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Mario Larch, Leandro Navarro

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Abstract

We analyse firms' sourcing decisions under institutional uncertainty in foreign countries. Firms can reduce their uncertainty by observing offshoring firms' behaviour. The model characterises a sequential offshoring equilibrium path, led by the most productive firms in the market. With multiple countries, information spillovers drive sourcing location choices, leading to multiple equilibria with implications for countries' comparative advantages and welfare. Using firm-level data from Colombia, we test for the determinants and timing of offshoring decisions. We also derive structural spatial probit models to identify the firms' dynamic trade-off when they decide on the offshoring location. We find supportive evidence for the model's predictions.

JEL-Codes: D810, D830, F100, F140, F230.

Keywords: global sourcing, institutions, uncertainty, information externalities, learning, sequential offshoring, specialisation patterns, comparative advantages, survival model, spatial probit.

Mario Larch
University of Bayreuth
Universitätsstraße 30
Germany – 95447 Bayreuth
mario.larch@uni-bayreuth.de

Leandor Navarro
University of Bayreuth
Universitätsstraße 30
Germany – 95447 Bayreuth
leandro.navarro@uni-bayreuth.de

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1 Introduction

The increasing share of intermediate inputs in global trade and the geographical vertical disintegration of the supply chains in past decades show that sourcing strategies have become global.[1] An important share of the global sourcing literature has focused on how institutions affect firms' organisational and technological choices, the location of intermediate-input suppliers across countries, and countries' comparative advantages.[2] Recent events such as Brexit, the China–US trade war, and the COVID-19 pandemic have also driven attention to their consequences on the relocation of suppliers across foreign countries—that is, the reorganisation of the global value chains—and reshoring decisions.[3]

When deciding on the relocation of intermediate-input suppliers to new foreign countries, firms usually face uncertainty about institutions in those locations. This uncertainty may affect the firms' exploration decisions regarding the offshoring potential in new locations, especially when it involves initial irreversible investments.[4] A clear case of uncertainty arises when firms consider sourcing from locations where they have never been active before.[5] But institutional uncertainty may also emerge in relation to locations where firms have had some experience in the past. For instance, after the implementation of an ambitious institutional reform by a foreign government, firms may have doubts about the scope of the reform and thus uncertainty emerges about the fundamentals of the new institutional regime.

We develop a global sourcing model that characterises firms' sourcing decisions under institutional uncertainty in foreign countries. The model shows that uncertainty leads to an initial low offshoring activity where only the most productive firms in the market offshore their intermediate inputs. The actions of these firms reveal information to the other firms about institutional conditions abroad (*information externalities*), allowing the latter to learn and progressively reduce their prior uncertainty. The resulting offshoring exploration is sequential in productivity, and it is led by the most productive firms in the market. We characterise the main prediction of the model by extending it to a multi-country setup. When firms have multiple alternative sourcing locations for the production of the intermediate inputs, information spillovers affect firms' offshoring location choices. Hence, a selection pattern in countries emerges.

[1] Hummels et al. (2001); Helpman (2006); Antràs and Helpman (2004, 2008); Grossman and Helpman (2005); Grossman and Rossi-Hansberg (2008); Alfaro and Charlton (2009); Nunn and Trefler (2008); Harms et al. (2012, 2016); Nunn and Trefler (2013); Antràs and Yeaple (2014); Antràs (2015); Ramondo et al. (2015); Antràs et al. (2017).

[2] See Helpman (2006); Acemoglu et al. (2007); Levchenko (2007); Nunn (2007); Antràs and Helpman (2008); Costinot (2009); Antràs and Chor (2013); Antràs et al. (2017).

[3] See Head and Mayer (2019); Blanchard (2019); Van Assche and Gangnes (2019); Grossman and Helpman (2020); Gereffi et al. (2021) and Bown et al. (2021).

[4] The exploration of the offshoring potential in new locations may require that the firm pay (sunk) costs on market research and feasibility studies on the regulatory conditions in the foreign country, as well as the search costs of potentially suitable intermediate input suppliers and sunk investments related to setting up a supply chain in the new location. For an analysis of the consequences of uncertainty in the context of irreversible investments, see Bernanke (1983).

[5] For example, firms may have incomplete knowledge of the environmental or labour regulations, property rights and foreign investment protection, import and export regulations, local taxes, sector- or input-specific regulations, etc.

As more firms offshore from one location, they reveal more information to the other active firms about institutions in that country. This increasingly differentiates the countries in terms of institutional beliefs, and thus drives the offshoring exploration of the other firms towards these countries. We characterise the multiple equilibria and the respective dynamic equilibrium paths, and analyse their consequences in terms of the countries' specialisation patterns and welfare.

We begin with a simple two-country (North–South) model, which characterises the information spillovers, the learning mechanism and the sequential offshoring exploration. We build on the literature of global sourcing with heterogeneous firms starting with Antràs and Helpman (2004). We deviate from it by assuming complete contracts and thus focus only on the location dimension of the sourcing decisions.[6] We define a model with multiple differentiated sectors, where each sector has a continuum of heterogeneous final-good producers (namely, firms), which we assume are located in the North. The production of the final-good varieties in the differentiated sectors requires manufactured intermediate inputs that can be supplied by a domestic or a foreign manufacturer (namely, a supplier).

The novelty of our model consists in introducing institutional uncertainty in the sourcing decisions, which we define as uncertainty in the operational (i.e., per-period) offshoring fixed costs. For simplicity, the initial conditions are defined by a situation where no firm offshores. In $t = 0$, there is an institutional reform in the South, which introduces uncertainty about the new southern institutional fundamentals.[7] In each period t, firms under domestic sourcing face a trade-off: they can explore their offshoring potential or wait. On the one hand, if they decide to explore it, they have to pay an offshoring sunk cost, which refers to the feasibility studies that firms must afford when they analyse the conditions for setting up a supply chain in a new foreign location.[8] After paying this sunk cost, firms learn the institutional fundamentals in the South—that is, they learn the true per-period offshoring fixed costs—and, thus, have no remaining uncertainty. This information remains private to the firms that paid the offshoring sunk cost. With this knowledge, they can decide with certainty the optimal location of their supplier (domestic or foreign). On the other hand, if they decide to wait, they receive new information by observing offshoring firms and use it to update their priors, which reduces their offshoring-exploration risk. However, they

[6] The main reference for a North-South model under perfect information is Antràs and Helpman (2004). Our model also complements Grossman and Helpman (2005), Harms et al. (2012, 2016) and Antràs et al. (2017). The model can be extended to incomplete contracts or partially contractible investments. However, the main predictions of the model remain robust. For the case of incomplete contracts and the effects of uncertainty on the organisational dimension of sourcing decisions—i.e., on the allocation of property rights—see Navarro (2023).

[7] That is, no firm in the market finds it profitable to offshore in the South in the pre-reform situation. The initial condition can be defined in a more general setting allowing for an initial steady state where some firms offshore in the South. The main features and results of the model are robust to this change. We discuss this further in section 2.

[8] The offshoring sunk cost represents investments in market research on intermediate inputs, the analysis of the regulatory and tax system in the foreign potential sourcing location, the analysis of the costs of setting up logistic and production facilities in the foreign location, and search costs for suitable intermediate-input suppliers.

reduce this risk at the (potential) cost of realising lower expected profits by sourcing domestically during the waiting period. The exploration decisions are characterised by a Markov decision process, where firms update their institutional prior beliefs through a Bayesian learning mechanism.

The dynamic equilibrium path shows that information spillovers allow firms to progressively learn about their offshoring potential in the foreign country and delay their exploration decision.[9] The main prediction of the baseline model is that the equilibrium path takes the form of a sequential offshoring exploration process led by the most productive firms in the market. The model also shows that the initial welfare costs, that arise due to the prior uncertainty, progressively vanish as the respective sector converges to the steady state. We show the conditions for convergence to the perfect information equilibrium and the cases under which the steady state shows 'excessive offshoring'.[10]

In section 3, we test the theoretical predictions of the baseline two-country model using manufacturing firm-level Colombian data for the period 2004–2018. In particular, we focus on the prediction that the offshoring exploration is sequential in productivity. In addition, we analyse the evidence on the role of general information spillovers on the timing of firms' offshoring exploration decisions.[11] We develop two complementary reduced-form empirical approaches. First, we build a conditional probability model to test for the determinants of the offshoring exploration decisions, as predicted by the theory. Second, given the dynamic nature of the equilibrium path, we use a transition (or survival) model to test for the timing dimension of the theoretical predictions.[12] In the last case, we find that a 10% increase in the productivity of domestic-sourcing firms increases the hazard rate of those firms to offshore (i.e., accelerates offshoring exploration) by up to about 0.5 percentage points. Furthermore, we find that firms start offshoring earlier the more information is revealed about the general offshoring conditions.[13] We conclude the empirical analysis of the baseline model with the derivation of a structural probit model, which estimates the trade-off function that explains the offshoring exploration decisions of domestic-sourcing firms in each period t, and also provides evidence in line with our model's predictions.

From the model's perspective, the information spillovers not only affect the timing of the exploration

[9]Firms can learn about conditions abroad through their own experience or by observing the behaviour of other firms in the same sector that are active (i.e., offshoring) in those countries.

[10]The hysteresis comes from those firms that, after exploration, discover that the discounted offshoring profit premium is positive but it is not enough to recover the offshoring sunk cost. They choose to remain under offshoring after exploration, but they would have chosen domestic sourcing under perfect information.

[11]The main role of (country-specific) information spillovers driving offshoring location choices, which is the main prediction of our model, is analysed later in the multi-country extension.

[12]For some applications of transition or survival models in international trade, see Besedeš and Prusa (2006), Nitsch (2009), Bergstrand et al. (2016), and Monarch et al. (2017). For general references on the topic, see Lancaster (1990), Jenkins (2005), Cameron and Trivedi (2005), and Wooldridge (2010).

[13]We find that a 10-unit increase in the standard deviation of the productivities of offshoring firms (which corresponds to a 20% increase at the mean) increases the hazard rate of domestic-sourcing firms to explore offshoring by about 0.3 percentage points (the mean probability of exploring offshoring in a given year is 8.5%).

decisions but also the location choices by revealing country-specific information. In section 4, we extend the model to multiple countries to analyse the role of information spillovers on the location dimension of firms' offshoring decisions.[14] In section 4.1, we develop the theoretical extension of the model, where we characterise the respective equilibrium paths and show that the information spillovers generate selection patterns in the location choices that lead to multiple equilibria. The offshoring allocation across countries and the sectoral specialisation patterns in the steady state driven by prior beliefs and information spillovers may differ from the specialisation patterns under perfect-information equilibrium defined by the institutional fundamentals. Hence, our model complements the literature investigating the role of institutions as determinants of countries' comparative advantages as well as the literature on external economies and trade by highlighting the role of information spillovers for the offshoring decisions and their consequences for the allocation of production across countries and welfare.

From a policy perspective, the multi-country model sheds light on situations where improvements in institutional fundamentals may not have the expected results as predicted by models under perfect information; that is, by models that ignore the presence of institutional uncertainty and learning. It brings new insights into the underlying determinants of the offshoring decisions and characterises the conditions that must be considered by governments when they implement reforms aimed to promote the entry of domestic intermediate-input suppliers in global value chains. On the one hand, when the sector converges to a non-efficient steady state, the country that has better fundamentals but does not receive any offshoring flows must concentrate in the short run on reforms (i.e., policies) oriented to produce changes in the perceptions (beliefs) instead of improving institutional fundamentals. On the other hand, the country with worse fundamentals but currently receiving the offshoring flows has an incentive to concentrate the efforts on improving the institutional fundamentals in the long run and reduce the probability of facing an adverse relocation to third countries in the future. In section 4.2, we also analyse the policy instruments that a Social Planner (SP) may implement to achieve the perfect-information steady state, and discuss decentralised policy implications of the multi-country model.

In sections 4.3–4.5, we test the theoretical predictions of the multi-country model. We follow the same two complementary approaches for the reduced-form models as before. We model the offshoring exploration decisions for domestic-sourcing firms and firms already offshoring in other locations. For the latter, we test the exploration decisions of new countries for potential relocations of offshore suppliers. In the reduced-form models, we identify the learning mechanism by incorporating measures for the institutional priors and the information spillovers, and we estimate their effects on the location choice of the

[14]We introduce heterogeneous countries defined in terms of fundamentals and beliefs.

offshoring exploration decisions. We summarise the main findings regarding the latter. We find evidence that a 10% increase in the average productivity accelerates the offshoring exploration of a new foreign country, represented by an increase of the hazard rate: i) by about 0.017 percentage points for domestic-sourcing firms, and ii) by about 0.08 percentage points for offshoring firms from other locations.[15] At the same time, an increase in the information revealed about a foreign country relative to other unexplored locations accelerates the exploration of that country, represented by an increase in the hazard rate to offshore from that location of: i) about 0.003 percentage points by domestic-sourcing firms, and ii) 0.02 percentage points by offshoring firms from other locations. We also derive a structural spatial probit model in section 4.5, which identifies the offshoring exploration decisions in a multi-country setup.[16] The structural spatial probit model also allows us to identify how the offshoring exploration decisions to a country are affected by the expected offshoring potential—and thus, the information revealed—in the alternative sourcing locations.

Literature review. We build on the literature on global sourcing with heterogeneous firms. The closest reference to our baseline model is the global sourcing model developed by Antràs and Helpman (2004). The main departure from them is that we introduce uncertainty in the organisational fixed costs of offshoring and focus on the location dimension of the sourcing decision (by assuming complete contracts).

We also relate and contribute to the literature on trade as well as institutions on comparative advantages, and on external economies and trade, in particular.[17] Acemoglu et al. (2007) and Costinot (2009) show how differences in the fundamentals of contractual institutions are a source of comparative advantages,[18] whereas Eaton and Kortum (2002) discusses the role of technological and geographical factors (i.e., fundamentals) as determinants of countries' specialisation patterns. Our model, instead, remarks the importance of both dimensions—beliefs and fundamentals—for countries' specialisation patterns.[19] We find that firms' prior beliefs and information externalities play an important role in determining

[15]The mean probability of exploring offshoring in a given year for a domestic-sourcing firm is 0.07%. In regard to offshoring firms, the mean probability to explore offshoring in a new location in a given year is 0.7%.

[16]Close references for the structural model are Das et al. (2007); Egger and Larch (2008); Dickstein and Morales (2018), and the general literature on spatial probit models (LeSage and Pace, 2009).

[17]For example, see Eaton and Kortum (2002) for trade and comparative advantage; Ethier (1982*a*,*b*), Krugman (1995), Choi and Yu (2002), Grossman and Rossi-Hansberg (2010) and Lyn and Rodríguez-Clare (2013) for external economies and trade; and Acemoglu et al. (2007), Levchenko (2007) and Costinot (2009) for institutions and comparative advantages.

[18]In our model, we focus on general institutional conditions that enter firms' profits through per-period fixed costs. However, the model can be extended to partially contractible investments with uncertainty in the degree of contract enforcement. In the empirical model, we partially consider the case of contractual institutions, by introducing—as robustness—the Rule of Law as institutional index.

[19]In other words, beliefs and fundamentals are determinants of the countries' *revealed* comparative advantages, which may differ from the countries *natural* comparative advantages. We refer with *natural* comparative advantages to the specialisation patterns explained by institutional fundamentals. We use the term *revealed* comparative advantages—different to Balassa (1965) and Balassa and Noland (1989)—for comparative advantages in terms of beliefs—that is, the perceived comparative advantages—that are a function of the institutional priors and the information spillovers. We discuss this further in section 4.

countries' sectoral specialisation. The extensive literature on external economies and trade discusses the conditions under which increasing returns to scale and trade lead to multiple equilibria with implications in terms of specialisation patterns and welfare. We show that multiple equilibria leading to different specialisation patterns and welfare may also emerge with information externalities under uncertainty and with constant returns to scale technologies and given (i.e., fixed) fundamentals.

To the best of our knowledge, this is the first paper in the global sourcing literature to introduce uncertainty in the form of imperfect knowledge about foreign conditions and to allow firms to learn about their offshoring potential by exploiting information externalities produced by other firms' behaviour. There is a growing literature on uncertainty in global sourcing decisions, but the attention has centred on how the exposure to shocks affects firms' choices (Carballo, 2018; Kohler and Kukharskyy, 2019).[20] Firms optimise their sourcing strategy with perfect knowledge of the distributions of shocks, i.e. the stochastic nature of the world. In our model, instead, firms face imperfect knowledge about the institutional fundamentals abroad, but they can progressively reduce their prior uncertainty by exploiting information externalities. There is a more extensive literature on export decisions under uncertainty, where firms may improve their prior knowledge by learning, and thus better assess their exporting potential.[21] However, as discussed in the literature, sourcing choices show fundamental differences in comparison to export decisions.[22] Finally, we characterise the dynamics of the model as a Markov decision process in which firms learn by a Bayesian recursive mechanism. In this regard, the closest references are Rob (1991) and Segura-Cayuela and Vilarrubia (2008).[23]

The paper is organised as follows. Section 2 introduces the theoretical two-country model and its main predictions, whereas section 3 presents the respective empirical models. Section 4 extends the theory to multiple countries and introduces the respective empirical models. We conclude in section 5.

[20]Carballo (2018) examines how different organisational sourcing types respond differently to demand shocks. Kohler and Kukharskyy (2019) analyse sourcing decisions when firms face shocks in demand (the size of the market) or supply (supplier's productivity) conditions and study the role of labour market institutions (rigidity vs. flexibility) in those choices.

[21]See, for example, Segura-Cayuela and Vilarrubia (2008), Albornoz et al. (2012), Nguyen (2012), Aeberhardt et al. (2014) and Araujo et al. (2016).

[22]See, for example, Antràs et al. (2017). Moreover, in the empirical structural model for the multi-country setting, we find a negative spatial effect, which reflects the substitutability of the alternative locations in sourcing decisions.

[23]Rob (1991) introduces a model of market entry in which there is imperfect information about the demand conditions (the size of the market). Rob introduces a Bayesian learning process, which allows firms to progressively improve the information about the demand, characterizing a sequential entry into the market. Based on Rob (1991), Segura-Cayuela and Vilarrubia (2008) applies this same approach to a Melitz (2003)'s type model with uncertainty in fixed exporting costs, leading to sequential entry in the foreign markets. We also draw from the general literature on recursive methods and statistical decisions such as Stokey and Lucas (1989), DeGroot (2005) and Sutton and Barto (2018).

2 The two-country model

The model consists of a world economy with two countries, North (N) and South (S), and a unique factor of production, labour (ℓ). The representative consumer preferences are given by:

$$U_t = \gamma_0 \ln q_{0,t} + \sum_{j=1}^{J} \gamma_j \ln Q_{j,t}, \quad \text{with } \gamma_j > 0 \quad \forall j = 0, ..., J, \quad \text{and } \sum_{j=0}^{J} \gamma_j = 1, \tag{1}$$

where $q_{0,t}$ denotes the consumption in period t of a perfectly competitive and tradable homogeneous good, and $Q_{j,t}$ is the aggregate consumption index in the differentiated sector j in period t. For simplicity, we assume that all goods are tradable in the world market, there are neither transport costs nor trade barriers, and consumers have identical preferences across countries.[24]

The per-period aggregate consumption in a differentiated sector j is $Q_{j,t} = \left[\int_{i \in I_{j,t}} q_{j,t}(i)^{\alpha_j} di\right]^{1/\alpha_j}$ with $0 < \alpha_j < 1$, which consists of the aggregation of the consumed varieties $q_{j,t}(i)$ on the range of varieties $i \in I_{j,t}$ of sector j in period t. The elasticity of substitution between any two varieties in this sector is $\sigma_j = 1/(1-\alpha_j)$. The inverse demand function for variety i in differentiated sector j in period t is given by $p_{j,t}(i) = \gamma_j E Q_{j,t}^{-\alpha_j} q_{j,t}(i)^{\alpha_j - 1}$, where E denotes the per-period total (world) expenditure, and the price index in each differentiated sector j in period t is defined as $P_{j,t} \equiv \left[\int_{i \in I_{j,t}} p_{j,t}(i)^{1-\sigma_j} di\right]^{\frac{1}{1-\sigma_j}}$.

The final-good variety i in sector j is produced with a Cobb-Douglas technology given by:

$$q_{j,t}(i) = \theta \left(\frac{x_{h,j,t}(i)}{\eta_j}\right)^{\eta_j} \left(\frac{x_{m,j,t}(i)}{1-\eta_j}\right)^{1-\eta_j}, \quad \text{with } \eta_j \in (0,1), \tag{2}$$

where θ represents the firm's productivity level, which varies across firms. We assume complete contracts, meaning that investments are fully contractible.[25] The inputs are the final-good producer services, $x_{h,j,t}$, and the intermediate input, $x_{m,j,t}$. They are supplied by the final-good producer, H, and the intermediate-input supplier, M, respectively.[26] Both inputs are produced with constant return technologies, i.e. $x_{k,j,t}(i) = \ell_{k,j,t}(i)$ with $k = h, m$. As in Antràs and Helpman (2004), we assume that the final-good producers in the differentiated sectors are only located in the North.

The homogenous-good sector has a constant-returns-to-scale technology $q_{0,t} = A_{0,l}\ell_{0,t}$, where $A_{0,l} > 0$ is a productivity parameter in country l. We assume that γ_0 is large enough such that the homogeneous good is produced in every country. Thus, relative wages are defined by the relative productivity in this sector.

[24]Given our focus on the location choices of intermediate input suppliers, we simplify the market structure in the final good sectors by assuming a fully integrated final good market for these sectors (see Antràs and Helpman, 2004; Grossman and Rossi-Hansberg, 2010, for examples). Relaxing this assumption by introducing trade frictions in the final good markets does not affect our model's predictions. The extension to non-tradable final goods in the differentiated sectors—that is, an economy where only homogeneous goods and intermediate inputs are tradable (see Antràs, 2003; Antràs et al., 2017, for examples)—is straightforward, while the extension to tradable differentiated final goods with trade costs would require a more structural identification of the final good markets.

[25]We introduce this simplifying assumption to focus on the location dimension of the sourcing decisions.

[26]We refer to the final-good producer alternatively as the firm or H.

Assumption A. 1. *The productivity of northern workers in the homogeneous-good sector is higher than southern workers in the same sector; that is, $A_{0,S} < A_{0,N}$. Therefore, $w^N > w^S$.*

In the differentiated sectors, firms enter the market according to a Melitz (2003)'s entry mechanism. Firms must pay a one-period market entry sunk cost s_j^e in northern units of labour, i.e. $w^N s_j^e$. After the payment, they discover their productivity θ, which is drawn from a c.d.f. denoted by $G(\theta)$.[27]

In the remainder of the section, we focus on the firms' dynamics in one differentiated sector j. Therefore, for simplicity of notation, we drop subscript j.

2.1 Perfect information equilibrium

The equilibrium under perfect information is closely related to that in Antràs and Helpman (2004) with two main differences. First, we assume perfectly contractible investments, instead of incomplete contracts.[28] Second, we introduce an offshoring sunk cost, measured in northern labour units, which must be paid in advance by those firms that want to offshore. It can be interpreted as the market research costs and feasibility studies that firms have to afford when they want to explore their offshoring potential and search for potential suppliers in different locations.[29] Figure 1 illustrates the timing of events under perfect information. To simplify the notation, we drop the subscript t in the characterisation of the perfect-information equilibrium. We reintroduce it in section 2.2 when we analyse the two-country dynamic model with institutional uncertainty.

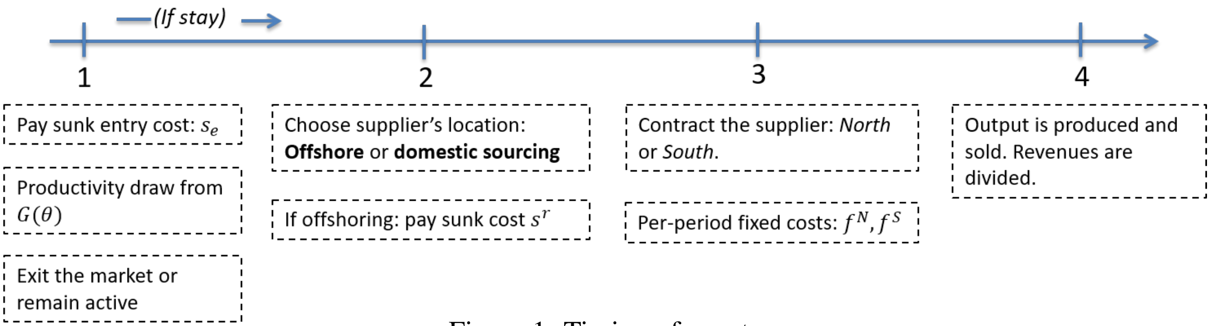


Figure 1: Timing of events

Assumption A. 2. *The ranking of per-period fixed production costs is $f^N < f^S$.*

Assumption A.2 implies that offshoring has higher operational fixed costs than domestic sourcing. We also assume that per-period fixed costs are defined in northern labour units.[30]

[27]The entry sunk cost represents the expenditures of the northern final-good firm to develop the final-good variety that the firm will commercialise (Melitz, 2003). Thus, following the literature, we define the entry sunk cost in northern labour units.

[28]For details on the perfect-information equilibrium, see Appendix A.

[29]The offshoring sunk cost does not play an important role in the model with perfect information, but as we will show in section 2.2, it makes it costly (and risky) for firms to explore their offshoring potential under uncertainty.

[30]As in Antràs and Helpman (2004), we define per-period fixed costs in northern labour units for simplicity. Defining the per-period fixed costs in different labour units—e.g., f^N and f^S in northern and southern labour units, respectively—or in a composite of northern and southern units changes neither the main features of the model nor the predictions.

Sourcing decision. We define the *per-period offshoring profit premium* of a firm with productivity θ as $\pi^{S,prem}(\theta) \equiv \pi^{S}(\theta) - \pi^{N}(\theta) = \frac{r^N(\theta)}{\sigma}\left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] - w^N\left[f^S - f^N\right]$. Firms must choose whether to source the intermediate inputs domestically or from a supplier in the South. They choose to offshore whenever the discounted lifetime offshoring profit premium is higher or equal to the offshoring sunk cost. Formally, the decision can be defined as:

$$\pi^{S,prem}(\theta)\begin{cases} < (1-\lambda)w^N s^r & \text{if } \underline{\theta}^* \leq \theta < \theta^{S,*} \Rightarrow \text{ firm } \theta \text{ sources domestically,} \\ \geq (1-\lambda)w^N s^r & \text{if } \theta \geq \theta^{S,*} \Rightarrow \text{ firm } \theta \text{ offshores,} \end{cases} \tag{3}$$

with $\lambda \in (0,1)$ denoting the per-period survival rate to an exogenous death shock that pushes the firm out of business, $\theta^{S,*}$ indicates the offshoring productivity cutoff, and $\underline{\theta}^*$ denotes the market productivity cutoff. Superscript $*$ refers to the equilibrium values under perfect information.

Perfect-information equilibrium. The most productive active firms (i.e., $\theta \geq \theta^{S,*}$) choose offshoring, whereas the least productive firms among the active ones (i.e., $\underline{\theta}^* \leq \theta < \theta^{S,*}$) choose to source domestically. Firms with a productivity $\theta < \underline{\theta}^*$ leave the market after entry.[31]

2.2 The global sourcing dynamic model with uncertainty

We now analyse the sourcing decisions when firms face uncertainty about the per-period fixed costs of offshoring in the South. In a dynamic setup, we show that domestic-sourcing firms can exploit information externalities by observing the behaviour of offshoring firms, progressively updating their knowledge and reducing their prior uncertainty. As in Bernanke (1983), the presence of uncertainty, together with the expected incoming of new information that reduces the risk of the decision, generates an option value of waiting. Hence, a firm delays the offshoring exploration when the expected gains from waiting exceed the expected gains from offshoring. The offshoring-exploration decision is characterised as a Markov decision process where firms update their beliefs through a Bayesian learning mechanism.[32]

We define the initial conditions as the steady state of a sector with non-tradable intermediate inputs (abbreviated by *n.t.i.*). This refers to a situation where the firms can only source with domestic suppliers, which may be explained by pre-existing (beliefs about) institutions in the South that make the cost of offshoring prohibitively high for all firms in the market.[33]

[31] Figure A1 in Appendix A.1.6 illustrates the respective sectoral equilibrium under perfect information. We also show the respective offshoring productivity cutoff.

[32] Close references for the exploration decisions and learning are Rob (1991) and Segura-Cayuela and Vilarrubia (2008).

[33] The final goods are still tradable in the world market, as above. The assumption of *n.t.i.* on the initial condition can be easily relaxed. Alternatively, we can define the initial condition as a steady state where a share of the most productive firms already offshore in the South in periods before $t = 0$ under a weaker pre-reform institutional environment with higher per-period fixed costs. After the announcement of the reform in $t = 0$, we assume that at least some of the most productive firms still under domestic sourcing will find it profitable to explore offshoring in the South. We discuss this further in Appendix

In $t = 0$, there is an unexpected institutional-information shock that makes offshoring in the South potentially profitable, initially at least for some firms in the market. We represent that information shock in $t = 0$ as the moment in which the southern government announces a deep institutional reform.[34] Northern firms do not fully believe in the announcement of the foreign government, but they know that some changes have been implemented. Therefore, northern firms build prior beliefs about the possible scope of the reforms. The institutional uncertainty is represented by a prior distribution on the per-period fixed costs of offshoring in the South.[35] We discuss this further in section 2.2.3.

2.2.1 Timing of events

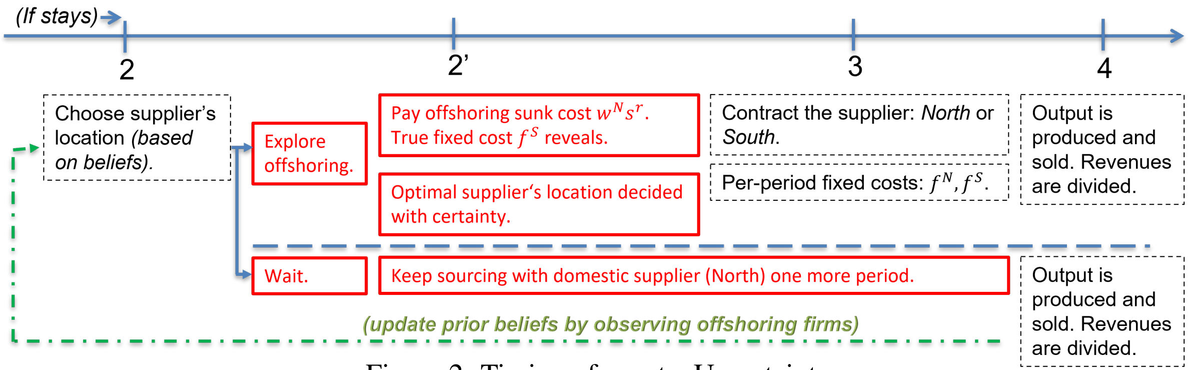


Figure 2: Timing of events. Uncertainty.

Figure 2 illustrates the timing of events for $t \geq 0$. After the institutional reform, at any period t, domestic-sourcing firms can choose whether to explore their offshoring potential or wait for new information to be revealed. If a firm chooses to explore its offshoring potential in the South, the offshoring sunk cost is paid and the true per-period fixed cost f^S is discovered, which remains private information. Thus, this firm can decide the optimal sourcing strategy with complete certainty.[36] If, instead, a firm decides to wait for more information to be revealed, it keeps sourcing with a domestic supplier. In the following period, the firm must decide again whether to explore the offshoring potential or wait, but now under a reduced uncertainty given the new information revealed by the new offshoring firms.

2.2.2 Initial conditions: Welfare implications

Under Assumption A.1, the price charged by a firm with productivity θ under domestic sourcing is higher than under offshoring. Therefore, comparing the *n.t.i.* and perfect-information steady states, we have: $P^{n.t.i.} > P^*$, $Q^{n.t.i.} < Q^*$ and $\underline{\theta}^{n.t.i.} < \underline{\theta}^*$, where superscript *n.t.i.* indicates the equilibrium value for the initial conditions, and $*$ refers to the equilibrium variables under perfect information with

B.2.1, where we also analyse the case of a sequence of institutional reforms.

[34] For example, an institutional reform that aims to promote the participation of southern intermediate-inputs manufacturers in global value chains.

[35] After the announcement, the adjustment under perfect information to the new equilibrium is instantaneous. Under uncertainty, instead, we show below that the adjustment is sequential and led by the most productive firms in the market.

[36] In terms of the Markov process, exploration is an absorbing state for the firm in the two-country model.

tradable intermediate inputs.[37] A comparison between the *n.t.i.* and the $*$ steady states shows the welfare gains from offshoring, which are summarised by $P^{n.t.i.} > P^*$, or alternatively by $Q^{n.t.i.} < Q^*$. In the steady state $*$, the differentiated sectors reach lower price indices and thus higher aggregate consumption levels. Moreover, welfare gains are increasing in the share of offshoring firms.[38]

2.2.3 Institutional prior uncertainty, information externalities and learning

An institutional reform in the South takes place in $t = 0$, but northern firms do not fully believe in the scope of the announced institutional reform. Thus, in $t = 0$, firms build prior (imperfect) beliefs about the quality of the after-reform institutions in the South. This prior uncertainty is modelled as a prior distribution of the per-period fixed costs of offshoring in the South, which is represented by:

$$f^S \sim Y(f^S) \quad \text{with} \quad f^S \in [\underline{f}^S, \bar{f}^S], \tag{4}$$

where $Y(.)$ denotes the c.d.f. of the prior distribution.

Figure 3 illustrates the perfect-information equilibrium (*dark lines*) in comparison to the expected profits by sourcing type under the initial prior uncertainty (*light lines*). The latter represents the equilibrium of a static model with uncertainty, where firms cannot learn. However, from a dynamic approach, we show that information externalities emerge and characterise the conditions under which the steady state converges to the perfect-information equilibrium.[39]

The dynamic model is characterised as a Markov decision process, where firms learn by exploiting the information externalities that emerge from observing other firms' behaviour.[40] The state of the Markov process has two dimensions: *beliefs* and *physical*. The former refers to the Bayesian learning mechanism through which firms update their beliefs and reduce their prior uncertainty. The latter corresponds to the data observed and used by the firms to update their beliefs; that is, it refers to the per-period information externalities produced by new offshoring firms. We define next both state dimensions.

[37] For expressions of the perfect information equilibrium $*$, see Appendix A.1. For characterisation of *n.t.i.* steady state and proofs, see Appendix B.1. For alternative specifications of the initial condition where firms are offshoring in periods previous to $t = 0$, as discussed in footnote 33, the variables labelled as *n.t.i.* represent the respective initial values. The only difference is that the initial price index (aggregate consumption) would be smaller (larger) and the market productivity cutoff would be higher than in the main specification of the initial conditions. Nevertheless, the relationships of each of these variables for the perfect information equilibrium still hold. All results of the model are robust to this generalisation of the initial conditions. For a detailed discussion, see Appendix B.2.1.

