific social goals. Consumers might want firms to behave prosocially rather than doing good on their own because they want firms to refrain from specific behavior. For example, consumers might want firms to refrain from polluting the environment and exploiting workers.

Finally, an interesting observation is that the literature on CSR mainly focuses on large and publicly traded corporations (Lee, 2008). One potential reason for this could be that the largest firms in the market are most likely to be involved in CSR: Udayasankar (2008), for example, argues that the smallest and largest firms in the market have the strongest incentive to participate in CSR. In contrast, middle-sized firms have minor participation. The author contends that the firms with a large scale of operation have a solid incentive to participate in CSR, as they are highly visible. Hence, they could experience strong external pressure to participate in CSR initiatives. Green and Peloza (2014) also provide an explanation for the prediction that the largest firms in the market might be most willing to participate in CSR. Using interview data from North America, the authors find that consumers distrust large firms and expect them to be more engaged in CSR than smaller firms. Moreover, they find that consumers are less willing to accept socially irresponsible behavior by large firms than by small firms.

[1] An alternative explanation could be that investing in countries or regions with, for example, high labor standards leads to direct economic benefits for firms. Kucera (2002) explains that higher labor standards can lead to more political and social stability and more investments in human capital. As both effects can foster economic growth, firms might be attracted to invest in countries with high standards. However, it should be noted that empirical evidence for this hypothesis is mixed (Olney, 2013).

One could argue that the models of the new-new trade theory do not support these predictions. Antràs and Yeaple (2014) suggest that the largest, most productive firms in the market are the most likely to invest in low-wage countries. This seems in sharp contrast to the result that the largest firms are most likely to participate in CSR. After all, anecdotal evidence suggests that FDI could involve significant scandals. The main reason why the predictions from the CSR literature differ from the predictions of the new-new trade theory is that the latter models do not incorporate any form of adverse consequences that FDI might bring. This paper will, therefore, extend the models of the new-new trade theory by introducing firm reputation as a factor that could influence firm profit.

3 Model

To investigate which firms are likely to select into FDI if reputational risk is involved, the model of Antràs and Yeaple (2014) will be used as a starting point.

3.1 Agents

Firms

The first group of agents is a number of firms. Let each firm be denoted by i, where $i \in \{1, 2, ..., n\}$. The firms offer a heterogeneous product, such that the market in which they compete can be characterized by monopolistic competition. Furthermore, they differ in productivity $a_i \in (0, \infty)$. Productivity is exogenously determined.

Each firm maximizes its profits. Firms optimize their pricing and production strategy. Assume that there are two countries, $j \in \{H, F\}$. Consumption only takes place in country H, which implies the optimal pricing strategy only depends on the consumers in that country.

Assume that the production process of a firm consists of two stages: manufacturing and headquarter (HQ) services. Let these activities be denoted by m and h, respectively. The intensity of HQ services in the production process is given by $\beta \in (0, 1)$, while the intensity of manufacturing is given by $1 - \beta$. The production function of firm i can, therefore, be given by the following Cobb-Douglas function:

$$q_i = a_i \Big(\frac{h}{\beta}\Big)^{\beta} \Big(\frac{m}{1-\beta}\Big)^{1-\beta} \tag{3.1}$$

Assume that HQ services will always take place in H. Manufacturing can take place in H or F. If a firm has all activities in H, it uses only domestic production. Let the fixed costs of domestic production be given by v_H. If a firm locates its manufacturing activities in F, it is said to be involved in FDI. The benefit of FDI over domestic production is that the wage in F is lower than in H: $w_F < w_H$. Meanwhile, FDI comes with iceberg transportation costs $\tau > 1$. In order to limit the analysis to interesting cases, I assume $w_H > \tau w_F$. In addition, FDI comes with higher fixed costs compared to domestic production: let the fixed costs of FDI be given by $v_F + v_H$.

To simplify the model, assume that one unit of h or m can be produced with one unit of labor. This yields two relevant profit functions for firm i. The complete derivation for these profit functions can be found in Appendix A. First, the profit function when a firm locates all production stages in H is given by:

$$\pi_i^H = \Big(p_i - \frac{w_H}{a_i}\Big) q_i - v_H \tag{3.2}$$

Second, profit under FDI is equal to:

$$\pi_i^{FDI} = \left(p_i - \frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right) q_i - v_H - v_F \tag{3.3}$$

Until this point, the set-up of the model is identical to the model of Antràs and Yeaple (2014). The novelty of this model lies in the assumption that investing in country F could be problematic for a firm's reputation. For example, labor or safety standards could be poor in country F, which could lead to exploitation of workers or even industrial accidents. These negative events could harm a firm's reputation. To capture the possibility of a negative event in country F, I introduce a new variable: s_j. This variable represents the state of the world in country j. If a negative event occurs, the world's state is bad: $s_j = b$. Let the probability that the state of the world is bad in country F be denoted by ρ, such that $Pr(s_F = b) = \rho$, where $\rho \in (0, 1)$. As I assume these negative events do not occur in country H, it must be that $Pr(s_H = b) = 0$. If no negative event occurs, the world's state is good: $s_j = g$.

Consumers

The consumers form the second group of agents. These consumers aim to maximize their utility. Each consumer has a budget w to spend on products. Let the total budget of all consumers in country H be denoted by Y. All consumers substitute imperfectly between the heterogeneous products of the sellers and have an identical CES utility function:

$$U = \left[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

In this function, c_i equals the number of products a consumer buys from firm i. Furthermore, σ measures the elasticity of substitution between goods, where $\sigma > 1$. Following Crozet and Erkel-Rousse (2004), α_{is_j} can be interpreted as a quality parameter and captures how consumers perceive a firm.[2] This parameter depends on the state of the world s_j in country j where firm i has its manufacturing site. More specifically, α_{is_j} is modeled as:

$$\alpha_{is_j} = \begin{cases} 1 & \text{if } i \text{ locates manufacturing in country } H \\ 1 & \text{if } i \text{ locates manufacturing in country } F \text{ and } s_F = g \\ \phi & \text{if } i \text{ locates manufacturing in country } F \text{ and } s_F = b \end{cases}$$

Where $\phi < 1$. The equation above illustrates that if the state of the world is good, the quality parameter is equal to 1. The utility function is then identical to the utility function in Antràs and Yeaple (2014). However, the parameter becomes smaller than 1 if a consumer buys from a firm that produces in the bad state of the world.

3.2 Timing

The timing of the events is as follows. First, Nature assigns each firm i a productivity level a_i and determines the state of the world in country F. Firms and consumers then learn the productivity a_i of each firm i. In addition, firms learn the state of the world in country F. Based on this information, firms can exit or enter the market. If they enter, they choose their production locations. Consumers observe these locations and form beliefs on the state of the world in country F. Firms set their optimal prices, and transactions occur between consumers

[2] Alternatively, I could model quality is a utility shifter: see, for example, Piveteau and Smagghue (2019). However, this utility shifter cannot always correctly capture a negative quality, while the set-up presented above can.

and firms. After these transactions, consumers learn the state of the world at the manufacturing locations. Finally, payoffs are realized.

The model can be solved using backward induction. The solution concept is a perfect Bayesian equilibrium.

4 Vertical FDI and Firm Reputation

4.1 Consumers

As described in the model outline, consumers aim to maximize their (expected) utility given their budget constraint. The following Lagrangean can be used to solve this problem:

$$\mathcal{L} = \left[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} - \lambda(\Sigma_i p_i c_i - w) \tag{4.1}$$

Theoretically, there are three possible scenarios to form the first-order conditions for consumers. That is, consumers can observe that a) all firms produce domestically; b) all firms produce using FDI; c) some firms produce domestically, and some firms produce using FDI. Which of these three cases emerges depends on the model's parameter values. As this paper aims to explain the sorting pattern into different production modes, I will focus on the parameter values that allow the third case to emerge. In Appendix B, I explain under which parameter values this case can emerge in the baseline model.

First, consider a firm that produces domestically. In this case, consumers do not experience any uncertainty about the utility they will derive from buying from this seller. If a consumer wants to buy from seller k that has all production in H, the following condition must therefore be met:

$$\frac{\partial \mathcal{L}}{\partial c_k} = \frac{\sigma}{\sigma-1}\left[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}-1} \frac{\sigma-1}{\sigma} \alpha_{ks_j} c_k^{\frac{\sigma-1}{\sigma}-1} - \lambda p_k = 0 \tag{4.2}$$

If production fully takes place in H, we know that $\alpha_{ks_j} = 1$. This gives:

$$\frac{\sigma}{\sigma-1}\left[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}-1} \frac{\sigma-1}{\sigma} * 1 * c_k^{\frac{\sigma-1}{\sigma}-1} = \lambda p_k \tag{4.3}$$

Meanwhile, consumers experience uncertainty if they buy from a seller involved in FDI. Suppose

a consumer observes that seller k' has its manufacturing activities located in country F. Let a consumer's belief that the state of the world is bad in country F be denoted by f. If the state of the world is bad, an adverse event takes place. In that case, $\alpha_{k's_j} = \phi$. Consumers believe the firm is not involved in such an event with a probability of $1 - f$. The quality parameter is then given by $\alpha_{k's_j} = 1$. The first-order condition is thus based on the expected utility of the consumer:

$$\frac{\partial \mathcal{L}}{\partial c_{k'}} = \frac{\sigma}{\sigma - 1}\Big[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\Big]^{\frac{\sigma}{\sigma-1}-1}\Big(f\frac{\sigma-1}{\sigma}\alpha_{k's_j}c_{k'}^{\frac{\sigma-1}{\sigma}-1} + (1-f)\frac{\sigma-1}{\sigma}\alpha_{k's_j}c_{k'}^{\frac{\sigma-1}{\sigma}-1}\Big) - \lambda p_{k'} = 0 \quad (4.4)$$

$$\frac{\sigma}{\sigma - 1}\Big[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\Big]^{\frac{\sigma}{\sigma-1}-1}\Big(f\frac{\sigma-1}{\sigma}\phi c_{k'}^{\frac{\sigma-1}{\sigma}-1} + (1-f)\frac{\sigma-1}{\sigma} * 1 * c_{k'}^{\frac{\sigma-1}{\sigma}-1}\Big) = \lambda p_{k'} \quad (4.5)$$

It is important to stress that the left-hand side of equation 4.5 can only be positive if $(f\phi+1-f) > 0$. As this left-hand side represents the marginal utility of buying from seller k', it needs to be positive to have an equilibrium in which FDI and domestic production coexist. This result is intuitive: consumers only buy goods produced using FDI if they believe the probability that a firm is involved in an adverse event is sufficiently small or if the quality parameter ϕ is sufficiently large.