[38] In other words, P^* is decreasing in χ^*, where the latter denotes the share of offshoring firms in the $*$ steady state. See Appendix A.1.3 for proofs and details. In section 2.2.4, we discuss the effects on the market productivity cutoff. The model also shows a polarisation effect as in Melitz (2003), but of a different nature. In our model, the polarisation effect results from the cost advantages that firms doing offshoring can exploit by obtaining access to foreign intermediate input suppliers with lower marginal costs. This finding is consistent with Antràs et al. (2017).

[39] The information externalities play a key role by allowing firms to progressively discover their offshoring potential and therefore adjust optimally their sourcing strategy.

[40] In particular, we assume that firms can observe the market's total revenues, the market share of every active firm, and the supplier location chosen by each of their competitors. These elements, together with the known wages at each location, allow firms to infer the productivity level of each competitor.

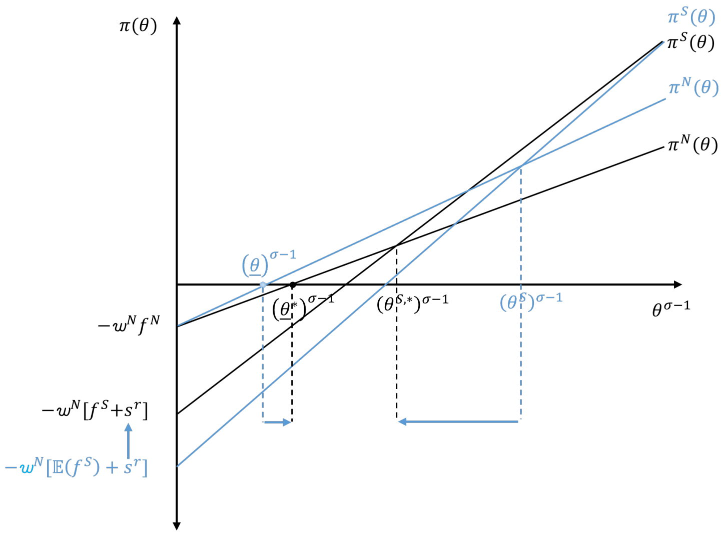


Figure 3: Perfect information and static equilibrium with uncertainty

'Physical' state: Information spillovers. We define $f^S(\theta)$ as the maximum affordable per-period fixed cost in the South for a firm with productivity θ. This implies that under this per-period fixed cost, a firm with productivity θ would earn zero per-period offshoring profit premium; that is:

$$\pi^{S,prem}(\theta) = 0 \quad \Rightarrow \quad f^S(\theta) = \frac{r^{N,*}(\theta, Q_t)}{\sigma w^N}\left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] + f^N.$$

In other words, if $f^S > f^S(\theta)$, firms with productivity θ will remain under domestic sourcing after exploring offshoring and discovering the true value f^S.

We define θ_t as the least productive firms under offshoring at the beginning of period t (i.e., the least productive firms that offshored in $t-1$). This implies that, after paying the offshoring sunk cost, firms with productivity greater than or equal to θ_t realise non-negative per-period offshoring profit premiums (i.e., $\pi^{S,prem} \geq 0$) and thus decide to offshore in the South. Therefore, the revealed upper bound at the beginning of period t is represented by the maximum affordable fixed cost in the South for the firms with productivity θ_t. This revealed upper bound is denoted as f_t^S, and it is given by:

$$f_t^S \equiv f^S(\theta_t) = \frac{r^N(\theta_t, Q_t)}{\sigma w^N}\left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] + f^N. \tag{5}$$

Finally, we define $\tilde{\theta}_t$ as the productivity of the least productive firms exploring offshoring in $t-1$. Therefore, $\tilde{f}_t^S \equiv f^S(\tilde{\theta}_t)$ is the expected revealed upper bound at the end of period t, and it is given by the maximum affordable fixed cost in the South such that the firms with productivity $\tilde{\theta}_t$ would choose offshoring after paying the sunk cost in $t-1$. By observing $\tilde{\theta}_t$ and θ_t, all the domestic-sourcing firms can compute $\tilde{f}_t^S$ and f_t^S, key elements defining the incoming data of the Bayesian learning mechanism.[41]

[41] We assume that $\tilde{\theta}_t$ is observable for the simplicity of the exposition. If $\tilde{\theta}_t$ is not observable by the firms, they can still compute it from the properties of the equilibrium path. $\tilde{\theta}_t$ corresponds to the least productive firms that are expected to explore offshoring in $t-1$. Therefore, firms do not need to observe the firms that explored offshoring and came back to domestic sourcing. Instead, firms know the expected offshoring productivity cutoff—given the expected information flow on the equilibrium path—and can compare it with the observed offshoring productivity cutoff. We discuss this further when we characterise the exploration productivity cutoff at each period t in section 2.2.4.

'Beliefs' state: Bayesian learning. The initial prior in $t = 0$ is given by equation (4). The learning mechanism takes the form of a recursive Bayesian learning process, in which the posterior distribution at any period $t > 0$ is given by:

$$f^S \sim \begin{cases} Y(f^S|f^S \leq f_t^S) = \frac{Y(f^S|f^S \leq f_{t-1}^S)}{Y(f_t^S|f^S \leq f_{t-1}^S)} & \text{if } \tilde{f}_t^S = f_t^S < f_{t-1}^S, \\ f_t^S & \text{if } \tilde{f}_t^S < f_t^S, \end{cases} \tag{6}$$

with $\tilde{f}_t^S$ and f_t^S defined above—see 'physical' state—and f^S denoting the true value.

The learning mechanism of domestic-sourcing firms shows that as firms with lower productivity explore their offshoring potential, the maximum affordable fixed cost for the least productive offshoring firms progressively reduces (represented by $f_t^S < f_{t-1}^S$). The reduction of the maximum affordable fixed cost for the least productive offshoring firms allows domestic-sourcing firms to update their prior beliefs. By applying Bayes rule, this leads to a progressive right truncation of the priors defined by the first line of equation (6). In other words, as firms with lower productivity explore their offshoring potential, they reveal more information about the upper bound of the per-period fixed costs in the South, allowing domestic-sourcing firms to progressively reduce their uncertainty.

The second line of equation (6) characterises the conditions under which the true value f^S is revealed to all the firms in the market. The condition $\tilde{f}_t^S < f_t^S$ implies that some of the exploring firms in $t-1$ decided to remain under domestic sourcing after discovering the true value f^S.[42] Therefore, when domestic-sourcing firms observe that $\tilde{f}_t^S < f_t^S$, the true value f^S is revealed, and it is given by the maximum affordable fixed cost of the least productive offshoring firms in t (i.e., $f^S = f_t^S$).

2.2.4 Offshoring exploration decision and sector dynamic equilibrium paths

Information externalities lead to two important consequences on firms' exploration decisions. First, some firms with a positive expected offshoring profit premium may decide to delay the offshoring exploration to reduce the risk of the decision by learning. Second, after enough information has been revealed, some firms that initially had a negative expected offshoring profit premium may now find it profitable to explore the offshoring potential in the South. Thus, at any period t, a domestic-sourcing firm must decide whether to discover its offshoring potential by paying the offshoring sunk cost or wait for new information. This 'explore or wait' trade-off characterises firms' offshoring exploration decisions. Formally, firms solve the value function $\mathcal{V}_t(\theta;\theta_t) = \max\{V_t^o(\theta;\theta_t); V_t^w(\theta;\theta_t)\}$, with $V_t^o(\theta;.)$ and $V_t^w(\theta;.)$ denoting, respectively, the value of offshoring and the value of waiting in period t for a firm with productivity θ and a sectoral state θ_t.

[42] The condition $\tilde{f}_t^S < f_t^S$ implies that $\tilde{\theta}_t^S < \theta_t^S$. This means that firms with productivity $\theta \in [\tilde{\theta}_t^S, \theta_t^S)$ explored their offshoring potential in $t-1$ but chose to remain under domestic sourcing after exploration.

The value of offshoring in period t is given by the discounted expected total offshoring profit premium that the firm can earn starting from period t minus the offshoring sunk cost, or a loss equivalent to this sunk cost in the case that the expected discounted offshoring profit premium is negative. Thus, the value of offshoring in t for a firm with productivity θ is given by:

$$V_t^o(\theta;\theta_t) = \mathbb{E}_t\left[\max\left\{0;\sum_{\tau=t}^{\infty}\lambda^{\tau-t}\pi_\tau^{S,prem}(\theta)\right\}\middle| f^S \leq f_t^S\right] - w^N s^r.$$

The value of waiting in period t for a firm with productivity θ is $V_t^w(\theta;\theta_t) = 0 + \lambda\mathbb{E}_t\left[\mathcal{V}_{t+1}(\theta;\theta_{t+1})\right]$. The first term on the right-hand side means that the firm continuos sourcing domestically in t, and therefore earns zero offshoring profit premium in t. The second term on the right-hand side gives the discounted expected value function in the next period. Thus, the Bellman equation is given by $\mathcal{V}_t(\theta;\theta_t) = \max\left\{V_t^o(\theta;\theta_t);\lambda\mathbb{E}_t\left[\mathcal{V}_{t+1}(\theta;\theta_{t+1})\right]\right\}$.

Assumption A. 3. *The prior distribution, $Y(f^S)$, satisfies* $\frac{\partial[f_t^S - \mathbb{E}(f^S|f^S\leq f_t^S)]}{\partial f_t^S} > 0$.

Intuitively, assumption A.3 implies that the information flows are decreasing as the upper bound of the uncertainty distribution reduces. By this assumption, and given the information set in t, the strategy of waiting for one period and exploring offshoring in the following period—i.e., $V_t^{w,1}(.)$—dominates waiting for a longer period. Therefore, the One-Step-Look-Ahead (OSLA) rule is the optimal policy.[43] Using this result, we derive a *trade-off function*, which defines the offshoring-exploration decision at any period t for any domestic-sourcing firm with productivity θ, and it is given by:

$$\mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+1}) = V_t^o(\theta;\theta_t,\tilde{\theta}_{t+1}) - V_t^{w,1}(\theta;\theta_t,\tilde{\theta}_{t+1}), \tag{7}$$

where the first argument of $\mathcal{D}_t(.)$ indicates the productivity of the firm taking the decision, the second argument refers to the state of the system at t—that is, the productivity of the least productive offshoring firms in the South—and the third argument denotes the expected new information that will be revealed at the end of period t; that is, the least productive firms that will attempt offshoring in t. Thus, at any time t, the firm's offshoring exploration decision is based on:

$$\mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+1})\begin{cases}\geq 0 \Rightarrow \text{ pay the sunk cost and discover the offshoring potential in } t,\\ < 0 \Rightarrow \text{ remain sourcing domestically for one more period.}\end{cases}$$

Proposition 1 (Sequential offshoring)**.** *Firms with higher productivity have an incentive to explore their offshoring potential earlier, which is given by* $\frac{\partial\mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+1})}{\partial\theta} \geq 0$.

Proof. See Appendix C.4. □

[43] This assumption defines a sufficient but not necessary condition for the OSLA rule. Moreover, it is a general condition fulfilled by the most commonly used distributions to characterise uncertainty on a bounded range. For example, in the case of $Y(f^S)$ represented by a uniform distribution, this derivative equals $1/2$. For proofs of the OSLA rule as the optimal policy, see Appendix C.2.

Using Proposition 1, the trade-off function becomes:[44]

$$\mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+1}) = \max\left\{0; \mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\middle| f^S \leq f_t^S\right]\right\} - w^N s^r\left[1-\lambda\frac{Y(f_{t+1}^S)}{Y(f_t^S)}\right], \tag{8}$$

with $\frac{Y(f_{t+1}^S)}{Y(f_t^S)} \equiv Y(f_{t+1}^S|f^S \leq f_t^S)$.

Assumption A. 4. *Given prior knowledge at $t=0$, at least the most productive firms find it profitable to offshore; that is, $\mathcal{D}_{t=0}(\bar{\bar{\theta}};\bar{\bar{\theta}},\bar{\bar{\theta}}) > 0$, where $\bar{\bar{\theta}}$ denotes the most productive firms in the market.*

Intuitively, assumption A.4 implies that at least the most productive firms in the market must find it profitable to explore offshoring in the initial period, given the prior uncertainty. This assumption is necessary to trigger the offshoring exploration sequence.[45]

Lemma 1 (Offshoring-exploration productivity cutoff)**.** *The offshoring-exploration productivity cutoff at any period t is given by* $\tilde{\theta}_{t+1} \equiv \tilde{\theta}_{t+1}^S = (\gamma E)^{\frac{\sigma}{1-\sigma}}\tilde{Q}_{t+1}\left[\frac{w^N\left[\mathbb{E}_t(f^S|f^S\leq f_t^S)-f^N+s^r\left(1-\lambda\frac{Y(f_{t+1}^S)}{Y(f_t^S)}\right)\right]}{\psi^S-\psi^N}\right]^{\frac{1}{\sigma-1}}$,
where $\tilde{Q}_{t+1}$ refers to the aggregate consumption defined by $\tilde{\theta}_{t+1}$, i.e. $\tilde{Q}_{t+1} \equiv Q(\tilde{\theta}_{t+1})$.

Proof. The offshoring exploration productivity cutoff $\tilde{\theta}_{t+1}$ in each period t is defined by the fixed point of the trade-off function given by $\mathcal{D}_t(\tilde{\theta}_{t+1};\theta_t,\tilde{\theta}_{t+1}) = 0$. This fixed point represents the firms with productivity $\tilde{\theta}_{t+1}$ that are indifferent between exploring the offshoring potential or waiting for one period, i.e., $\mathbb{E}_t\left[\pi_t^{S,prem}(\tilde{\theta}_{t+1})\middle| f^S \leq f_t^S\right] = w^N s^r\left[1-\lambda\frac{Y(f_{t+1}^S)}{Y(f_t^S)}\right]$. See Appendix C.5. □

Long-run properties of the trade-off function: Convergence analysis. We focus now on the characterisation of the steady state and the conditions under which the sector converges to the perfect-information equilibrium. First, in the long run, the learning mechanism collapses at the lower bound of the prior distribution unless the true fixed cost f^S is revealed and the updating process stops in a finite time.[46] Second, Proposition 2 characterises the steady states in terms of the prior beliefs and f^S.

Proposition 2 (Convergence of offshoring productivity cutoff)**.** *There is asymptotic convergence to the perfect information equilibrium (i.e., $\theta_t^S \xrightarrow{t\to\infty} \theta^{S,*}$) when:*

Case I: $f^S = \underline{f}^S \Rightarrow f_\infty^S = \underline{f}^S$,

Case II: $\underline{f}^S + (1-\lambda)s^r < f^S$.

Hysteresis takes place—that is, the convergence produces some 'excess' of offshoring—when:

[44] See Appendix C.3 for derivation of the trade-off function. For those firms facing a trade-off in the exploration decision, i.e. those with a positive expected offshoring profit premium, the first term of the trade-off function is strictly positive, and therefore the trade-off function is strictly increasing in the productivity.

[45] When the support of the productivity distribution $G(\theta)$ is $[\theta_{min},\infty)$, it is enough to assume that the prior distribution $Y(f^S)$ has a finite expected value.

[46] If $f^S \in (\underline{f}^S + (1-\lambda)s^r, \bar{f}^S]$, the updating stops in a finite time and the true value is revealed. For any $f^S \in [\underline{f}^S, \underline{f}^S + (1-\lambda)s^r]$, the distribution collapses at the lower bound of the prior distribution as $t\to\infty$.

$$\textit{Case III: } \underline{f}^S + (1-\lambda)s^r = f^S \Rightarrow \theta_t^S \xrightarrow{t\to\infty} \theta^{S,\neg r},$$

$$\textit{Case IV: } \underline{f}^S + (1-\lambda)s^r > f^S \Rightarrow \theta_t^S \xrightarrow{t\to\infty} \theta_\infty^S,$$

with $\theta^{S,*} > \theta_\infty^S > \theta^{S,\neg r}$*, and* $\theta^{S,\neg r}$ *denoting the case where the marginal firms obtain zero per-period offshoring profit premium. In other words, marginal firms cannot recover the offshoring sunk cost.*

Proof. The trade-off function has a unique fixed point in the long run—$\mathcal{D}(\theta_\infty; \theta_\infty, \theta_\infty) = 0$—and it is given by $\mathbb{E}\left[\pi^{S,prem}(\theta_\infty^S) \middle| f^S \leq f_\infty^S\right] = w^N s^r (1-\lambda)$. See Appendix C.6. □

Proposition 2 shows that there are four possible cases of convergence. Although the steady state is unique, the convergence point depends on the distance of the lower bound of the prior distribution to the true value f^S. In Case I, the sector converges to the perfect information equilibrium in infinite periods. In Case II, there is also convergence to the same steady state although through a different path. The priors are initially 'too optimistic', leading to the full revelation of the true fixed cost f^S in a finite number of periods.[47] Thus, the offshoring productivity cutoff initially converges to $\theta_t^S \xrightarrow{t<\infty} \theta^{S,\neg r}$. However, the hysteresis is transitory. The exogenous death shock progressively eliminates the excess of offshoring firms, pushing the sector to the perfect-information equilibrium in the long run (i.e., $\theta_t^S \xrightarrow{t\to\infty} \theta^{S,*}$).[48] In Cases III and IV, the steady states are represented by some excessive offshoring. In other words, the hysteresis remains in the long-run as the true value is not revealed in any finite number of periods. Figure 4 illustrates these convergence points. Case IV corresponds to any point between Case I and III, and Case II to any point below Case III.

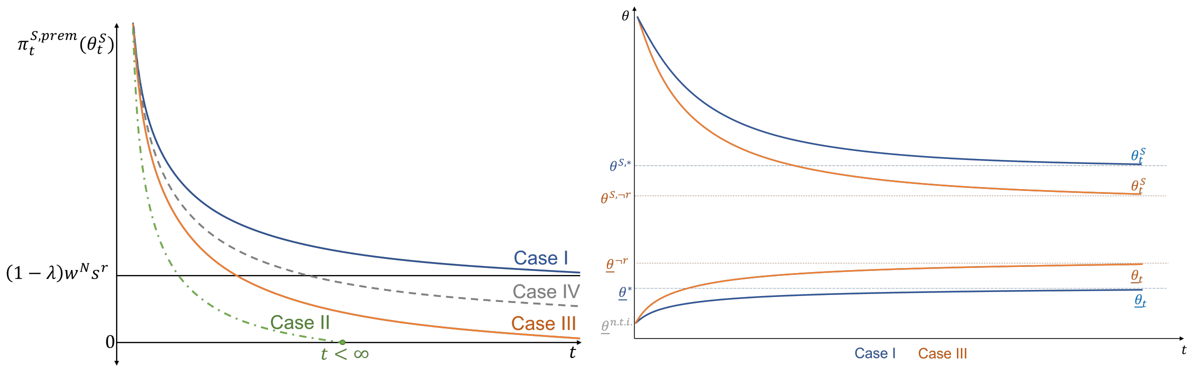


Figure 4: Convergence paths

Figure 5 illustrate the underlying learning mechanism, the sequential offshoring equilibrium paths and the respective steady states for Proposition 2's cases.[49] The horizontal line f^S represents the true

[47] We define as 'too optimistic' priors to the situation where the lower bound of the distribution is to low relative to the institutional fundamentals; that is, $\underline{f}^S + (1-\lambda)s^r < f^S$.

[48] After the true fixed cost is revealed to all firms in the market (Case II), there is no remaining uncertainty. The offshoring firms with productivity $\theta \in [\theta_\infty, \theta^{S,*})$ will progressively leave the market, as they are affected by the exogenous death shock. Therefore, all new firms entering the market at later periods with productivity $\theta < \theta^{S,*}$ know that it is not profitable to them to offshore. Thus, the hysteresis reduces progressively in the long run.

[49] We want to thank Wilhelm Kohler for the idea of this figure.

value of the per-period fixed cost of offshoring, whereas the curve $f^S(\theta)$ represents the maximum affordable fixed cost of offshoring for a firm with productivity θ. For a value f^S above that curve, the firm θ realises negative per-period offshoring profit premium, whereas below it, the firm realises a positive premium. The red line represents the case where the per-period offshoring profit premiums are high enough to recover the offshoring sunk cost. The point A illustrates the case of a firm realising zero per-period offshoring profit premium. We analyse the four cases.

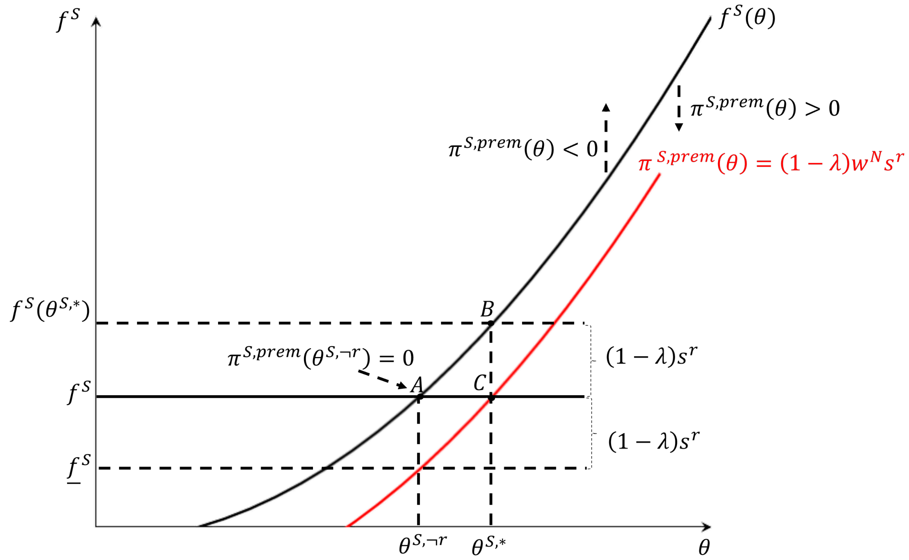


Figure 5: Prior beliefs, learning and convergence

Case I is defined by $\underline{f}^S = f^S$, which implies that in the steady state the marginal offshoring firms realise positive per-period offshoring profit premiums that are high enough to recover the offshoring sunk cost. Thus, the perfect information steady state (i.e., $\theta^{S,*}$) is achieved in the long run. When $\underline{f}^S < f^S$, we are in one of the other three cases. The horizontal line $\underline{f}^S$ in the Figure represents Case III; that is, when $\underline{f}^S + (1-\lambda)s^r = f^S$. The marginal offshoring firms in the steady state (i.e., $\theta^{S,\neg r}$) realise zero per-period offshoring profit premium—represented by point A—and thus they cannot recover any share of the offshoring sunk cost. The excessive offshoring in Case III is represented by the difference between $\theta^{S,*}$ and $\theta^{S,\neg r}$. Case II is represented by a $\underline{f}^S$ below the case in the Figure. The convergence stops when the firms with productivity $\theta < \theta^{S,\neg r}$ explore their offshoring potential and realise that they earn negative per-period offshoring profit premiums. Thus, there is a temporary excessive offshoring given by the difference between $\theta^{S,*}$ and $\theta^{S,\neg r}$, but it vanishes in the long run (death shock effect). Finally, Case IV is represented by a $\underline{f}^S$ above the case in the Figure, but below f^S. The steady state is defined by the intersection of $\underline{f}^S$ and the red line, leading to excessive offshoring given by the difference between θ^S_∞ and $\theta^{S,*}$, where $\theta^S_\infty \in (\theta^{S,\neg r}, \theta^{S,*})$ is the offshoring productivity cutoff in the long run.

To conclude, the equilibrium path of the offshoring productivity cutoff, as shown in Figure 4, defines a respective path of the market productivity cutoff. The increasing number of offshoring firms reduces the sectoral price index, increasing the competition intensity in the final-good market. This leads the least productive firms to progressively leave the market.[50]

Welfare implications. The transition from the initial conditions '*n.t.i.*' to the perfect information steady-state presents potential welfare gains from offshoring. Proposition 2 shows that, in the long run, the information spillovers allow the sector to achieve those welfare gains, as $P_t \searrow P^*$ and therefore $Q_t \nearrow Q^*$. The convergence in Cases III and IV involve some hysteresis in the offshoring decisions—that is, excessive offshoring—due to the presence of the offshoring sunk costs. This implies that the price index converges to a level below P^*, and thus the aggregate consumption index increases more than Q^*. Instead, the hysteresis in Case II vanishes in the long run through the death-shock effect.

3 Empirical analysis: The two-country model

We test the predictions from our theoretical model in section 2. In particular, we focus on the identification of the sequential offshoring equilibrium path led by the most productive firms in the market, and the effect of the information spillovers on the exploration decisions. In section 3.1, we describe the data and the sample selection criteria. In section 3.2, we introduce two complementary reduced-form approaches: i) conditional probit models and ii) transition (or survival) models. In section 3.3, we conclude with the derivation of a structural empirical model of the trade-off function.[51]

In the case of the reduced-form probit models, we test for the determinants of the offshoring exploration decisions. In particular, we centre the attention on the effects of firm productivity and the information spillovers on the offshoring-exploration decisions.[52]

We use transition or survival methods to identify the timing dimension of the offshoring exploration decisions. In particular, we test whether the most productive firms explore the offshoring potential earlier and whether the information spillovers accelerate the exploration decisions of the domestic-sourcing firms.[53] Given the dynamic nature of the exploration decision, this approach drives us closer to the identification of the predictions in Proposition 1.

We use the total assets of the firm (in million USD) as a proxy measure for productivity. We identify the information spillovers with two alternative measures. The main specification comes directly from the theory and it is defined by the productivity of the least productive offshoring firm in the same sector

[50]For further discussions about the effect on the market productivity cutoff, see Antràs et al. (2017).

[51]Close references for the identification of the trade-off function are Das et al. (2007) and Dickstein and Morales (2018).

[52]The information spillovers in the two-country setup refers to the general offshoring conditions in the sense that they are not related to any specific potential foreign location. Instead, they refer to aggregated conditions from all sourcing countries. Later, in section 4, we extend the empirical model to multiple countries, where the information spillovers are related to country-specific offshoring conditions.

[53]For the role of the information spillovers in the location choices, see the multi-country extension in section 4.

in the previous year. As an alternative measure, we use the standard deviation of the productivity of the offshoring firms in the same sector in the previous year. The intuition for the latter is the following. From theory, we expect that the upper bound of the uncertainty distribution reduces as more firms explore offshoring, which is equivalent to an increase in the variance of the productivities of the offshoring firms.

3.1 Data description and sample definition

We use data on Colombian manufacturing firms for the period 2004–2018. The data come from two main sources. The Superintendencia de Sociedades (SIREM) of Colombia provides firm-level balance sheet information and the firms' sectoral classification by ISIC (4 digits).[54] The National Statistics Office [Dirección Nacional de Estadística (DANE)] provides the data on firms' imports.[55]

The universe of firms is defined by the manufacturing firms in the SIREM dataset. Both datasets are merged by firm ID (namely, NIT) and year. When a firm in the SIREM dataset is not included in the DANE imports data, it is considered a non-importer; that is, as a fully domestic-sourcing firm.

In terms of the model, Colombia represents the North—that is, the location of the firms—whereas the South is represented by the aggregation of all sourcing foreign countries. Moreover, considering that the model in section 2 characterises the predictions in terms of one intermediate input m, the product codes are also aggregated. Thus, we have a sample with total imports by firms per year, in addition to the firm's yearly balance sheet data and ISIC classification. Finally, considering that the model's prediction relies on a mechanism where firms can learn from other firms in the same sector, we drop all sectors with less than 50 firms during the sample period.[56]

Definition of main variables. First, we proxy the productivity of the firm by the total assets. The total assets of firm i in sector j in period t are denoted as $ta_{i,j,t}$, measured in millions USD. Second, the offshoring status of a firm i in sector j in period t is indicated by the dummy variable $os_{i,j,t} = 1$. It takes the value one if firm i in sector j imports (any input from any location) in period t and zero otherwise. Finally, we define the information spillovers at the beginning of period t in sector j, denoted in general as $is_{j,t}$, in two alternative ways:

- Direct (theory-based) measure: $is_{j,t} = minta_{j,t-1} \equiv \min_i\{ta_{i,j,t-1}|os_{i,j,t-1} = 1\}$. It refers to the productivity of the least productive offshoring firm in sector j in the previous year.
- Alternative (theory-consistent) measure: $is_{j,t} = sdta_{j,t-1} \equiv \mathrm{sd}_i(ta_{i,j,t-1}|os_{i,j,t-1} = 1)$. It refers to the standard deviation of the productivity of offshoring firms in sector j in the previous year.

[54] The most important variables we use are: firm tax ID number (NIT), sector (ISIC at 4 digits), year and total assets. Values are converted to USD using mean exchange rates by year reported by the Central Bank of Colombia.

[55] The most important variables we use are: the tax ID number of the importer (NIT), year, imports USD CIF, country of origin, country of purchase, and product code (10 digits).

[56] For further details on the data, see Appendix D.1.

3.2 Reduced-form models

3.2.1 Conditional probit models

We estimate the probability of exploring offshoring in period t of a domestic-sourcing firm. The empirical model is given by:

$$\Pr\left(os_{i,j,t} = 1 \middle| cos_{i,j,t-1} = 0\right) = \Phi\Big(\beta_1 \ln(ta_{i,j,t}) + \beta_2 is_{j,t} + \gamma_j + \gamma_t\Big), \quad (9)$$

where i, j denote the firm and sector, respectively. The variable $cos_{i,j,t-1}$ indicates the cumulative offshoring status of firm i in sector j up to period $t-1$. It is a dummy variable that takes the value one if the firm i has offshored in any period previous to t and zero otherwise (i.e., it has always sourced with domestic suppliers). Finally, γ_j and γ_t represent sector and year fixed effects, respectively.

Results. Columns (1)–(4) of Table 1 report the results of the empirical model given in equation (9). Columns (1) and (2) report the estimated coefficients for the sample including all sectors with at least 50 firms, whereas columns (3) and (4) refer to a sample including all sectors with at least 100 firms. In all the cases, the table shows that the probability of exploring the offshoring potential is increasing in the productivity of the firm. These results are consistent with the prediction summarised in Proposition 1.[57] We illustrate the quantitative effects by considering the specification in column (2). An average increase of 10% in productivity increases the probability of offshoring in t by 0.487 percentage points.[58]

Table 1: Non-offshoring firms. First-time offshoring exploration decisions

Model:		**Conditional Probit Model**				**Transition (survival) Model**			
Sample:		*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	Exp. sign	(1) $os_{i,j,t}$	(2) $os_{i,j,t}$	(3) $os_{i,j,t}$	(4) $os_{i,j,t}$	(5) $\Lambda_{i,j,t}$	(6) $\Lambda_{i,j,t}$	(7) $\Lambda_{i,j,t}$	(8) $\Lambda_{i,j,t}$
$\ln(ta_{i,j,t})$	+	0.336***	0.337***	0.329***	0.329***	0.612***	0.614***	0.593***	0.594***
		(0.0273)	(0.0276)	(0.0329)	(0.0337)	(0.0448)	(0.0451)	(0.0496)	(0.0505)
$minta_{j,t-1}$	-	-0.0290		0.0556		-0.190		-0.0529	
		(0.0943)		(0.111)		(0.174)		(0.205)	
$sdta_{j,t-1}$	+		0.00303***		0.00314**		0.00351*		0.00350
			(0.00111)		(0.00158)		(0.00200)		(0.00250)
$\ln(t)$						-0.871***	-0.963***	-0.868***	-0.940***
						(0.0958)	(0.0806)	(0.119)	(0.0941)
FEs		j , t	j , t	j , t	j , t	j	j	j	j
Observations		11985	11985	9002	9002	11985	11985	9002	9002
Pseudo R^2		0.095	0.096	0.087	0.088				

Coefficients reported. Standard errors are clustered at the sector level and reported in parenthesis. Survival analysis includes the year of entry of the firm into the sample as a control. *Exp. sign* indicates expected coefficient sign from the theory. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Regarding the information spillovers, the results show non-significant coefficients at the reported

[57] The results are also consistent with the steady-state equilibrium shown in Figure A1 and with the selection of firms into offshoring based on productivity in Antràs et al. (2017).

[58] Average marginal effects are reported in Table A5 in Appendix D.2.3.

levels for the direct spillover measure, whereas the alternative measure shows significant and theory-consistent results. The interpretation of the latter result is as follows: the higher the information revealed about the general offshoring conditions in sector j in period t, measured by the standard deviation of the productivity of the offshoring firms in sector j in period $t-1$, the higher the probability that domestic-sourcing firms in sector j will explore the offshoring potential in period t. From a quantitative perspective, the model predicts—column (2)—that an average increase of 10 units in the standard deviation of the productivities of offshoring firms in $t-1$ (which is about a 20% increase from the mean of the standard deviation of the productivities of offshoring firms) increases the probability of offshoring in t of a domestic-sourcing firm by 0.439 percentage points.[59]

To summarise, we find strong supportive evidence for the prediction that the probability of exploring offshoring by domestic-sourcing firms increases in the productivity of the firm. Moreover, the increasing effect of the information revealed about the general offshoring conditions in the offshoring probability provides some support for the prediction that information spillovers are part of the information set of domestic-sourcing firms when they decide whether to explore the offshoring potential or wait.

3.2.2 Transition (or survival) model

Due to the grouped nature of the data and the time-varying covariates, the complementary log-logistic distribution (cloglog) is a standard choice for the modelling of the baseline hazard.[60] Thus, the hazard rate for a firm i in sector j to transition from domestic sourcing to offshoring status in period t is:

$$\Lambda_{i,j,t}\left(t \middle| cos_{i,j,t-1}=0\right) = 1-\exp[-\exp(\boldsymbol{x}'_{i,j,t}\boldsymbol{\beta}+\delta_t)], \tag{10}$$

with $\boldsymbol{x}'_{i,j,t}\boldsymbol{\beta} = \beta_0+\beta_1\ln(ta_{i,j,t})+\beta_2 is_{j,t}+\beta_3 entry_i+\gamma_j$. The information spillovers are defined by the two alternative measures described above, $entry_i$ indicates the year in which firm i enters the sample, and δ_t refers to the general time-trend. We considered two types of modelling for the time-trend: a logarithmic form $\delta_t=\alpha\ln(t)$, and a non-parametric approach.[61]

Results. Columns (5)–(8) of Table 1 report the results of the empirical model given in equation (10). We observe that the most productive domestic-sourcing firms transition faster to offshoring. Thus, the results provide strong supportive evidence for the prediction characterised in Proposition 1: *the most productive firms explore their offshoring potential earlier*. In other words, from a temporal dimension,

[59] As one robustness check, we specify a model with a discrete productivity measure, and we estimate the effects of the information spillovers for each productivity category. The discrete productivity measure refers to the quintile of the firm's productivity within the sector for each year, and it is increasing in the productivity level. Table A4 in Appendix D.2.2 shows theory-consistent and significant results for the more productive firms. Thus, considering the sequential offshoring exploration path, the most productive domestic-sourcing firms are those that face the strongest trade-off between exploring offshoring and waiting, and thus have the highest potential gains from waiting by learning from the information spillovers.

[60] The grouped nature comes from the underlying continuous process but with discrete time data collection.

[61] The estimation results for the non-parametric approach are reported in Table A3 in Appendix D.2.2.

the empirical evidence supports that the offshoring equilibrium path is led by the most productive firms in the sector. To quantify the effect of a productivity change, we consider the average marginal effects related to column (6).[62] An average increase of 10% in the productivity of domestic-sourcing firms increases the hazard rate of those firms to offshore in t by 0.478 percentage points.

Regarding the effects of information spillovers, the direct measure shows, as before, non-signficant estimated coefficients but with theory-consistent signs. The alternative measure shows, instead, theory-consistent signs in all specifications and significant results for sectors with at least 50 firms.[63] The intuition behind the results is the following: the more information is revealed by the offshoring firms in sector j in period t about the general offshoring conditions, the earlier the offshoring exploration of the domestic-sourcing firms. From a quantitative analysis, the average marginal effects of the empirical model in column (6) show that an average increase of 10 units in the standard deviation of the productivities of offshoring firms in $t-1$ increases the hazard rate of domestic-sourcing firms to offshoring in t by 0.273 percentage points.

In summary, the survival model shows strong support for the leading role of the most productive firms in the offshoring exploration (Proposition 1). The results also present some evidence in favour of the role of information spillovers for offshoring exploration decisions. As more information is revealed by the offshoring firms, the domestic-sourcing firms transition to an offshoring status sooner.

3.3 Structural model

We develop a structural probit model that identifies the trade-off function for domestic-sourcing firms conditional on the information set (i.e., $\mathcal{I}_{i,j,t}$) that they possess when deciding whether to explore offshoring or wait. In the paper, we focus the analysis on the structural model for the multi-country extension, where we analyse in full extend the role of information spillovers in the location choices. Thus, we relegate all the details and analysis of the two-country empirical structural model—in all its specifications—to Appendix D.3. Nevertheless, we summarise below the main findings.

Summary of results. We start with models that assume a *small open economy* (SMOPEC), and conclude with the identification of *full structural* models.[64] For the SMOPEC specifications and results, see

[62] Average marginal effects are reported in Table A5 in Appendix D.2.3.

[63] When we analyse the differential effects of the information spillovers by introducing the discrete productivity measure, we observe the expected effects for the more productive domestic-sourcing firms. See Table A4 in Appendix D.2.2.

[64] The SMOPEC assumption implies that $P_{j,t} = P_j$ and thus $Q_{j,t} = Q_j$ $\forall t$. That is, the price index and the aggregate consumption index are not affected by the increasing offshoring activity of Colombian firms. Therefore, $z^S_{j,t} = z^S_j$ $\forall t$. In the SMOPEC and full structural models, we consider first models with fixed wages (as defined by the theory). Then we extend the respective specifications to allow for time-varying wages and total expenditure. In these cases, we allow for changes in northern and southern wages, as well as in total expenditure. Nevertheless, we assume that those changes do not respond to the Colombian offshoring dynamics. In other words, these changes are exogenous to the offshoring dynamics and cannot be predicted by the firms based on the information set that they possess at each period t.

Appendix D.3.6, whereas for the *full structural* specifications and results, see Appendix D.3.7.

All specifications of the structural model provide strong supportive evidence for Proposition 1. In particular, they show that the trade-off function is increasing in productivity of the firm. In other words, the probability of exploring the offshoring potential for the first time in period t is increasing in the productivity of the domestic-sourcing firms. That means that the offshoring exploration is sequential in productivity, as predicted by Proposition 1.

Regarding the role of the information spillovers, the empirical evidence shows a strong heterogeneity across sectors and information spillover measures—as well as across specifications—limiting the conclusions that the empirical results can provide about the role of information spillovers in a two-country setup. However, if the information spillovers are related to country-specific offshoring conditions, the scope of the two-country setup is too narrow to identify the influence of the former on the offshoring decisions. Therefore, we next extend our framework to multiple countries, which will shed more light on the role of information spillovers for the offshoring decisions and location choices.

4 The multi-country model

When the information spillovers reveal country-specific information, they may affect the offshoring decisions towards those countries perceived to have better institutions but that do not have better institutional fundamentals. In this case, information spillovers may drive the sector into a non-efficient equilibrium path, and thus lead to a steady state with suboptimal specialisation of countries—that is, non-efficient allocation of intermediate-input production across countries—and welfare costs.

To explore the role that information spillovers play in the location dimension of the offshoring decisions, we extend the model to multiple countries. In a multi-country setup, where northern firms can offshore in alternative foreign locations, two questions arise: i) how is the allocation of intermediate inputs' suppliers across countries affected by the information spillovers? and ii) what are the welfare consequences in the steady state?

4.1 Theory extension to multiple countries

We assume a world with three countries: North (N), East (E), and South (S). The firms in the differentiated sectors are still located in the North, but they can choose the location of the intermediate-input suppliers. They can either source domestically, offshore in the East, or offshore in the South.

To discover their offshoring potential in the South or the East, northern firms must pay the country-specific offshoring sunk cost $s^{r,S}$ or $s^{r,E}$, respectively. For simplicity, both are expressed in northern labour units and we assume that $s^{r,S} = s^{r,E} = s^r$.[65]

Assumption A. 5. *Institutional fundamentals are better in the South than in the East: $f^S < f^E$.*[66]

We assume in A.5 that the fundamentals of southern institutions are better than those in the East. However, under uncertainty, this is unknown to the firms.

Initial conditions. As in the two-country model, we define the initial conditions by the *n.t.i.* equilibrium.[67] In $t = 0$, there are simultaneous institutional reforms in the East and the South. These shocks introduce uncertainty about institutional fundamentals in each of those countries, which is represented as prior uncertainty about the offshoring per-period fixed costs. Formally, the prior uncertainty for each location is defined as:

$$f^S \sim Y(f^S) \quad \text{with} \quad f^S \in [\underline{f}^S, \bar{f}^S],$$

$$f^E \sim Y(f^E) \quad \text{with} \quad f^E \in [\underline{f}^E, \bar{f}^E].$$

Firms can update their prior beliefs by exploiting the information externalities generated by offshoring firms in each country, according to the learning mechanism in section 2.2.3. An important remark is that firms offshoring from one location can still learn about the offshoring conditions in alternative sourcing locations, which also explains part of the relocation dynamics. We discuss this further below.

4.1.1 Firms' offshoring exploration decisions

Domestic-sourcing firms: First-time offshoring exploration. In any period t, domestic-sourcing firms decide whether to explore their offshoring potential or wait. If they decide to explore it, they have two options: South or East. Therefore, the decision in t for any domestic-sourcing firm with productivity θ takes the following form:

$$\mathcal{V}_t(\theta; \mathcal{I}_{i,j,t}) = \max \left\{ V_t^{o,S}(\theta; \mathcal{I}_{i,j,t}); V_t^{o,E}(\theta; \mathcal{I}_{i,j,t}); \lambda \mathbb{E}_t \left[\mathcal{V}_{t+1}(\theta; \mathcal{I}_{i,j,t}) \right] \right\},$$

where $\mathcal{I}_{i,j,t}$ refers to the information set that domestic-sourcing firms posses in period t. Defining $V_t^{o,l}(\theta; \mathcal{I}_{i,j,t})$ as the solution to $\max \left\{ V_t^{o,S}(\theta; \mathcal{I}_{i,j,t}); V_t^{o,E}(\theta; \mathcal{I}_{i,j,t}) \right\}$, with $l = E$ or $l = S$, the decision becomes $\mathcal{V}_t(\theta; .) = \max \left\{ V_t^{o,l}(\theta; .); V_t^{w,1,l}(\theta; .) \right\}$, with $V_t^{o,l}(\theta; \mathcal{I}_{i,j,t})$ as the value of exploring offshoring in country l in period t for firm θ under domestic sourcing, and $V_t^{w,1,l}(\theta; \mathcal{I}_{i,j,t})$ as the value of waiting one period and offshoring in country l in the next period. From this expression, we derive the

[65]Instead of characterising the effects of heterogeneous sunk costs across foreign countries, we focus on analysing the effects of symmetric and asymmetric beliefs. Incorporating heterogeneity in both dimensions is straightforward but expands significantly the number of paths to characterise.

[66]For simplicity, we assume that the institutional fundamentals in each location are deterministic; that is, a fixed (unknown) value. However, under certain conditions, the main features and predictions of the model are robust to an extension that defines stochastic institutional fundamentals (i.e., allow fixed costs of offshoring in each location to be stochastic). Nevertheless, considering that our focus is on firms' learning processes about conditions abroad and how location choices are affected by them, we prefer to focus on a simpler version of the model with deterministic fundamentals.

[67]In Appendix B.2.2, we discuss alternative specifications for the initial conditions and show that the main features of the dynamic equilibrium paths and predictions of the model are robust to the alternative specifications.

trade-off function:

$$\mathcal{D}_t^l(\theta;\mathcal{I}_{i,j,t}) = \max\left\{0;\mathbb{E}_t\left[\pi_t^{l,prem}(\theta)\Big|\mathcal{I}_{i,j,t}\right]\right\} - w^N s^r\left[1-\lambda\frac{Y(f_{t+1}^l)}{Y(f_t^l)}\right],$$

where $\mathcal{I}_{i,j,t} = \{\boldsymbol{\theta_t}, \boldsymbol{\tilde{\theta}_{t+1}}\}$, with $\boldsymbol{\theta_t} = \{\theta_t^S, \theta_t^E\}$ and $\boldsymbol{\tilde{\theta}_{t+1}} = \{\tilde{\theta}_{t+1}^S, \tilde{\theta}_{t+1}^E\}$.

Offshoring firms: Relocation exploration decisions. In any period t, firms that offshore in country l' decide whether to explore their offshoring potential in the alternative sourcing location l or wait. We derive the trade-off function:

$$\mathcal{D}_t^{l/l'}(\theta;\mathcal{I}_{i,j,t}) = \max\left\{0;\mathbb{E}_t\left[\pi_t^{l/l',prem}(\theta)\Big|\mathcal{I}_{i,j,t}\right]\right\} - w^N s^r\left[1-\lambda\frac{Y(f_{t+1}^l)}{Y(f_t^l)}\right],$$

with $\mathcal{I}_{i,j,t} = \{\boldsymbol{\theta_t}, \boldsymbol{\tilde{\theta}_{t+1}}, f^{l'}\}$. An important difference to the information set of domestic-sourcing firms is that in the case of firms offshoring in county l', they possess knowledge of the true fixed costs of offshoring in country l' (i.e., $f^{l'}$). The variable $V_t^{o,l/l'}(\theta;\mathcal{I}_{i,j,t})$ represents the value of exploring offshoring in country l in period t for a firm with productivity θ that currently offshores in country l', $V_t^{w,1,l/l'}(\theta;\mathcal{I}_{i,j,t})$ refers to the value of waiting one period and offshoring in country l in the next period for that same firm, and $\mathbb{E}_t\left[\pi_t^{l/l',prem}(\theta)\Big|\mathcal{I}_{i,j,t}\right]$ denotes the expected relocation profit premium in country l in period t for a firm with productivity θ that currently offshores in l'.

4.1.2 Dynamic equilibrium paths and multiple equilibria

Under uncertainty, firms in the differentiated sectors can reduce the risk of exploring their offshoring potential by learning. However, given that the information externalities in each sector are country-specific, the behaviour of offshoring firms in one country does not affect firms' beliefs about institutions in other foreign locations. The model shows that the steady state, and thus the sectoral specialisation of countries, depends on both the institutional fundamentals and the beliefs that firms have about institutional conditions in those countries. In other words, the information spillovers play a key role in the specialisation patterns and the observed countries' comparative advantages. We characterise the multiple equilibria that emerge from the model and their respective welfare consequences.

Assumption A. 6. *South and East have the same labour productivity in the homogeneous sector:* $A_{0,S} = A_{0,E}$*, which leads to* $w^S = w^E$*.*

For simplicity, we assume in A.6 identical wages across foreign countries. Therefore, the steady state under perfect information implies that firms will offshore only from the South.[68]

In the remainder of this section—and with a small abuse in terminology and notation—we refer as convergence to the *perfect-information equilibrium* or the *perfect-information steady state* to the

[68]This is a simplifying assumption that, as in the previous case, allows us to reduce the number of cases to analyse. The main results and predictions of the model are not affected by introducing heterogeneous wages across countries.

situation where the offshoring productivity cutoff in the South converges to any of the steady states defined in Proposition 2 and where firms offshore only in the South.[69] That is, $\theta_t^E \rightarrow \infty$ and $\theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$.

Dynamic equilibrium paths. We describe now the general features of different types of equilibrium paths, followed by a characterisation of the multiple steady states. We identify the multiple equilibria and the underlying equilibrium paths under different initial belief conditions: *symmetric* and *asymmetric* priors across countries. We characterise and discuss in detail the equilibrium paths under symmetric and asymmetric beliefs in Appendices E.2 and E.3, respectively.

When initial beliefs are symmetric across foreign countries, firms in $t = 0$ are indifferent between exploring offshoring in the East or the South. Thus, firms that explore the offshoring potential in $t = 0$ randomise the location choice. Due to the continuum of firms, they are divided equally into the East and the South. The offshoring exploration continues in both countries in future periods as long as the symmetry in beliefs remains unbroken. When the prior beliefs about eastern institutions are 'pessimistic'—that is, the true value f^E is not revealed in any finite number of periods—we show that the welfare gains from offshoring are achieved in the long run, but a non-efficient specialisation of countries remains. That is, offshoring firms distribute the production of intermediate inputs equally in the East and the South. Instead, when the prior beliefs about eastern institutions are 'optimistic'—i.e., the true value f^E is revealed in a finite number of periods—the sector also converges to the efficient allocation of production across countries; that is, to the optimal specialisation of countries according to institutional fundamentals. We also show the conditions under which this convergence takes place through a relocation dynamic of suppliers from the South to the East, or in the long run through the death-shock effect.

When initial beliefs are asymmetric across countries, we have two general cases to consider: i) initial coordination to the efficient equilibrium, and ii) initial coordination to the non-efficient equilibrium. In the first case, the sector converges to the efficient allocation of production across countries (i.e., offshoring in the South), and welfare gains from offshoring are fully achieved. In the second case, we show general conditions under which the sector shows a stable equilibrium offshoring path to the East. Thus, the sector converges to a non-efficient steady state, where the welfare gains from offshoring are not fully achieved and there is a suboptimal specialisation of countries (i.e., offshoring only in the East). Finally, we also characterise the specific conditions under which this path is unstable, triggering

[69] Proposition 2 shows cases where excessive offshoring emerges. Therefore, with a slight abuse of notation, we now denote with superscript $*$ any of the cases characterised in Proposition 2.

relocation dynamics and converging in the long run to the optimal specialisation of countries and the respective welfare gains from offshoring are fully realised.

Multiple equilibria. The multiple equilibria of the multi-country extension identify the risks and costs faced by firms when they explore their offshoring potential across multiple alternative potential locations. Morevover, the model shows the importance of information spillovers as drivers of the revealed or observed countries' comparative advantages. Propositions 3 and 4 present the main results in terms of countries' specialisation patterns and welfare implications, respectively.[70]

Proposition 3 (Countries' sectoral specialisation: equilibrium paths and multiple equilibria)**.** *Under symmetric beliefs, the sector converges to a steady state with specialisation of countries according to fundamentals when the priors about eastern institutions are 'optimistic'. The equilibrium path shows:*[71]

1. *relocation of suppliers from East to South in a finite time if* $f^E - \mathbb{E}_t\left[f^S | f^S \leq f_t^S\right] \geq (1-\lambda)s^r$ *for some period* $t > \hat{t}$*, with* $\hat{t}$ *denoting the revelation period for* f^E*.*
2. *reduction of offshoring in East through the death-shock effect in the long run, otherwise.*

Instead, when the priors about eastern institutions are 'pessimistic', the sector converges to a steady state with an inefficient specialisation of countries.

Under asymmetric beliefs, the sector converges to a steady state with specialisation of countries according to fundamentals when the initial prior beliefs drive the offshoring exploration to: i) the South—that is, coordination to efficient equilibrium—or ii) the East—that is, coordination to non-efficient equilibrium—but priors about the East are 'optimistic' and $\mathcal{D}_{\hat{t}}^S(\theta_{\hat{t}}^E;.) \geq 0$*, where* $\theta_{\hat{t}}^E$ *is the offshoring productivity cutoff in the East in period* $\hat{t}$*. In the last case, the equilibrium path shows:*

1. *relocation of suppliers from East to South in a finite time if* $f^E - \mathbb{E}_t\left[f^S | f^S \leq f_t^S\right] \geq (1-\lambda)s^r$ *for some period* $t > \hat{t}$*.*
2. *reduction of offshoring in East through the death-shock effect in the long run, otherwise.*

Instead, the sector converges to a steady state with an inefficient specialisation of countries when there is coordination to the non-efficient equilibrium with: i) pessimistic' priors about eastern institutions, or ii) with 'optimistic' priors about the East and $\mathcal{D}_{\hat{t}}^S(\theta_{\hat{t}}^E;.) < 0$*.*

[70] The proofs of the propositions follow from Appendices E.2 and E.3. See also these Appendices for further details.

[71] We have simplified the exposition—to avoid constant repetition of cases in Proposition 2—and consider these cases as convergence to the specialisation of countries according to fundamentals as equivalent to the perfect-information steady state. However, the excessive offshoring, as defined in Cases II to IV in Proposition 2, may still hold. Case II refers to excessive offshoring that vanishes in the long run, whereas Cases III and IV are persistent in the long run.

Proposition 4 (Welfare effects)**.** *In the long run, the welfare gains from offshoring are fully realised when the prior beliefs are symmetric, or they are asymmetric and:*[72]

1. *in favour of the country with the best fundamentals.*
2. *in favour of the country with worse fundamentals but 'optimistic' and with* $\mathcal{D}^S_{\hat{t}}(\theta^E_{\hat{t}};.) \geq 0$.

Instead, they are not fully realised when the prior beliefs are asymmetric in favour of a country with worse fundamentals and: i) 'pessimistic', or ii) 'optimistic' with $\mathcal{D}^S_{\hat{t}}(\theta^E_{\hat{t}};.) < 0$.

4.2 Policy implications: Social planner analysis

We define a Social Planner (SP) as one who has perfect knowledge of the prior beliefs of the northern firms and about the offshoring conditions in every country. We assume that the SP can influence northern firms' behaviour by implementing a policy of taxes and subsidies. In other words, the SP cannot directly allocate resources, but it can drive firms to the perfect-information steady state through tax and subsidy policies. In Appendix F, we characterise alternative policy strategies that allow the SP to achieve the perfect-information steady state in $t = 0$. In general terms, the SP's subsidy policy encourages firms to explore their offshoring potential in $t = 0$—by eliminating the risk of the exploration decision—while the SP's tax policy discourages the exploration by firms with productivity lower than the offshoring productivity cutoff under perfect information. Thus, through the tax policy, the SP avoids the excessive offshoring—that is, hysteresis—characterised in Cases II–IV in Proposition 2.

The model's predictions also provide new insights on decentralised policies. In particular, the focus of southern countries' policies should differ depending on the position of each country in the offshoring dynamics. On the one hand, southern countries that currently serve the North with intermediate inputs should focus on reforms that improve their institutional fundamentals, such that they reduce the probability of facing a future adversed relocation process. On the other hand, southern countries that currently do not export intermediate inputs to the North should, instead, focus on reforms that target the foreign firms' beliefs. In other words, an improvement in fundamentals may not be effective to trigger a relocation dynamic in their favour if it is not believed or observed by foreign firms. However, reforms that provide more information about institutional conditions to foreign firms may prove more effective in attracting offshoring activity to these locations. In this sense, international institutions such as multilateral agreements and free-trade agreements may play a role in belief formation.[73]

[72] We have simplified the exposition and abstract from the distinction of Cases I to IV in Proposition 2. However, the excessive offshoring, as defined in Cases II to IV in Proposition 2, may still hold. Case II refers to excessive offshoring that vanishes in the long run, whereas Cases III and IV are persistent in the long run.

[73] We aim to pursue the characterisation of the role of unilateral and multilateral decentralised policies in future research. In particular, the role of free-trade agreements and multilateral agreements as institutional-information shocks.

4.3 Empirical models: Data and definition of main variables

We now extend the empirical model to multiple alternative foreign countries to locate the intermediate-input suppliers. There are S foreign countries in the world, with $l = 1, ..., l, ...S$, where the subindex l denotes one particular foreign country. In the sample that includes sectors with at least 100 firms, the set S has 167 potential foreign locations.[74]

4.3.1 Data

In addition to the Colombian data already described, we use data on institutional measures such as *Governance Efficiency (GE)*, *Regulatory Quality (RQ)* and *Rule of Law (RL)* from the Worldwide Governance Indicators of the World Bank, and distance (between capitals) from CEPII.[75]

We identify the offshoring-exploration decisions of country l in period t separately for domestic-sourcing firms (i.e., non-offshoring firms) and offshoring firms. *Non-offshoring firms* in t are defined as firms that up to $t-1$ have not imported from any country. The set of non-offshoring firms at the beginning of t in sector j is defined as $\{i \in I_j : cos_{i,j,t-1} = 0\}$ with $cos_{i,j,t-1} = 0 \Leftrightarrow cos_{i,l,j,t-1} = 0$ $\forall\ l \in S$, where $cos_{i,l,j,t-1}$ is a dummy variable that indicates the cumulative offshoring status of firm i in sector j and country l up to period $t-1$.[76] Thus, we analyse the first-time exploration decision of these firms. Instead, *offshoring firms* in period t are defined as firms that up to $t-1$ have imported from at least one country. Formally, the set of offshoring firms is defined as $\{i \in I_j : cos_{i,j,t-1} = 1\}$ with $cos_{i,j,t-1} = 1 \Leftrightarrow cos_{i,l,j,t-1} = 1$ for at least one country $l \in S$. In this case, we characterise the exploration decision of new countries for a potential relocation of offshore suppliers.

We define $S_{i,j,t}$ as the set of countries that has not been explored by a firm i in sector j up to and in period t. Thus, $S_{i,j,t} = S$ for a firm in sector j that has never imported from any country up to and in period t. Instead, $S_{i,j,t} = \emptyset$ for the extreme case of a firm i in sector j that up to period t has already explored the offshoring potential in all countries.

4.3.2 Identification of the learning mechanism

In this subsection, we show the identification of the learning mechanism on institutional conditions. From the theory, we know that the posterior beliefs, which influence the exploration decisions to specific locations, are a positive function of the prior beliefs (*beliefs state*) and the information spillovers

[74] See Figure A16 in Appendix D.4.1 for information on the observed number of sourcing countries by sector.

[75] As our model focuses on uncertainty about the per-period fixed costs of offshoring, we concentrate on the GE and RQ indices. However, considering the extensive use of RL in the literature, we use it in a robustness check. In the models without country fixed effects, we also use income per capita and GDP from the World Bank, and common language from CEPII. We use the mean income per capita as a proxy for wage level (marginal cost) in the foreign country, and the mean GDP as a measure of market thickness. The latter is based on Grossman and Helpman (2005), who show that the thickness of the market is an important determinant of the location choices for offshoring. As a control variable, it also allows us to account for potential scale economies or agglomeration economies that may influence the location choices.

[76] $cos_{i,l,j,t-1} = 0$ when firm i in sector j has never imported from country l up to and in period $t-1$, and one otherwise.

(*physical state*). Thus, we introduce a measure of relative prior beliefs on institutional conditions together with a measure of relative information spillovers. We define the latter first and then the former.

Identification of *physical state*: Information spillovers. The variable $\ln(ris^{W}_{i,l,j,t})$ refers to the information revealed about country l in period t for firms in sector j relative to the information revealed about the other alternative non-explored locations. This allows us to consider the effect of third-country information on the exploration decision of country l by firms in sector j. The superscript W denotes the selection and weighting criteria of third countries. We use for that purpose the weighted mean where the weights are a function of the distance to Colombia (denoted by W^{dist}). As robustness, in Appendix D.4.4, we use the simple mean (denoted by W^{mean}) and the maximum information revealed (denoted by W^{max}) among alternative non-explored locations.

We develop two alternative indices, one for each information-spillover measure. Regarding the direct measure, the relative spillover index is given by:

$$\ln(ris\_minta^{W^{dist}}_{i,l,j,t}) \equiv \ln\left(\frac{minta_{l,j,t-1}}{\sum_{s=1}^{S_{i,j,t-1}} minta_{s,j,t-1} \times weight_{i,s,t}}\right), \tag{11}$$

where, in this case, the weights are defined by the distance from Colombia to each location among the non-explored countries $s \in S_{i,j,t-1}$. The weights are normalised to add up to one for each firm i in each period t. Intuitively, this relative information spillover measure compares the information revealed about country l relative to a weighted mean of the information revealed in all non-explored locations.[77]

The alternative measure, $sdta_{i,l,j,t}$, allows us to keep the locations from which no information has been revealed in the sample, by defining $sdta_{i,l,j,t} = 0$ for a location l where no firm in sector j registers imports in period t.[78] The equivalent relative information-spillover index for this measure is:

$$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t}) \equiv \ln\left(1 + \frac{sdta_{l,j,t-1}}{\sum_{s=1}^{S_{i,j,t-1}} sdta_{s,j,t-1} \times weight_{i,s,t}}\right). \tag{12}$$

In this case, the weights are defined by the inverse of the distance from Colombia to each location among the non-explored countries $s \in S_{i,j,t-1}$, and they are normalised to add up to one for each firm i in sector j in each period t. The interpretation of the measure is similar to the previous one.

Identification of prior and posterior institutional beliefs. We use the institutional indices from the Worldwide Governance Indicators of the World Bank—namely, *GE*, *RQ* and *RL*—as a measure of the

[77] We define in Appendix D.4.4 the two alternative specifications for each measure. One measure compares the information revealed in country l relative to the simple mean information revealed in all non-explored locations (denoted by W^{mean}). Instead, the other measure compares it relative to the country l' with the maximum information revealed (denoted by W^{max}).

[78] A drawback from this replacement is that the variable $sdta_{i,l,j,t}$ is equal to zero in two cases. First, when no firm offshores from l in sector j and period t. Second, when only one firm offshores from l in sector j and period t. Whereas in the former case no information has been revealed about offshoring conditions in country l, in the latter case, some information has been revealed about the offshoring conditions in that location.

prior beliefs about the institutional conditions in each foreign country. Considering that these indices are built based on surveys instead of being direct measures of the institutional fundamentals, they are closer to capturing the perceptions (i.e., prior beliefs) about the institutional conditions in each country.[79] Thus, we use them as proxies for the *prior* beliefs about the institutional conditions in each location.

We take the exponential values of the original institutional indices, such that they are defined in the range $(0, \infty)$. As we did above, we define a relative institutional index that captures the prior beliefs about the institutional conditions in country l relative to the prior beliefs about the institutional conditions in third non-explored countries, and it is given by:

$$\ln(rel\_inst^{W^{dist}}_{i,l,j,t}) \equiv \ln\left(\frac{inst_{l,t-1}}{\sum_{s=1}^{S_{i,j,t-1}} inst_{s,t-1} \times weight_s}\right). \tag{13}$$

The institutional measure for third countries is given by the mean of the institutional index of each non-explored country weighted by the inverse of the distance to Colombia, where the weights are normalised by firm i and year to add up to one.[80]

4.4 Empirical reduced-form models

We explore the reduced-form models for the multi-country extension.[81] In section 4.4.1, we test for the determinants and timing of the offshoring-exploration decision of domestic-sourcing firms, whereas the respective models for offshoring firms are introduced in section 4.4.2.

4.4.1 Non-offshoring firms: First-time exploration decision

We investigate the first-time offshoring-exploration decision, which refers to domestic-sourcing firms that in period t must decide whether to explore their offshoring potential for the first time or wait. We test for the sequential exploration in productivity, but we focus the analysis on the role of information spillovers on the location choice.

Conditional probit model. We test for the determinants of the location choice of the offshoring-exploration decisions of domestic-sourcing firms. According to the theory, given the prior beliefs, domestic-sourcing firms tend to explore offshoring in countries from where more information has been

[79] *'Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies'. 'Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development'. 'Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence'.* World Bank http://info.worldbank.org/governance/wgi/Home/Documents. For methodological information see Kraay et al. (2010).

[80] $rel\_inst^{W^{dist}}_{i,l,j,t}$ alternatively refers to $rel\_GE^{W^{dist}}_{i,l,j,t}$, $rel\_RQ^{W^{dist}}_{i,l,j,t}$, $rel\_RL^{W^{dist}}_{i,l,j,t}$, depending on the institutional index used.

[81] In Appendix D.4.2, we show the results for the models where we only consider the role of information spillovers. These results are consistent with those shown in this section and the theoretical model's predictions.

revealed. Thus, the probability of a domestic-sourcing firm i in sector j exploring the offshoring potential in country l in period t is given by:

$$\begin{aligned}\Pr\left(os_{i,l,j,t}=1\middle|cos_{i,j,t-1}=0\right)=\Phi\Big(&\beta_1\ln(ta_{i,j,t})+\beta_2\ln(rel\_inst^{W^{dist}}_{i,l,j,t})\\&+\beta_3\ln(ris^{W^{dist}}_{i,l,j,t})+\gamma_l+\gamma_j+\gamma_t\Big).\end{aligned}\tag{14}$$

The variable $cos_{i,j,t-1}$ is, as before, a dummy variable that takes the value 1 if firm i in sector j has imported from any country up to and in period $t-1$, and zero otherwise. Instead, $os_{i,l,j,t}$ refers to the offshoring status of firm i in country l and sector j in period t. The latter takes the value one when firm i in sector j imports from country l in period t, and zero otherwise. The variable $rel\_inst^{W^{dist}}_{i,l,j,t}$ is defined above. Finally, γ_l, γ_j, and γ_t indicate country, sector and year fixed effects, respectively.

Transition (survival) model. We test for the timing and location choice of the first-time exploration decision of domestic-sourcing firms. According to the theory, domestic-sourcing firms tend to explore offshoring earlier in countries where more information has been revealed. Thus, the hazard rate for a firm i in sector j to transition from domestic sourcing to offshoring status in country l in period t is:

$$\Lambda_{i,l,j,t}\left(t\middle|cos_{i,j,t-1}=0\right)=1-\exp[-\exp(\boldsymbol{x}'_{i,l,j,t}\boldsymbol{\beta}+\delta_t)],\tag{15}$$

with $\boldsymbol{x}'_{i,j,t}\boldsymbol{\beta}=\beta_0+\beta_1\ln(ta_{i,j,t})+\beta_2\ln(rel\_inst^{W^{dist}}_{i,l,j,t})+\beta_3\ln(ris^{W^{dist}}_{i,l,j,t})+\beta_3 entry_i+\gamma_l+\gamma_j$, and $\delta_t=\alpha\ln(t)$ represents the time-trend in a logarithmic form.

Results. Table 2 reports the estimated coefficients for the empirical models above. Columns (1)–(6) show the results for the models in equation (14), whereas columns (7)–(12) show the results for the models in equation (15). The table shows strong supportive evidence for the effect of productivity on the probability of exploring the offshoring potential of domestic-sourcing firms, as well as for the timing of the exploration decisions. Higher productivity increases the probability and accelerates the timing of exploring the offshoring potential in period t by a domestic-sourcing firm. Both results are consistent with the theoretical prediction in Proposition 1.[82]

Regarding the role of information spillovers, the empirical evidence shows strong support for the predictions from the theoretical model in all specifications. Columns (1)–(6) show that an increase in the information revealed in the offshoring conditions in country l relative to the weighted mean information revealed in the other alternative sourcing locations increases the probability that domestic-sourcing firms explore the offshoring potential in t in country l. Moreover, columns (7)–(12) show that it also leads to

[82] From a quantitative perspective, column (1) shows that an average increase of 10% in the productivity of the firm increases the probability of offshoring in period t in country l in 0.0173 percentage points, whereas column (7) shows that it accelerates the exploration of country l in 0.0179 percentage points. For average marginal effects, see Appendix D.4.5. Tables in Appendix D.4.6 show the estimated coefficients of the models, where we relaxed the specification by replacing the country fixed effects by country-level control variables.

Table 2: Non-offshoring firms

Model:		Conditional Probit Model						Transition (Survival) Model					
Institutional Index:		GE	RQ	RL	GE	RQ	RLest	GE	RQ	RL	GE	RQ	RL
	Exp. sign	(1) $os_{i,l,j,t}$	(2) $os_{i,l,j,t}$	(3) $os_{i,l,j,t}$	(4) $os_{i,l,j,t}$	(5) $os_{i,l,j,t}$	(6) $os_{i,l,j,t}$	(7) $\Lambda_{i,l,j,t}$	(8) $\Lambda_{i,l,j,t}$	(9) $\Lambda_{i,l,j,t}$	(10) $\Lambda_{i,l,j,t}$	(11) $\Lambda_{i,l,j,t}$	(12) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.225***	0.225***	0.225***	0.222***	0.222***	0.222***	0.627***	0.626***	0.627***	0.632***	0.632***	0.632***
		(0.0224)	(0.0224)	(0.0224)	(0.0214)	(0.0214)	(0.0214)	(0.0543)	(0.0543)	(0.0540)	(0.0537)	(0.0537)	(0.0537)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-	-0.0436***	-0.0440***	-0.0434***				-0.133***	-0.133***	-0.134***			
		(0.0115)	(0.0116)	(0.0115)				(0.0344)	(0.0345)	(0.0344)			
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$	+				0.0495***	0.0490***	0.0494***				0.141**	0.140**	0.141**
					(0.0188)	(0.0188)	(0.0188)				(0.0571)	(0.0567)	(0.0570)
$\ln(rel\_inst^{W^{dist}}_{i,l,j,t})$		-0.174	0.0774	-0.252	-0.0198	0.300**	0.102	-0.314	0.0780	-0.603	0.290	0.565	0.584
		(0.113)	(0.145)	(0.234)	(0.158)	(0.141)	(0.271)	(0.375)	(0.353)	(0.694)	(0.354)	(0.411)	(0.853)
$\ln(t)$								-1.008***	-1.011***	-1.002***	-0.945***	-0.926***	-0.944***
								(0.101)	(0.104)	(0.103)	(0.108)	(0.109)	(0.108)
FEs		j,t,l	j,t,l	j,t,l	j,t,l	j,t,l	j,t,l	j,l	j,l	j,l	j,l	j,l	j,l

Sample: Sectors with at least 100 firms. Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. *Exp. sign* column reports the expected sign from our theoretical model for main coefficients. *Survival model*: includes year of entry of firm into sample as control. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

an earlier exploration of those countries. That is, domestic-sourcing firms choose to explore offshoring first in those locations where more information has been revealed by other firms in their sector.[83]

Finally, the table shows that changes in institutional indices do not affect the probability nor the timing of offshoring decisions by domestic-sourcing firms. This is consistent with the theoretical model: firms that are still under domestic sourcing are mainly driven in the offshoring choices by the information revealed by the already offshoring firms, and not by the exogenous information shocks on prior beliefs, as they follow the most productive firms location choices sequentially in time.

4.4.2 Offshoring firms: Exploration of potential new sourcing countries

We analyse the exploration decisions of new foreign locations by offshoring firms. The model aims to capture the determinants and timing of the exploration decisions of new (i.e., unexplored) locations that may trigger a potential supplier relocation. We analyse the sequential exploration in productivity, but we focus mainly on the role of information spillovers and priors as drivers of the location choices.