To find which firms could sort into FDI, I therefore assume $(f\phi + 1 - f) > 0$ holds. Combining equations 4.3 and 4.5 yields the following optimal ratio for the two products:

$$\frac{\frac{\sigma}{\sigma-1}\Big[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\Big]^{\frac{\sigma}{\sigma-1}-1}\frac{\sigma-1}{\sigma} * 1 * c_k^{\frac{\sigma-1}{\sigma}-1}}{\frac{\sigma}{\sigma-1}\Big[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\Big]^{\frac{\sigma}{\sigma-1}-1}\Big(f\frac{\sigma-1}{\sigma}\phi c_{k'}^{\frac{\sigma-1}{\sigma}-1} + (1-f)\frac{\sigma-1}{\sigma} * 1 * c_{k'}^{\frac{\sigma-1}{\sigma}-1}\Big)} = \frac{\lambda p_k}{\lambda p_{k'}} \quad (4.6)$$

$$c_k = c_{k'}\left(\frac{p_k(1-f+f\phi)}{p_{k'}}\right)^{-\sigma} \quad (4.7)$$

This optimal ratio can be used in the third condition, the budget restriction. This budget restriction is given by:

$$\mathcal{L}'_{\lambda} = -\Sigma_i p_i c_i + w = 0 \Leftrightarrow w = \Sigma_i p_i c_i \tag{4.8}$$

Suppose that seller i uses domestic production, similar to seller k. Furthermore, suppose that seller i' engages in FDI, like seller k'. Plugging the optimal ratio as found in equation 4.7 into the budget restriction gives:

$$w = \Sigma_i p_i c_i = \Sigma_i p_i c_{i'} \left(\frac{p_i(1 - f + f\phi)}{p_{i'}} \right)^{-\sigma} \Leftrightarrow c_{i'} = \frac{w}{\Sigma_i p_i^{1-\sigma}} p_{i'}^{-\sigma} (1 - f + f\phi)^{\sigma} \tag{4.9}$$

Since the total budget of all consumers in country H can be denoted by Y, the total demand for firm i' is equal to:

$$q_{i'} = \frac{Y}{\Sigma_i p_i^{1-\sigma}} p_{i'}^{-\sigma} (1 - f + f\phi)^{\sigma} \tag{4.10}$$

Furthermore, the demand for firm i that only uses domestic production can be found by setting $f = 0$ in equation 4.10. Demand is then given by:

$$q_i = \frac{Y}{\Sigma_i p_i^{1-\sigma}} p_i^{-\sigma} \tag{4.11}$$

4.2 Firms

Now that the consumers' incentives are considered, firm behavior can be investigated. To investigate which firms could prefer FDI over domestic production, comparing the profit under both alternatives is essential.

Complete Domestic Production

First, the profit under domestic production for firm i is given by the following function:

$$\pi_i^H = \left(p_i - \frac{w_H}{a_i} \right) \frac{Y}{\Sigma_i p_i^{1-\sigma}} p_i^{-\sigma} - v_H \tag{4.12}$$

Given this profit function, the optimal price can be found by taking the derivative with respect to p_i:

$$\frac{\partial}{\partial p_i} \left[\left(p_i - \frac{w_H}{a_i} \right) \frac{Y}{\Sigma_i p_i^{1-\sigma}} p_i^{-\sigma} - v_H \right] = 0 \tag{4.13}$$

$$p_i^* = \frac{\sigma}{\sigma - 1} \frac{w_H}{a_i} \tag{4.14}$$

Plugging this optimal price into the profit function yields:

$$\pi_i^H = \Big(\frac{\sigma}{\sigma - 1} \frac{w_H}{a_i} - \frac{w_H}{a_i}\Big) \frac{Y}{\Sigma_i p_i^{1-\sigma}} \Big(\frac{\sigma}{\sigma - 1} \frac{w_H}{a_i}\Big)^{-\sigma} - v_H \tag{4.15}$$

Vertical FDI

Next, if firm i would open a manufacturing site in F, its profit would be given by:

$$\pi_i^{FDI} = \left(p_i - \frac{w_H^\beta (w_F \tau)^{1-\beta}}{a_i}\right) \frac{Y}{\Sigma_i p_i^{1-\sigma}} p_i^{-\sigma} (1 - f + f\phi)^\sigma - v_H - v_F \tag{4.16}$$

Again, the optimal price can be found by taking the first-order derivative with respect to p_i:

$$\frac{\partial}{\partial p_i} \left[\left(p_i - \frac{w_H^\beta (w_F \tau)^{1-\beta}}{a_i}\right) \frac{Y}{\Sigma_i p_i^{1-\sigma}} p_i^{-\sigma} (1 - f + f\phi)^\sigma - v_H - v_F \right] = 0 \tag{4.17}$$

$$p_i^* = \frac{\sigma}{\sigma - 1} \frac{w_H^\beta (w_F \tau)^{1-\beta}}{a_i} \tag{4.18}$$

Remarkably, the optimal price does not depend on either the consumers' belief f or the quality parameter ϕ. This result is driven by the fact that these variables work as a constant demand shifter. As a result, these variables do not influence the optimal price. Using this optimal price, the FDI profit function is given by:

$$\pi_i^{FDI} = \left(\frac{\sigma}{\sigma - 1} \frac{w_H^\beta (w_F \tau)^{1-\beta}}{a_i} - \frac{w_H^\beta (w_F \tau)^{1-\beta}}{a_i}\right) \frac{Y}{\Sigma_i p_i^{1-\sigma}} \Big(\frac{\sigma}{\sigma - 1} \frac{w_H^\beta (w_F \tau)^{1-\beta}}{a_i}\Big)^{-\sigma} (1 - f + f\phi)^\sigma - v_H - v_F \tag{4.19}$$

4.3 Equilibrium

The profit resulting from domestic production and FDI can be compared to determine which firms will likely sort into FDI. In this analysis, I focus on pure strategies. In Appendix C, I

explain that the possibility of playing mixed strategies does not alter the conclusions from the pure strategy equilibrium.

In equilibrium, firms can exit the market, produce domestically, or produce using FDI. First, it is relevant to see that both the profit under domestic production and the profit under FDI strictly increase in productivity:

$$\frac{\partial \pi_i^H}{\partial a_i} = \left(\frac{\sigma}{\sigma-1} w_H\right)^{1-\sigma} \frac{1}{\sigma}(\sigma-1) a_i^{\sigma-2} \frac{Y}{\Sigma_i p_i^{1-\sigma}} > 0 \qquad \forall a_i \tag{4.20}$$

$$\frac{\partial \pi_i^{FDI}}{\partial a_i} = \left(\frac{\sigma}{\sigma-1} w_H^{\beta}(w_F \tau)^{1-\beta}\right)^{1-\sigma} \frac{1}{\sigma}(\sigma-1) a_i^{\sigma-2} \frac{Y}{\Sigma_i p_i^{1-\sigma}} (1-f+f\phi)^{\sigma} > 0 \qquad \forall a_i \tag{4.21}$$

In other words, more productive firms consistently earn more profit than their less productive competitors in equilibrium. This reveals that the firms that exit the market must be relatively unproductive.

Alternatively, the proof of this result can be found by solving $\pi_i^H < 0$ for a_i. In Appendix B, I explain why there does not exist a value of a_i for which $\pi_i^H < 0$ and $\pi_i^{FDI} > 0$ in the baseline equilibrium. Hence, it is sufficient to check for which firms $\pi_i^H < 0$ is true. Using the profit from equation 4.15, one can see that firms exit the market if:

$$a_i < \left(\frac{v_H}{\left(\frac{\sigma}{\sigma-1} w_H\right)^{1-\sigma} \frac{1}{\sigma} \frac{Y}{\Sigma_i p_i^{1-\sigma}}}\right)^{\frac{1}{\sigma-1}} \tag{4.22}$$

Next, firms choose FDI if condition 4.22 is not met and FDI yields strictly more profit than domestic production. In Appendix B, I show that the derivative of π_i^{FDI} with respect to a_i must be larger than the derivative of π_i^H with respect to a_i to have an equilibrium in which FDI and domestic production coexist. This condition already reveals that the firms that prefer FDI over domestic production are likely on the upper end of the productivity spectrum. Comparing the profit under FDI and domestic production yields the same prediction:

$$\left(\frac{\sigma}{\sigma-1}\frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}(1-f+f\phi)^{\sigma}-v_H-v_F> \left(\frac{\sigma}{\sigma-1}\frac{w_H}{a_i}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}-v_H \quad (4.23)$$

$$a_i > \left(\frac{v_F}{\left(\frac{\sigma}{\sigma-1}w_H^{\beta}(w_F\tau)^{1-\beta}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}(1-f+f\phi)^{\sigma}-\left(\frac{\sigma}{\sigma-1}w_H\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}}\right)^{\frac{1}{\sigma-1}} \quad (4.24)$$

This expression shows that only firms with sufficiently high values of a_i prefer FDI over domestic production.[3] Another notable observation is that the minimum productivity level for which firms prefer FDI over domestic production decreases in $(1-f+f\phi)$. This means that the lowest productivity level for firms choosing FDI over total production in H increases in f and decreases in ϕ. This result is intuitive: relatively large values of f mean that consumers believe it is likely that firms are involved in negative events. Hence, they are less willing to buy from these firms. This decreases the profitability of FDI, which increases the minimum productivity value for which firms choose FDI. Similarly, if ϕ increases, consumers derive less disutility from buying from firms involved in an adverse event. This increases the profitability of FDI and decreases the productivity cutoff for FDI.