Conditional probit model. The probability of exploring the offshoring potential in country l in period t for an offshoring firm i in sector j that has not explored the offshoring potential in country l is:

$$\Pr\left(os_{i,l,j,t} = 1 \middle| cos_{i,l,j,t-1} = 0, cos_{i,j,t-1} = 1\right) = \Phi\Big(\beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(rel\_inst^{W^{dist}}_{i,l,j,t}) + \beta_3 \ln(ris^{W^{dist}}_{i,l,j,t}) + \gamma_l + \gamma_j + \gamma_t\Big). \quad (16)$$

The variable $cos_{i,j,t-1}$ is defined above. The variable $cos_{i,l,j,t-1}$, instead, refers to the cumulative offshoring status of the firm in country l, and it is defined as a dummy variable that takes the value one if the firm i in sector j has imported from country l up to and in period $t-1$. The variable $os_{i,l,j,t}$ refers to the offshoring status of firm i in sector j and country l in period t. The variable $rel\_inst^{W^{dist}}_{i,l,j,t}$ is defined

[83] From a quantitative perspective, an average reduction of 10% in the minimum productivity of the offshoring firms in country l in period $t-1$ relative to the weighted mean of minimum productivities of offshoring firms in alternative sourcing locations increases the probability of domestic-sourcing firms to offshore in l in period t by 0.00334 p.p. (column 1), and accelerates the exploration of that country in 0.0038 p.p. [column (7)]. For average marginal effects, see Appendix D.4.5.

above. Finally, γ_l, γ_j, and γ_t indicate country, sector and year fixed effects, respectively.

Transition (survival) model. According to the theory, given the prior beliefs, offshoring firms tend to explore earlier in countries where more information has been revealed. Thus, the hazard rate for a firm i in sector j to transition from offshoring from other locations $l' \neq l$ to offshore from l in period t is:

$$\Lambda_{i,l,j,t}\left(t \middle| cos_{i,l,j,t-1} = 0, cos_{i,j,t-1} = 1\right) = 1 - \exp[-\exp(\boldsymbol{x}'_{i,l,j,t}\boldsymbol{\beta} + \delta_t)], \tag{17}$$

with $\boldsymbol{x}'_{i,j,t}\boldsymbol{\beta} = \beta_0 + \beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(rel\_inst^{W^{dist}}_{i,l,j,t}) + \beta_3 \ln(ris^{W^{dist}}_{i,l,j,t}) + \beta_3 entry_i + \gamma_l + \gamma_j$, and $\delta_t = \alpha \ln(t)$ represents the time-trend in a logarithmic form.

Results. Table 3 reports the estimated coefficients of the models for offshoring firms. Columns (1)–(6) report the results of the models in equation (16), whereas columns (7)–(12) show the results of the models in equation (17). The table provides strong evidence consistent with the predictions of the model in terms of the effect of productivity on the probability of exploring the offshoring potential in new locations by offshoring firms. Higher productivity increases the probability that offshoring firms explore the offshoring potential in period t in a new location. At the same time, it shows that more productive offshoring firms explore new unexplored locations earlier, which is consistent with the prediction that relocation dynamics to new locations are led by the most productive firms in the market.[84]

Table 3: Offshoring firms

Model:		**Conditional Probit Model**						**Transition (Survival) Model**					
Institutional Index:		**GE**	**RQ**	**RL**	**GE**	**RQ**	**RL**	**GE**	**RQ**	**RL**	**GE**	**RQ**	**RL**
	Exp. sign	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.249***	0.251***	0.249***	0.239***	0.241***	0.239***	0.569***	0.573***	0.570***	0.574***	0.577***	0.574***
		(0.00884)	(0.00887)	(0.00899)	(0.00770)	(0.00779)	(0.00777)	(0.0247)	(0.0249)	(0.0254)	(0.0206)	(0.0210)	(0.0211)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-	-0.0610***	-0.0613***	-0.0610***				-0.143***	-0.144***	-0.142***			
		(0.00712)	(0.00699)	(0.00699)				(0.0166)	(0.0161)	(0.0162)			
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$	+				0.119***	0.119***	0.119***				0.279***	0.281***	0.279***
					(0.0206)	(0.0204)	(0.0205)				(0.0450)	(0.0447)	(0.0449)
$\ln(rel\_inst^{W^{dist}}_{i,l,j,t})$	+	0.355***	0.260***	0.334***	0.519***	0.275***	0.583***	0.982***	0.701***	0.809***	1.375***	0.789***	1.562***
		(0.0719)	(0.0539)	(0.0881)	(0.0635)	(0.0425)	(0.0803)	(0.143)	(0.129)	(0.194)	(0.136)	(0.114)	(0.209)
$\ln(t)$								-0.595***	-0.580***	-0.592***	-0.515***	-0.501***	-0.510***
								(0.0498)	(0.0508)	(0.0483)	(0.0448)	(0.0447)	(0.0432)
FEs		j,t,l	j,t,l	j,t,l	j,t,l	j,t,l	j,t,l	j,l	j,l	j,l	j,l	j,l	j,l

Sample: Sectors with at least 100 firms. Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. *Exp. sign* column reports the expected sign from our theoretical model for main coefficients. *Survival model*: includes year of entry of firm into sample as control. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Regarding the role of information spillovers, the empirical results show also strong supportive evidence for the predictions of the model in all specifications. Columns (1)–(6) show that an increase in the information revealed in the offshoring conditions in country l relative to the weighted mean information revealed about the alternative non-explored sourcing locations increases the probability that offshoring firms explore the offshoring potential in t in country l. Columns (7)–(12) show that it also leads to

[84]From a quantitative analysis, an average increase of 10% in the productivity of the firm increases the probability of offshoring in period t in country l by offshoring firms in 0.0817 percentage points [column (1)]. At the same time, this increase in average productivity leads accelerates the exploration of a new location l in period t by 0.082 p.p. [column (7)]. For average marginal effects, see Appendix D.4.5. Tables in Appendix D.4.6 shows the estimated coefficients of the models where we relaxed the specification by replacing the country fixed effects by country-level control variables.

a faster exploration of those unexplored locations. That is, offshoring firms tend to choose first those locations where more information has been revealed by other firms in the market.[85]

Finally, concerning the role of the prior beliefs, we find theory-consistent evidence for the case of offshoring firms: an improvement in the priors about country l relative to the weighted mean priors of the non-explored locations increases the probability and accelerates the exploration of the offshoring potential in country l in period t. In other words, exogenous positive changes (i.e., shocks) in prior beliefs have a direct impact on the exploration decisions of offshoring firms, which are the most productive firms in the market. This is consistent with the theoretical prediction that the exploration of new locations after an institutional shock is led by the most productive firms in the market, whereas less productive firms (domestic sourcing firms) are driven mainly by the endogenous information externalities produced by already offshoring firms.[86]

4.5 Empirical structural model

We develop the structural empirical model of the exploration decisions in the multi-country model. Based on the theory, we define the exploration decision among non-explored locations $l \in S_{i,j,t-1}$ in any period t of a firm i with productivity θ in sector j sourcing from location l' as:

$$\mathcal{D}^{*l/l'}_{i,j,t}(\theta; \mathcal{I}_{i,j,t}) = \max\left\{\mathcal{D}^{1/l'}_{i,j,t}(\theta; \mathcal{I}_{i,j,t}); ...; \mathcal{D}^{S_{i,j,t-1}/l'}_{i,j,t}(\theta; \mathcal{I}_{i,j,t})\right\}, \tag{18}$$

with the trade-off function relative to any specific non-explored location l given by:

$$\mathcal{D}^{l/l'}_{i,j,t}(\theta; \mathcal{I}_{i,j,t}) = \max\left\{0; \mathbb{E}_t\left[\pi^{l/l',prem}_{j,t}(\theta)\middle|\mathcal{I}_{i,j,t}\right]\right\} - w^N s^r_j\left[1 - \lambda_j \frac{Y(f^l_{j,t+1})}{Y(f^l_{j,t})}\right]. \tag{19}$$

Thus, a firm i with productivity θ sourcing from country l' explores offshoring potential in country l if $\mathcal{D}^{*l/l'}_{i,j,t}(\theta; \mathcal{I}_{i,j,t}) \geq 0$, or wait for one period sourcing from its previous location l' otherwise.

In section 4.5.1, we introduce the empirical identification of the bilateral trade-off function (19) for each $l \in S_{i,j,t-1}$. In section 4.5.2, we follow with the characterisation of a spatial probit model to identify the exploration decision defined in equation (18). For proofs, see Appendix D.5.

4.5.1 Bilateral trade-off function

From equation (19), we derive the conditional probit:

[85] From a quantitative perspective, an average reduction of 10% in the minimum productivity of the offshoring firms in country l in period $t-1$ relative to the weighted mean of minimum productivities of offshoring firms in alternative non-explored locations increases the probability of offshoring firms to explore offshoring potential in l in period t by 0.02 percentage points [column (1)]. From a timing perspective, that change also increases the hazard rate to explore offshoring in that location in period t by 0.0206 p.p. [column (7)]. For average marginal effects, see Appendix D.4.5.

[86] From a quantitative perspective, an average improvement of 10% in the prior beliefs (government efficiency) about country l relative to the weighted mean of the prior beliefs about the alternative non-explored locations increases the probability of offshoring firms to explore offshoring in l in period t by 0.117 percentage points [column (1)]. It also increases the respective hazard rate in 0.141 p.p. [column (7)]. For average marginal effects, see Appendix D.4.5. The results are robust across specifications in robustness checks (see Appendix D.4.6).

$$\Pr\left(d^l_{i,j,t}=1\middle|d^l_{i,j,t-1}=0,\mathcal{I}_{i,j,t}\right)=\Phi\Big[\Sigma^{-1}\Big(\sigma_j^{-1}\mathbb{E}\Big[z^{l/l'}_{j,t}\theta^{\sigma_j-1}\Big|\mathcal{I}_{i,j,t}\Big]-w^N\Big[\mathbb{E}(f^l_j|\mathcal{I}_{i,j,t})-f^{l'}_j\Big] \\ -w^N s^r_j\Big[1-\lambda_j Y(f^l_{j,t+1}|\mathcal{I}_{i,j,t})\Big]\Big)\Big], \tag{20}$$

with $z^{l/l'}_{j,t} \equiv \left[\left(\frac{w^{l'}}{w^l}\right)^{(1-\eta_j)(\sigma_j-1)}-1\right]\left(\frac{w^N}{w^{l'}}\right)^{(1-\eta_j)(\sigma_j-1)}\left[\frac{\sigma_j-1}{\sigma_j}\right]^{\sigma_j-1}(\gamma_j E)^{\sigma_j}\,Q^{1-\sigma_j}_{j,t}\left(w^N\right)^{1-\sigma_j}$. This model characterises the trade-off function relative to country l for a firm i in sector j that sources from country l' and possesses the information set $\mathcal{I}_{i,j,t}$.

Identification of expected fixed-cost differential and information spillovers. We identify the expected fixed-cost differential as follows:

$$w^N\left[\mathbb{E}\left(f^l_j|\mathcal{I}_{i,j,t}\right)-f^{l'}_j\right]=\gamma_l-\gamma_1 \mathit{FTA}_{l,t}-\gamma_2 \mathit{inst}^{\mathit{posterior}}_{l,j,t}+\gamma_j+v_{i,l,j,t}, \tag{21}$$

where the country fixed effects γ_l in equation (21) absorb all country-level time-invariant variables.[87] The variable $\mathit{inst}^{\mathit{posterior}}_{l,j,t}$ refers to the posterior beliefs of firms in sector j in year t about the institutional conditions of country l. Finally, the variable $\mathit{FTA}_{l,t}$ represents a dummy variable that identifies whether country l has a FTA with Colombia in t, and γ_j denotes sector fixed effects.[88]

Intuitively, an improvement in posterior beliefs about institutional conditions in country l in period t for firms in sector j reduces the expected fixed costs of offshoring in country l. However, the posterior beliefs are unobservable. From the theory, we know that the posterior beliefs about institutional conditions in country l in period t for firms in sector j are a positive function of the prior beliefs and the information spillovers. Therefore, we use both measures as a proxy for the posterior beliefs; that is:

$$\mathit{inst}^{\mathit{posterior}}_{l,j,t}=\rho_1 \mathit{is}_{l,j,t}+\rho_2 \mathit{inst}_{l,t}, \tag{22}$$

where the information spillovers (i.e., $\mathit{is}_{l,j,t}$) are alternatively identified by: i) $\mathit{minta}_{l,j,t-1}$, and ii) $\mathit{sdta}_{l,j,t-1}$. We use the institutional index of country l in year t (e.g., *GE, RQ* or *RL*) as a proxy measure for the prior beliefs. We assume that the priors are homogenous across sectors; that is, the variable $\mathit{inst}_{l,t}$ does not vary in the j dimension. Therefore, using equation (22), equation (21) becomes:

$$w^N\left[\mathbb{E}\left(f^l_j|\mathcal{I}_{i,j,t}\right)-f^{l'}_j\right]=\gamma_l-\gamma_1 \mathit{FTA}_{l,t}-\gamma_{21}\mathit{is}_{l,j,t}-\gamma_{22}\mathit{inst}_{l,t}+\gamma_j+v_{i,l,j,t}. \tag{23}$$

Intuitively, an exogenous improvement in the prior beliefs about institutions in country l reduces the expected fixed costs of offshoring in that location.[89] In the empirical model, the exogenous improvements in institutional prior beliefs are identified by the changes in the institutional index.

[87]In the model without country fixed effects, we include a vector of time-invariant country l level variables such as market thickness ($\ln(\overline{\mathit{mkt\_thick}_l})$), mean income per capita ($\ln(\overline{\mathit{inc\_pc}_l})$), common language ($\mathit{common\_lang}_l$), and distance ($\ln(\mathit{dist}_l)$. The results are robust and theory-consistent across all specifications. In Appendix D.6, we provide a summary of those results.

[88]The FTA dummy aims to capture the changes in trade costs and potential regulation changes (i.e., institutional fundamentals) at the bilateral level due to the implementation of the agreement.

[89]We define them as exogenous in the sense that these are changes in beliefs that do not come from the endogenous learning mechanism defined by the theoretical model above.

Identification of the expected gains from waiting. The expected gains from waiting in period t are a positive function of the expected posterior beliefs in $t+1$. We characterise them as:

$$w^N s_j^r \left[1 - \lambda_j Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t})\right] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j} \mathbb{E}\left[inst_{l,j,t+1}^{posterior} | \mathcal{I}_{i,j,t}\right] + e_{l,j,t}, \tag{24}$$

where $\mathbb{E}\left[inst_{l,j,t+1}^{posterior} | \mathcal{I}_{i,j,t}\right]$ represents the expected posterior beliefs about country l in $t+1$ of firms in sector j conditional on the information set that those firms possess in period t. As before, the expected posterior beliefs are not observable.[90]

From the theory, the expected posterior beliefs about country l in period $t+1$ of firms in sectors j are a function of the respective expected information spillovers. The underlying assumption is that firms cannot predict exogenous changes in the future priors (e.g., exogenous institutional-information shocks) from the information set they possess in period t. Based on this setup, we identify the expected gains from waiting with a two-step procedure. We begin by defining an AR(1) model that estimates the expected information spillovers in $t+1$ about each country l for firms in sector j conditional on the information set they possess in t:

$$is_{l,j,t+1} = \rho_{1,j} is_{l,j,t} + \epsilon_{l,j,t} \quad \Rightarrow \quad \mathbb{E}\left[is_{l,j,t+1}\right] = \rho_{1,j} is_{l,j,t}. \tag{25}$$

In a second step, we identify the expected gains from waiting as:

$$w^N s_j^r \left[1 - \lambda_j Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t})\right] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j} \widehat{is}_{l,j,t+1} + e_{l,j,t}, \tag{26}$$

where $\widehat{is}_{l,j,t+1}$ is the predicted value from the model in equation (25), which identifies the expected new information to be revealed, and $\tilde{\gamma}_{1,j}$ captures the interaction of the expected new information and the sector's death shock rates and offshoring sunk cost. Intuitively, an increase in the expected new information to be revealed, which represents an improvement in the expected posteriors, increases the gains from waiting.

Empirical identification of the bilateral trade-off function. Back to equation (20), replacing with expressions from equations (23) and (26), the model is given by:

$$\begin{aligned} \Pr\left(d_{i,j,t}^l = 1 \middle| d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t}\right) = \Phi\Big[\Sigma^{-1}\Big(\sigma_j^{-1}\mathbb{E}\Big[z_{j,t}^{l/l'}\theta^{\sigma_j - 1}\Big|\mathcal{I}_{i,j,t}\Big] - \Gamma_l - \Gamma_j + \Gamma_1 inst_{l,t} \\ + \Gamma_2 FTA_{l,t} + \Gamma_3 is_{l,j,t} - \Gamma_{4,j}\widehat{is}_{l,j,t+1}\Big)\Big]. \end{aligned} \tag{27}$$

The first term on the right-hand side—i.e., $\sigma_j^{-1}\mathbb{E}[z_{j,t}^{l/l'}\theta^{\sigma_j - 1}|\mathcal{I}_{i,j,t}]$—is empirically identified below.

4.5.2 Multi-country trade-off function

We define as $\boldsymbol{\mathcal{D}}_{i,j,t}^{/l'}(\boldsymbol{\theta}; \boldsymbol{\mathcal{I}}_{i,j,t})$ the vector of trade-off functions for locations $l \in S_{i,t-1}$ that constitute the arguments of the max function in equation (18). The spatial probit is given by:

[90] For proofs and details, see Appendix D.5.3.

$$\mathcal{D}^{l/l'}_{i,j,t}(\theta;\mathcal{I}_{i,j,t}) = \psi \boldsymbol{W_{i,j,t}} \boldsymbol{\mathcal{D}^{/l'}_{i,j,t}(\theta;\mathcal{I}_{i,j,t})} + \Big[\sigma_j^{-1}\mathbb{E}\Big[z^{l/l'}_{j,t}\theta^{\sigma_j-1}\Big|\mathcal{I}_{i,j,t}\Big] - \Gamma_l - \Gamma_j - \Gamma_t + \Gamma_1 inst_{l,t} + \Gamma_2 FTA_{l,t} + \Gamma_3 is_{l,j,t} - \Gamma_{4,j}\widehat{is}_{l,j,t+1}\Big], \tag{28}$$

where $\boldsymbol{W_{i,j,t}}$ is a $S_{i,j,t-1} \times S_{i,j,t-1}$ weighting matrix with zeros in the diagonal for each firm i in sector j in period t. The matrix is row-normalised to one in each period t. On the other hand, $\boldsymbol{I_{i,j,t}}$ refers to the identity matrix of dimension equivalent to the respective weighting matrix.

For the case of domestic-sourcing firms, the set $S_{i,t-1} = S$ corresponds to all foreign countries in the sample and it is the same for all domestic-sourcing firms. Thus, the weighting matrix $\boldsymbol{W_{i,j,t}}$ has a constant dimension $S \times S$ for each year t and domestic-sourcing firm i in sector j. Instead, in the case of offshoring firms, the set $S_{i,t-1}$ is defined by the non-explored countries by firm i up to and including period $t-1$. Therefore, the matrix is firm-specific and changes over time, as new locations are explored by firm i.[91] Thus, the weighting matrix for offshoring firm i in period t (i.e., $\boldsymbol{W_{i,j,t}}$) has dimension $S_{i,t-1} \times S_{i,t-1}$.

Definition of weighting matrix. In our main specification, we use equal weights among all non-explored locations, i.e., we set the off-diagonal elements of all non-explored locations equal to one before we row-normalise. This is equivalent to taking the simple mean among alternative sourcing countries. We denote this matrix by $W_{i,j,t} = W^{mean}_{i,j,t}$. We use equal weighting in our main specification because, after considering the effect of distance in the bilateral trade-off functions, firms' choices among alternative locations should not be affected by the distance. Nevertheless, as robustness, we report results for models where we define the off-diagonal elements by the inverse of the distance to Colombia before we row-normalise. This alternative matrix is denoted as $W_{i,j,t} = W^{dist}_{i,j,t}$.

Sample definition. For computational reasons, we reduce the dimension of $W_{i,j,t}$ by excluding from the sample the high-income countries according to the World Bank classification. Thus, the sample includes 76 alternative sourcing countries.

Methodology and additional considerations. For the estimation of the model, we follow a Bayesian MCMC approach based on LeSage and Pace (2009) and use the R-package developed by Wilhelm and de Matos (2013). We take 5000 draws with 500 draws as a burn-in phase.

For computational reasons, we simplify the model from equation (28) and estimate a 'reduced-form' of the spatial structural model, which is given by:

$$\mathcal{D}^{l/l'}_{i,j,t}(\theta;\mathcal{I}_{i,j,t}) = \psi \boldsymbol{W_{i,j,t}} \boldsymbol{\mathcal{D}^{/l'}_{i,j,t}(\theta;\mathcal{I}_{i,j,t})} + \Big[\Gamma_1 \ln(ta_{i,j,t}) - \Gamma_l - \Gamma_j - \Gamma_t + \Gamma_1 inst_{l,t} + \Gamma_2 FTA_{l,t} + \Gamma_3 is_{l,j,t} - \Gamma_4\widehat{is}_{l,j,t+1}\Big]. \tag{29}$$

[91] As the firm i explores new locations, the dimension of the weighting matrix reduces its dimension for that firm i.

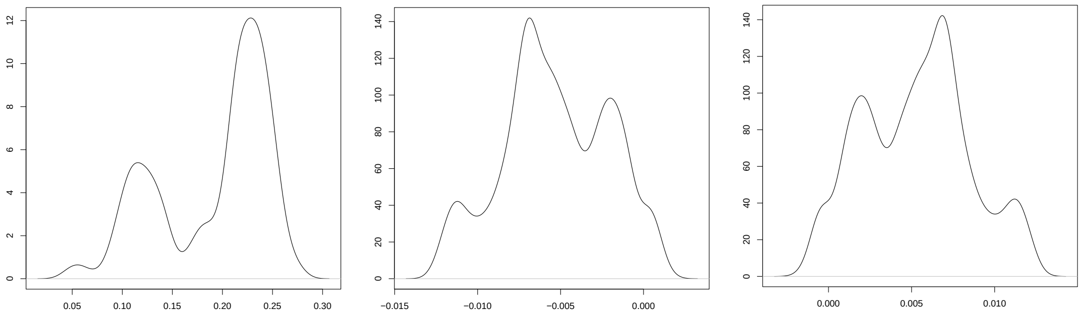
This specification of the model abstracts from the differential effects at the sector level of: i) productivity, which comes from the term $\sigma_j^{-1}\mathbb{E}\left[z_{j,t}^{l/l'}\theta^{\sigma_j-1}\middle|\mathcal{I}_{i,j,t}\right]$ in equation (28), and ii) the expected new information defined by coefficient $\Gamma_{5,j}$ in equation (28).[92]

Results: Analysis of main effects. Table 4 reports the results for domestic-sourcing firms and offshoring firms. We report the estimated coefficients and marginal effects of the models with the weighting matrix given by $W_{i,j,t}^{mean}$, and the information spillover measured by *minta*. The institutional index is *RQ*.[93] We analyse first the estimated spatial coefficients. The table shows negative spatial effects ($\psi < 0$) revealing that the decision of a firm to explore the offshoring potential in one location reduces the probability that it will also explore the offshoring potential in other non-explored countries.[94]

Table 4: Structural model results—Information spillover measure: *minta*

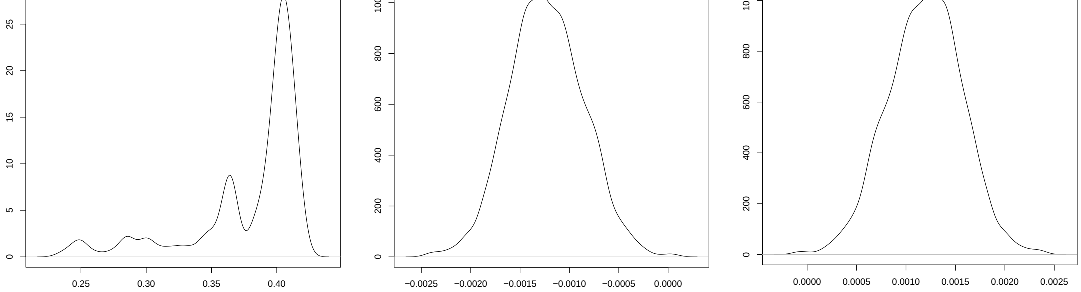
	Domestic sourcing firms					**Offshoring firms**				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000470	-0.000228	0.000243	0.191514	0.0000	0.003663	-0.001811	0.001852	0.379308	0.0000
$minta_{l,j,t-1}$	-0.000012	0.000006	-0.000006	-0.005313	0.0492	-0.000012	0.000006	-0.000006	-0.001231	0.0016
$\widehat{minta}_{l,j,t+1}$	0.000012	-0.000006	0.000006	0.005291	0.0494	0.000012	-0.000006	0.000006	0.001193	0.0018
$RQ_{l,t}$	0.000149	-0.000071	0.000078	0.058371	0.3472	-0.000015	0.000007	-0.000008	-0.001581	0.4568
ψ	0.000000	0.000000	0.000000	-0.924422	0.0000	0.000000	0.000000	0.000000	-0.966336	0.0000

Marginal effects and coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA. Weighting matrix: $W_{i,j,t}^{mean}$.



(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{l,j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0

Figure 6: Coefficients. Domestic-sourcing firms—Model w/ RQ and $W_{i,j,t}^{mean}$



(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{l,j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0

Figure 7: Coefficients. Offshoring firms—Model w/ RQ and $W_{i,j,t}^{mean}$

[92]Nevertheless, the estimated simplified version in equation (29) represents a more conservative structure than the one based on equation (28). In Appendices D.5.5 and D.5.6 we show the expressions for the spatial probit models for the *SMOPEC* and the *full structural* models, respectively.

[93]For the results with *GE* and *RL* indices, as well as for a summary of the robustness checks, see Appendix D.6.

[94]The estimation of the spatial effect on offshoring-exploration decisions among non-explored locations is a clear advantage of the specification of the structural model as a spatial probit.

We focus now on the analysis of the results of the estimated effects that are directly related to the main theoretical predictions of the multi-country model. In particular, we focus on Proposition 1 (sequential offshoring in productivity) and the role of information spillovers on location choices. Concerning Proposition 1, the results show that higher productivity has a significant effect on the offshoring exploration decision in period t. In particular, the marginal effects show a direct positive effect on the offshoring exploration of the country l in period t—that is, a positive effect on the bilateral trade-off function—as well as a positive total effect on the probability of offshoring in period t.

Regarding the role of information spillovers, the table shows theory-consistent and significant effects for the current information revealed about offshoring conditions in country l ($minta_{l,j,t-1}$) and the expected new information to be revealed next period about offshoring conditions in that same country ($\widehat{minta}_{l,j,t+1}$). We zoom in on the characterisation of the marginal effects, starting with $minta_{l,j,t-1}$. The results show that an increase in the current information revealed about country l—that is, a reduction in $minta_{l,j,t-1}$—increases the probability of exploring country l in period t (*direct effect*), reduces the probability of exploring other locations in period t (*indirect effect*), and has a *total effect* of increasing the probability of offshoring in t. Concerning the expected new information, the marginal effects show that an increase in the expected information to be revealed next period about offshoring conditions in country l—that is, a reduction in $\widehat{minta}_{l,j,t+1}$—reduces the probability of exploring offshoring in country l in period t (*direct effect*) and has a negative *total effect* on the probability of exploring offshoring in t. From the analysis above, the results show strong supportive evidence for the role of information spillovers in a multi-country setting, as predicted by the theory.

Finally, regarding the role of prior beliefs, the results show mixed evidence concerning the model's predictions. In table 4, in particular, the regulatory quality index has no significant effect on exploration decisions. In general, the country fixed effects absorb the effects of the institutional indices on the exploration decisions in the structural model; however, theory-consistent and significant results emerge in models without country fixed effects. See Appendix D.6.3.

5 Conclusions

Institutions are key drivers of multinational firms' sourcing decisions, and in consequence in the definition of the comparative advantages of countries and the allocation of production worldwide. However, firms usually possess an uncertain knowledge about the institutional fundamentals in foreign (unexplored) countries.

In a two-country model, we showed that uncertainty leads initially to low offshoring activity, with welfare costs. However, in a dynamic setting, we show that firms can exploit information externalities that emerge from observing other firms' behaviour, and thus better asses their offshoring potential and progressively adjust their sourcing strategies. These information spillovers result in a sequential offshoring dynamic path led by the most productive firms in the market, which converges to the perfect-information steady state. In consequence, information externalities allow the differentiated sectors to progressively overcome the initial inefficiencies produced by uncertainty, and therefore fully achieve the welfare gains from offshoring in the long run.

We extended the model to multiple countries in which firms can choose among different foreign locations for offshoring. We showed that a selection pattern in supplier's location choices emerges when firms do not possess perfect information about the true offshoring (institutional) conditions in foreign countries. This leads to multiple equilibria driven by information spillovers. Therefore, the prior beliefs and the differences in institutional fundamentals across countries may lead the sectors to the perfect-information equilibrium or may push them to a non-optimal steady state. In the first case, the steady state is characterised by the perfect-information welfare gains from offshoring and the optimal specialisation of countries. In the second case, the sector reaches a steady state with non-optimal specialisation of countries and welfare gains from offshoring that may not be fully realised. The latter shows how priors and information spillovers affect the offshoring flows to certain locations and become a source of the countries' *revealed* comparative advantages. In this regard, the model complements the literature on institutions and comparative advantages (Costinot, 2009; Acemoglu et al., 2007), which focuses on the importance of institutional fundamentals in the specialisation of countries.

We test the model using firm-level data of manufacturing Colombian firms. We defined reduced-form as well as structural empirical models and find support for the main predictions of the model. In particular, our empirical evidence supports the learning mechanism and the sequential offshoring equilibrium path led by the most productive firms in the market, and the selection patterns in the location choices, driven by the information spillovers.

In terms of policy implications, we introduced a social planner analysis and show the conditions under which the perfect information steady-state can be achieved. The model's predictions also provide new insights on decentralised policies. In particular, the focus of southern countries' policies should differ depending on the position of each country in the sectoral offshoring dynamics. On the one hand, southern countries that are currently receiving offshoring flows should focus on reforms that improve their institutional fundamentals, such that they reduce the probability of facing a future adversed relocation process. On the other hand, southern countries that do not receive offshoring flows and want to promote the insertion of domestic intermediate-input suppliers in global value chains should focus, instead, on reforms that target foreign firms' beliefs about offshoring conditions in these countries and aim to trigger a relocation dynamic in their favour. In other words, an improvement in fundamentals may not be effective for these countries if it is not believed or observable by foreign firms. However, reforms that provide more information about institutional conditions to the foreign firms may prove more effective in attracting offshoring activity to these locations. In this sense, international institutions such as multilateral agreements and free-trade agreements may play a role in beliefs' formation.[95]

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[95] We aim to pursue the characterisation of the role of unilateral and multilateral decentralised policies in future research. In particular, the role of free-trade agreements and multilateral agreements as institutional information shocks.

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Online Appendix for 'Uncertainty in Global Sourcing: Learning, Sequential Offshoring, and Selection Patterns'

by Mario Larch and Leandro Navarro

Contents

A Perfect information model

Consumer's problem. To obtain the variety i demand function $q_j(i)$, we maximize the utility subject to the budget constraint $p_0 q_0 + \sum_{j=1}^{J} \int_{i\in I_j} p_j(i) q_j(i) di \leq E$. Thus, the demand function for a variety i in sector j in period t is given by $q_j(i) = \frac{\gamma_j E}{P}\left[\frac{p_j(i)}{P_j}\right]^{-\sigma_j}$, or equivalently $q_j(i) = \left[\gamma_j E Q_j^{-\alpha} p_j(i)^{-1}\right]^{\sigma_j}$.

Producers' problem. The per-period revenues of a firm producing a variety i is given by $r_j(i) = p_j(i)q_j(i)$. Plugging in the inverse demand function and replacing with the production function (2), we have that $r_j(i) = \gamma_j E Q_j^{-\alpha_j}\left[\theta\left(\frac{x_{h,j}(i)}{\eta_j}\right)^{\eta_j}\left(\frac{x_{m,j}(i)}{1-\eta_j}\right)^{1-\eta_j}\right]^{\alpha_j}$. Therefore, the final-good producer solves the optimization problem given by $\max_{x_{h,j}(i),x_{m,j}(i)} \pi_j = r_j(i) - w^N x_{h,j}(i) - w^l x_{m,j}(i) - w^N f_j^l$, where $l = \{N, S\}$ refers to the location of the input's supplier. From the FOCs, we obtain $x^*_{h,j}(i) = \frac{\alpha_j \eta_j}{w^N} r_j^{l,*}(\theta)$ and $x^*_{m,j}(i) = \frac{\alpha_j(1-\eta_j)}{w^l} r_j^{l,*}(\theta)$, with $r_j^{l,*}(\theta) \equiv \alpha_j^{\sigma_j-1}\theta^{\sigma_j-1}(\gamma_j E)^{\sigma_j} Q_j^{1-\sigma_j}\left[(w^N)^{\eta_j}(w^l)^{1-\eta_j}\right]^{1-\sigma_j}$. Finally, the profits realised by a firm with productivity θ for each sourcing strategy, i.e. domestic sourcing and offshoring, are:

$$\pi_j^l(\theta, .) = \theta^{\sigma_j-1}(\gamma_j E)^{\sigma_j} Q_j^{1-\sigma_j}\psi_j^l - w^N f_j^l, \tag{A1}$$

with $l = \{N, S\}$, and $\psi_j^l \equiv \frac{\alpha_j^{\sigma_j-1}}{\sigma_j\left[(w^N)^{\eta_j}(w^l)^{1-\eta_j}\right]^{\sigma_j-1}}$.

A.1 Perfect information equilibrium

A.1.1 Firm's prices: Domestic sourcing and offshoring

By assumption A.1 the price of a firm with productivity θ under domestic sourcing is higher than under offshoring. That is, $p(\theta) = \frac{w^N}{\alpha\theta} > \frac{(w^N)^{\eta}(w^S)^{1-\eta}}{\alpha\theta} = p^{\text{off}}(\theta)$, where $p^{\text{off}}(\theta)$ refers to the price of a firm with productivity θ under offshoring, whereas $p(\theta)$ denotes the price of the same firm under domestic sourcing.

A.1.2 Offshoring premiums: Revenues and profits

The revenues for a firm with productivity θ doing domestic sourcing are represented as $r^{N,*}(\theta)$. Instead, when the firm chooses to offshore the revenue is denoted as $r^{S,*}(\theta)$. Dividing both expressions, we get $r^{S,*}(\theta) = \left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} r^{N,*}(\theta)$. Subtracting on both sides $r^{N,*}(\theta)$, we obtain the offshoring premium in revenues received by a firm with productivity θ when the firm decides to offshore:

$$r^{S,prem}(\theta) \equiv r^{S,*}(\theta) - r^{N,*}(\theta) = \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] r^{N,*}(\theta). \tag{A2}$$

Equivalently, the per period offshoring premium in profits for a firm with productivity θ (without considering the offshoring sunk cost) is $\pi^{S,prem}(\theta) \equiv \pi^S(\theta) - \pi^N(\theta)$, which is given by:

$$\pi^{S,prem}(\theta) = \frac{r^{N,*}(\theta)}{\sigma}\left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] - w^N\left[f^S - f^N\right]. \tag{A3}$$

It is straightforward to see that this offshoring profit premium can be positive or negative depending on the productivity level of the firm.

Following a similar approach to Melitz (2003) and Antràs and Helpman (2004), it is possible to express the equilibrium revenues, profits, market productivity cutoff and offshoring productivity cutoff in terms of the model's parameters and moments of the productivity distribution. We define the $\bar{\theta}^S \equiv \left[\frac{1}{1-G(\theta^{S,*})}\int_{\theta^{S,*}}^{\infty}\theta^{\sigma-1}g(\theta)d\theta\right]^{\frac{1}{\sigma-1}}$

as the average productivity of the offshoring firms, and $\bar{\theta} \equiv \left[\frac{1}{1-G(\underline{\theta})}\int_{\underline{\theta}}^{\infty}\theta^{\sigma-1}g(\theta)d\theta\right]^{\frac{1}{\sigma-1}}$ as the average productivity of the active firms in the final-good market.

The per-period profits of the average productivity firm under domestic-sourcing cost structure can be expressed as $\pi^N(\bar{\theta}) = w^N f^N\left[\left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} - 1\right]$. The per-period offshoring premium in profits, without considering the offshoring market research sunk cost, of the average productivity offshoring firm is given by $\pi^{S,prem}(\bar{\theta}^S) \equiv \pi^S(\bar{\theta}^S) - \pi^N(\bar{\theta}^S)$, and substituting with the expressions above, we get:

$$\pi^{S,prem}(\bar{\theta}^S) = \frac{r^{N,*}(\bar{\theta}^S)}{\sigma}\left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] - w^N\left[f^S - f^N\right]. \tag{A4}$$

Therefore, the average per-period profits when the intermediate inputs become tradable are given by:

$$\begin{aligned}\bar{\pi} &= \pi^N(\bar{\theta}) + \chi^*\left[\pi^{S,prem}(\bar{\theta}^S) - (1-\lambda)w^N s^r\right]\\ &= w^N f^N\left[\left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} - 1\right] + \chi^*\left[\pi^{S,prem}(\bar{\theta}^S) - (1-\lambda)w^N s^r\right],\end{aligned} \tag{A5}$$

with $\chi^* \equiv \frac{1-G(\theta^{S,*})}{1-G(\underline{\theta}^*)}$ denoting the share of offshoring firms. The first term of the right-hand side refers to the average profits obtained by the firms if they would all have chosen domestic sourcing, whereas the second term denotes the profit premium received by those firms that decide to offshore adjusted by the share of active offshoring firms. Equivalently, the average revenue is given by:

$$\begin{aligned}\bar{r} &= r^N(\bar{\theta}) + \chi^*\left[r^S(\bar{\theta}^S) - r^N(\bar{\theta}^S)\right]\\ &= r^N(\bar{\theta}) + \chi^*\left[\left(\frac{w^N}{w^S}\right)^{(\sigma-1)(1-\eta)} - 1\right]r^N(\bar{\theta}^S).\end{aligned} \tag{A6}$$

Finally, the offshoring profit premium for the firm with the offshoring productivity cutoff is defined by the condition $\pi^{S,prem}(\theta^{S,*}) - (1-\lambda)w^N s^r = 0$, which leads to:

$$r^{N,*}(\theta^{S,*}) = \sigma w^N\left[f^S + (1-\lambda)s^r - f^N\right]\left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right]^{-1}.$$

Dividing by the revenues of the firm at the market cutoff productivity level leads to:

$$\begin{aligned}\frac{r^{N,*}(\theta^{S,*})}{r^{N,*}(\underline{\theta}^*)} &= \left(\frac{f^S + (1-\lambda)s^r}{f^N} - 1\right)\left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right]^{-1},\\ &= \left(\frac{\theta^{S,*}}{\underline{\theta}^*}\right)^{\sigma-1}.\end{aligned}$$

Putting both equations together we can solve for the offshoring productivity cutoff:

$$\theta^{S,*} = \left(\frac{f^S + (1-\lambda)s^r}{f^N} - 1\right)^{\frac{1}{\sigma-1}}\left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right]^{\frac{1}{1-\sigma}}\underline{\theta}^*. \tag{A7}$$

A.1.3 Price index in sector j

The offshoring price of a firm with productivity θ as a function of its domestic sourcing price is given by:

$$p^{\text{off}}(\theta) = \left(\frac{w^S}{w^N}\right)^{1-\eta}p(\theta). \tag{A8}$$

We define P^{off} as the price index of the firms doing offshoring, and $P^{\text{off}|n.t.i}$ as the price index of the same firms doing offshoring but computed under the cost structure of domestic sourcing. Formally, they are defined as:

$$P^{\text{off}} \equiv \left[\int_{\theta^{S,*}}^{\infty}[p^{\text{off}}(\theta)]^{1-\sigma}H\frac{g(\theta)}{1-G(\theta^{S,*})}d\theta\right]^{\frac{1}{1-\sigma}}, \tag{A9}$$

$$P^{\text{off}|n.t.i} \equiv \left[\int_{\theta^{S,*}}^{\infty} [p(\theta)]^{1-\sigma} H \frac{g(\theta)}{1-G(\theta^{S,*})} d\theta\right]^{\frac{1}{1-\sigma}}. \tag{A10}$$

The sectoral price index is:

$$P^{1-\sigma} = \int_{\underline{\theta}^*}^{\theta^{S,*}} p(\theta)^{1-\sigma} H \frac{g(\theta)}{1-G(\underline{\theta}^*)} d\theta + \int_{\theta^{S,*}}^{\infty} [p^{\text{off}}(\theta)]^{1-\sigma} H \frac{g(\theta)}{1-G(\underline{\theta}^*)} d\theta$$

$$P^{1-\sigma} = \int_{\underline{\theta}^*}^{\infty} p(\theta)^{1-\sigma} H \frac{g(\theta)}{1-G(\underline{\theta}^*)} d\theta + \chi^* \left[\int_{\theta^{S,*}}^{\infty} [p^{\text{off}}(\theta)]^{1-\sigma} H \frac{g(\theta)}{1-G(\theta^{S,*})} d\theta - \int_{\theta^{S,*}}^{\infty} p(\theta)^{1-\sigma} H \frac{g(\theta)}{1-G(\theta^{S,*})} d\theta\right].$$

with $\chi^* \equiv \frac{1-G(\theta^{S,*})}{1-G(\underline{\theta}^*)}$. Therefore, the price index is:

$$P^{1-\sigma} = \left(P^{\text{n.t.i.}}\right)^{1-\sigma} + \chi^* \left[\left(P^{\text{off}}\right)^{1-\sigma} - \left(P^{\text{off|n.t.i.}}\right)^{1-\sigma}\right].$$

Furthermore, using equation (A8), the sectoral price index for the tradable intermediate input equilibrium, P, is:

$$P^{1-\sigma} = \left(P^{\text{n.t.i.}}\right)^{1-\sigma} + \chi^* \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] \left(P^{\text{off|n.t.i.}}\right)^{1-\sigma}. \tag{A11}$$

The price index is increasing in southern wages, i.e. $\partial P/\partial w^S > 0$. Moreover, given $w^S < w^N$, the price index is increasing in the offshoring cutoff $\theta^{S,*}$. Therefore, reductions in the offshoring productivity cutoff—that is, more firms choosing to offshore—lead to reductions in the price index of the respective sector.

As $\theta^{S,*} \to \infty$, the share of offshoring firms goes to zero, i.e. $\chi^* \to 0$. Therefore, the second term of the right-hand side of equation (A11) vanishes and the first term shows $P^{n.t.i.}(\underline{\theta}^*) \nearrow P^{n.t.i}(\underline{\theta}^{n.t.i})$ and $\underline{\theta}^* \searrow \underline{\theta}^{n.t.i.}$. In other words, $P \nearrow P^{n.t.i.}$, where the last term corresponds to the price index of the $n.t.i.$ model.

A.1.4 Aggregate consumption in sector j

Using the relation $Q = \frac{\gamma E}{P}$, and the price index from equation (A11), the sectoral aggregate consumption is:

$$Q = \gamma E \left[\left(P^{\text{n.t.i.}}\right)^{1-\sigma} + \chi^* \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] \left(P^{\text{off|n.t.i.}}\right)^{1-\sigma}\right]^{\frac{1}{\sigma-1}}. \tag{A12}$$

The sectoral aggregate consumption is decreasing in both, southern wages and the offshoring productivity cutoff. The latter implies that more firms choosing to offshore leads to higher sectoral aggregate consumption.

A.1.5 Firm entry and exit

The mass of active firms in equilibrium is $H^* = \frac{\gamma E}{\bar{r}}$, where $\bar{r}$ denotes the average revenues of the active firms, which is given by $\bar{r} = r^N(\bar{\theta}) + \chi^* \left[\left(\frac{w^N}{w^S}\right)^{(\sigma-1)(1-\eta)} - 1\right] r^N(\bar{\theta}^S)$, with $\bar{\theta}^S$—defined as the average productivity of the firms doing offshoring—given by $\bar{\theta}^S \equiv \left[\frac{1}{1-G(\theta^{S,*})} \int_{\theta^{S,*}}^{\infty} \theta^{\sigma-1} g(\theta) d\theta\right]^{\frac{1}{\sigma-1}}$. The average productivity of active firms $\bar{\theta}$ is defined as $\bar{\theta} \equiv \left(\int_0^{\infty} \theta^{\sigma-1} \mu(\theta) d\theta\right)^{\frac{1}{\sigma-1}} = \left(\frac{1}{1-G(\underline{\theta})} \int_{\underline{\theta}}^{\infty} \theta^{\sigma-1} g(\theta) d\theta\right)^{\frac{1}{\sigma-1}}$, where $\mu(\theta)$ denotes the ex-post distribution of firm productivities in the market.

It is possible to show that when $w^N > w^S$, the number of active firms with tradable intermediate inputs is smaller than in the case when offshoring is not possible. This is due to the reduction of the price index induced by offshoring firms, which leads to stronger competition in the final-good market.

Following a similar approach to Melitz (2003) and Antràs and Helpman (2004), we characterise the Zero Cutoff Profit Condition (ZCPC) and the Free Entry Condition (FEC).

Zero Cutoff Profit Condition (ZCPC). The firm's value function is represented by $v(\theta) = \max\left\{0; v^l(\theta)\right\}$, with $v^l(\theta) = \max\left\{0; \sum_{t=0}^{\infty} \lambda^t \pi^l(\theta)\right\} = \max\left\{0; \frac{\pi^l(\theta)}{1-\lambda}\right\}$. The market productivity cutoff is implicitly defined by the zero cutoff profit condition (ZCPC), $\pi^N(\underline{\theta}^*) = 0$, and it is given by $\underline{\theta}^* = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q \left[\frac{w^N f^N}{\psi^N}\right]^{\frac{1}{\sigma-1}}$.

Dividing $\bar{r}$ from equation (A6) by the firm's revenues of the market productivity cutoff firms, we get $\frac{\bar{r}}{r(\underline{\theta}^*)} = \frac{r^N(\bar{\theta})}{r(\underline{\theta}^*)} + \chi^* \left[\left(\frac{w^N}{w^S}\right)^{(\sigma-1)(1-\eta)} - 1\right] \frac{r^N(\bar{\theta}^S)}{r(\underline{\theta}^*)}$, which leads to an expression of the average revenues as a function of the cutoff firm's revenues. Solving for $\bar{r}$ and replacing the revenue expressions, we get:

$$\bar{r} = \left[\left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} + \chi^* \left[\left(\frac{w^N}{w^S}\right)^{(\sigma-1)(1-\eta)} - 1\right] \left(\frac{\bar{\theta}^S}{\underline{\theta}^*}\right)^{\sigma-1}\right] \sigma w^N f^N. \tag{A13}$$

Taking the average profits from equation (A5), and plugging it into equation (A4):

$$\begin{aligned}\bar{\pi} =& \pi^N(\bar{\theta}) + \chi^* \left[\pi^{S,prem}(\bar{\theta}^S) - (1-\lambda) w^N s^r\right] \\ =& w^N f^N \left[\left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} - 1\right] + \chi^* \frac{r^{N,*}(\bar{\theta}^S)}{\sigma} \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] - \chi^* w^N \left[f^S + (1-\lambda)s^r - f^N\right].\end{aligned}$$

Finally, replacing $r^{N,*}(\bar{\theta}^S)$, the ZCPC leads to the average profits in the final-good market given by:

$$\bar{\pi} = w^N f^N \left[\left[\left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} - 1\right] + \chi^* \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] \left(\frac{\bar{\theta}^S}{\underline{\theta}^*}\right)^{\sigma-1}\right] - \chi^* w^N \left[f^S + (1-\lambda)s^r - f^N\right].$$

Free Entry Condition (FEC). It is given by $v_e = p_{\text{in}} \frac{\bar{\pi}}{1-\lambda} - w^N s_e = 0$, which leads to $\bar{\pi} = \frac{(1-\lambda) w^N s_e}{1-G(\underline{\theta}^*)}$.

By putting the ZCPC and FEC together, we obtain:

$$w^N f^N \left[\left[\left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} - 1\right] + \chi^* W(.) \left(\frac{\bar{\theta}^S}{\underline{\theta}^*}\right)^{\sigma-1}\right] - \chi^* w^N f^N F(.) = \frac{(1-\lambda) w^N s_e}{1-G(\underline{\theta}^*)},$$

with $W(w^N, w^S) \equiv \left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1$ and $F(f^N, f^S, s^r) \equiv \left(\frac{f^S + (1-\lambda)s^r}{f^N}\right) - 1$. Solving for $\bar{\theta}$ leads to:

$$\bar{\theta} = \left[\frac{(1-\lambda)s_e}{\left[1-G(\underline{\theta}^*)\right] f^N} + \chi^* \left[F(.) - W(.) \left(\frac{\bar{\theta}^S}{\underline{\theta}^*}\right)^{\sigma-1}\right] + 1\right]^{\frac{1}{\sigma-1}} \underline{\theta}^*. \tag{A14}$$

Finally, we obtain the number of active firms, i.e. the number of active final-good producers, in the differentiated sector. For this, we consider $H^* = \frac{\gamma E}{\bar{r}}$, which using $\bar{r}$ from equation (A13), we can write:

$$H^* = \frac{\gamma E}{\left[\left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} + \chi^* \left[\left(\frac{w^N}{w^S}\right)^{(\sigma-1)(1-\eta)} - 1\right] \left(\frac{\bar{\theta}^S}{\underline{\theta}^*}\right)^{\sigma-1}\right] \sigma w^N f^N}. \tag{A15}$$

A.1.6 Offshoring productivity cutoff

Figure A1 illustrates the offshoring productivity cutoff, $\theta^{S,*}$, and the market entry productivity cutoff, $\underline{\theta}^*$, at equilibrium. The dark area in between the profit curves represents the per-period offshoring profit premium of each firm with a productivity θ above the offshoring productivity cutoff.

The firm at the offshoring productivity cutoff is indifferent between offshoring and domestic sourcing. That is, $\frac{\pi^S(\theta^{S,*})}{1-\lambda} - w^N s^r = \frac{\pi^N(\theta^{S,*})}{1-\lambda}$. Thus, the offshoring and market productivity cutoffs are given by:

$$\theta^{S,*} = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q^* \left[\frac{w^N \left[f^S - f^N + (1-\lambda)s^r\right]}{\psi^S - \psi^N}\right]^{\frac{1}{\sigma-1}}, \tag{A16}$$

$$\underline{\theta}^* = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q^* \left[\frac{w^N f^N}{\psi^N}\right]^{\frac{1}{\sigma-1}}. \tag{A17}$$

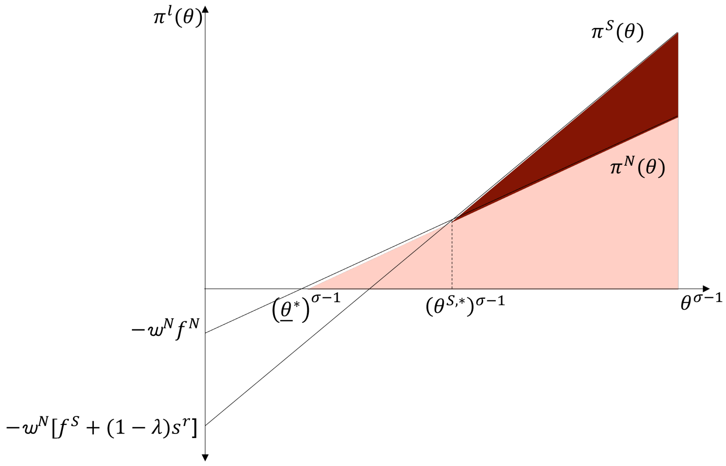


Figure A1: Per-period offshoring profit premium

B Initial conditions

We show in Appendix B.1 the initial conditions under *n.t.i.* scenario. Then, in Appendix B.2, we discuss alternative initial conditions.

B.1 Non-tradable intermediate inputs ($n.t.i.$)

We focus the analysis on the case of non-tradable intermediate inputs in one differentiated sector and therefore drop the subscript j for now. The quantity, price and per-period profits for a firm with productivity θ in the steady state of the non-tradable intermediate inputs (n.t.i.) sector are given by $q_t^{n.t.i.}(\theta) = \left(\frac{\theta\alpha\gamma E(Q^{n.t.i.})^{-\alpha_j}}{w^N}\right)^{\sigma}$, $p_t^{n.t.i.}(\theta) = \frac{w^N}{\alpha\theta}$ and $\pi_t^N(.) = \theta^{\sigma-1}(\gamma E)^{\sigma}(Q^{n.t.i.})^{1-\sigma}\psi^N - w^N f^N$, respectively, with $\psi^N \equiv \sigma^{-1}\left[\frac{\alpha}{w^N}\right]^{\sigma-1}$.

B.1.1 Sectoral price index

The price index can be represented as:

$$P^{n.t.i.} = \left[\int_{i\in I} p(i)^{1-\sigma} di\right]^{\frac{1}{1-\sigma}} \quad \Leftrightarrow \quad P^{n.t.i.} = \left[\int_{\underline{\theta}^{n.t.i.}}^{\infty} p(\theta)^{1-\sigma} H^{n.t.i.} \frac{g(\theta)}{1-G(\underline{\theta}^{n.t.i.})} d\theta\right]^{\frac{1}{1-\sigma}}, \qquad \text{(A18)}$$

where $H^{n.t.i.}$ refers to the total number of final-good producers active in the market in this sector.

Defining $\bar{\theta}^{n.t.i.}$ as the average productivity in the sector and using the price expression from above, we have that the price index of the differentiated sector in terms of the average productivity in that sector is given by:

$$P^{n.t.i.} = (H^{n.t.i.})^{\frac{1}{1-\sigma}} \frac{w^N}{\alpha\bar{\theta}^{n.t.i.}} \quad \Rightarrow \quad P^{n.t.i.} = (H^{n.t.i.})^{\frac{1}{1-\sigma}} p(\bar{\theta}^{n.t.i.}), \qquad \text{(A19)}$$

with $\bar{\theta}^{n.t.i.} \equiv \left(\frac{1}{1-G(\underline{\theta}^{n.t.i.})}\int_{\underline{\theta}^{n.t.i.}}^{\infty} \theta^{\sigma-1} g(\theta) d\theta\right)^{\frac{1}{\sigma-1}}$.

B.1.2 Sectoral aggregate consumption

The aggregate consumption index is given by $Q^{n.t.i.} = \frac{\gamma E}{P^{n.t.i.}}$.

B.1.3 Firm entry and exit, ZCPC, FEC and number of firms

The market productivity cutoff is $\underline{\theta}^{n.t.i.} = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q^{n.t.i.}\left[\frac{w^N f^N}{\psi^N}\right]^{\frac{1}{\sigma-1}}$. The average revenues are $\bar{r}^{n.t.i.} \equiv r^N(\bar{\theta}^{n.t.i.}) = \left(\frac{\bar{\theta}^{n.t.i.}}{\underline{\theta}^{n.t.i.}}\right)^{\sigma-1}\sigma w^N f^N$, and the profits of the average firm are $\bar{\pi}^{n.t.i.} \equiv \pi^N(\bar{\theta}^{n.t.i.}) = \frac{r^N(\bar{\theta}^{n.t.i.})}{\sigma} - w^N f^N$. Thus, from the ZCPC and the FEC, we get the number (mass) of active firms $H^{n.t.i.} = \frac{\gamma E}{\bar{r}^{n.t.i.}}$.

Following a similar approach to Melitz (2003) and Antràs and Helpman (2004), we characterise the Zero Cutoff Profit Condition (ZCPC), the Free Entry Condition (FEC) and derive the mass of active firms at *n.t.i.* equilibrium in terms of the model's parameters and moments of the productivity distribution.

Zero Cutoff Profit Condition (ZCPC). The firm's value function is $v^{n.t.i.}(\theta) = \max\left\{0; v^{N,n.t.i.}(\theta)\right\}$, with $v^{N,n.t.i.}(\theta) = \max\left\{0; \sum_{t=0}^{\infty} \lambda^t \pi^{N,n.t.i.}(\theta)\right\} = \max\left\{0; \frac{\pi^{N,n.t.i.}(\theta)}{1-\lambda}\right\}$. Using the ZCPC, the market productivity cutoff is implicitly defined by $\pi^{N,n.t.i.}(\underline{\theta}^{n.t.i.}) = 0$. Thus, solving this expression for $\underline{\theta}^{n.t.i.}$, we get:

$$\underline{\theta}^{n.t.i.} = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q^{n.t.i.} \left[\frac{w^N f^N}{\psi^N}\right]^{\frac{1}{\sigma-1}}. \tag{A20}$$

and thus, we can express the revenues for the cutoff productivity firm $r^{N,n.t.i.}(\underline{\theta}^{n.t.i.})$ as $\pi_t^N(\underline{\theta}^{n.t.i.}) = 0 \Rightarrow r^N(\underline{\theta}^{n.t.i.}) = \sigma w^N f^N$. Furthermore, the revenues of the average firm as a function of the cutoff firm revenues are given by:

$$\frac{r^N(\bar{\theta}^{n.t.i.})}{r^N(\underline{\theta}^{n.t.i.})} = \left(\frac{\bar{\theta}^{n.t.i.}}{\underline{\theta}^{n.t.i.}}\right)^{\sigma-1} \quad \Rightarrow \quad r^N(\bar{\theta}^{n.t.i.}) = \left(\frac{\bar{\theta}^{n.t.i.}}{\underline{\theta}^{n.t.i.}}\right)^{\sigma-1} r^N(\underline{\theta}^{n.t.i.}). \tag{A21}$$

The average revenues are:

$$\bar{r}^{n.t.i.} \equiv r^N(\bar{\theta}^{n.t.i.}) = \left(\frac{\bar{\theta}^{n.t.i.}}{\underline{\theta}^{n.t.i.}}\right)^{\sigma-1} \sigma w^N f^N. \tag{A22}$$

Finally, it is possible to obtain the profits of the average firm as:

$$\bar{\pi}^{n.t.i.} \equiv \pi^N(\bar{\theta}^{n.t.i.}) = \frac{r^N(\bar{\theta}^{n.t.i.})}{\sigma} - w^N f^N.$$

Replacing $r^N(\bar{\theta}^{n.t.i.})$ with the expression from equation (A22), we obtain the ZCPC:

$$\bar{\pi}^{n.t.i.} \equiv \pi^N(\bar{\theta}^{n.t.i.}) = w^N f^N \left[\left(\frac{\bar{\theta}^{n.t.i.}}{\underline{\theta}^{n.t.i.}}\right)^{\sigma-1} - 1\right]. \tag{A23}$$

Free Entry Condition (FEC). All active final-good producers, except for the cutoff firm $\underline{\theta}^{n.t.i.}$, earn positive profits. Therefore, $\bar{\pi}^{n.t.i.} > 0$. Given these expected positive profits, firms decide to sink the entry cost s_e and enter into the market. The present value of a firm, conditional on successful entry, is $\bar{v} = \int_{\underline{\theta}^{n.t.i.}}^{\infty} v(\theta)\mu(\theta)d\theta = \frac{\bar{\pi}^{n.t.i.}}{1-\lambda}$, whereas the net value of entry is given by $v_e = p_{in}\bar{v} - w^N s_e = \frac{1-G(\underline{\theta}^{n.t.i.})}{1-\lambda}\bar{\pi}^{n.t.i.} - w^N s_e$. The FEC condition implies $v_e = 0$. Therefore, $\bar{\pi}^{n.t.i.} = \frac{(1-\lambda)s_e w^N}{1-G(\underline{\theta}^{n.t.i.})}$.

From ZCPC and FEC, we get $\bar{\theta}^{n.t.i.} = \left[\frac{(1-\lambda)s_e}{[1-G(\underline{\theta}^{n.t.i.})]f^N} + 1\right]^{\frac{1}{\sigma-1}} \underline{\theta}^{n.t.i.}$, and the number of active firms is given by $H^{n.t.i.} = \frac{\gamma E}{\bar{r}^{n.t.i.}}$. Using $\bar{r}^{n.t.i.} = \sigma\left[\bar{\pi}^{n.t.i.} + w^N f^N\right]$, it leads to $H^{n.t.i.} = \frac{\gamma E}{\sigma[\bar{\pi}^{n.t.i.} + w^N f^N]}$, and finally, replacing $\bar{\pi}^{n.t.i.}$ with ZCPC, the number of active firms is:

$$H^{n.t.i.} = \frac{\gamma E}{\sigma w^N f^N}\left(\frac{\underline{\theta}^{n.t.i.}}{\bar{\theta}^{n.t.i.}}\right)^{\sigma-1}. \tag{A24}$$

B.2 Alternative specifications of initial conditions

B.2.1 Two-country model

Pre-reform in the South, we assume that the offshoring productivity cutoff is $\theta_{t<0}^S < \bar{\bar{\theta}}$. That is, firms with productivity $\theta \geq \theta_{t<0}^S$ offshore from the South under pre-reform conditions. Thus, the initial condition is characterised by $P^{(\theta_{t<0}^S)} > P^*$, $Q^{(\theta_{t<0}^S)} < Q^*$ and $\underline{\theta}^{(\theta_{t<0}^S)} < \underline{\theta}^*$, where $P^{(\theta_{t<0}^S)}$ and $Q^{(\theta_{t<0}^S)}$ refer to the price and aggregate consumption indices of the steady state where the offshoring productivity cutoff is given by $\theta_{t<0}^S$.[96]

At $t = 0$, the institutional reform in the South takes place and new priors emerge, as shown in section 2.2.3. The main difference is that if the institutional reform implies an improvement in the fundamentals—that is,

[96]Comparing these conditions with the *n.t.i.* scenario, we have that $P^{(\theta_{t<0}^S)} < P^{n.t.i.}$, $Q^{(\theta_{t<0}^S)} > Q^{n.t.i.}$ and $\underline{\theta}^{(\theta_{t<0}^S)} > \underline{\theta}^{n.t.i.}$.

$f^S_{t<0} > f^S$, where $f^S_{t<0}$ refers to the pre-reform fundamentals—the least productive offshoring firms previous to the reform remain under offshoring. Therefore, the upper bound of the initial prior distribution cannot be larger than the maximum affordable fixed cost for firms with productivity $\theta^S_{t<0}$. Formally,

$$f^S \sim Y(f^S) \quad \text{with} \quad f^S \in [\underline{f}^S, \bar{f}^S] \quad \text{and} \quad \bar{f}^S \leq f^S(\theta^S_{t<0}) \tag{A25}$$

Considerations on sequential institutional reforms. In the previous case, we assumed that the initial conditions represent a steady-state situation. However, $\theta^S_{t<0}$ can represent the offshoring productivity cutoff of a sequential offshoring path from a previous reform, which was in a converging trajectory to $f^S_{t<0}$. The new institutional reform announced in $t = 0$ represents a new exogenous information shock that leads in $t = 0$ to a change in the beliefs about institutions in the South. Thus, the previous offshoring sequence is redefined according to the new priors—given by equation (A25)—and the sector converges to the new institutional fundamentals f^S according to the conditions defined in Proposition 2.

B.2.2 Multi-country model

We analyse alternative initial conditions and the resulting equilibrium paths and equilibria. However, we do not aim to provide a complete taxonomy of cases.

Initial conditions: Offshoring in South. The initial conditions are defined by offshoring productivity cutoffs $\theta^S_{t<0} < \bar{\bar{\theta}}$ and $\theta^E_{t<0} \to \infty$. That is, previous to the simultaneous reform in the East and South, firms with productivity $\theta \geq \theta^S_{t<0}$ offshore from the South, and no firm offshores from the East.

In $t = 0$ simultaneous reforms are implemented in both countries, and uncertainty emerges about the fixed cost of offshoring in both locations. As in section 4.1, we assume that the lower bound of the priors is the same for both countries. Therefore, the difference in terms of the upper bound defines whether we are in the symmetric or asymmetric situation. As discussed in section B.2.1, $\bar{f}^S \leq f^S(\theta^S_{t<0})$ denotes the upper bound of the new prior distribution related to the South.[97] Therefore, when $\bar{f}^E > \bar{f}^S$ the sector follows an equilibrium path of asymmetric beliefs with coordination to the efficient equilibrium, when $\bar{f}^E < \bar{f}^S$ the sector is placed in the asymmetric beliefs situation with coordination to the inefficient equilibrium, whereas when $\bar{f}^E = \bar{f}^S$ the equilibrium path of the sector is characterised by the symmetric beliefs situation.

Initial conditions: Offshoring in East. The initial conditions show offshoring productivity cutoffs $\theta^S_{t<0} \to \infty$ and $\theta^E_{t<0} < \bar{\bar{\theta}}$. That is, previous to the simultaneous reform in the East and South, firms with productivity $\theta \geq \theta^E_{t<0}$ offshore from the East, and no firm offshores from the South. In $t = 0$ simultaneous reforms are implemented in both countries, and uncertainty emerges about the fixed cost of offshoring in both locations. Similarly, as before, we assume that the lower bound of the priors is the same for both countries. Thus, the difference in terms of the upper bound defines whether we are in the symmetric or asymmetric situation. $\bar{f}^E \leq f^E(\theta^E_{t<0})$ denotes the upper

[97] The underlying assumption is that the institutional reform in the South improves the institutional fundamentals in that country. If the new fundamentals were worse, the offshoring productivity cutoff would increase, as some firms do not find it profitable to continue offshore from the South. In that case, the true value f^S is immediately revealed to all firms in the market.

bound of the new prior distribution related to the East.[98] Therefore, the cases $\bar{f}^S > \bar{f}^E$, $\bar{f}^S < \bar{f}^E$ or $\bar{f}^S = \bar{f}^E$ define—as above—the equilibrium paths and equilibria followed by the sector in the long run.

We can extend the model to allow for other scenarios such as: i) unilateral reforms in one country (i.e., East or South) with initial conditions defined by offshoring in the other country; ii) sequential reforms in foreign countries. The results of the model and the predictions in terms of sequential exploration and relocation, the role of information spillovers driving the location choices, and the multiple equilibria with consequences in terms of sectoral specialisation and welfare remain robust.

C Dynamic model with uncertainty

When a firm decides whether to explore its offshoring potential or remain active under domestic sourcing, it must compute the present value of the total offshoring profit premium that it expects to obtain and compare it to the offshoring sunk cost. At time t, the present value of the expected offshoring profit premium for a firm with productivity θ, which is currently sourcing domestically, is given by $\mathbb{E}_t\left[\Pi^{S,\text{prem}}(\theta)|f^S \leq f_t^S\right] = \mathbb{E}_t\left[\sum_{\tau=t}^{\infty}\lambda^{\tau-t}\pi_\tau^{S,\text{prem}}\left(\theta, f_\tau^S, Q(f_\tau^S), f^N, w^N, w^S\right)\Big| f^S \leq f_t^S\right]$. From this expression, it is clear that the expected profit premium flow depends on the expected offshoring fixed costs at the moment of the decision and the expected flow of new incoming information from the behaviour of other firms. The per-period profits depend on the expected fixed costs at time t and on the expected information flow. Therefore, they are affected by the changes in the sectoral price index and the sectoral aggregate consumption induced by the increasing share of offshoring firms over time. To simplify notation, we define $\pi_t^{S,\text{prem}}(\theta, f_t^S, Q(f_t^S), f^N, w^N, w^S) \equiv \pi_t^{S,\text{prem}}(\theta)$, whereas $\pi^{S,prem}(\theta)$ refers to the per-period offshoring profit premium when there is no remaining uncertainty in the industry; that is, when the true fixed cost has been revealed.

C.1 Proofs: Bayesian learning mechanism

After $t = 0$, firms sourcing domestically update their prior knowledge by observing the 'physical state'. By applying Bayes rule recursively, firms update their beliefs every period. The posterior distribution at time t is:

$$Y(f^S|f^S \leq f_t^S) = \frac{Y(f^S|f^S \leq f_{t-1}^S)Y(f_t^S|f^S)}{Y(f_t^S|f^S \leq f_{t-1}^S)},$$

where $Y(f^S|f^S \leq f_{t-1}^S)$ indicates the prior distribution at time t, $Y(f_t^S|f^S)$ refers to the likelihood function, and the denominator is the scaling factor. The likelihood takes the following form:

$$Y(f_t^S|f^S) = \begin{cases} 1 & \text{if } f_t \geq f^S, \\ 0 & \text{if } f_t < f^S. \end{cases}$$

Therefore, the posterior distribution is represented by $Y(f^S|f^S \leq f_t^S) = \frac{Y(f^S|f^S \leq f_{t-1}^S)}{Y(f_t^S|f^S \leq f_{t-1}^S)}$, which is similar to the learning mechanisms in Rob (1991) and Segura-Cayuela and Vilarrubia (2008).

On the other hand, if a firm that explored offshoring in period $t-1$ is sourcing domestically during period t, this reveals that this firm has made a 'mistake'. After paying the offshoring sunk cost, this firm learned that

[98] The underlying assumption is that the institutional reform in the East improves the institutional fundamentals. As before, if the new fundamentals were worse, the offshoring productivity cutoff would increase, as firms do not find it profitable to continue offshore from the East. Hence, the true value f^E is immediately revealed to all firms in the market.

the true fixed cost in the South is too high for it; that is, the firm would obtain a negative per-period offshoring profit premium if it offshores in the South. Therefore, given the assumption of a continuum of firms, this situation implies that the true fixed cost in the South has been revealed to all the firms in the market, and it corresponds to the maximum affordable fixed cost in the South of the least productive firms doing offshoring in t.