Finally, the firms for which neither condition 4.22 nor condition 4.24 hold choose for domestic production. These firms must be in the middle of the productivity spectrum.

A final step in describing the equilibrium is to check whether consumers' beliefs are consistent. This is the case. Given a firm's productivity and consumer beliefs, a firm will always have a dominant strategy. Hence, if consumers observe that a firm chooses FDI, we know that $f = \frac{\rho*1}{\rho*1+(1-\rho)*1} = \rho$. As we have that $\rho \in (0,1)$, condition $(1-f+f\phi) > 0$ may be met, such that it is sequentially rational for consumers to buy from firms that have their manufacturing located in country F. In addition, given that firms find it most attractive to use domestic pro-

[3] Relevant to stress is that this result is viable, as the right-hand side of equation 4.24 will always be a positive number. As explained in Appendix B, I only consider parameter values for which $\left(w_H^{\beta}(w_F\tau)^{1-\beta}\right)^{1-\sigma}(1-f+f\phi)^{\sigma} > w_H^{1-\sigma}$ is true. As a result, both the numerator and the denominator of the right-hand side of equation 4.24 are positive.

duction, it is also sequentially rational for consumers to buy from these firms. After all, there is no uncertainty in this case.

The equilibrium sorting pattern is also depicted in Figure 1: firms on the lower part of the productivity spectrum cannot make any profit and will exit the market. Next, the firms in the middle of the productivity spectrum find it most profitable to produce only in H. Finally, there is a group of firms for which FDI is more profitable than domestic production, regardless of the state of the world. These are the most productive firms in the market.

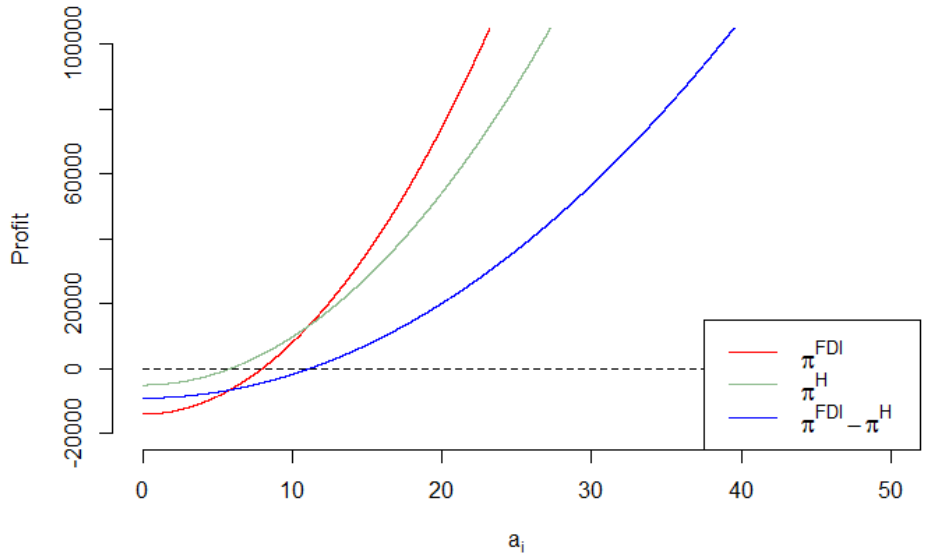

Figure 1: Profit under production through FDI, complete production in H and the difference between these two. Used parameter values: $\sigma = 3$, $\frac{Y}{\Sigma_i p_i} = 1000$, $w_H = 1$, $w_F = 0.6$, $\tau = 1.1$, $\beta = 0.5$, $v_H = 5000$, $v_F = 9000$, $\phi = 0.5$ and $f = \rho = 0.01$.

Comparing these results to the literature reveals that introducing a fixed level of reputational risk for all firms does not alter the existing predictions on sorting behavior into production locations. Given that some firms produce domestically and some firms produce using FDI, Antràs and Yeaple (2014) predict the same pattern: only the most productive firms in the market can profitably pursue an FDI strategy. The only difference between the results described above and those of Antràs and Yeaple (2014) is that the productivity cutoff value for which firms can profitably engage in FDI is larger in this analysis. This can be attributed to the assumption that consumers value products produced in the bad state of the world less than goods produced in the good state of the world. As a result, the profitability of FDI is reduced with a certain factor

in this analysis.

The similarity with the literature is driven by the fact that the reputational risk functions as a constant demand shifter for the products produced using FDI. As a result, the excess profit of FDI over domestic production still strictly increases in productivity. This means that the baseline model cannot explain the predictions from the CSR literature that the largest firms in the market might be most willing to participate in CSR. This raises the question of whether it is plausible that all firms experience the same level of reputational damage when engaging in FDI. The next section will, therefore, consider the possibility for the reputational damage to vary by firm productivity.

5 Reputational risk and Firm Productivity

Consider the set-up of the baseline model, but now with the quality parameter a_{is_j} given by:

$$\alpha_{is_j} = \begin{cases} 1 & \text{if } i \text{ locates manufacturing in country } H \\ 1 & \text{if } i \text{ locates manufacturing in country } F \text{ and } s_F = g \\ \phi(a_i) & \text{if } i \text{ locates manufacturing in country } F \text{ and } s_F = b \end{cases}$$

Where $\phi(a_i)$ is a concave and strictly decreasing function in a_i, such that $\frac{\partial \phi(a_i)}{\partial a_i} < 0$ and $\frac{\partial}{\partial a_i}\left(\frac{\partial \phi(a_i)}{\partial a_i}\right) \leq 0$ with $\lim_{a_i \to 0^+} \phi(a_i) < 1$. This assumption ensures that the consumer disutility of buying from a firm that operates in the bad state of the world is larger for more productive firms.

This assumption is plausible for three reasons. First, more productive firms have a relatively high level of production and are, therefore, likely to have larger production sites. Adverse events at larger production sites are likely to get more negative news coverage than smaller incidents. As a result, accidents of more productive firms can yield more negative reactions from consumers than accidents of less productive firms. Second, consumers could have higher expectations in terms of CSR efforts of more productive firms compared to less productive firms. After all, productive firms might have more resources or power to achieve certain social outcomes compared to less productive firms. This second argument is illustrated by consumer interview data from Green

and Peloza (2014): their interviews suggest that consumers have relatively high expectations of the CSR behavior of larger corporations, as they have more power than smaller firms. Third, more productive firms might experience more brand recognition from consumers compared to less productive firms. If a consumer buys a product from such a productive firm and firm reputation is damaged, other consumers might recognize that the consumer has an unethically produced product. This could also reduce the utility a consumer receives from buying the product.

The next sections describe which firms are likely to opt for FDI under this alternatively defined quality parameter.

5.1 Consumers

Similar to the baseline model, consumers will only derive a positive expected marginal utility from buying from a firm engaged in FDI if $(1 - f + f\phi(a_i)) > 0$. It is important to note that larger values of a_i now have a negative effect on the quality parameter, $\phi(a_i)$. Larger values of a_i make it, therefore, less likely that $(1 - f + f\phi(a_i)) > 0$ is met. This observation already reveals that the largest firms in the market might not necessarily be the most likely to opt for FDI anymore. To find which firms might have an incentive to invest in country F, I will again only consider combinations of f and $\phi(a_i)$ for which this condition is met.

5.2 Equilibrium

Again, firms exit the market if they cannot make any profit through domestic production or FDI; choose FDI if $\pi_i^{FDI} > 0$ and $\pi_i^{FDI} - \pi_i^H > 0$; and opt for complete production in H otherwise.

To start, it is relevant to note that the profit derived from domestic production is still given by the function from equation 4.15. After all, the change in reputational risk does not affect the profit derived from domestic production. As described, the profit derived from domestic production strictly increases in a_i.

In contrast, the profit under vertical FDI is affected by the change in reputational risk and is equal to:

$$\pi_i^{FDI} = \left(\frac{\sigma}{\sigma-1}\frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i} - \frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right)\frac{Y}{\Sigma_i p_i^{1-\sigma}}\left(\frac{\sigma}{\sigma-1}\frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right)^{-\sigma}(1-f+f\phi(a_i))^{\sigma} - v_H - v_F \quad (5.1)$$

Moreover, this FDI profit does not strictly increase in a_i anymore:

$$\frac{\partial \pi_i^{FDI}}{\partial a_i} = \left(\frac{\sigma}{\sigma-1}w_H^{\beta}(w_F\tau)^{1-\beta}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}(\sigma-1)a_i^{\sigma-2}(1-f+f\phi(a_i))^{\sigma} + \left(\frac{\sigma}{\sigma-1}w_H^{\beta}(w_F\tau)^{1-\beta}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}a_i^{\sigma-1}\sigma(1-f+f\phi(a_i))^{\sigma-1}f\frac{\partial\phi(a_i)}{\partial a_i} \lesseqgtr 0 \quad (5.2)$$

For the set of firms for which $(1-f+f\phi(a_i)) > 0$, the sign of the derivative depends on the productivity level, a_i. Put differently, whether the profit earned through FDI grows in productivity depends on the exact level of productivity one is considering. More specifically, there exists one value of a_i for which the derivative changes sign. To see this, equation 5.2 can be rewritten as:

$$\frac{\partial \pi_i^{FDI}}{\partial a_i} = \left[\left(\frac{\sigma}{\sigma-1}w_H^{\beta}(w_F\tau)^{1-\beta}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}a_i^{\sigma-1}(1-f+f\phi(a_i))^{\sigma}\right] \left[(\sigma-1)a_i^{-1} + \sigma(1-f+f\phi(a_i))^{-1}f\frac{\partial\phi(a_i)}{\partial a_i}\right] \quad (5.3)$$