To summarise, the knowledge that firms have before taking the offshoring decision in period t is given by:

$$f^S \sim \begin{cases} Y(f^S) & \text{with } f^S \in [\underline{f}^S, \bar{f}^S] \text{ for } t = 0, \\ Y(f^S | f^S \leq f_t^S) & \text{if } \tilde{f}_t^S = f_t^S < f_{t-1}^S \text{ for } t > 0, \\ f_t^S & \text{if } \tilde{f}_t^S < f_t^S \text{ for } t > 0. \end{cases} \tag{A26}$$

C.2 Proof of the OSLA rule as optimal policy

The Bellman equation takes the form $\mathcal{V}_t(\theta; \theta_t) = \max\{V_t^o(\theta; \theta_t); \lambda \mathbb{E}_t[\mathcal{V}_{t+1}(\theta; \theta_{t+1})]\}$, which leads to:

$$\mathcal{V}_t(\theta; \theta_t) = \max\left\{\mathbb{E}_t\left[\max\left\{0; \sum_{\tau=t}^{\infty} \lambda^{\tau-t} \pi_\tau^{S,prem}(\theta)\right\} \middle| f^S \leq f_t^S\right] - w^N s^r; \lambda \mathbb{E}_t[\mathcal{V}_{t+1}(\theta; \theta_{t+1})]\right\}.$$

Now we find the optimal policy, which defines how many periods it is optimal to wait given the information at t.

Solution by policy function iteration. By policy function iteration, it is possible to prove that the One-Step-Look-Ahead (OSLA) rule is the optimal policy. In other words, in expectation at t, waiting for one period dominates waiting for more periods.

At any given point in time, all firms sourcing domestically have an expected flow of new information for every future period. According to this, firms know that they can gain from waiting by receiving new information and take the offshoring decision at a later period under a reduced uncertainty, or eventually with certainty if the true fixed cost has been revealed during the waiting period(s). However, firms also face an opportunity cost of waiting, which is given by the offshoring profit premium that firms can obtain by exploring the South in the current period and discovering their respective offshoring potential.

We define as $V_t^{w,1}(.), ..., V_t^{w,n}(.)$ the value of waiting in t for $1, ..., n$ periods, respectively.

$$\begin{aligned} V_t^{w,1}(\theta; \theta_t, \theta_{t+1}) =& 0 + \frac{[Y(f_t^S) - Y(f_{t+1}^S)]}{Y(f_t^S)} \lambda \mathbb{E}_t\left[\max\left\{0; \frac{\pi^{S,prem}(\theta)}{1-\lambda} - w^N s^r\right\} \middle| f_{t+1}^S < f^S \leq f_t^S\right] \\ &+ \frac{Y(f_{t+1}^S)}{Y(f_t^S)} \lambda \left[\mathbb{E}_t\left[\max\left\{0; \sum_{\tau=t+1}^{\infty} \lambda^{\tau-t-1} \pi_\tau^{S,prem}(\theta)\right\} \middle| f^S \leq f_{t+1}^S\right] - w^N s^r\right], \\ V_t^{w,2}(\theta; \theta_t, \theta_{t+2}) =& 0 + \frac{[Y(f_t^S) - Y(f_{t+2}^S)]}{Y(f_t^S)} \lambda^2 \mathbb{E}_t\left[\max\left\{0; \frac{\pi^{S,prem}(\theta)}{1-\lambda} - w^N s^r\right\} \middle| f_{t+2}^S < f^S \leq f_t^S\right] \\ &+ \frac{Y(f_{t+2}^S)}{Y(f_t^S)} \lambda^2 \left[\mathbb{E}_t\left[\max\left\{0; \sum_{\tau=t+2}^{\infty} \lambda^{\tau-t-2} \pi_\tau^{S,prem}(\theta)\right\} \middle| f^S \leq f_{t+2}^S\right] - w^N s^r\right], \\ &\vdots \\ V_t^{w,n}(\theta; \theta_t, \theta_{t+n}) =& 0 + \frac{[Y(f_t^S) - Y(f_{t+n}^S)]}{Y(f_t^S)} \lambda^n \mathbb{E}_t\left[\max\left\{0; \frac{\pi^{S,prem}(\theta)}{1-\lambda} - w^N s^r\right\} \middle| f_{t+n}^S < f^S \leq f_t^S\right] \\ &+ \frac{Y(f_{t+n}^S)}{Y(f_t^S)} \lambda^n \left[\mathbb{E}_t\left[\max\left\{0; \sum_{\tau=t+n}^{\infty} \lambda^{\tau-t-n} \pi_\tau^{S,prem}(\theta)\right\} \middle| f^S \leq f_{t+n}^S\right] - w^N s^r\right]. \end{aligned}$$

It is straightforward to see that $\lim_{n\to\infty} V_t^{w,n}(\theta; \theta_t, \theta_{t+n}) = 0$.

The relevant analysis consists in the case when a firm θ faces a trade-off in its decision. That is, when the value of offshoring for the firm θ in period t is non-negative [$V_t^o(\theta;.) \geq 0$], and the firm can reduce the risk of exploring offshoring in t by waiting n periods for new incoming information.[99] In this situation, considering the decision characterised in section 2.2.3, a firm θ must decide what is the optimal number of periods for waiting and compare it to the value of offshoring in t to decide whether it will explore its offshoring potential or wait. Therefore, if we narrow the analysis to the firms with a non-negative value of offshoring [$V_t^o(\theta;.) \geq 0$], it is easy to see that for each of these firms the value of waiting for any period $n = 1, ..., \infty$ is non-negative [$V_t^{w,n}(\theta;.) \geq 0 \; \forall n$].

So we go one step further in analysing this trade-off situation and define the number of periods that, in expectation at t, a firm θ finds optimal to wait. Following a similar argument as Segura-Cayuela and Vilarrubia (2008), we begin with the case of the marginal firm that compares the value of exploring offshoring now with the value of waiting for one period and explore in the next one [i.e., $\mathcal{D}_t(\theta;.) = V_t^0(\theta;.) - V_t^{w,1}(\theta;.) = 0$].

The argument of the proof is as follows (formal proof is provided below). The value of waiting for n periods before exploring the offshoring potential falls at a rate of λ^n for firms that weakly prefer exploring the offshoring potential now than waiting for one period. Since $\lambda < 1$, waiting for any number of periods $n > 1$ is dominated by waiting for only one period. In other words, given Assumption A.3, if waiting for the information revealed in one period does not convince a firm to wait, waiting for two or more periods is even less preferred, as less new information is revealed in further periods. Therefore, to characterise the optimal equilibrium path it is only necessary to consider those firms who are deciding between exploring the offshoring in the current period or waiting for one period.

We start by comparing the value of waiting for one period with the value of waiting for two periods [i.e., $V_t^{w,1}(\theta;.); V_t^{w,2}(\theta;.)$]. As mentioned above, we focus the analysis on the marginal firm; that is, the firm that is indifferent between offshoring today or waiting for one period. Formally,[100]

$$\begin{aligned}\mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+1}) =& V_t^o(\theta;\theta_t) - V_t^{w,1}(\theta;\theta_t,\tilde{\theta}_{t+1}) = 0\\ =& \max\left\{0;\mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\middle|f^S \leq f_t^S\right]\right\} - w^N s^r\left[1-\lambda\frac{Y(f_{t+1}^S)}{Y(f_t^S)}\right]\\ &+\frac{[Y(f_t^S)-Y(f_{t+1}^S)]}{Y(f_t^S)}\lambda\mathbb{E}_t\Big[\max\left\{0;\frac{\pi^{S,prem}(\theta)}{1-\lambda}\right\}\\ &-\max\left\{0;\frac{\pi^{S,prem}(\theta)}{1-\lambda}-w^N s^r\right\}\Big|f_{t+1}^S < f^S \leq f_t^S\Big] = 0.\end{aligned}$$

Equivalently, the expression of the trade-off function for waiting for two periods is given by:

$$\begin{aligned}\mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+2}) =& V_t^o(\theta;\theta_t) - V_t^{w,2}(\theta;\theta_t,\tilde{\theta}_{t+2})\\ =& \max\left\{0;\mathbb{E}_t\left[\pi_t^{S,prem}(\theta)+\lambda\pi_{t+1}^{S,prem}(\theta)\middle|f^S \leq f_t^S\right]\right\} - w^N s^r\left[1-\lambda^2\frac{Y(f_{t+2}^S)}{Y(f_t^S)}\right]\\ &+\frac{[Y(f_t^S)-Y(f_{t+2}^S)]}{Y(f_t^S)}\lambda^2\mathbb{E}_t\Big[\max\left\{0;\frac{\pi^{S,prem}(\theta)}{1-\lambda}\right\}\\ &-\max\left\{0;\frac{\pi^{S,prem}(\theta)}{1-\lambda}-w^N s^r\right\}\Big|f_{t+2}^S < f^S \leq f_t^S\Big].\end{aligned}$$

[99] Otherwise, the firms who have a negative value of offshoring in t, i.e. $V_t^o(\theta;.) < 0$, are not facing any trade-off in their decisions. In other words, they do not confront any dilemma, given that exploring their offshoring potential in t is not attractive, they do not face any opportunity cost from waiting.

[100] We derive the trade-off function in the main part of the paper, and the respective proofs are in Appendix C.3.

We consider the case in which the third term of the right-hand side is zero for both trade-off functions.[101] Therefore, the trade-off functions become:

$$\mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+1}) = \mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\Big|f^S \le f_t^S\right] - w^N s^r\left[1-\lambda\frac{Y(f_{t+1}^S)}{Y(f_t^S)}\right],$$

$$\mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+2}) = \mathbb{E}_t\left[\pi_t^{S,prem}(\theta)+\lambda\pi_{t+1}^{S,prem}(\theta)\Big|f^S \le f_t^S\right] - w^N s^r\left[1-\lambda^2\frac{Y(f_{t+2}^S)}{Y(f_t^S)}\right].$$

If the value of waiting for one period dominates the value of waiting for two periods, we have:

$$V_t^0(\theta;.) - V_t^{w,1}(\theta;.) - \left[V_t^0(\theta;.) - V_t^{w,2}(\theta;.)\right] \overset{!}{<} 0 \quad\Leftrightarrow\quad V_t^{w,2}(\theta;.) - V_t^{w,1}(\theta;.) \overset{!}{<} 0.$$

By replacing the respective trade-off functions in this last expression, we have:

$$\mathbb{E}_t\left[\pi_{t+1}^{S,prem}(\theta)\Big|f^S \le f_t^S\right] \overset{!}{>} w^N s^r\left[\frac{Y(f_{t+1}^S)}{Y(f_t^S)} - \lambda\frac{Y(f_{t+2}^S)}{Y(f_t^S)}\right].$$

From the marginal firm condition above, we know that $\mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\Big|f^S \le f_t^S\right] = w^N s^r\left[1-\lambda\frac{Y(f_{t+1}^S)}{Y(f_t^S)}\right]$ and by Assumption A.3, we have that $1-\lambda Y\left(f_{t+1}^S|f^S\le f_t^S\right) > Y\left(f_{t+1}^S|f^S\le f_t^S\right) - \lambda Y\left(f_{t+2}^S|f^S\le f_t^S\right)$. Thus,

$$\mathbb{E}_t\left[\pi_{t+1}^{S,prem}(\theta)\Big|f^S \le f_t^S\right] > w^N s^r\left[\frac{Y(f_{t+1}^S)}{Y(f_t^S)} - \lambda\frac{Y(f_{t+2}^S)}{Y(f_t^S)}\right] \quad\Leftrightarrow\quad V_t^{w,2}(\theta;.) - V_t^{w,1}(\theta;.) < 0.$$

From the result above, it is easy to see that $V_t^{w,n}(\theta;.) > V_t^{w,n+1}(\theta;.)$ for any $n>0$. Therefore, $V_t^{w,1}(\theta;.) > V_t^{w,2}(\theta;.) > .... > V_t^{w,n}(\theta;.)$. In other words, for firms facing a trade-off, in expectation in period t, waiting for one period dominates waiting for longer periods.

Given that our interest concentrates on modelling the 'offshoring vs. waiting' trade-off and characterising the decision rule that drives the movements of the offshoring productivity cutoff at every period t, it is sufficient to focus on the case for which $V_t^o(\theta;.) \ge 0$; that is, when firms face a non-negative value of offshoring.[102] Thus, given that the OSLA rule is the optimal rule under this condition, the optimal value function becomes:

$$\mathcal{V}_t(\theta;\theta_t) = \max\left\{\mathbb{E}_t\left[\max\left\{0;\sum_{\tau=t}^{\infty}\lambda^{\tau-t}\pi_\tau^{S,prem}(\theta)\right\}\Bigg|f^S\le f_t^S\right] - w^N s^r; V_t^{w,1}(\theta;\theta_t,\theta_{t+1})\right\},$$

and by the transformation explained in section 2.2.3, we obtain the trade-off function.

C.3 Derivation of the trade-off function

We start from the trade-off function in equation (7). Decomposing the value of offshoring leads to:

$$\begin{aligned} V_t^o(\theta;.) = &\max\left\{0;\mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\Big|f^S\le f_t^S\right]\right\} - w^N s^r \\ &+ \frac{[Y(f_t^S)-Y(f_{t+1}^S)]}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\max\left\{0;\frac{\pi^{S,prem}(\theta)}{1-\lambda}\right\}\Bigg|f_{t+1}^S < f^S \le f_t^S\right] \\ &+ \frac{Y(f_{t+1}^S)}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\max\left\{0;\sum_{\tau=t+1}^{\infty}\lambda^{\tau-t-1}\pi_\tau^{S,prem}(\theta)\right\}\Bigg|f^S\le f_{t+1}^S\right]. \end{aligned}$$

[101] This assumption allows us to focus on the most restrictive condition. It is possible to show that if the value of waiting for one period is optimal in this case, it is also optimal in the other cases.

[102] We show here that there is no degeneration in firms' choices when $V_t^o(\theta;.)<0$. In other words, we show that there is no reversion of the trade-off function sign under this situation, so firms will never find it optimal to explore offshoring in t when $V_t^o(\theta;.)<0$. If $V_t^{w,n}(\theta;.)\ge 0$, then the trade-off function $\mathcal{D}(\theta;.)$ is negative for any waiting period n with a positive value of waiting. On the other hand, it is possible to think that if $V_t^{w,n}(\theta;.)<0$ this may result in a positive value for the trade-off function $\mathcal{D}(\theta;.)$. It is easy to see that in these cases $|V_t^o(\theta;.)| > |V_t^{w,n}(\theta;.)|$. Therefore, the trade-off function is still negative in all those cases. In consequence, when the value of offshoring in t is negative, the trade-off function leads to a waiting decision. However, the number of periods that these firms find optimal to wait depends on the productivity level of each of them. Sufficiently low productive firms, for which $V_t^{w,n}(\theta;.)<0\ \forall n$, find it optimal to wait infinite periods. On the other hand, firms relatively more productive than the previous ones find it optimal to wait a finite number of periods, which is decreasing in the productivity of the firms.

Note that $\frac{[Y(f_t^S)-Y(f_{t+1}^S)]}{Y(f_t^S)} = 1 - \frac{Y(f_{t+1}^S)}{Y(f_t^S)}$ denotes the probability that the true fixed cost is revealed in period t, whereas $\frac{Y(f_{t+1}^S)}{Y(f_t^S)}$ is the probability that the true value is not revealed but the uncertainty will reduce given the new information flow. Going one step further, by introducing the maximum affordable fixed cost of production in the South for a firm, i.e. $f^S(\theta)$, we can write:

$$\begin{aligned} V_t^o(\theta;.) =& \max\left\{0; \mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\Big|f^S \le f_t^S\right]\right\} - w^N s^r + \frac{[Y(f_t^S) - Y(f^S(\theta))]}{Y(f_t^S)}\lambda 0 \\ &+ \frac{[Y(f^S(\theta)) - Y(f_{t+1}^S)]}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\frac{\pi^{S,prem}(\theta)}{1-\lambda}\Big|f_{t+1}^S < f^S \le f^S(\theta)\right] \\ &+ \frac{Y(f_{t+1}^S)}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\max\left\{0; \sum_{\tau=t+1}^{\infty}\lambda^{\tau-t-1}\pi_{j,\tau}^{S,prem}(\theta)\right\}\Big|f^S \le f_{t+1}^S\right]. \end{aligned}$$

The probability of true value revealed and above the maximum affordable fixed cost for the firm θ is $\frac{[Y(f_t^S)-Y(f^S(\theta))]}{Y(f_t^S)}$, and the probability of the fixed cost revealed below it is $\frac{[Y(f^S(\theta))-Y(f_{t+1}^S)]}{Y(f_t^S)}$. Hence we can write:

$$\begin{aligned} V_t^o(\theta;.) =& \max\left\{0; \mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\Big|f^S \le f_t^S\right]\right\} - w^N s^r \\ &+ \frac{[Y(f^S(\theta)) - Y(f_{t+1}^S)]}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\frac{\pi^{S,prem}(\theta)}{1-\lambda}\Big|f_{t+1}^S < f^S \le f^S(\theta)\right] \\ &+ \frac{Y(f_{t+1}^S)}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\sum_{\tau=t+1}^{\infty}\lambda^{\tau-t-1}\pi_{\tau}^{S,prem}(\theta)\Big|f^S \le f_{t+1}^S\right]. \end{aligned}$$

On the other hand, with an equivalent decomposition for the value of waiting one period, we have:

$$\begin{aligned} V_t^{w,1}(\theta;.) =& 0 + \frac{[Y(f_t^S) - Y(f_{t+1}^S)]}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\max\left\{0; \frac{\pi^{S,prem}(\theta)}{1-\lambda} - w^N s^r\right\}\Big|f_{t+1}^S < f^S \le f_t^S\right] \\ &+ \frac{Y(f_{t+1}^S)}{Y(f_t^S)}\lambda\left[\mathbb{E}_t\left[\max\left\{0; \sum_{\tau=t+1}^{\infty}\lambda^{\tau-t-1}\pi_{\tau}^{S,prem}(\theta)\right\}\Big|f^S \le f_{t+1}^S\right] - w^N s^r\right], \\ V_t^{w,1}(\theta;.) =& \frac{[Y(f^S(\theta)) - Y(f_{t+1}^S)]}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\max\left\{0; \frac{\pi^{S,prem}(\theta)}{1-\lambda} - w^N s^r\right\}\Big|f_{t+1}^S < f^S \le f^S(\theta)\right] \\ &+ \frac{Y(f_{t+1}^S)}{Y(f_t^S)}\lambda\left[\mathbb{E}_t\left[\sum_{\tau=t+1}^{\infty}\lambda^{\tau-t-1}\pi_{\tau}^{S,prem}(\theta)\Big|f^S \le f_{t+1}^S\right] - w^N s^r\right]. \end{aligned}$$

Replacing the value of offshoring and the value of waiting for one period in the trade-off function gives:

$$\begin{aligned} \mathcal{D}_t(\theta;.) =& \max\left\{0; \mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\Big|f^S \le f_t^S\right]\right\} - w^N s^r\left[1 - \lambda\frac{Y(f_{t+1}^S)}{Y(f_t^S)}\right] \\ &+ \frac{[Y(f_t^S) - Y(f_{t+1}^S)]}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\max\left\{0; \frac{\pi^{S,prem}(\theta)}{1-\lambda}\right\} - \max\left\{0; \frac{\pi^{S,prem}(\theta)}{1-\lambda} - w^N s^r\right\}\Big|f_{t+1}^S < f^S \le f_t^S\right], \end{aligned} \tag{A27}$$

$$\begin{aligned} \mathcal{D}_t(\theta;.) =& \max\left\{0; \mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\Big|f^S \le f_t^S\right]\right\} - w^N s^r\left[1 - \lambda\frac{Y(f_{t+1}^S)}{Y(f_t^S)}\right] \\ &+ \frac{[Y(f(\theta)) - Y(f_{t+1}^S)]}{Y(f_t^S)}\lambda\mathbb{E}_t\left[\frac{\pi^{S,prem}(\theta)}{1-\lambda} - \max\left\{0; \frac{\pi^{S,prem}(\theta)}{1-\lambda} - w^N s^r\right\}\Big|f_{t+1}^S < f^S \le f^S(\theta)\right]. \end{aligned} \tag{A28}$$

Proposition 1 implies that the probability of the true value being revealed below the maximum affordable fixed cost for firm θ is zero. If it is not zero, this means that a firm with a lower productivity (i.e., $\tilde{\theta}_{t+1} < \theta$) has tried offshoring before firm θ, which is not possible due to Proposition 1. Thus, given the sequential dynamic of the offshoring equilibrium path—led by the most productive firms—a firm θ will discover its positive offshoring potential by waiting with probability zero. Therefore, we get the trade-off function shown in equation (8).

C.4 Proof of Proposition 1

From section 2.1, it is clear that the offshoring profit premium $\pi^{S,prem}(\theta)$ is increasing in θ. Taking the trade-off function expression from equation (A27), it is straightforward to see that $\frac{\partial \mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+1})}{\partial \theta} \geq 0$. Moreover, for firms facing a trade-off, i.e. those with a positive value of offshoring, it is strictly increasing in productivity.

C.5 Proof of Lemma 1

$$\mathcal{D}_t(\tilde{\theta}_{t+1};\theta_t,\tilde{\theta}_{t+1}) = 0 \quad \Leftrightarrow \quad \mathbb{E}_t[\pi_t^{S,prem}(\tilde{\theta}_{t+1})|f^S \leq f_t^S] - w^N s^r \left[1 - \lambda \frac{Y(\tilde{f}_{t+1}^S)}{Y(f_t^S)}\right] = 0.$$

Replacing $\pi_t^{S,prem}(\tilde{\theta}_{t+1})$ with expressions for $\pi_t^S(\tilde{\theta}_{t+1})$ and $\pi_t^N(\tilde{\theta}_{t+1})$ from equation (A1) leads to:

$$\tilde{\theta}_{t+1} = (\gamma E)^{\frac{\sigma}{1-\sigma}} \tilde{Q}_{t+1} \left[\frac{w^N \left[E_t(f^S|f^S \leq f_t^S) - f^N + s^r \left(1 - \lambda \frac{Y(\tilde{f}_{t+1}^S)}{Y(f_t^S)}\right)\right]}{\psi^S - \psi^N}\right]^{\frac{1}{\sigma-1}}.$$

C.6 Proof of Proposition 2

By *Assumption A.4*, we have that $\mathcal{D}_t(\bar{\bar{\theta}};\bar{\bar{\theta}},\bar{\bar{\theta}}) > 0$. Thus, $\mathbb{E}_t[\pi_t^{S,prem}(\bar{\bar{\theta}})|f^S \leq \bar{f}^S] - w^N s^r(1-\lambda) > 0$, implying that $\frac{r_t^{N,*}(\bar{\bar{\theta}})}{\sigma} W(.) - w^N E_t(f^S|f^S \leq \bar{f}^S) - w^N[s^r(1-\lambda) - f^N] > 0$, with $W(.) \equiv \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right]$.

Taking the limit of the trade-off function as $t \to \infty$, leads to:

$$\mathcal{D}(\theta_\infty;\theta_\infty,\theta_\infty) = \frac{r^{N,*}(\theta_\infty)}{\sigma} W(.) - w^N E\left(f^S|f^S \leq f_\infty^S\right) - w^N \left[s^r(1-\lambda) - f^N\right].$$

Totally differentiating $\mathcal{D}(\theta_\infty;\theta_\infty,\theta_\infty)$ with respect to each of its arguments we end up with:

$$\frac{d\mathcal{D}(\theta_\infty;\theta_\infty,\theta_\infty)}{d\theta_\infty} = \frac{W(.)}{\sigma} \frac{\partial r^{N,*}(\theta_\infty)}{\partial \theta_\infty} - w^N \frac{\partial E(f^S|f^S \leq f_\infty^S)}{\partial f_\infty^S} \frac{\partial f_\infty^S}{\partial \theta_\infty}.$$

By equation (5), f_∞^S is given by $f_\infty^S \equiv f^S(\theta_\infty) = \frac{r^N(\theta_\infty)}{\sigma w^N} \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right] + f^N$. Therefore,

$$\begin{aligned}\frac{d\mathcal{D}(\theta_\infty;\theta_\infty,\theta_\infty)}{d\theta_\infty} &= \frac{W(.)}{\sigma} \frac{dr^{N,*}(\theta_\infty)}{d\theta_\infty} - w^N \frac{W(.)}{w^N \sigma} \frac{dr^{N,*}(\theta_\infty)}{d\theta_\infty} \frac{\partial E(f^S|f^S \leq f_\infty^S)}{\partial f_\infty^S} \\ &= \frac{dr^{N,*}(\theta_\infty)}{d\theta_\infty} \frac{W(.)}{\sigma} \left[1 - \frac{\partial E(f^S|f^S \leq f_\infty^S)}{\partial f_\infty^S}\right].\end{aligned}$$

From this expression, $\frac{dr^{N,*}(\theta_\infty)}{d\theta_\infty} > 0$ and $\frac{W(.)}{\sigma} > 0$ follow. From *Assumption A.3* we have:

$$\frac{\partial[f_t^S - E(f^S|f^S \leq f_t^S)]}{\partial f_t^S} > 0 \Leftrightarrow 1 - \frac{\partial E(f^S|f^S \leq f_t^S)}{\partial f_t^S} > 0 \Leftrightarrow \frac{\partial E(f^S|f^S \leq f_t^S)}{\partial f_t^S} < 1.$$

With this assumption, the expression in brackets is $\left[1 - \frac{\partial E(f^S|f^S \leq f_\infty^S)}{\partial f_\infty^S}\right] > 0$. Only in the limit, when the distribution collapses at the lower bound, we obtain $\frac{\partial E(f^S|f^S \leq f_t^S)}{\partial f_t^S} = 1$ implying that $\mathcal{D}(\theta_\infty;\theta_\infty,\theta_\infty) = 0$. Thus, it is possible to see that this problem has at most one unique fixed point. Therefore, the fixed point defined in Proposition 2 is unique.

D Empirical model

D.1 Data

Imports data. The data from DANE reports monthly imports at the country, product and firm level for the period 2004–2018. Firms are identified by the tax ID (namely, NIT). We normalise the product classification by concordance tables provided by DANE. Then, we aggregate the imports by country and year and create an offshoring status dummy variable, $os_{i,l,j,t}$, that indicates if firm i of sector j imports from country l in year t.

In the year 2005, the NIT is missing for the months from January to July. To address this issue without loosing two years of the sample, we proceed in the following way. If firm i has a non-offshoring status from country l in 2005—that is, $os_{i,j,t=2005} = 0$—but has offshored from country l in 2004—that is, $os_{i,j,t=2004} = 1$—we assume that the firm has also offshored from country l in 2005—that is, $os_{i,j,t=2005} = 1$. Instead, if the firm has non-offshoring status from l in 2005—i.e, $os_{i,j,t=2005} = 0$—and also in 2004—i.e., $os_{i,j,t=2004} = 0$—we assume that the firm has non-offshoring status from country l in 2005.

The supplier country l is defined by the country of origin category in DANE's import dataset. Only when the country of origin is missing, it is replaced by the country of purchase. In the multi-country models, we drop the imports from countries that are not included in the WGI institutional dataset, the CEPII dataset, and the GDP data from the World Bank. Thus, in the multi-country models, we have a sample with 167 foreign countries.

Firms' sectoral classification. SIREM data report for each year the ISIC code of the firms. We homogenize the ISIC codes using the concordance tables provided by DANE. There are cases in the SIREM dataset where a firm NIT has different ISIC codes reported over time. In those cases, we replace the ISIC code with the mode of the reported ISIC codes of that firm.

Balance sheet data. In the cases of missing values on total assets, revenues and other variables used from SIREM for a year between the moment the firm enters the sample and the year the firm leaves the sample, we replace the missing value with the mean value of the previous and later year of the respective variable. In the case of gaps of two years, we do a linear interpolation. Finally, for missing values in the first year the firm enters the sample, we replace them with the respective value of the second year, whereas for missing values in the last year the firm is in the sample, we replace them with the lagged value.

D.2 Two-country model: Reduced-form models

D.2.1 Two-country model: Summary statistics

Table A1: Summary statistics—Information spillovers. Sample: sectors w/ at least 50 firms

	(1) mean	(2) sd	(3) min	(4) max
$minta_{j,t}$	0.6439	0.6497	0.0157	5.6350
$sdta_{j,t}$	44.1458	46.6864	0.0000	347.0329

Table A2: Summary statistics—Information spillovers. Sample: sectors w/ at least 100 firms

	(1) mean	(2) sd	(3) min	(4) max
$minta_{j,t}$	0.5448	0.6579	0.0157	5.6350
$sdta_{j,t}$	38.5549	28.2175	0.0000	212.4403

D.2.2 Two-country model: Robustness checks

Table A3 reports the estimated coefficients of the survival model with non-parametric general time trend. Table A4 reports the results for the probit and survival models with a discrete productivity measure (quintiles) and the interaction term between the latter and the information spillovers.

Table A3: Survival model—Non-offshoring firms. Non-parametric time-trend

Sample:	*w/at least 50 firms*		*w/at least 100 firms*	
	(1)	(2)	(3)	(4)
	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$
$\ln(ta_{i,j,t})$	0.614***	0.616***	0.593***	0.594***
	(0.0452)	(0.0459)	(0.0492)	(0.0506)
$minta_{j,t-1}$	-0.0739		0.0922	
	(0.170)		(0.200)	
$sdta_{j,t-1}$		0.00580***		0.00581**
		(0.00208)		(0.00271)
FEs	j , t	j , t	j , t	j , t
Observations	11985	11985	9002	9002

Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Other controls: market thickness, income per capita (mean), common language, distance, and year of entry of firm in the sample. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: Non-offshoring firms. Discrete productivity measure

Model:	**Conditional Probit Model**				**Transition (survival) Model**			
Sample:	*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
is **measure:**	*minta*	*sdta*	*minta*	*sdta*	*minta*	*sdta*	*minta*	*sdta*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$
$ta_{i,j,t}$: q2	0.503***	0.403***	0.545***	0.495***	1.013***	0.810***	1.082***	1.001***
	(0.0777)	(0.0887)	(0.0858)	(0.119)	(0.144)	(0.169)	(0.151)	(0.204)
$ta_{i,j,t}$: q3	0.778***	0.720***	0.814***	0.851***	1.546***	1.419***	1.619***	1.662***
	(0.0773)	(0.0983)	(0.0880)	(0.136)	(0.143)	(0.184)	(0.154)	(0.231)
$ta_{i,j,t}$: q4	0.975***	0.818***	1.004***	0.868***	1.940***	1.647***	1.982***	1.749***
	(0.0755)	(0.0838)	(0.0845)	(0.102)	(0.147)	(0.156)	(0.155)	(0.178)
$ta_{i,j,t}$: q5	1.160***	0.983***	1.155***	1.011***	2.318***	2.051***	2.334***	2.153***
	(0.146)	(0.172)	(0.162)	(0.217)	(0.235)	(0.273)	(0.257)	(0.327)
$is_{j,t-1}$	0.0229	0.00137	0.150	0.00282*	0.0262	0.000145	0.264	0.00330
	(0.139)	(0.00145)	(0.146)	(0.00157)	(0.320)	(0.00297)	(0.286)	(0.00305)
$ta_{i,j,t}$: q2 $\times$ $is_{j,t-1}$	-0.0550	0.00217	-0.162	-0.0000670	-0.140	0.00417	-0.316	-0.000541
	(0.153)	(0.00167)	(0.151)	(0.00220)	(0.321)	(0.00340)	(0.266)	(0.00362)
$ta_{i,j,t}$: q3 $\times$ $is_{j,t-1}$	-0.0485	0.00103	-0.155	-0.00269	-0.119	0.00225	-0.322	-0.00450
	(0.138)	(0.00200)	(0.120)	(0.00274)	(0.293)	(0.00412)	(0.216)	(0.00497)
$ta_{i,j,t}$: q4 $\times$ $is_{j,t-1}$	-0.133	0.00289**	-0.181	0.00232	-0.270	0.00529**	-0.366	0.00343
	(0.118)	(0.00124)	(0.124)	(0.00182)	(0.272)	(0.00235)	(0.238)	(0.00315)
$ta_{i,j,t}$: q5 $\times$ $is_{j,t-1}$	-0.280*	0.00172	-0.261*	0.00152	-0.486	0.00219	-0.514*	0.000113
	(0.167)	(0.00306)	(0.155)	(0.00413)	(0.314)	(0.00511)	(0.268)	(0.00637)
FEs	j , t	j , t	j , t	j , t	j	j	j	j

Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Other controls: market thickness, income per capita (mean), common language, and distance. Columns (5)–(8) include the year of entry of the firm into the sample and $\ln(t)$ as controls. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.2.3 Two-country model: Marginal effects

Table A5: Conditional probit model—Non-offshoring firms. Average marginal effects

	Conditional Probit Model				**Transition (survival) Analysis**			
	w/at least 50 firms		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$
$\ln(ta_{i,j,t})$	0.0486***	0.0487***	0.0485***	0.0485***	0.0464***	0.0478***	0.0462***	0.0470***
	(0.00367)	(0.00372)	(0.00452)	(0.00462)	(0.00255)	(0.00289)	(0.00289)	(0.00330)
$minta_{j,t-1}$	-0.00420		0.00819		-0.0144		-0.00412	
	(0.0137)		(0.0164)		(0.0129)		(0.0159)	
$sdta_{j,t-1}$		0.000439***		0.000462**		0.000273*		0.000277
		(0.000161)		(0.000232)		(0.000158)		(0.000199)
FEs	j , t	j , t	j , t	j , t	j	j	j	j

Average marginal effects reported. Standard errors are clustered at the sector level and reported in parenthesis. Controls: market thickness, income per capita (mean), common language, and distance. Survival model includes the year of entry of the firm into the sample as a control. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.3 Two-country model: Structural empirical model

We derive the structural models that estimate the offshoring exploration decisions of domestic-sourcing firms characterised by the trade-off function in the two-country model of section 2. In Appendix D.3.2, we define the main variables, introduce notation and general assumptions, and derive probit models from the trade-off function. Then we relax this assumption in Appendix D.3.3 and derive the respective structural probit model for the case of time-varying wages, as well as time-varying total expenditure. We introduce a first-order Taylor approximation for the identification of the information spillovers and the gains from waiting. In Appendix D.3.4, we present the estimation results for the AR(1) model, while Appendix D.3.5 contains the result for the 'reduced-form' version of the structural model. Appendix D.3.6 presents the results from the structural model for the small open economy, and Appendix D.3.7 for the full structural model.