To grasp this derivative, note that it consists of two factors that are multiplied. These two factors are each presented in square brackets. The first factor is always strictly positive:

$$\left[\left(\frac{\sigma}{\sigma-1}w_H^{\beta}(w_F\tau)^{1-\beta}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}a_i^{\sigma-1}(1-f+f\phi(a_i))^{\sigma}\right] > 0 \qquad \forall a_i \quad (5.4)$$

The sign of the second factor is less clear-cut. Relevant to point out is that this factor consists

of two terms: the first term is strictly positive, and the second term is strictly negative[4]:

$$(\sigma - 1)a_i^{-1} > 0 \qquad \forall a_i \tag{5.5}$$

$$\sigma(1 - f + f\phi(a_i))^{-1} f \frac{\partial \phi(a_i)}{\partial a_i} < 0 \qquad \forall a_i \tag{5.6}$$

The sign of the second factor, therefore, depends on which of the two terms dominates. Note that for extremely small values of a_i, the first term dominates the second term:

$$\lim_{a_i \to 0^+} \left[(\sigma - 1)a_i^{-1} + \sigma(1 - f + f\phi(a_i))^{-1} f \frac{\partial \phi(a_i)}{\partial a_i} \right] = \infty + \sigma(1 - f + f\phi(a_i))^{-1} f \frac{\partial \phi(a_i)}{\partial a_i} = \infty \tag{5.7}$$

As a_i grows, the first, positive term becomes smaller. Meanwhile, the second term becomes more negative. To see this, note that $(1 - f + f\phi(a_i))^{-1}$ is assumed to be positive and increases in a_i. In addition, the negative factor $\frac{\partial \phi(a_i)}{\partial a_i}$ is either a constant or a decreasing function in a_i. This implies that the second, negative term becomes smaller as a_i grows, while the positive term approaches zero. Therefore, a critical level of a_i exists, for which the sign of the second factor, and hence the sign of the derivative, changes. For values of a_i smaller than this critical level, the derivative is positive; for values of a_i larger than this critical level, the derivative is negative. Consequently, π_i^{FDI} must exhibit an inverse U-shape.

The functional forms of the two profit functions can now be used to determine which firms likely select into FDI. Recall that FDI is more attractive than complete production in H if $\pi_i^{FDI} - \pi_i^H > 0$. Using the results from above, it becomes clear that $\pi_i^{FDI} - \pi_i^H > 0$ consists of an inverse U-shaped function from which a strictly increasing function is subtracted. This implies that $\pi_i^{FDI} - \pi_i^H$ also needs to be an inverse U-shaped function. In contrast to the baseline model results, the excess profit of FDI over domestic production does, therefore, not strictly increase in a_i. As a result, the most productive firms are not most likely to opt for FDI anymore, but the firms somewhere in the middle of the productivity spectrum are.

[4]Recall that I only consider the set of firms for which $(1 - f + f\phi(a_i)) > 0$. Moreover, recall that $\frac{\partial \phi(a_i)}{\partial a_i} < 0$

These results are illustrated in Figure 2. The blue line represents the additional profit of FDI over total production in H. Clearly, this additional profit exhibits an inverse U-shape: the additional profit increases until $a_i \approx 15$, but then declines and eventually becomes negative.

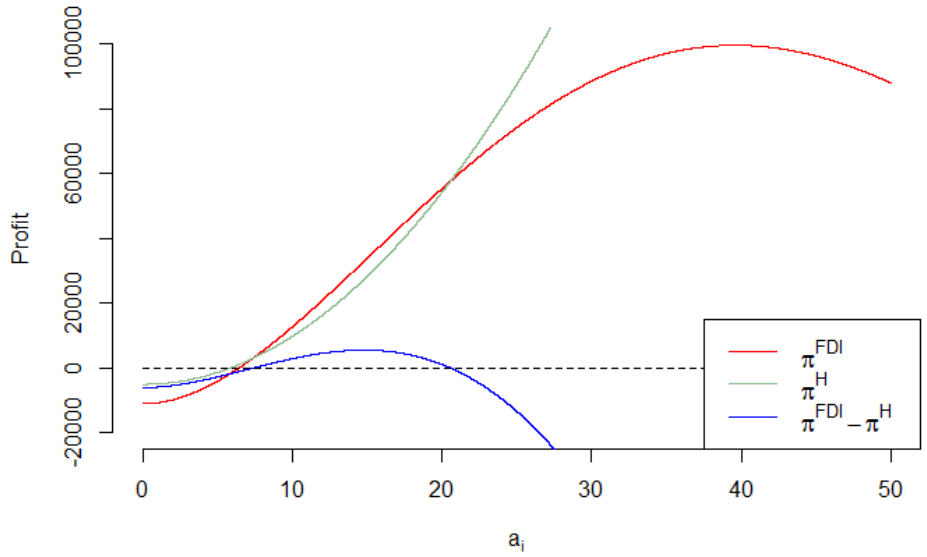

Figure 2: Profit under production through FDI, complete production in H and the difference between these two. Used parameter values: $\sigma = 3$, $\frac{Y}{\Sigma_i p_i} = 1000$, $w_H = 1$, $w_F = 0.4$, $\beta = 0.5$, $\tau = 1.1$, $v_H = 5000$, $v_F = 6000$, $f = \rho = 0.01$, and $\phi(a_i) = -a_i$.

Finally, it is important to stress that consumers' beliefs are consistent in this equilibrium. Similar reasoning as in the baseline model can be applied: a firm will always have a dominant strategy. Therefore, we need to have that $f = \frac{\rho * 1}{\rho * 1 + (1-\rho) * 1} = \rho$, such that it is possible that the condition $(1 - f + f\phi(a_i)) > 0$ is met.

5.3 Equilibrium in Mixed Strategies

Similar to the baseline model, there can exist equilibria in which firms play a mixed strategy. As these equilibria are less intuitive than the mixed equilibria from the baseline model, I will elaborate in this section on how mixed strategies could affect the results from the pure strategy equilibrium. All in all, I will explain that the likelihood of firms choosing FDI will still exhibit an inverse U-shape in a_i.

To start, it is important to stress that firms are only willing to mix between two strategies when they are indifferent. As explained in Appendix C, it is not trivial to see when firms are

indifferent. This is driven by the fact that firms can decrease consumers' belief f and, therefore, increase π_i^{FDI}. Recall that f decreases if the probability that a firm opts for FDI if $s_F = b$ decreases or if the probability that a firm chooses FDI if $s_F = g$ increases. Firms could even pick these probabilities such that f becomes sufficiently close to 0 and that the profit of FDI becomes nearly the same as in Antràs and Yeaple (2014).[5] Similar to the baseline model, this implies that a firm can play a mixed strategy to become indifferent between FDI and domestic production, while it strictly prefers domestic production over FDI in the pure strategy equilibrium.

Therefore, more firms could be willing to engage in FDI than the pure strategy equilibrium. After all, the firms that selected themselves into FDI in the pure strategy equilibrium will still opt for FDI if mixed strategies are considered. In addition, firms that first did not find FDI profitable might now also opt for FDI with a positive probability.

While more firms might opt for FDI in the mixed strategy equilibrium compared to the pure strategy equilibrium, the likelihood of choosing FDI will still exhibit the inverse U-shape. This can be proved as follows. First, firms on the lower end of the productivity scale will not invest in FDI, not even when mixed strategies are considered. To see this, consider the following limit:

$$\lim_{a_i \to 0^+} \left[\left(\frac{\sigma}{\sigma - 1} \frac{w_H^{\beta} (w_F \tau)^{1-\beta}}{a_i} - \frac{w_H^{\beta} (w_F \tau)^{1-\beta}}{a_i} \right) \frac{Y}{\Sigma_i p_i^{1-\sigma}} \left(\frac{\sigma}{\sigma - 1} \frac{w_H^{\beta} (w_F \tau)^{1-\beta}}{a_i} \right)^{-\sigma} (1 - f + f\phi(a_i))^{\sigma} - v_H - v_F \right] = -v_H - v_F \quad (5.8)$$

If a_i is sufficiently close to 0, firms have little sales, such that they make a loss when choosing FDI. After all, FDI comes with relatively high fixed costs. Hence, the firms in the market with productivity close to 0 will still never choose for FDI. Second, consider the set of firms that prefers FDI over domestic production in the pure strategy equilibrium. These firms are likely to be somewhere in the middle of the productivity spectrum. These firms still prefer FDI over domestic production when considering mixed equilibria. Hence, this set of firms will always opt for FDI and will pursue the FDI strategy with a probability of 1. Finally, consider the mixing firms on the upper part of the productivity spectrum. For these firms, it must be that the

[5] Of course, it should be noted that for a mixed equilibrium, the probabilities should then be picked such that $\pi_i^{FDI} = \pi_i^H$.

probability that they opt for FDI if $s_F = b$ is small. After all, recall that after a critical point, π_i^{FDI} is decreasing in a_i, while π_i^H is increasing in a_i. This means that the difference between π_i^{FDI} and π_i^H grows in a_i after this point. Therefore, firms with relatively high values of a_i need to decrease f more than firms with smaller values of a_i to become indifferent between FDI and domestic production. This implies that the probability that a firm chooses FDI over full production in H eventually needs to decline as a_i increases.

Overall, the results above suggest that the likelihood of firms engaging in FDI first increases in productivity but then declines. Similar to the results from the pure strategy equilibrium, this indicates that the probability that firms are involved in FDI exhibits an inverse U-shape. These results are not in line with the results of Antràs and Yeaple (2014): their analysis suggests that productivity has a strictly positive effect on the incentive to produce using FDI. While this positive effect is still present in this analysis, this is only true until a certain level of a_i. After this critical level is reached, a negative effect will dominate: the consumers' belief that the firm is involved in an adverse event.