D.3.1 Structural model: Summary of identification

We describe the main steps and features of our structural empirical model. For the details on the formal derivation of the structural model and proofs, as well as the underlying assumptions, see Appendix D.3.2. We can express the trade-off function (8) for a domestic-sourcing firm i in sector j in period t as:

$$\mathcal{D}_{i,j,t}(\theta;\mathcal{I}_{i,j,t}) = \max\left\{0;\mathbb{E}\left[\pi^{S,prem}_{j,t}(\theta)\Big|\mathcal{I}_{i,j,t}\right]\right\} - w^N s^r_j\left[1-\lambda_j Y(f^S_{t+1}|\mathcal{I}_{i,j,t})\right], \tag{A29}$$

where $\mathcal{I}_{i,j,t}$ refers to the information set that a firm i in sector j possesses in period t when deciding whether to explore offshoring or wait. In the case of domestic-sourcing firms, $\mathcal{I}_{i,j,t}$ is defined by the past firm-specific information and the information spillover.[103] From the trade-off function (A29), we derive the probit model:

$$\begin{aligned}\Pr\left(d^S_{i,j,t}=1\Big|d^S_{i,j,t-1}=0,\mathcal{I}_{i,j,t}\right) = \Phi\Big[\Sigma^{-1}\Big(&\sigma_j^{-1}\mathbb{E}\Big[z^S_{j,t}\theta^{\sigma_j-1}\Big|\mathcal{I}_{i,j,t}\Big] - w^N\left[\mathbb{E}(f^S_j|\mathcal{I}_{i,j,t}) - f^N_j\right]\\ &- w^N s^r_j\left[1-\lambda_j Y(f^S_{j,t+1}|\mathcal{I}_{i,j,t})\right]\Big)\Big],\end{aligned} \tag{A30}$$

where $d^S_{i,j,t}$ is a dummy variable that indicates the offshoring status of the firm i in sector j and period t, $z^S_{j,t} \equiv \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta_j)(\sigma_j-1)} - 1\right]\left[\frac{\sigma_j-1}{\sigma_j}\right]^{\sigma_j-1}(\gamma_j E)^{\sigma_j} Q^{1-\sigma_j}_{j,t}\left(w^N\right)^{1-\sigma_j}$, and Σ denotes the variance-covariance matrix.

[103] From theory, the information set includes the past firm-specific information and the information related to $\theta_{j,t}$ and $\tilde{\theta}_{j,t+1}$.

Identification of expected fixed-cost differential and information spillovers. The expected fixed-cost differential between domestic sourcing and offshoring, conditional on $\mathcal{I}_{i,j,t}$, is given by:

$$w^N \left[\mathbb{E}\left(f_j^S|\mathcal{I}_{i,j,t}\right) - f_j^N\right] = \gamma_j - \gamma_1 is_{j,t} + v_{i,j,t}, \tag{A31}$$

where $is_{j,t}$ indicates the information spillover in sector j in period t, $v_{i,j,t}|\mathcal{I}_{i,j,t} \sim i.i.d.$ with mean zero, and γ_j denotes sector fixed effects. The information spillover $is_{j,t}$ is alternatively defined by $minta_{j,t-1}$ and $sdta_{j,t-1}$. Intuitively, an increase in the information spillovers—i.e., a reduction in the productivity of the least productive offshoring firm in $t-1$ or an increase in the standard deviation of the productivities of offshoring firms in $t-1$—reduces the expected fixed-cost differential between offshoring and domestic sourcing. The sector fixed effects control for the initial expected fixed-cost differential.

Identification of expected gains from waiting. The last term of the trade-off function—given by $w^N s_j^r\Big[1-\lambda_j Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})\Big]$—captures the expected gains from the information to be revealed at the end of the period. That is, it represents the potential gains from waiting for one period and exploring the offshoring potential in the next period with reduced uncertainty. We characterise the expected information to be revealed—that is, $Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})$—as an AR(1) process, which is given by $is_{j,t+1} = \rho_{1,j} is_{j,t} + \epsilon_{j,t}$. From this model, we obtain $\mathbb{E}\left[is_{j,t+1}\right] = \rho_{1,j} is_{j,t}$, which is the empirical equivalent to $Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})$. Therefore, the empirical identification of the expected gains from waiting is given by:

$$w^N s_j^r\left[1-\lambda_j Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})\right] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j}\widehat{is}_{j,t+1} + e_{j,t}, \tag{A32}$$

where $e_{j,t}|\mathcal{I}_{i,j,t} \sim i.i.d.$ with mean zero, $\tilde{\gamma}_j$ is a sector fixed effect that captures the first term on the left-hand side, $\widehat{is}_{j,t+1}$ refers to the predicted values of the estimated AR (1) model, and $\tilde{\gamma}_{1,j}$ captures the differential effects of the latter due to interaction with sector-level variables (i.e., $w^N s_j^r \lambda_j$). Intuitively, an increase in the expected new information to be revealed—that is, an expected lower $f_{j,t+1}^S$—increases the gain from waiting in t.[104]

We introduce a set of empirical models for the structural framework. First, a 'reduced-form' version, where we ignore the differential effects in the main variables at the sector and time level. In the other specifications, we progressively relax the assumptions, first by allowing for sector-level differential effects and assuming the case of Colombia as a small open economy. Then, we estimate the full structural model. We conclude with an extension that allows for time-varying wages, which goes beyond the theoretical model.[105]

D.3.2 Structural model: Identification, notation and proofs

Offshoring revenue premium. The revenue of a domestic-sourcing firm i with productivity θ in period t and sector j is $r_{i,j,t}^N \equiv r_{j,t}^N(\theta) = \left[\frac{\sigma_j-1}{\sigma_j}\right]^{\sigma_j-1} \theta^{\sigma_j-1}\left(\gamma_j E\right)^{\sigma_j} Q_{j,t}^{1-\sigma_j}\left(w^N\right)^{1-\sigma_j}$. Instead, the revenue of an offshoring firm i with productivity θ is $r_{i,j,t}^S \equiv r_{j,t}^S(\theta) = \left(\frac{w^N}{w^S}\right)^{(1-\eta_j)(\sigma_j-1)} r_{j,t}^N(\theta)$, and the respective revenue premium from offshoring in t is $r_{j,t}^{S,\text{prem}}(\theta) = \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta_j)(\sigma_j-1)} - 1\right] r_{j,t}^N(\theta)$. Replacing $r_{j,t}^N(\theta)$ in the offshoring revenue premium, we get:

[104] Figure A2 in Appendix D.3.4 reports the estimation results for the coefficients $\rho_{1,j}$ of the AR(1) model for both information spillover measures. The figure shows a theory-consistent positive estimated coefficient for each sector for both measures of information spillovers.

[105] Appendix D.3.2 shows the derivation of the empirical models with fixed wages, whereas Appendix D.3.3 does it for the extension of the empirical models that allow for time-varying wages.

$$r_{i,j,t}^{S,\text{prem}} \equiv r_{j,t}^{S,\text{prem}}(\theta) = z_{j,t}^{S}\theta^{\sigma_j-1}, \tag{A33}$$

with $z_{j,t}^{S} \equiv \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta_j)(\sigma_j-1)} - 1\right]\left[\frac{\sigma_j-1}{\sigma_j}\right]^{\sigma_j-1}(\gamma_j E)^{\sigma_j}\, Q_{j,t}^{1-\sigma_j}\left(w^N\right)^{1-\sigma_j}$.

Expected offshoring profits. The expected offshoring profit premium in period t for firm i in sector j that is currently under domestic sourcing is given by:

$$\mathbb{E}\left[\pi_{i,j,t}^{S,\text{prem}}|\mathcal{I}_{i,j,t}\right] = \sigma_j^{-1}\mathbb{E}\left[z_{j,t}^{S}\theta^{\sigma_j-1}|\mathcal{I}_{i,j,t}\right] - w^N\left[\mathbb{E}(f_j^S|\mathcal{I}_{i,j,t}) - f_j^N\right]. \tag{A34}$$

Trade-off function and probability of exploration. The exploration decision in each period t is characterised by the trade-off function $\mathcal{D}_t(\theta;\theta_t,\tilde{\theta}_{t+1})$ defined in equation (8). Using $\mathcal{I}_{i,j,t}$ to denote the information firm i in sector j possesses at any period t, the trade-off function is expressed as:[106]

$$\mathcal{D}_t(\theta;\mathcal{I}_{i,j,t}) = \mathbb{E}\left[\pi_{i,j,t}^{S,prem}\middle|\mathcal{I}_{i,j,t}\right] - w^N s_j^r\left[1-\lambda_j Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})\right]. \tag{A35}$$

Firm i in sector j with productivity θ decides to explore the offshoring potential in t when $\mathcal{D}_t(\theta;\mathcal{I}_{i,j,t}) \geq 0$, or wait when it is negative. We define $d_{i,j,t}^S = \{0,1\}$ as the offshoring status of firm i in sector j and period t. The probability of firm i in sector j exploring the offshoring potential in t, conditional on the information set in t, can be represented as $\Pr\left[d_{i,j,t}^S = 1\middle|d_{i,j,t-1}^S = 0, \mathcal{I}_{i,j,t}\right]$, with $d_{i,j,t}^S\Big|_{d_{i,j,t-1}^S=0} = \mathbb{1}\{\mathcal{D}_{j,t}(\theta;\mathcal{I}_{i,j,t}) \geq 0\}$. Replacing with equation (A35) and $\mathbb{E}\left[\pi_{i,j,t}^{S,prem}\middle|\mathcal{I}_{i,j,t}\right]$ with the expression in equation (A34), we have:

$$\begin{aligned} d_{i,j,t}^S\Big|_{d_{i,j,t-1}^S=0} = \mathbb{1}\Big\{&\sigma_j^{-1}\mathbb{E}\left[z_{j,t}^S\theta^{\sigma_j-1}|\mathcal{I}_{i,j,t}\right] - w^N\left[\mathbb{E}(f_j^S|\mathcal{I}_{i,j,t}) - f_j^N\right] \\ &- w^N s_j^r\left[1-\lambda_j Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})\right] \geq 0\Big\}. \end{aligned} \tag{A36}$$

Modelling of expected fixed-cost differential and information spillovers. The expected fixed-cost differential is given by $w^N\left[\mathbb{E}\left(f_j^S|\mathcal{I}_{i,j,t}\right) - f_j^N\right] = w^N\mathbb{E}\left(f_j^S|\mathcal{I}_{i,j,t}\right) - w^N f_j^N$. Thus, the empirical identification is given by (A31).

Modelling of the expected gains from waiting. The gains from waiting are given by the expression $w^N s_j^r\Big[1-\lambda_j Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})\Big]$. It captures the expected information to be revealed by the end of the period. Therefore, it represents the potential gains from waiting for one period and exploring offshoring in the next period with reduced uncertainty. Thus, we have:

$$w^N s_j^r\Big[1-\lambda_j Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})\Big] = w^N s_j^r - w^N s_j^r\lambda_j Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t}). \tag{A37}$$

To identify the expected information to be revealed—that is, $Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})$—we model the expected information flow conditional on the information set as an AR(1) process. We define the underlying AR(1) process for the formation of expectations about future information revealed as $Y(f_{j,t+1}^S) = \rho_{1,j}Y(f_{j,t}^S) + \epsilon_{j,t}$, where $\epsilon_{j,t}$ is a white noise error term. Therefore, the expected new information to be revealed during t given the information set at the beginning of period t is $Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t}) \equiv \mathbb{E}[Y(f_{j,t+1}^S)] = \rho_{1,j}Y(f_{j,t}^S)$. Replacing with the spillover measures, we estimate the AR(1) model given by:

$$is_{j,t+1} = \rho_{1,j}is_{j,t} + \epsilon_{j,t} \quad\Rightarrow\quad \mathbb{E}\left[is_{j,t+1}\right] = \rho_{1,j}is_{j,t}. \tag{A38}$$

Back to equation (A37), the empirical identification of the expected gains from waiting is given by (A32).

[106] As mentioned, firms that have a positive expected per-period offshoring profit premium are facing a trade-off situation. Thus, the first term on the right-hand side of equation (A35) is positive.

Second stage regression: Probit model. In a first stage, we estimate the model from equation (A38). Back to equation (A36), we derive a probit model for the trade-off function. Using the expressions (A36), (A31) and (A32), the probit model is:

$$\begin{aligned}
\Pr\left[d^s_{i,j,t}=1\middle|d^s_{i,j,t-1}=0,\mathcal{I}_{i,j,t}\right] &= \int_v \mathbb{1}\left\{\mathcal{D}_{j,t}(\theta;\mathcal{I}_{i,j,t})\geq 0\right\}\frac{1}{\Sigma}\phi\left(\frac{v}{\Sigma}\right)dv,\\
\Pr\left(d^s_{i,j,t}=1\middle|d^s_{i,j,t-1}=0,\mathcal{I}_{i,j,t}\right) =&\Phi\Big\{\Sigma^{-1}\Big(\sigma_j^{-1}\mathbb{E}\Big[r^{s,\text{prem}}_{i,j,t}\Big|\mathcal{I}_{i,j,t}\Big]-w^N\left[\mathbb{E}(f^s_j|\mathcal{I}_{i,j,t})-f^N_j\right]\\
&-w^N s^r_j\left[1-\lambda_j Y(f^s_{j,t+1}|\mathcal{I}_{i,j,t})\right]\Big)\Big\},\\
\Pr\left(d^s_{i,j,t}=1\middle|d^s_{i,j,t-1}=0,\mathcal{I}_{i,j,t}\right) =&\Phi\Big\{\Sigma^{-1}\Big(\sigma_j^{-1}\mathbb{E}\Big[r^{s,\text{prem}}_{i,j,t}\Big|\mathcal{I}_{i,j,t}\Big]-\Big[\gamma_j-\gamma_1 is_{j,t}\Big]-\Big[\tilde{\gamma}_j+\tilde{\gamma}_{1,j}\widehat{is}_{j,t+1}\Big]\Big)\Big\}.
\end{aligned}$$

Reorganising the variables, we get the probit model:

$$\Pr\left(d^s_{i,j,t}=1\middle|d^s_{i,j,t-1}=0,\mathcal{I}_{i,j,t}\right)=\Phi\left[\Sigma^{-1}\left(\sigma_j^{-1}\mathbb{E}\Big[z^S_{j,t}\theta^{\sigma_j-1}\Big|\mathcal{I}_{i,j,t}\Big]-\Gamma_j+\Gamma_2 is_{j,t}-\Gamma_{3,j}\widehat{is}_{j,t+1}\right)\right], \tag{A39}$$

with $\Gamma_j\equiv\gamma_j+\tilde{\gamma}_j$, $\Gamma_2\equiv\gamma_1$, and $\Gamma_{3,j}\equiv\tilde{\gamma}_{1,j}$. According to the model, the time-dimension of the variable $z^S_{j,t}$ is defined by the aggregate consumption index that increases as more firms offshore. This, together with σ_j^{-1}, would be captured by the introduction of a sector-year fixed effect. However, we define three models that go from a more reduced-form approach to a full structural identification.

First, we define a model that captures the simplest structure of the trade-off function, namely a *reduced-form version of the structural model*, where the sector-level differential effects of productivity and gains from waiting are ignored. Results for this model are presented in Appendix D.3.5. Second, we identify a *small open economy* (see Appendix D.3.6). Third, we relax further the assumptions and identify a *full structural model* (see Appendix D.3.7). Before we go into these details, we derive a first-order Taylor approximation of the structural model with time-varying wages in Appendix D.3.3 and present AR(1) estimation results in Appendix D.3.4.

D.3.3 Structural model with time-varying wages: First-order Taylor approximation

We now introduce an extension that allows for changes in the northern and southern wages and time-varying total expenditure. However, we assume that these changes are not endogenous to the sectoral dynamics derived from the learning process; that is, they are exogenous to the model. When the northern wages are not endogenous to the sectoral offshoring dynamics, firms cannot predict future changes in northern wages based on the information set that they posses in period t. In addition, we assume that firms cannot predict changes in total expenditure given their information. Under such conditions, the model's predictions are not affected.

In this situation, the offshoring revenue premium for a firm i with productivity θ in period t is given by $r^{S,\text{prem}}_{i,j,t}\equiv r^{S,\text{prem}}_{j,t}(\theta)=z^S_{j,t}\theta^{\sigma_j-1}$, with $z^S_{j,t}\equiv\left[\left(\frac{w^N_t}{w^S_t}\right)^{(1-\eta_j)(\sigma_j-1)}-1\right]\left[\frac{\sigma_j-1}{\sigma_j}\right]^{\sigma_j-1}(\gamma_j E_t)^{\sigma_j}Q^{1-\sigma_j}_{j,t}\left(w^N_t\right)^{1-\sigma_j}$.

Expected offshoring profits. The expected offshoring profit premium in period t for firm i in sector j that is currently under domestic sourcing is $\mathbb{E}\left[\pi^{S,\text{prem}}_{i,j,t}|\mathcal{I}_{i,j,t}\right]=\sigma_j^{-1}\mathbb{E}\left[z^S_{j,t}\theta^{\sigma_j-1}|\mathcal{I}_{i,j,t}\right]-w^N_t\left[\mathbb{E}(f^S_j|\mathcal{I}_{i,j,t})-f^N_j\right]$.

Modelling of expected fixed-cost differential and information spillovers. We linearise the expected differential in the per-period fixed costs in period t in sector j by a first-order Taylor approximation around point $\left(w^N_0,\mathbb{E}\left(f^s_j|\mathcal{I}_{i,j,0}\right)\right)$:

$$w_t^N\left[\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,t}\right)-f_j^N\right]\approx w_0^N\left[\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,0}\right)-f_j^N\right]+\left[\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,0}\right)-f_j^N\right]\left(w_t^N-w_0^N\right)$$
$$+w_0^N\left[\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,t}\right)-\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,0}\right)\right],$$

$$w_t^N\left[\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,t}\right)-f_j^N\right]\approx -w_0^N\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,0}\right)+w_t^N\left[\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,0}\right)-f_j^N\right]+w_0^N\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,t}\right).$$

The first-term on the right-hand side is captured by a sector fixed effect, whereas the third term is identified by the information spillover measures. Regarding the second term, it could be captured by a sector-year fixed effect. However, the information spillovers vary in the same dimension. Thus, we approximate the third term by the inclusion of sector fixed effects and year fixed effects. The empirical identification of the equation above is thus:

$$w_t^N\left[\mathbb{E}\left(f_j^s|\mathcal{I}_{i,j,t}\right)-f_j^N\right]=\gamma_j+\gamma_t-\gamma_1 is_{j,t}+v_{i,j,t}. \tag{A40}$$

Modelling of the expected gains from waiting. We identify now the second term of the trade-off function, i.e. the gains from waiting, which is given by the expression $w_t^N s_j^r\Big[1-\lambda_j Y(f_{j,t+1}^s|\mathcal{I}_{i,j,t})\Big]$. Applying first-order Taylor approximation around $\left(w_0^N, Y(f_{j,1}^s|\mathcal{I}_{i,j,0})\right)$, we get:

$$w_t^N s_j^r\left[1-\lambda_j Y(f_{j,t+1}^s|\mathcal{I}_{i,j,t})\right]\approx w_0^N s_j^r\left[1-\lambda_j Y(f_{j,1}^s|\mathcal{I}_{i,j,0})\right]+s_j^r\left[1-\lambda_j Y(f_{j,1}^s|\mathcal{I}_{i,j,0})\right]\left[w_t^N-w_0^N\right]$$
$$-w_0^N s_j^r\lambda_j\Big[Y(f_{j,t+1}^s|\mathcal{I}_{i,j,t})-Y(f_{j,1}^s|\mathcal{I}_{i,j,0})\Big],$$

$$w_t^N s_j^r\left[1-\lambda_j Y(f_{j,t+1}^s|\mathcal{I}_{i,j,t})\right]\approx w_0^N s_j^r\lambda_j Y(f_{j,1}^s|\mathcal{I}_{i,j,0})+w_t^N s_j^r\left[1-\lambda_j Y(f_{j,1}^s|\mathcal{I}_{i,j,0})\right]$$
$$-w_0^N s_j^r\lambda_j Y(f_{j,t+1}^s|\mathcal{I}_{i,j,t}).$$

The first term of the expression above is captured by a sector fixed effect. The second term is approximated by introducing sector fixed effects and year fixed effects. The identification of the expected information to be revealed, i.e. $Y(f_{j,t+1}^s|\mathcal{I}_{i,j,t})$, follows the same AR(1) process as above. Thus, the empirical identification of the expected gains from waiting is given by:

$$w_t^N s_j^r\left[1-\lambda_j Y(f_{j,t+1}^S|\mathcal{I}_{i,j,t})\right]=\tilde{\gamma}_j+\tilde{\gamma}_t+\tilde{\gamma}_{1,j}\widehat{is}_{j,t+1}+e_{j,t}. \tag{A41}$$

Second stage regression: Probit model. The conditional probit model is given by:

$$\Pr\left(d_{i,j,t}^s=1\Big|d_{i,j,t-1}^s=0,\mathcal{I}_{i,j,t}\right)=\Phi\Big\{\Sigma^{-1}\Big[\sigma_j^{-1}\mathbb{E}(z_{j,t}^S\theta^{\sigma_j-1}|\mathcal{I}_{i,j,t})$$
$$-w_t^N\left[\mathbb{E}(f_j^s|\mathcal{I}_{i,j,t})-f_j^N\right]-w_t^N s_j^r\left[1-\lambda_j Y(f_{j,t+1}^s|\mathcal{I}_{i,j,t})\right]\Big]\Big\},$$

$$\Pr\left(d_{i,j,t}^s=1\Big|d_{i,j,t-1}^s=0,\mathcal{I}_{i,j,t}\right)=\Phi\Big\{\Sigma^{-1}\Big[\sigma_j^{-1}\mathbb{E}(z_{j,t}^S\theta^{\sigma_j-1}|\mathcal{I}_{i,j,t})-\Big[\gamma_j+\gamma_t-\gamma_1 is_{j,t}\Big]$$
$$-\Big[\tilde{\gamma}_j+\tilde{\gamma}_t+\tilde{\gamma}_{1,j}\widehat{is}_{j,t+1}\Big]\Big]\Big\}.$$

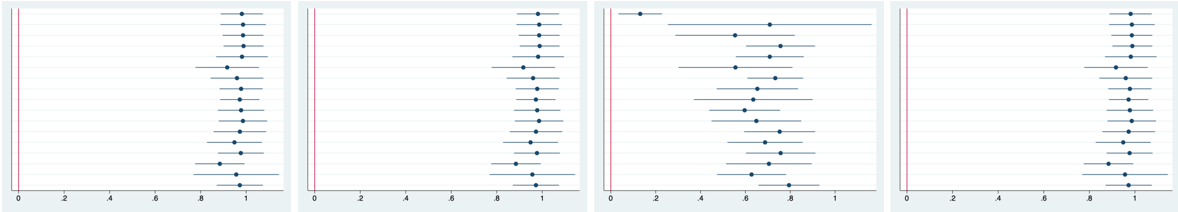
Reorganising the variables, we get the following specification for the probit model:

$$\Pr\left(d_{i,j,t}^s=1\Big|d_{i,j,t-1}^s=0,\mathcal{I}_{i,j,t}\right)=\Phi\Big\{\Sigma^{-1}\Big[\sigma_j^{-1}\mathbb{E}(z_{j,t}^S\theta^{\sigma_j-1}|\mathcal{I}_{i,j,t})-\Gamma_j-\Gamma_t+\Gamma_2 is_{j,t}-\Gamma_{3,j}\widehat{is}_{j,t+1}\Big]\Big\}, \tag{A42}$$

with $\Gamma_j\equiv\gamma_j+\tilde{\gamma}_j$, $\Gamma_t\equiv\tilde{\gamma}_t+\gamma_t$, $\Gamma_2\equiv\gamma_1$ and $\Gamma_{3,j}\equiv\tilde{\gamma}_{1,j}$.

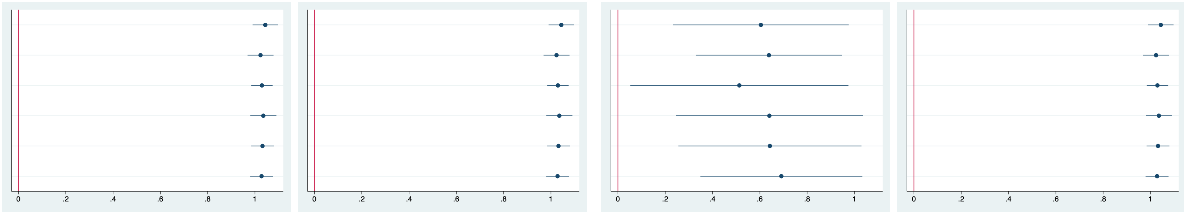
D.3.4 AR(1) estimation results.

The estimation results for the AR(1) model defined in equation (A38) are reported in Figure A2. The figure shows positive coefficients consistent with a persistent and sequential offshoring exploration process. Figure A3 reports the respective results for sectors with at least 200 firms, also showing positive coefficients.



(a) *minta* (b) *sdta* (c) $\ln(minta)$ (d) $\ln(1 + sdta)$

Figure A2: Sectors with at least 100 firms. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals



(a) *minta* (b) *sdta* (c) $\ln(minta)$ (d) $\ln(1 + sdta)$

Figure A3: Sectors with at least 200 firms. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals

D.3.5 'Reduced-form' version of structural model

This specification identifies the simplest structure of the trade-off function, where the differential effects of productivity and gains from waiting by sectors are ignored. The model is given by:

$$\Pr\left(d^s_{i,j,t} = 1 \middle| d^s_{i,j,t-1} = 0, \mathcal{I}_{i,j,t}\right) = \Phi\left[\Sigma^{-1}\left(\Gamma_1 \ln(ta_{i,j,t}) - \Gamma_j + \Gamma_2 is_{j,t} - \Gamma_3 \widehat{is}_{j,t+1}\right)\right]. \tag{A43}$$

Columns (1) and (2) of Table A6 report the estimated coefficients of the probit model defined in equation (A43). Columns (3) and (4) report the results for the extension that allows for time-varying wages and total expenditure, which includes year fixed effects.

Table A6: Non-offshoring firms. 'Reduced-form' model

Sample		*sectors w/ at least 100 firms*			
	Exp. sign	(1) $os_{i,j,t}$	(2) $os_{i,j,t}$	(3) $os_{i,j,t}$	(4) $os_{i,j,t}$
$\ln(ta_{i,j,t})$	+	0.285***	0.296***	0.307***	0.316***
		(0.0375)	(0.0295)	(0.0310)	(0.0304)
$minta_{j,t-1}$	-	-0.257		-0.547	
		(0.335)		(0.340)	
$\widehat{minta}_{j,t+1}$	+	-0.667**		0.361	
		(0.299)		(0.470)	
$sdta_{j,t-1}$	+		-0.00568		0.00203
			(0.00380)		(0.00158)
$\widehat{sdta}_{j,t+1}$	-		-0.0100**		-0.0162***
			(0.00454)		(0.00280)
FEs		j	j	j, t	j, t
Observations		9002	9002	9002	9002

Coefficients reported. Standard errors are clustered at the sector level and reported in parenthesis. *Exp. sign* indicates expected coefficient sign from the theory. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The results show that the probability of exploring the offshoring potential in period t by domestic-sourcing firms is increasing in productivity (Proposition 1). Focusing on the average marginal effects of column (4)'s model, an average increase of 10% in the productivity of domestic-sourcing firms increases the probability that these firms explore offshoring in t by 0.481 percentage points.[107] Regarding the role of the information spillovers, the results in columns (1) and (2) do not provide clear support for the model's predictions. However, columns (3) and (4) show theory-consistent signs for both coefficients, but mostly not significant at the reported levels.[108] As already discussed, the information spillovers in the two-country setup correspond to general (i.e., not country-specific) offshoring conditions. In section 4, we show that the information spillovers play a major role in the location choices in a multi-country setup, as they are related to country-specific offshoring conditions.

Table A7 reports the average marginal effects for the models reported in Table A6.

Table A7: Non-offshoring firms. Structural 'reduced-form' model

	Average Marginal Effects			
	(1)	(2)	(3)	(4)
	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$
$\ln(ta_{i,j,t})$	0.0456***	0.0453***	0.0469***	0.0477***
	(0.00544)	(0.00433)	(0.00496)	(0.00452)
$minta_{j,t-1}$	-0.0410		-0.0835*	
	(0.0527)		(0.0503)	
$\widehat{minta}_{j,t+1}$	-0.107**		0.0551	
	(0.0461)		(0.0713)	
$sdta_{j,t-1}$		-0.000868		0.000307
		(0.000584)		(0.000238)
$\widehat{sdta}_{j,t+1}$		-0.00153**		-0.00245***
		(0.000685)		(0.000404)
FEs	j	j	j, t	j, t

Standard errors are clustered at the sector level and reported in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Model with variables in natural logarithms. From the theory, the information spillover variables enter the trade-off function in levels. However, as robustness, we report the results for the models with information spillover variables in natural logarithms. Table A8 shows that the results are robust across all the specifications in relation to the positive effect of the productivity on the probability of exploring offshoring. However, in regard to the role of information spillovers, they show only theory-consistent and significant effects for the alternative information spillover measure (i.e., *sdta*) in the most general specification with time-varying wages and total expenditure reported in column (4).

[107] For average marginal effects, see Table A7 in Appendix D.3.5.

[108] The intuition behind the theory-consistent results is the following. The higher the information revealed about the offshoring conditions, the higher the probability of exploring offshoring in t. However, the higher the information that a firm expects to be revealed in the next period about the general offshoring conditions, the higher the gains from waiting and thus the lower the probability of exploring the offshoring potential in t.

Table A8: Non-offshoring firms. 'Reduced-form' model in natural logarithms

Sample		*w/ at least 100 firms*			
	Exp. sign	(1) $os_{i,j,t}$	(2) $os_{i,j,t}$	(3) $os_{i,j,t}$	(4) $os_{i,j,t}$
$\ln(ta_{i,j,t})$	+	0.254***	0.305***	0.310***	0.323***
		(0.0601)	(0.0307)	(0.0311)	(0.0316)
$\ln(minta_{j,t-1})$	-	0.274*		0.337	
		(0.144)		(0.281)	
$\ln(\widehat{minta}_{j,t+1})$	+	-0.349**		-0.357	
		(0.170)		(0.398)	
$\ln(1+sdta_{j,t-1})$	+		-0.735***		2.941***
			(0.190)		(0.975)
$\ln(\widehat{1+sdta}_{j,t+1})$	-		0.361*		-3.338***
			(0.185)		(0.991)
FEs		j	j	j,t	j,t
Observations		9002	9002	9002	9002

Coefficients reported. Standard errors are clustered at the sector level and reported in parenthesis. *Exp. sign* indicates expected coefficient sign from our theoretical model. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.3.6 Structural Model for Small Open Economy (SMOPEC): Results

We now identify the differential effects at the sector level of the main variables assuming a small open economy (SMOPEC). The latter implies that $P_{j,t} = P_j$ and thus $Q_{j,t} = Q_j$ $\forall t$, that is, the price index and the aggregate consumption index are not affected by the increasing offshoring activity of Colombian firms. Therefore, $z^S_{j,t} = z^S_j$ $\forall t$. Under these conditions, we have:

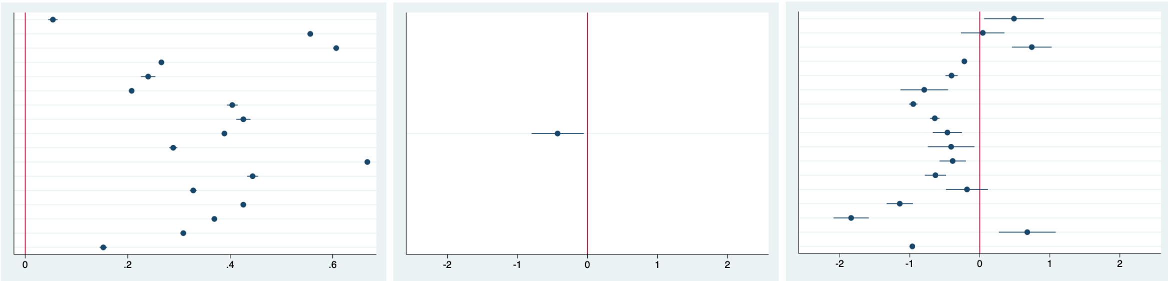
$$\Pr\left(d^s_{i,j,t} = 1 \middle| d^s_{i,j,t-1} = 0, \mathcal{I}_{i,j,t}\right) = \Phi\left[\Sigma^{-1}\left(\Gamma_{1,j}\ln(ta_{i,j,t}) - \Gamma_j + \Gamma_2 is_{j,t} - \Gamma_{3,j}\widehat{is}_{j,t+1}\right)\right]. \quad \text{(A44)}$$

We report in Figure A4 the estimation results of the model above for the direct and alternative information spillover measures. Figure A5 reports the respective results for the models with information spillovers in natural logarithm. Finally, Figures A6 and A7 report the respective results for the sample that includes only sectors with at least 200 firms. On the one hand, all specifications provide strong supportive evidence for the prediction that the trade-off function is increasing in the productivity of the firms, as defined in Proposition 1. On the other hand, the results show mixed evidence about the model's predictions in terms of information spillovers. Whereas some specifications show supportive evidence in relation to the expected fixed-cost differential effect—i.e., the current information revealed—[109], other specifications show a non-significant effect or theory-inconsistent evidence. Concerning the effect of expected new information, the results show substantial heterogeneity.

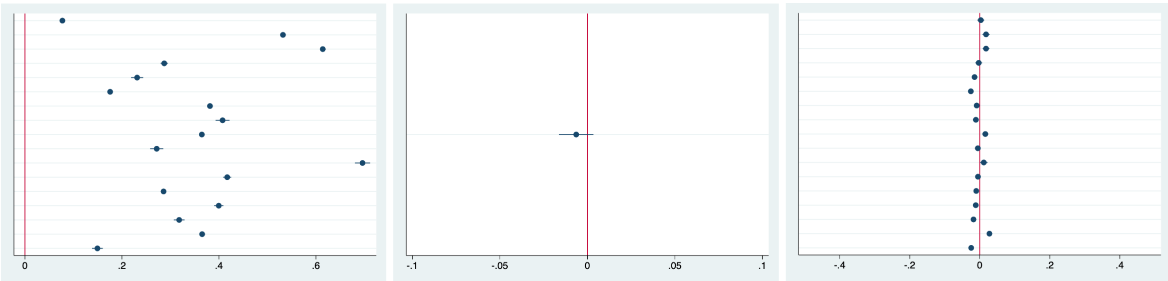
Figures A8–A11 report the results for the respective small open economy model that allows for time-varying wages. Also in this case the results are still supportive for Proposition 1,[110] but the evidence is still not supportive for the role of information spillovers.

[109] For instance, the direct measure *minta* in Figure A4.

[110] That is, the trade-off function—and thus the probability of exploration—is increasing in productivity.