Meanwhile, the results do provide a theoretical explanation for the predictions of Udayasankar (2008). First, the analysis suggests that the likelihood of firms choosing FDI first increases in productivity and then decreases. This implies that the firms with a productivity level between the least and most productive firms in the market are most likely to opt for FDI. Recall that these firms are willing to invest using FDI, even though this could result in involvement in an adverse event. This is in line with Udayasankar's prediction that middle-sized firms have the weakest incentive to participate in CSR. Second, I show that the most productive firms in the market are less likely to produce in F. The driver in this analysis is that producing in that country can entail reputational damage, which is primarily a problem for the larger, more productive firms in the market. This is also in line with the predictions of Udayasankar: as large firms are highly visible, they have a strong incentive to refrain from socially irresponsible behavior. Finally, the model also predicts that the smallest firms in the market are less likely to invest in F. It is relevant to note that the driving force in this analysis is not CSR, as Udayasankar predicts, but rather the inability to earn back the fixed costs associated with FDI.

6 Outsourcing

A question that naturally emerges from the previous results is how the conclusions would change if firms could outsource production. Suppose that firms could not only manufacture in F by opening a manufacturing facility but also by buying inputs from local suppliers. The literature describes various trade-offs between vertical integration and outsourcing when offshoring production. A relevant consideration is that the profitability of outsourcing to a foreign country depends on the quality of contracting institutions in that country. Acemoglu et al. (2007) find that outsourcing production to a foreign country can decrease firm productivity. This finding could have implications for the results described above. On the one hand, decreasing productivity increases marginal costs, which could make outsourcing to F less attractive compared to FDI. On the other hand, it is plausible that outsourcing production could result in lower reputational damage compared to FDI. There could be two effects at play: a direct effect and an indirect effect. First, if firms lose some productivity, the size and power of a firm could be smaller. This could reduce the severity of potential accidents from the perspective of consumers. Second, outsourcing could indirectly reduce the reputational damage to firms. If firms outsource production rather than operate an owned manufacturing facility, consumers might believe that these firms also lose a significant share of control over the production process. As a result, consumers could hold firms less accountable for industrial accidents at third-party production sites than at firm-owned production sites. These effects could make outsourcing to F more attractive than FDI.

To find which of these effects dominates, the model of Section 5 will be used as a starting point. Moreover, assume that a firm with initial productivity a_i decreases its productivity to $a_i\eta$ if it enters country F through outsourcing, where $\eta \in (0, 1)$. As mentioned above, outsourcing could increase the marginal costs of production and reduce reputational costs. To capture this, let the quality parameter be given by:

$$\alpha_{is_j} = \begin{cases} 1 & \text{if } i \text{ locates manufacturing in country } H \\ 1 & \text{if } i \text{ locates manufacturing in country } F \text{ and } s_F = g \\ \phi(a_i) & \text{if } i \text{ locates manufacturing in country } F \text{ through FDI and } s_F = b \\ \phi^O(a_i\eta) & \text{if } i \text{ locates manufacturing in country } F \text{ through outsourcing and } s_F = b \end{cases}$$

Where $\phi^O(a_i\eta)$ is also a strictly decreasing and concave function in a_i, such that $\frac{\partial \phi^O(a_i\eta)}{\partial a_i} < 0$ and $\frac{\partial}{\partial a_i}\left(\frac{\partial \phi^O(a_i\eta)}{\partial a_i}\right) \leq 0$ with $\lim_{a_i \to 0^+} \phi^O(a_i\eta) < 1$. To capture the indirect effect of outsourcing on reputational risk, I assume that $\phi^O(a_i) > \phi(a_i) \forall a_i$. Furthermore, note that the direct effect of outsourcing on reputational costs is incorporated as the quality parameter for outsourced products now depends negatively on $a_i\eta$ rather than on a_i, and $a_i\eta < a_i$.

Following Antras and Helpman (2004), let the fixed costs of outsourcing to F be given by $v_F^O + v_H$, where $v_F^O < v_F$. In other words, the fixed costs of outsourcing are higher than those of domestic production but lower than those of FDI.

6.1 Consumers

To start, it is relevant to stress that firms can only sell outsourced products if $(1 - f + f\phi^O(a_i\eta)) > 0$. Similar to Section 5.1, it is still true that larger values of a_i make it less likely that this condition holds. However, this condition is more likely to hold compared to the condition[6] from Section 5.1 for a given value of a_i. This is driven by the two effects related to outsourcing that reduce the reputational risk of being involved in country F. As a result, it could be possible that firms that were too productive to sell anything through FDI might be able to sell to consumers using an outsourcing strategy.

6.2 Equilibrium

To start, consider the set of firms for which $(1 - f + f\phi^O(a_i\eta)) > 0$ is true. These firms could potentially sell to consumers through outsourcing. Their outsourcing profit is given by:

$$\pi_i^O = \left(\frac{\sigma}{\sigma - 1}\frac{w_H^\beta (w_F\tau)^{1-\beta}}{a_i\eta} - \frac{w_H^\beta (w_F\tau)^{1-\beta}}{a_i\eta}\right)\frac{Y}{\Sigma_i p_i^{1-\sigma}}\left(\frac{\sigma}{\sigma - 1}\frac{w_H^\beta (w_F\tau)^{1-\beta}}{a_i\eta}\right)^{-\sigma}(1 - f + f\phi^O(a_i\eta))^\sigma - v_H - v_F^O \quad (6.1)$$

This profit function shows that while firms lose some productivity through outsourcing, they can

[6] Recall that consumers were only willing to buy products from firms engaged in FDI if $(1 - f + f\phi(a_i)) > 0$.

also reduce their reputational costs and fixed costs. Depending on the exact parameter values, this could imply that more firms are willing to enter country F. If η is, for example, extremely close to 1, it is likely that the number of firms that enters country F increases. After all, the outsourcing profit will be nearly identical to the FDI profit, except that the reputational costs and fixed costs will be strictly lower under outsourcing than under FDI. Firms that were either too unproductive or too productive for FDI could now potentially enter country F profitably through outsourcing. This observation is also illustrated in Figure 3: both firms less productive and more productive than the firms that opt for FDI can maximize their profits through outsourcing.

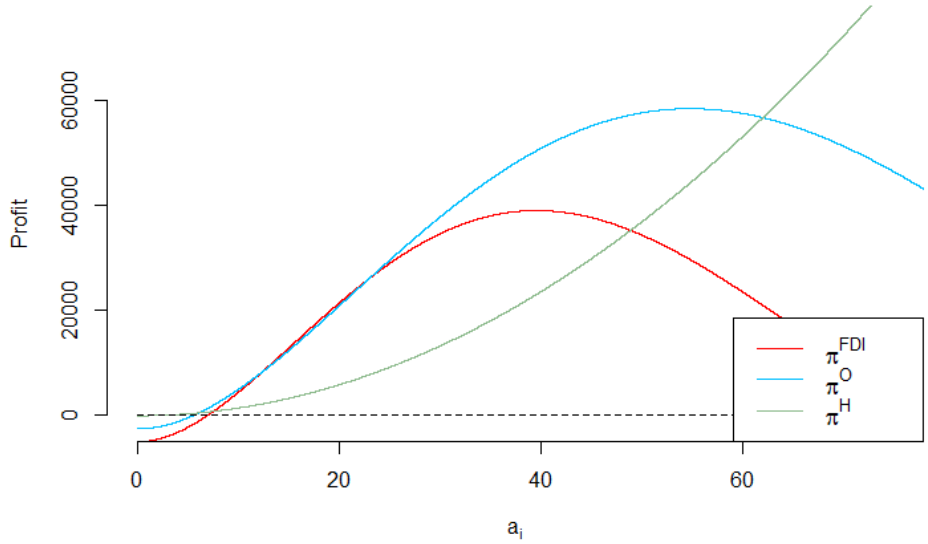

Figure 3: Profit under production through FDI, production through outsourcing in F and complete production in H. Used parameter values: $\sigma = 3$, $\frac{Y}{\Sigma_i p_i} = 100$, $w_H = 1$, $w_F = 0.1$, $\tau = 1.1$, $\beta = 0.5$, $v_H = 250$, $v_F^O = 2500$, $v_F = 5000$, $f = \rho = 0.01$, $\phi(a_i) = -a_i$, $\phi^O(a_i\eta) = -(a_i\eta * 0.85)$, and $\eta = 0.85$.

I should stress that the intuition and figure do not give a complete overview. That is, the sorting pattern into the different strategies strongly depends on the exact parameter values of the model. The remainder of this section will, therefore, present a formal proof on the relation between productivity and the likelihood of opting for outsourcing. To start, it is helpful to evaluate the difference between outsourcing and FDI profit:

$$\Delta\pi \equiv \left(\frac{\sigma}{\sigma-1}\frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}\Big(\eta^{\sigma-1}(1-f+f\phi^O(a_i\eta))^{\sigma}-(1-f+f\phi(a_i))^{\sigma}\Big) - (v_F^O - v_F) \quad (6.2)$$

The expression shows that the additional profit of outsourcing over FDI depends on firm productivity. To find whether firm productivity has a positive or negative effect on this difference, consider the following derivative:

$$\frac{\partial\Delta\pi}{\partial a_i} = \left(\frac{\sigma}{\sigma-1}\frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}} \left[(\sigma-1)a_i^{\sigma-2}\Big(\eta^{\sigma-1}(1-f+f\phi^O(a_i\eta))^{\sigma}-(1-f+f\phi(a_i))^{\sigma}\Big) + a_i^{\sigma-1}\Big(\eta^{\sigma-1}\sigma(1-f+f\phi^O(a_i\eta))^{\sigma-1}f\frac{\partial\phi^O(a_i\eta)}{\partial a_i}-\sigma(1-f+f\phi(a_i))^{\sigma-1}f\frac{\partial\phi(a_i)}{\partial a_i}\Big)\right] \lesseqgtr 0 \quad (6.3)$$

The derivative reveals that the effect of productivity on the additional profit derived from outsourcing compared to FDI is ambiguous. To find the equilibrium strategies, it is, therefore, once again more insightful to consider the functional forms of the profit functions. The derivative of the outsourcing profit function is given by:

$$\frac{\partial\pi_i^O}{\partial a_i} = \left[\left(\frac{\sigma}{\sigma-1}\frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{\eta}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}a_i^{\sigma-1}(1-f+f\phi^O(a_i\eta))^{\sigma}\right] \left[(\sigma-1)a_i^{-1}+\sigma(1-f+f\phi(a_i\eta))^{-1}f\frac{\partial\phi^O(a_i\eta)}{\partial a_i}\right] \quad (6.4)$$

Considering the set of firms for which $(1-f+f\phi(a_i\eta))>0$, it is again evident that the derivative consists of two factors. The first factor is strictly positive. The second factor is similar to the second factor of $\frac{\partial\pi^{FDI}}{\partial a_i}$: for sufficiently small values of a_i, this second factor is positive and infinitely large. As a_i grows, the second, negative term of the factor will eventually dominate the first, positive term, such that the entire factor becomes negative. This implies that π_i^O is also an inverse U-shaped function in a_i.

A difference compared to the derivative of π_i^{FDI} is that the switch of sign will occur for a larger value of a_i. Proof:

$$(1 - f + f\phi^O(a_i\eta))^{-1} < (1 - f + f\phi(a_i))^{-1} \tag{6.5}$$

$$\frac{\partial \phi^O(a_i\eta)}{\partial a_i} > \frac{\partial \phi(a_i)}{\partial a_i} \tag{6.6}$$

Therefore:

$$\sigma(1 - f + f\phi^O(a_i\eta))^{-1} f \frac{\partial \phi(a_i\eta)}{\partial a_i} > \sigma(1 - f + f\phi(a_i))^{-1} f \frac{\partial \phi(a_i)}{\partial a_i} \tag{6.7}$$

This expression shows that the absolute value of the negative term is smaller for a given value of a_i in the derivative of π_i^O than in the derivative of π_i^{FDI}. Consequently, the derivative of π_i^O changes sign for a larger value of a_i compared to the derivative of π_i^{FDI}. Put differently, π_i^O reaches its maximum at a larger value of a_i compared to π_i^{FDI}.

Furthermore, the maximum value of π_i^O is strictly larger than the maximum value of π_i^{FDI}. The intuition behind this is as follows. First, suppose that the indirect effect of outsourcing on reputational damage is not present, such that the quality parameter for outsourcing under $s_F = b$ would be given by $\phi(a_i\eta)$. In that case, the maximum point of π_i^O could be retrieved by dividing the maximum point of π_i^{FDI} by η. Furthermore, the difference between the maximum value of π_i^O and the maximum value of π_i^{FDI} must then be equal to the difference in fixed costs, $v_F - v_F^O$. If we would then introduce the indirect effect of outsourcing on reputational damage, the difference in maximum profits increases even more. After all, the indirect effect reduces the reputational costs for a given value of a_i, increasing the outsourcing profit.

Overall, the insights on the outsourcing profit function and its derivative have three important implications. First, the most productive firms in the market still opt for domestic production. Second, the firms that opt for FDI or outsourcing are somewhere in the middle of the productivity spectrum. These two results are driven by the fact that both the outsourcing profit and the FDI profit show an inverse U-shape in a_i, while the profit from domestic production strictly

increases in a_i. Third, within the set of firms that choose to outsource, there can both be firms that were initially too productive or not productive enough for FDI. Hence, outsourcing could expand the set of firms active in country F.

This third result can be attributed to three effects: a fixed costs effect, an indirect effect of outsourcing on reputational damage, and a direct effect of outsourcing on reputational damage. The first effect is driven by the assumption that fixed costs are lower under outsourcing than under FDI. Lower fixed costs will positively affect the number of firms producing in country F. Both firms that were not productive enough or too productive for FDI might choose to outsource production. The second effect is based on the assumption that consumers hold outsourcing firms less accountable for negative events compared to firms engaged in FDI. Similar to the fixed costs effect, all types of firms could benefit from this, as reputational damage decreases for a given value of a_i. The third effect is more complex. This effect is based on the assumption that outsourcing involves a loss in productivity, which in turn also lowers reputational costs. Mathematically, the productivity loss shifts the maximum point of the outsourcing profit function to the right of the FDI profit function. This mechanism is especially attractive for firms too productive for FDI and could induce them to enter country F through outsourcing. However, considerable losses in productivity are not necessarily beneficial for firms that were not productive enough for FDI. As the productivity loss caused by outsourcing grows, it becomes less likely that these latter firms are willing to outsource production. Finally, it is important to stress that the number of firms that outsources production also depends on the profitability of domestic production. After all, if domestic production is relatively profitable, it is unlikely that many firms will enter country F through outsourcing.

Figures 4 and 5 illustrate these results. Figure 4 shows the fixed costs effect. In order to isolate this effect from the two other effects, I use the quality parameter of FDI: $\phi^O(a_i\eta) = \phi(a_i)$. The figure shows that the fixed costs effect indeed drives more firms to enter country F, as profit is strictly higher under outsourcing than under FDI. Figure 5 captures both the direct and indirect effect of outsourcing on the reputational costs. The fixed costs of outsourcing are, therefore, equated to the fixed costs of FDI. As explained, the loss in reputational risk could drive both firms that were not productive enough or too productive into outsourcing, depending on the size of the direct and indirect effect. In this case, only firms that were initially too productive for

FDI seem to benefit from the option to outsource production.

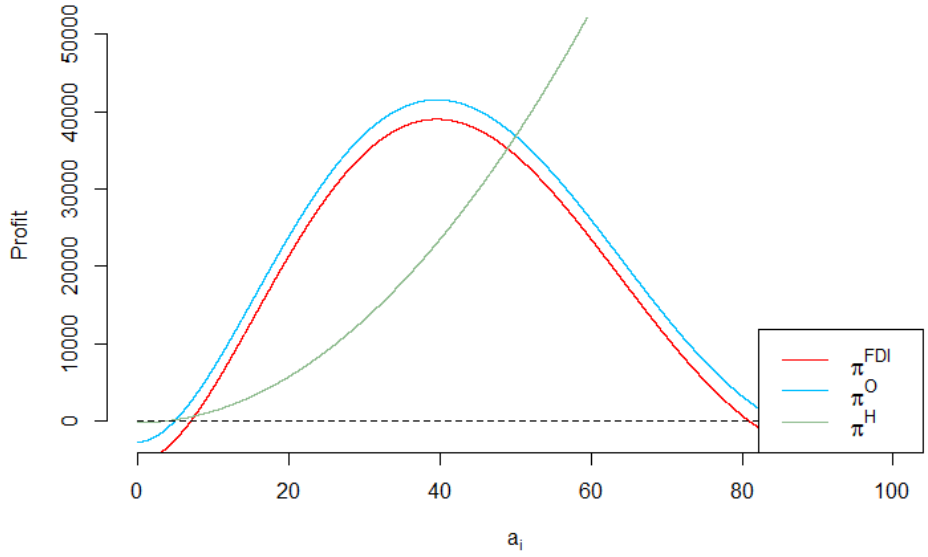

Figure 4: Profit under production through FDI, production through outsourcing in F and complete production in H. Used parameter values: $\sigma = 3$, $\frac{Y}{\Sigma_i p_i} = 100$, $w_H = 1$, $w_F = 0.1$, $\tau = 1.1$, $\beta = 0.5$, $v_H = 250$, $v_F^O = 2500$, $v_F = 5000$, $f = \rho = 0.01$, $\phi(a_i) = \phi^O(a_i\eta) = -a_i$, and $\eta = 1$.

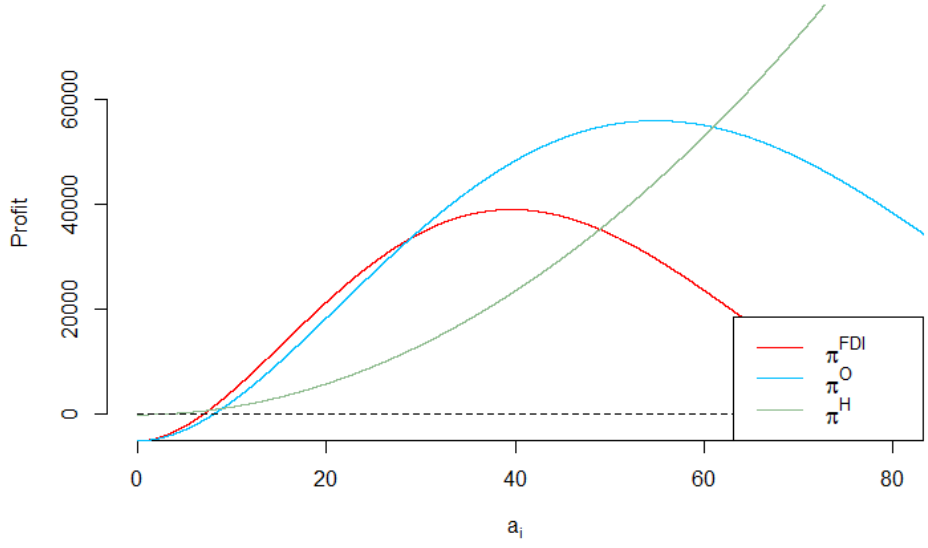

Figure 5: Profit under production through FDI, production through outsourcing in F and complete production in H. Used parameter values: $\sigma = 3$, $\frac{Y}{\Sigma_i p_i} = 100$, $w_H = 1$, $w_F = 0.1$, $\tau = 1.1$, $\beta = 0.5$, $v_H = 250$, $v_F^O = 5000$, $v_F = 5000$, $f = \rho = 0.01$, $\phi(a_i) = -a_i$, $\phi^O(a_i\eta) = -(a_i\eta * 0.85)$, and $\eta = 0.85$.

Finally, it is important to note that beliefs are again consistent and that the possibility of playing

mixed strategies will not alter the results as described above. To prove this, same reasoning can be applied as in Section 5.

These results are not in line with the existing literature on the trade-off between FDI and outsourcing. More specifically, Antras and Helpman (2004) find that in HQ-intensive sectors, the most productive firms in the market sort into vertical FDI; moreover, these firms must be more productive than those that outsource to a foreign country. The driving force behind their results is that integration in HQ-intensive sectors provides better incentives to suppliers of parts. As a result, the profit under FDI increases more in productivity than the profit under outsourcing. The results described above suggest that this is not necessarily true: firms that opt for outsourcing can be of higher initial productivity compared to those that opt for FDI. The fact that these results are contrasting can be attributed to the fact that this model uses a different mechanism to explain the trade-off between FDI and outsourcing. In this analysis, firms experience reputational costs when entering country F. As a result, the profit under FDI and the profit under outsourcing have an inverse U-shape in productivity. Combining this with the assumption that outsourcing involves relatively low fixed costs and limits reputational costs leads to the conclusion that firms that were too productive for FDI can potentially profitably outsource.

7 Conclusion

This paper investigates which types of firms want to produce using FDI if this involves reputational risk. While the existing theoretical models on FDI predict that the largest, most productive firms in the market have the strongest incentive to invest in low-wage countries, this is not necessarily trivial when taking the CSR literature into account. Hence, I have extended the existing theoretical models on FDI by developing a model in which firms could be involved in an adverse event when investing in a low-wage country. In this model, consumers dislike buying from firms involved in such an adverse event, such that firms might want to avoid this low-wage country.

The paper has three main findings. The first finding is that introducing a constant reputational risk for all firms gives the same sorting pattern into production modes as the existing models on FDI. More specifically, the most productive firms in the market are still more likely to produce

using FDI than less productive firms. The second result is that if reputational risk grows in firm productivity, the sorting pattern changes: the likelihood of firms opting for FDI first increases in productivity but then declines. As a result, the probability of a firm sorting into FDI is an inverse U-shaped function in productivity. This makes the most productive firms in the market not the most likely to engage in FDI anymore. Finally, I show that outsourcing might be a profitable alternative to FDI for both firms that were initially too unproductive or too productive for FDI.

One of the main limitations of this analysis is the assumption that reputational damage increases in firm productivity. This assumption is based on the idea that more productive firms have a larger production size, are likely to have more resources and power, and experience more brand awareness from consumers. However, this is a rather implausible assumption: consumers are not likely to observe firm productivity in reality. In addition, it is impossible to prove that - in equilibrium - production is strictly increasing in productivity. Therefore, it is relevant for further research to investigate which sorting pattern would emerge if reputational risk would, for example, depend on production size. In such a model, more productive firms can consider the negative effect of increasing production on their FDI profits. As a result, a larger set of productive firms might opt for FDI.

If one would perform such an analysis in which reputational costs depend on production size, it is also interesting to explore the option for firms to split production. While opening multiple facilities likely involves relatively high fixed costs, it also reduces the severity of adverse events at the manufacturing sites. This in turn mitigates reputational risk. This effect would expand the set of productive firms opting for FDI even more: the more productive firms in the market are likely able to pay a relatively high amount of fixed costs to reduce their reputational risk.

Another limitation is that firms cannot signal that they are not involved in unethical processes in the current model. This is a rather strong and unrealistic assumption. In reality, firms can likely signal prosocial behavior through a Fairtrade certification label or by disclosing supply chain information. If firms were able to give signals about their production process to consumers, my results would be affected. That is, firms can then condition their location decision on the state of the world in the low-wage country. If the state of the world is good, firms can signal this to

consumers and produce profitably using FDI. As a result, it is possible that the most productive firms are willing to use FDI.

A final strong assumption is that the indirect effect of outsourcing on reputational costs is equal among firms. Recall that this effect captured the idea that consumers hold firms less accountable for adverse events at third-party locations than at firm-owned sites. Arguably, more productive firms might have more resources and power to create complex holding structures to minimize any responsibility for negative events. As a result, consumers might not be able to link productive firms to a negative event. In terms of the model, this would imply that more productive firms are able to reduce the reputational risk more through outsourcing than less productive firms. This also affects the result that the most productive firms prefer to produce domestically over outsourcing.

Despite these limitations, this paper still provides interesting insights for governments and organizations that aim to promote social and environmental standards in value chain decisions. First, it might pay off for these organizations to shed light on the role of middle-sized firms in industrial accidents. As the focus of the media is often on the decisions of large corporations, socially irresponsible behavior of somewhat smaller firms might not receive elaborate coverage. Meanwhile, the results of this analysis suggest that not the most productive firms in the market are most likely to be involved in negative events in a foreign country, but somewhat less productive firms are. By raising consumer awareness of socially irresponsible behavior of these somewhat smaller firms, the reputational risk for these firms can grow. This could in turn induce them to make more prosocial value chain decisions. Second, the result that outsourcing can be an attractive strategy for firms too unproductive or too productive for FDI is relevant. As described, firms can find outsourcing attractive as it involves relatively low fixed costs and limited reputational risk compared to FDI. In other words, a diverse set of firms can exist that prefer outsourcing to a foreign country over FDI to avoid responsibility for potentially negative events. In case of an industrial accident, it is thus important for local authorities to thoroughly investigate which firms could be indirectly accountable for potential damage. Moreover, it is also relevant to make consumers aware that some firms might actively try to avoid any social responsibility by buying sourced inputs abroad than producing them themselves.

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A Appendix: Derivation Profit Functions

To determine the relevant profit functions for firm i, the production function needs to be maximized subject to the total operating cost. As explained, h and m can be produced one-to-one with labor. Let the wage for HQ services and manufacturing be denoted by w_h and w_m, respectively. Note that the operating costs do not depend on the fixed costs. This yields the following total operating cost function:

$$TC_i = w_h * h + w_m * m \tag{A.1}$$

Using this operating cost function, the Lagrangean and the three first order conditions are as follows:

$$\mathcal{L} = a_i \Big(\frac{h}{\beta}\Big)^{\beta} \Big(\frac{m}{1-\beta}\Big)^{1-\beta} - \lambda(w_h h + w_m m - TC_i) \tag{A.2}$$

$$\frac{\partial \mathcal{L}}{\partial h} = a_i \frac{\beta h^{\beta-1}}{\beta^{\beta}} \Big(\frac{m}{1-\beta}\Big)^{1-\beta} - \lambda w_h = 0 \tag{A.3}$$

$$\frac{\partial \mathcal{L}}{\partial m} = a_i \Big(\frac{h}{\beta}\Big)^{\beta} \frac{(1-\beta)m^{-\beta}}{(1-\beta)^{1-\beta}} - \lambda w_m = 0 \tag{A.4}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = -w_h h - w_m m + TC_i = 0 \tag{A.5}$$

Using equations A.3 and A.4, I find that:

$$\frac{\beta m}{(1-\beta)h} = \frac{w_h}{w_m} \Leftrightarrow h = \frac{w_m}{w_h} \frac{m\beta}{(1-\beta)} \tag{A.6}$$

Plugging this into the production function gives:

$$q_i = a_i \left(\frac{\frac{w_m}{w_h} \frac{m\beta}{(1-\beta)}}{\beta} \right)^{\beta} \Big(\frac{m}{1-\beta}\Big)^{1-\beta} \Leftrightarrow m = (1-\beta) \frac{q_i}{a_i} \Big(\frac{w_h}{w_m}\Big)^{\beta} \tag{A.7}$$

$$h = \frac{w_m}{w_h} \frac{(1-\beta)\frac{q_i}{a_i}\Big(\frac{w_h}{w_m}\Big)^{\beta}\beta}{(1-\beta)} = \beta \frac{q_i}{a_i} \Big(\frac{w_h}{w_m}\Big)^{1-\beta} \tag{A.8}$$

Rewriting h and m in terms of q_i then allows me to rewrite the total operating costs (TC_i) in terms of q_i:

$$TC_i = w_m(1-\beta)\frac{q_i}{a_i}\Big(\frac{w_h}{w_m}\Big)^{\beta} + w_h\beta\frac{q_i}{a_i}\Big(\frac{w_h}{w_m}\Big)^{1-\beta} = \frac{q_i}{a_i}w_h^{\beta}w_m^{1-\beta} \tag{A.9}$$

Differentiating this expression with respect to q_i gives the marginal costs for firm i:

$$\frac{\partial TC_i}{\partial q_i} = \frac{w_h^{\beta}w_m^{1-\beta}}{a_i} \tag{A.10}$$

Finally, this marginal cost function can be used to determine the profit margin per product. After all, the marginal costs are constant and equal to the average variable costs. If production fully takes place in country H, the wage for manufacturing and HQ services is equal to w_H. In addition, the fixed costs can be given by v_H. Hence, the profit function is given by:

$$\pi_i = \Big(p_i - \frac{w_h^{\beta}w_m^{1-\beta}}{a_i}\Big)q_i - v_H = \Big(p_i - \frac{w_H}{a_i}\Big)q_i - v_H \tag{A.11}$$

If firm i locates its manufacturing in country F, we know that w_m is equal to the wage in that country, w_F. Moreover, as the manufactured goods need to be transported from F to H, iceberg transport costs of τ are incurred. As HQ services always takes place in country H, we know that $w_h = w_H$. Finally, we know the fixed costs for FDI are given by $v_F + v_H$. This yields the following profit function:

$$\pi_i = \left(p_i - \frac{w_h^{\beta}w_m^{1-\beta}}{a_i}\right)q_i - v_H - v_F = \left(p_i - \frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right)q_i - v_H - v_F \tag{A.12}$$

B Appendix: Conditions for Vertical FDI and Complete Domestic Production

As described, the analysis aims to explain the sorting pattern of firms into different production modes. This implies that limiting the analysis to the case in which different production modes can coexist is most interesting. Therefore, I will not consider the situation in which all producing firms opt for FDI or domestic production. In the coming sections, I will show under which conditions the latter two cases would emerge. Clearly, if neither of these two cases can emerge, the case in which FDI and domestic production coexist will emerge.

First, all firms prefer domestic production over FDI if the slope of π_i^{FDI} does not exceed the slope of π_i^H. This is driven by the assumption that the fixed costs of FDI are higher than the fixed costs of domestic production. Suppose that all firms produce domestically. In this case, the optimal ratio for consumers of the products from seller k and seller k' is given by:

$$\frac{\frac{\sigma}{\sigma-1}\left[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}-1} \frac{\sigma-1}{\sigma} * 1 * c_k^{\frac{\sigma-1}{\sigma}-1}}{\frac{\sigma}{\sigma-1}\left[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}-1} \frac{\sigma-1}{\sigma} * 1 * c_{k'}^{\frac{\sigma-1}{\sigma}-1}} = \frac{\lambda p_k}{\lambda p_{k'}} \tag{B.1}$$

$$c_k = c_{k'} \left(\frac{p_k}{p_{k'}}\right)^{-\sigma} \tag{B.2}$$

This implies that the demand and profit for firm i are equal to:

$$q_i = \frac{Y}{\Sigma_i p_i^{1-\sigma}} p_i^{-\sigma} \tag{B.3}$$

$$\pi_i^H = \left(\frac{\sigma}{\sigma-1}\frac{w_H}{a_i} - \frac{w_H}{a_i}\right) \frac{Y}{\Sigma_i p_i^{1-\sigma}} \left(\frac{\sigma}{\sigma-1}\frac{w_H}{a_i}\right)^{-\sigma} - v_H \tag{B.4}$$

Given that all firms produce domestically, the profit from deviating to FDI is given by the profit function from equation 4.19.[7] As I describe in the derivation of this function, deviating to FDI will always yield a negative profit if $(1 - f + f\phi) < 0$. Hence, all firms will then prefer domestic production. In addition, all producing firms may prefer domestic production over FDI

[7] After all, the derivation of this FDI profit function is implicitly based on the assumption that some firms produce domestically, while others produce using FDI.

if $(1 - f + f\phi) > 0$. This is the case if the derivative of π_i^H with respect to a_i is larger than the derivative of π_i^{FDI} with respect to a_i:

$$\left(\frac{\sigma}{\sigma-1} w_H^{\beta}(w_F\tau)^{1-\beta}\right)^{1-\sigma} \frac{1}{\sigma}(\sigma-1)a_i^{\sigma-2}\frac{Y}{\Sigma_i p_i^{1-\sigma}}(1-f+f\phi)^{\sigma} < \left(\frac{\sigma}{\sigma-1} w_H\right)^{1-\sigma} \frac{1}{\sigma}(\sigma-1)a_i^{\sigma-2}\frac{Y}{\Sigma_i p_i^{1-\sigma}} \quad \text{(B.5)}$$

$$\left(w_H^{\beta}(w_F\tau)^{1-\beta}\right)^{1-\sigma}(1-f+f\phi)^{\sigma} < w_H^{1-\sigma} \quad \text{(B.6)}$$

Next, suppose that $(1 - f + f\phi) > 0$ and the slope of π_i^{FDI} exceeds the slope of π_i^H. It could then be possible that all producing firms opt for FDI. Important to note is that if all firms opt for FDI, the FDI profit is not given by the function from equation 4.19. The reason behind this is that the FDI profit from equation 4.19 is based on the assumption that there are both firms that opt for FDI and firms that produce domestically. To find the FDI profit if all producing firms opt for FDI, consider seller k and k'. The optimal ratio of the products from seller k and k' for a consumer is now given by:

$$\frac{\frac{\sigma}{\sigma-1}\left[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}-1}\left(f\frac{\sigma-1}{\sigma}\phi c_k^{\frac{\sigma-1}{\sigma}-1} + (1-f)\frac{\sigma-1}{\sigma} * 1 * c_k^{\frac{\sigma-1}{\sigma}-1}\right)}{\frac{\sigma}{\sigma-1}\left[\Sigma_i \alpha_{is_j} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}-1}\left(f\frac{\sigma-1}{\sigma}\phi c_{k'}^{\frac{\sigma-1}{\sigma}-1} + (1-f)\frac{\sigma-1}{\sigma} * 1 * c_{k'}^{\frac{\sigma-1}{\sigma}-1}\right)} = \frac{\lambda p_k}{\lambda p_{k'}} \quad \text{(B.7)}$$

$$c_k = c_{k'}\left(\frac{p_k}{p_{k'}}\right)^{-\sigma} \quad \text{(B.8)}$$

This optimal ratio gives the following demand and profit for a firm i in the case that all firms opt for FDI:

$$q_i = \frac{Y}{\Sigma_i p_i^{1-\sigma}} p_i^{-\sigma} \quad \text{(B.9)}$$

$$\pi_i^{FDI} = \left(\frac{\sigma}{\sigma-1}\frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i} - \frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right)\frac{Y}{\Sigma_i p_i^{1-\sigma}}\left(\frac{\sigma}{\sigma-1}\frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right)^{-\sigma} - v_H - v_F \quad \text{(B.10)}$$

If there exist a value of a_i for which $\pi_i^{FDI} > 0$ and $\pi_i^H < 0$, all firms will opt for FDI. Using the domestic profit from equation 4.15 and the FDI profit from B.10 shows that such a value of a_i exists if:

$$\left(\frac{v_H + v_F}{\left(\frac{\sigma}{\sigma-1} w_H^{\beta} (w_F \tau)^{1-\beta} \right)^{1-\sigma} \frac{1}{\sigma} \frac{Y}{\Sigma_i p_i^{1-\sigma}}} \right)^{\frac{1}{\sigma-1}} < \left(\frac{v_H}{\left(\frac{\sigma}{\sigma-1} w_H \right)^{1-\sigma} \frac{1}{\sigma} \frac{Y}{\Sigma_i p_i^{1-\sigma}}} \right)^{\frac{1}{\sigma-1}} \tag{B.11}$$

$$\frac{v_H + v_F}{\left(w_H^{\beta} (w_F \tau)^{1-\beta} \right)^{1-\sigma}} < \frac{v_H}{\left(w_H \right)^{1-\sigma}} \tag{B.12}$$

To have an equilibrium in which some firms opt for FDI while others opt for domestic production in the baseline model, we thus need the following three conditions to hold:

$$(1 - f + f\phi) > 0 \tag{B.13}$$

$$\left(w_H^{\beta} (w_F \tau)^{1-\beta} \right)^{1-\sigma} (1 - f + f\phi)^{\sigma} > w_H^{1-\sigma} \tag{B.14}$$

$$\frac{v_H + v_F}{\left(w_H^{\beta} (w_F \tau)^{1-\beta} \right)^{1-\sigma}} > \frac{v_H}{\left(w_H \right)^{1-\sigma}} \tag{B.15}$$

Clearly, there exist parameter values such that these conditions hold. For example, if ϕ is extremely close to 1, condition B.13 and B.14 will hold. After all, I assume that $w_F \tau < w_H$. In addition, consider a situation in which v_F is an extremely large number. Condition B.15 is then most likely met.

C Appendix: Baseline Mixed Equilibrium

In this section, I will explain that the possibility of playing a mixed strategy does not change the conclusions from the baseline model. The intuition behind this is as follows.

First, on the lower end of the productivity spectrum, there exists a set of firms that earn a strictly negative profit regardless of their location choice. These firms will always exit the market, even if mixed strategies are considered. Next, consider the most productive firms in the market. These firms opt for FDI as they make a strictly higher profit using FDI compared to domestic production. Hence, even when given the choice to mix, these firms prefer to produce using FDI. All in all, these two sets of firms will never play a mixed strategy.

Another possibility for firms to mix is between exiting the market and producing in H. However, note that this is only the case for firms that are indifferent between these two strategies. Hence, this would not alter the sorting pattern from the pure strategy equilibrium.

Finally, it could be possible that firms mix between FDI and complete production in H or between FDI and exiting the market. In this context, finding an equilibrium in mixed strategies is not necessarily trivial. By playing a mixed strategy, firms can influence consumers' belief f. This belief then, in turn, affects π_i^{FDI}. To see this, let the probability that a firm opts for FDI if $s_F = b$ be denoted by r, and the probability that it opts for FDI if $s_F = g$ be denoted by z. Consumers' belief that $s_F = b$ after a firm opts for FDI is now given by:

$$f = \frac{\rho * r}{\rho * r + (1 - \rho) * z} \tag{C.1}$$

The expression reveals that the f increases in r but decreases in z. This is intuitive: consumers' belief that the firm is involved in a negative accident increases if the firm is more likely to opt for FDI if $s_F = b$ and decreases if the firm is more likely to opt for FDI if $s_F = g$. In addition, note that π_i^{FDI} negatively depends on f:

$$\frac{\partial \pi_i^{FDI}}{\partial f} = \left(\frac{\sigma}{\sigma - 1}\frac{w_H^{\beta}(w_F\tau)^{1-\beta}}{a_i}\right)^{1-\sigma}\frac{1}{\sigma}\frac{Y}{\Sigma_i p_i^{1-\sigma}}(1 - f + f\phi)^{\sigma-1}\sigma(-1 + \phi) < 0 \tag{C.2}$$

Thus, firms can increase π_i^{FDI} by increasing z or reducing r. In fact, firms can pick z and r so that f becomes sufficiently close to 0. In this case, profits approach the result obtained by Antràs and Yeaple (2014). For an equilibrium, z and r should be picked so that the firm is willing to mix between FDI and the other strategy.

All in all, it is possible that more firms opt for FDI in the mixed strategy equilibrium than in the pure strategy equilibrium. Important to note is that these firms must be in the middle of the productivity spectrum as the least productive firms always exit and the most productive ones always opt for FDI. In addition, these mixing firms do not always opt for FDI. Hence, their likelihood of choosing FDI is smaller than for firms that always choose FDI. Overall, this implies that the likelihood of sorting into FDI still decreases in productivity.