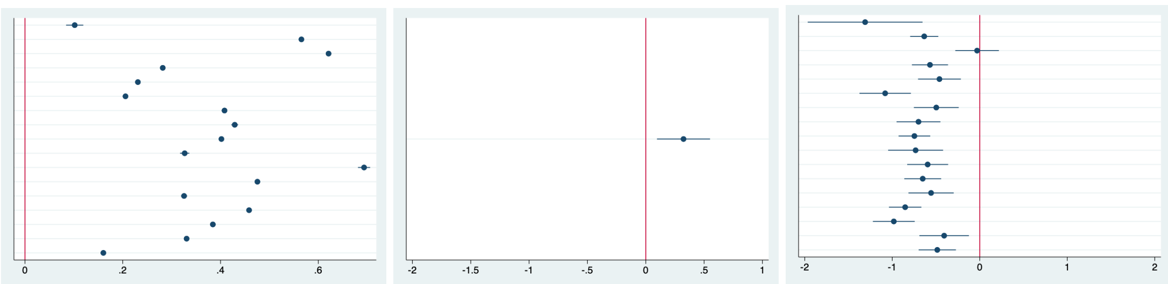


(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{j,t+1}$. Exp. sign > 0

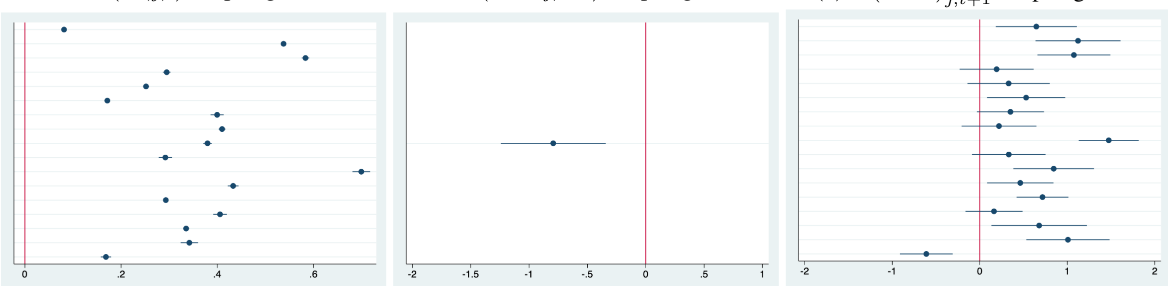


(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $sdta_{j,t-1}$. Exp. sign > 0 (f) $\widehat{sdta}_{j,t+1}$. Exp. sign < 0

Figure A4: Structural Model for Small Open Economy (SMOPEC). Sectors with at least 100 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

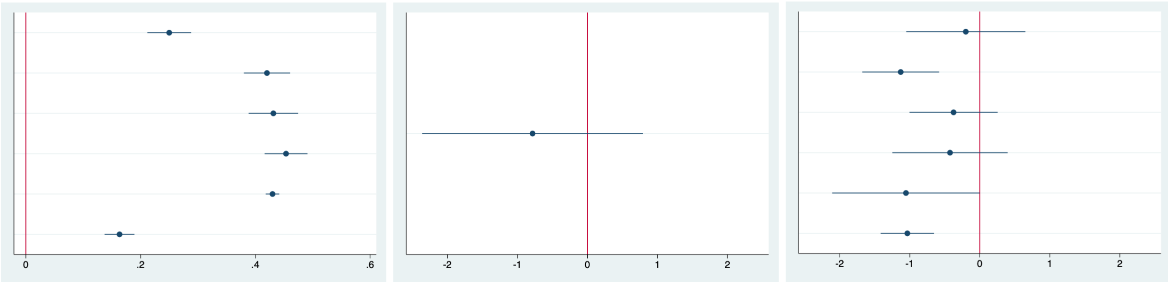


(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $\ln(minta_{j,t-1})$. Exp. sign < 0 (c) $\ln\widehat{(minta)}_{j,t+1}$. Exp. sign > 0

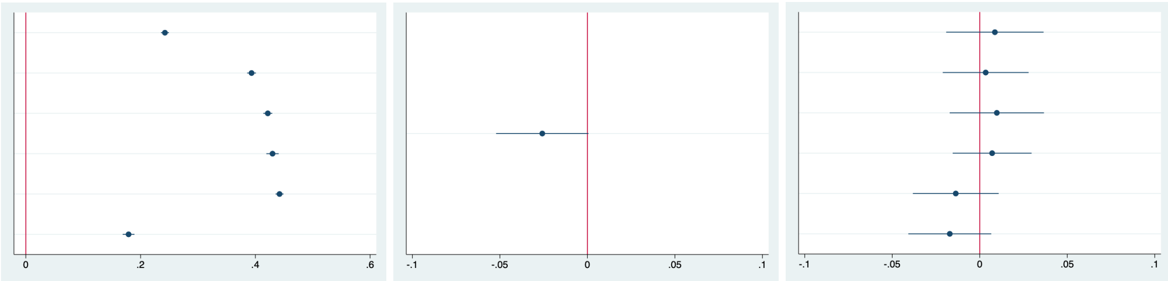


(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $\ln(1 + sdta_{j,t-1})$. Exp. sign > 0 (f) $\ln\widehat{(1 + sdta)}_{j,t+1}$. Exp. sign < 0

Figure A5: Structural Model for Small Open Economy (SMOPEC). Sectors with at least 100 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

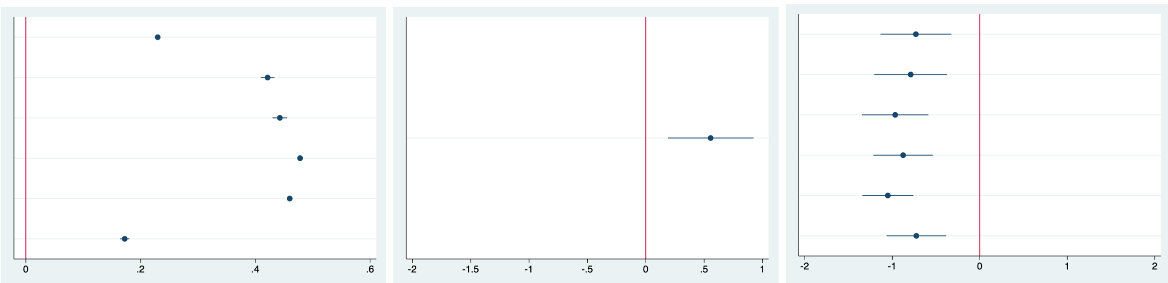


(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{j,t+1}$. Exp. sign > 0

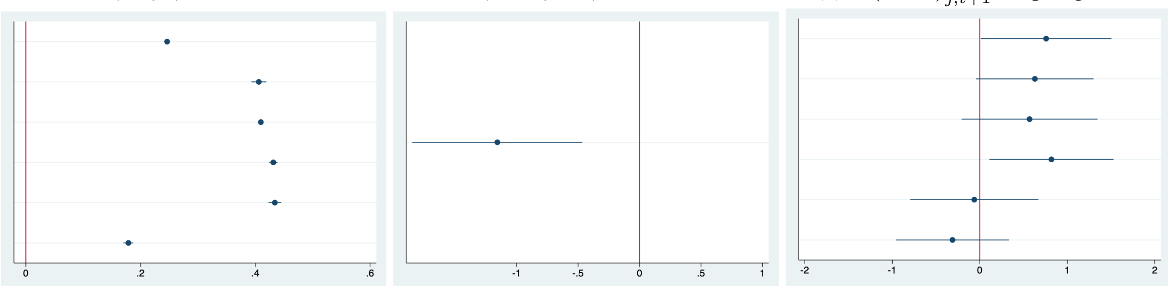


(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $sdta_{j,t-1}$. Exp. sign > 0 (f) $\widehat{sdta}_{j,t+1}$. Exp. sign < 0

Figure A6: Structural Model for Small Open Economy (SMOPEC). Sectors with at least 200 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.



(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $\ln(minta_{j,t-1})$. Exp. sign < 0 (c) $\ln\widehat{(minta)}_{j,t+1}$. Exp. sign > 0



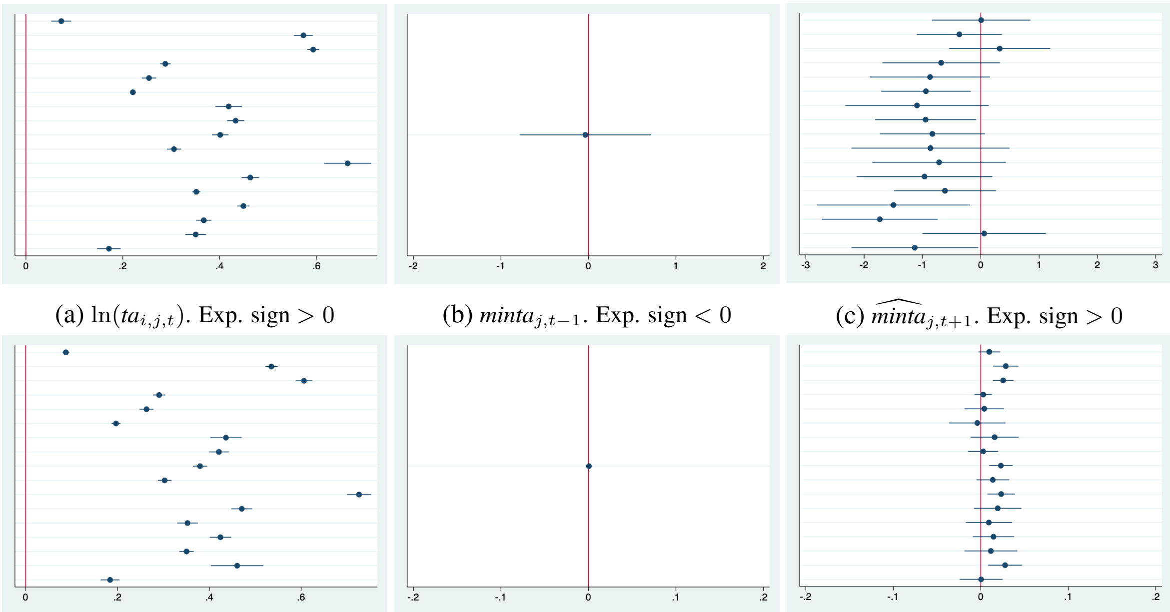
(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $\ln(1 + sdta_{j,t-1})$. Exp. sign > 0 (f) $\ln\widehat{(1 + sdta)}_{j,t+1}$. Exp. sign < 0

Figure A7: Structural Model for Small Open Economy (SMOPEC). Sectors with at least 200 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

Model with time-varying wages: Taylor approximation. We extend the SMOPEC model to allow for time-varying wages and total expenditure. Thus, the structural model is given by:

$$\Pr\left(d^s_{i,j,t} = 1 \middle| d^s_{i,j,t-1} = 0, \mathcal{I}_{i,j,t}\right) = \Phi\left[\Sigma^{-1}\left(\Gamma_{1,j}\ln(ta_{i,j,t}) - \Gamma_j - \Gamma_t + \Gamma_2 is_{j,t} - \Gamma_{3,j}\widehat{is}_{j,t+1}\right)\right]. \quad \text{(A45)}$$

Figure A8 reports the results for the direct and alternative information spillover measures for the sample with sectors with at least 100 firms, whereas Figure A9 reports the respective results for the models with information spillovers in natural logarithm. The effects of the productivity remain robust and theory-consistent in all specifications from Figures A8–A11. However, concerning the effects of the expected fixed-cost differential and the expected new information, we observe heterogeneous evidence. Whereas some specifications show theory-consistent effects,[111] other specifications show ambiguous and theory-inconsistent results.

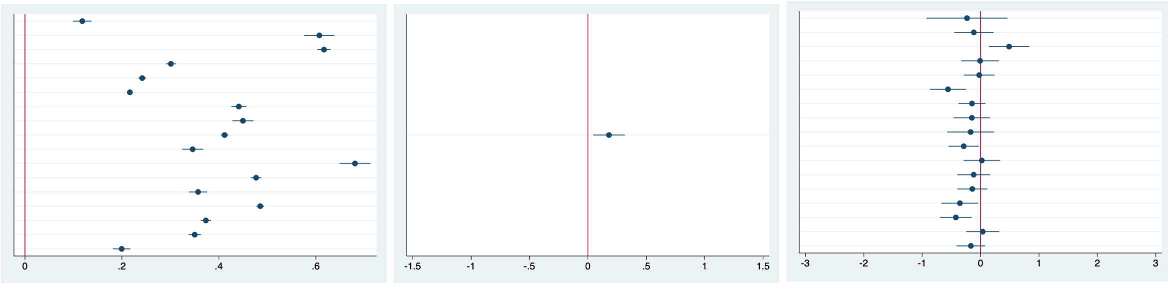


(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{j,t+1}$. Exp. sign > 0

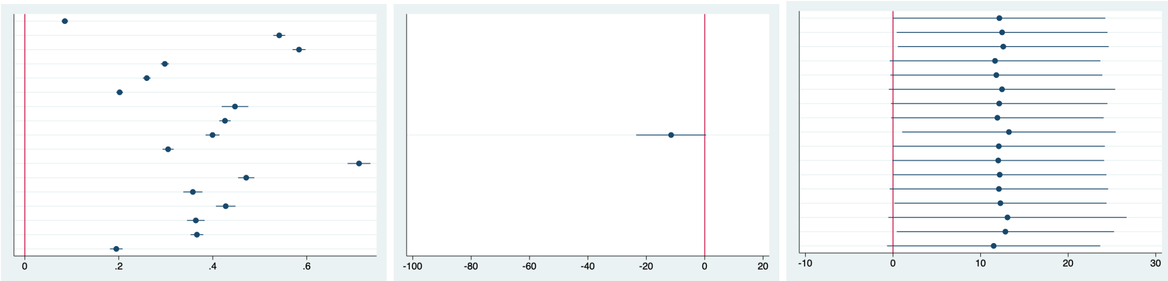
(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $sdta_{j,t-1}$. Exp. sign > 0 (f) $\widehat{sdta}_{j,t+1}$. Exp. sign < 0

Figure A8: Structural Model for Small Open Economy (SMOPEC) with time-varying wages. Sectors with at least 100 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

[111] For example, Figure A8e, A8b, A10b, A10c.

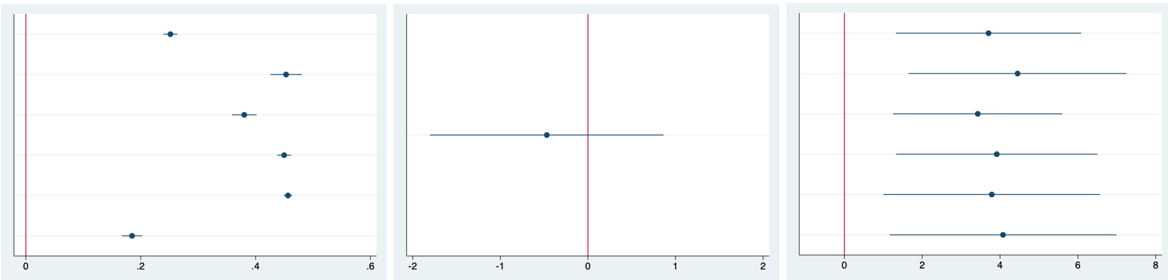


(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $\ln(minta_{j,t-1})$. Exp. sign < 0 (c) $\ln\widehat{(minta)}_{j,t+1}$. Exp. sign > 0

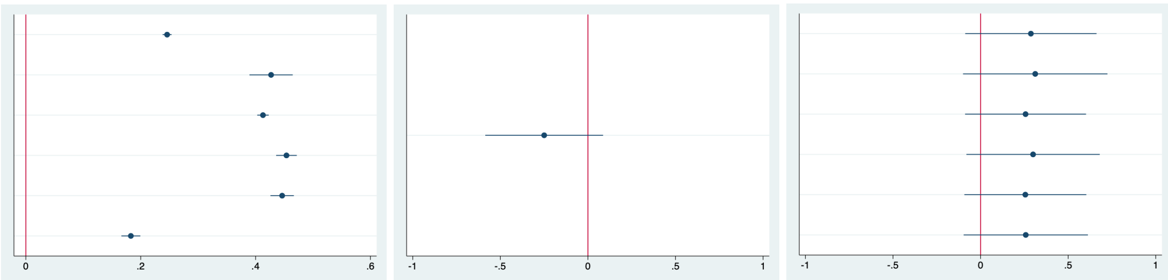


(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $\ln(1 + sdta_{j,t-1})$. Exp. sign > 0 (f) $\ln\widehat{(1 + sdta)}_{j,t+1}$. Exp. sign < 0

Figure A9: Structural Model for Small Open Economy (SMOPEC) with time-varying wages. Sectors with at least 100 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

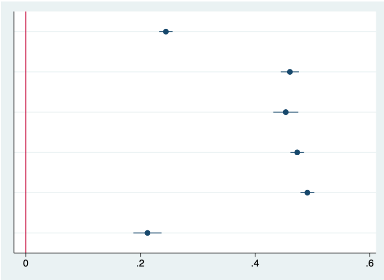


(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{j,t+1}$. Exp. sign > 0

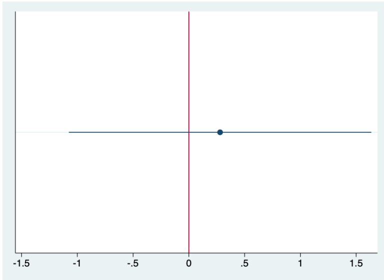


(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $sdta_{j,t-1}$. Exp. sign > 0 (f) $\widehat{sdta}_{j,t+1}$. Exp. sign < 0

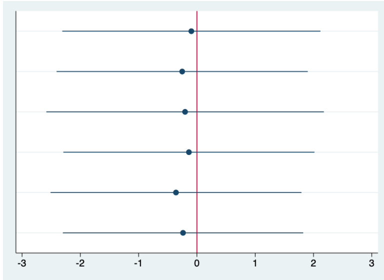
Figure A10: Structural Model for Small Open Economy (SMOPEC) with time-varying wages. Sectors with at least 200 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.



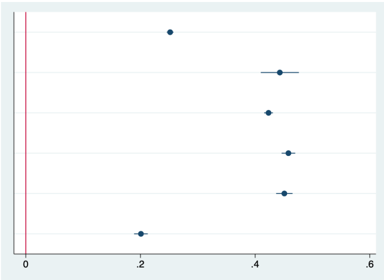
(a) $\ln(ta_{i,j,t})$. Exp. sign > 0



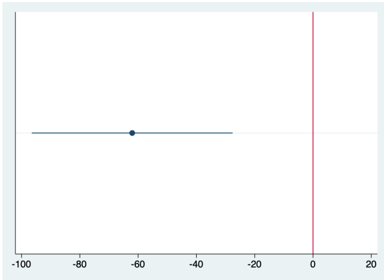
(b) $\ln(minta_{j,t-1})$. Exp. sign < 0



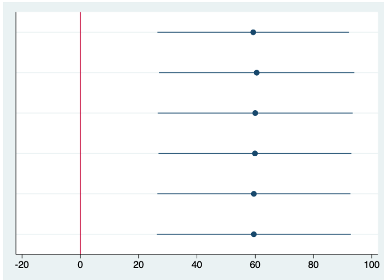
(c) $\ln\widehat{(minta)}_{j,t+1}$. Exp. sign > 0



(d) $\ln(ta_{i,j,t})$. Exp. sign > 0



(e) $\ln(1 + sdta_{j,t-1})$. Exp. sign > 0



(f) $\ln\widehat{(1 + sdta)}_{j,t+1}$. Exp. sign < 0

Figure A11: Structural Model for Small Open Economy (SMOPEC) with time-varying wages. Sectors with at least 200 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

D.3.7 Full Structural Model: Results

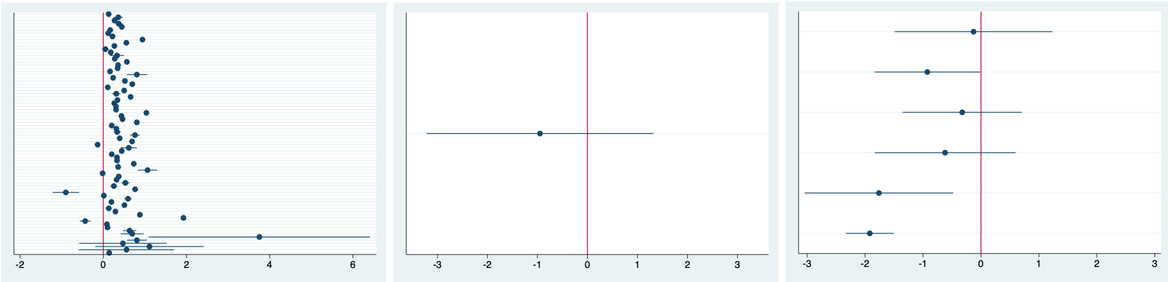
We relax the SMOPEC assumption and specify a full model defined in equation (A30):

$$\Pr\left(d^s_{i,j,t} = 1 \middle| d^s_{i,j,t-1} = 0, \mathcal{I}_{i,j,t}\right) = \Phi\left[\Sigma^{-1}\left(\Gamma_{1,j,t}\ln(ta_{i,j,t}) - \Gamma_j + \Gamma_2 is_{j,t} - \Gamma_{3,j}\widehat{is}_{j,t+1}\right)\right]. \tag{A46}$$

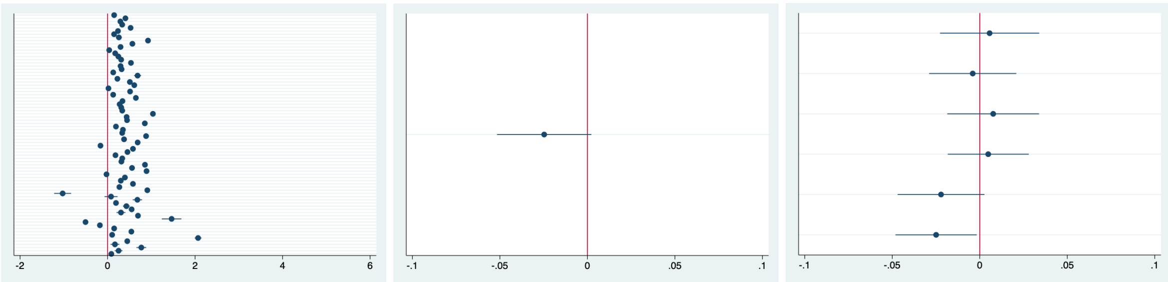
We estimate the model for sectors with at least 200 firms.[112] Figure A12 reports the results for the models with the direct and alternative information spillover measures in levels, whereas Figure A13 reports the respective results for the model with information spillovers in natural logarithm.

As in the previous cases, we observe a robust positive effect of the productivity of the firm on the probability of exploring the offshoring potential in period t, as defined by Proposition 1. Concerning the model's prediction in terms of information spillovers, the evidence is still mixed.

[112]The reason to estimate the model for only this reduced sample (and not for the larger sample with sectors with at least 100 firms) is to reduce the number of coefficients to report, in particular for the case of $\ln(ta_{i,j,t})$.

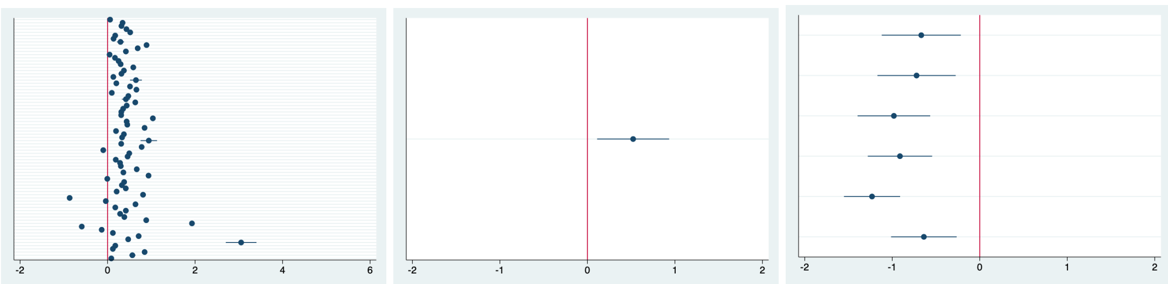


(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{j,t+1}$. Exp. sign > 0

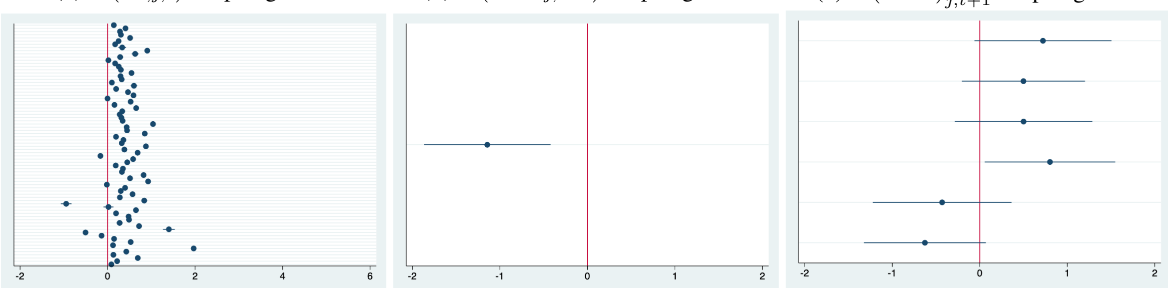


(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $sdta_{j,t-1}$. Exp. sign > 0 (f) $\widehat{sdta}_{j,t+1}$. Exp. sign < 0

Figure A12: Full structural model. Sectors with at least 200 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.



(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $\ln(minta_{j,t-1})$. Exp. sign < 0 (c) $\ln\widehat{(minta)}_{j,t+1}$. Exp. sign > 0



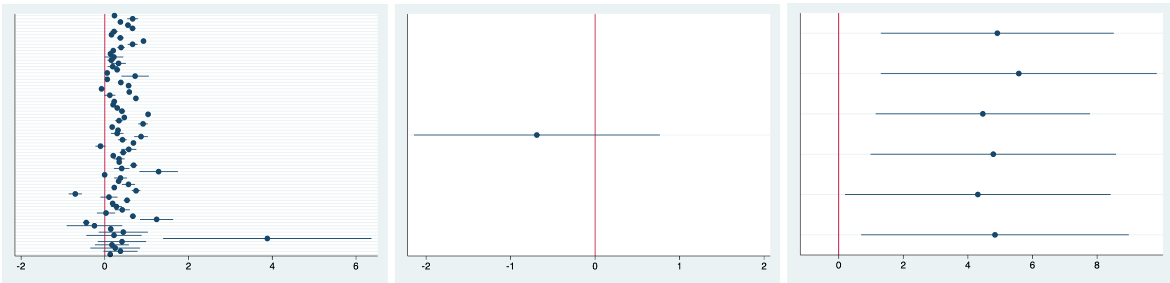
(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $\ln(1+sdta_{j,t-1})$. Exp. sign > 0 (f) $\ln\widehat{(1+sdta)}_{j,t+1}$. Exp. sign < 0

Figure A13: Full structural model. Sectors with at least 200 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

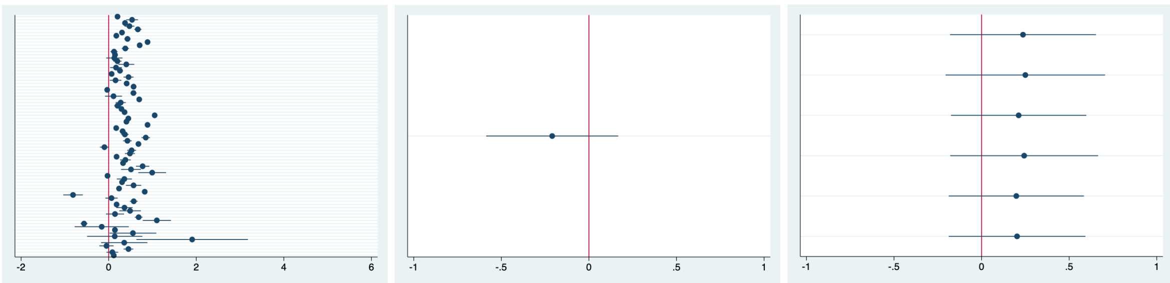
Model with time-varying wages: Taylor approximation. We extend the structural model to allow for time-varying wages (i.e., w_t^N, w_t^S) and time-varying total expenditure (i.e., E_t):[113]

$$\Pr\left(d^s_{i,j,t}=1\middle|d^s_{i,j,t-1}=0,\mathcal{I}_{i,j,t}\right)=\Phi\left[\Sigma^{-1}\left(\Gamma_{1,j,t}\ln(ta_{i,j,t})-\Gamma_j-\Gamma_t+\Gamma_2 is_{j,t}-\Gamma_{3,j}\widehat{is}_{j,t+1}\right)\right]. \qquad \text{(A47)}$$

As before, we estimate the model for sectors with at least 200 firms. We report in Figure A14 reports the results for the models with the direct and alternative information spillover measures in levels, whereas Figure A15 reports the respective results for the model with information spillovers in natural logarithm.



(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{j,t+1}$. Exp. sign > 0



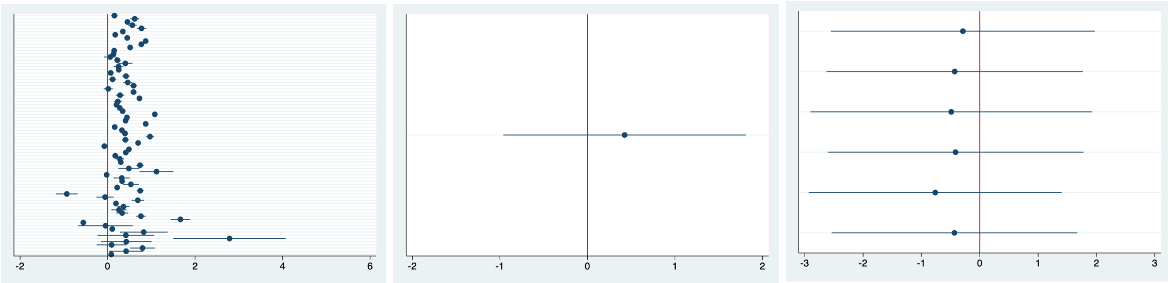
(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $sdta_{j,t-1}$. Exp. sign > 0 (f) $\widehat{sdta}_{j,t+1}$. Exp. sign < 0

Figure A14: Full structural model with time-varying wages. Sectors with at least 200 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

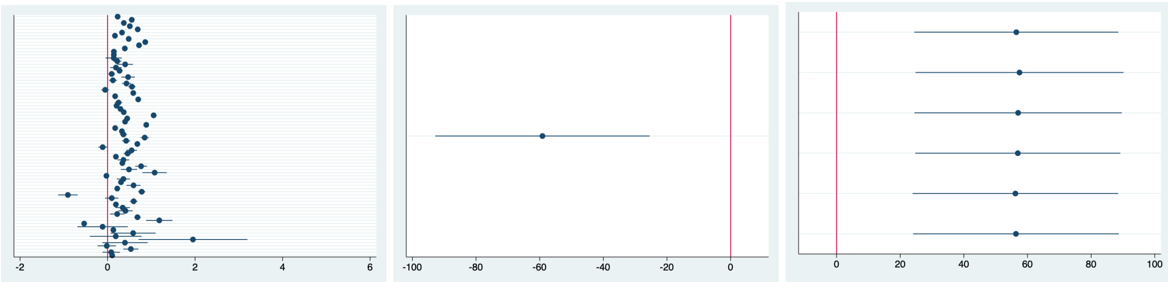
We observe again robust positive effects of the productivity of the firm on the probability of exploring the offshoring potential in period t, as defined by Proposition 1. That is, the most productive domestic-sourcing firms have a higher probability of exploring the offshoring potential in t.

In terms of information spillovers, the results are still mixed. Whereas some specifications—such as the model for the direct measure (*minta*) reported in Figure A14, show strong support for the role of the information spillovers—other empirical models report non-significant or theory-inconsistent results.

[113]The main underlying assumption is that neither changes in northern wages nor total expenditures can be predicted by the firm based on the information set. In other words, those changes are independent of the offshoring flows of each sector j.



(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $\ln(minta_{j,t-1})$. Exp. sign < 0 (c) $\ln\widehat{(minta)}_{j,t+1}$. Exp. sign > 0



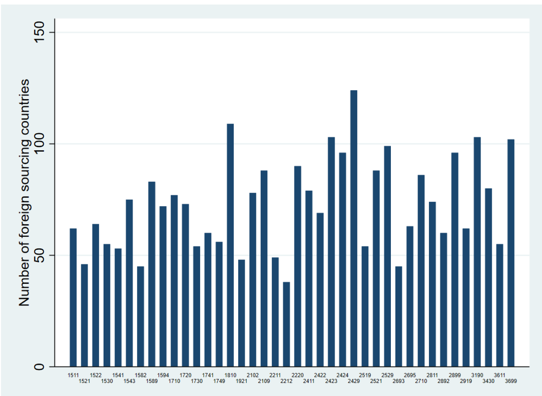
(d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $\ln(1 + sdta_{j,t-1})$. Exp. sign > 0 (f) $\ln\widehat{(1 + sdta)}_{j,t+1}$. Exp. sign < 0

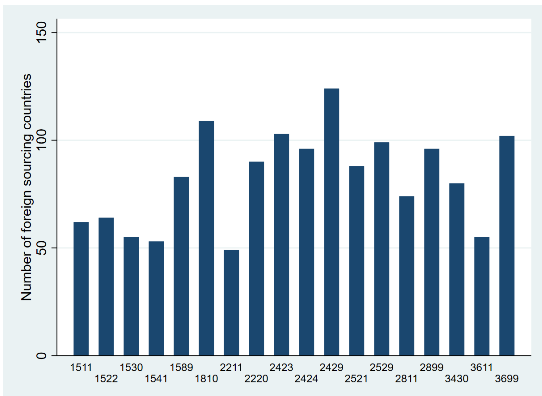
Figure A15: Full structural model with time-varying wages. Sectors with at least 200 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

D.4 Multi-country model

D.4.1 Number of sourcing countries by sector

Figure A16 shows the mean number of countries of origin by sector. In the sample that includes sector with at least 50 firms, the set S includes 173 potential sourcing foreign locations, whereas for the sample with at least 100 firms, it includes 167 potential foreign locations.





(a) with at least 50 firms (b) with at least 100 firms

Figure A16: Number of suppliers' countries by sector

D.4.2 Empirical reduced-form models: Basic model

In this basic empirical reduced-form model, we partially identify the effects of the learning mechanism in the offshoring exploration and location choices, in a similar manner as in the two-country model. Thus, we estimate the effects of the information spillovers (i.e., the endogenous learning mechanism). In the main specification, instead, we also estimate the effects of exogenous changes in the priors beliefs (i.e., an exogenous learning mechanism).

Non-offshoring (domestic-sourcing) firms: First-time exploration decision. We introduce first the probit models and then the respective transition (or survival) models.

Conditional probit model. The probability of exploration of the offshoring potential in country l for a firm in sector j in period t, conditional on being a domestic-sourcing firm up to period $t-1$, is given by:

$$\Pr\left(os_{i,l,j,t} = 1 \middle| cos_{i,j,t-1} = 0\right) = \Phi\Big(\beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(ris^{W}_{i,l,j,t}) + \gamma_l + \gamma_j + \gamma_t\Big), \tag{A48}$$

where i, l, j denote the firm, country and sector, respectively. The variables $cos_{i,j,t-1}$ and $os_{i,l,j,t}$ are already defined in section 4.4. The results are reported in columns (1)–(4) of Table A9.

Table A9: Non-offshoring firms

Model:		**Conditional Probit Model**				**Transition (survival) Model**			
Sample:		*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	Exp.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	sign	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.240***	0.236***	0.225***	0.222***	0.673***	0.679***	0.626***	0.632***
		(0.0199)	(0.0193)	(0.0224)	(0.0214)	(0.0543)	(0.0540)	(0.0544)	(0.0537)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-	-0.0557***		-0.0440***		-0.168***		-0.133***	
		(0.0141)		(0.0116)		(0.0383)		(0.0345)	
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$	+		0.0713***		0.0495***		0.202***		0.142**
			(0.0203)		(0.0188)		(0.0570)		(0.0572)
$\ln(t)$						-1.072***	-0.990***	-1.014***	-0.943***
						(0.102)	(0.107)	(0.102)	(0.109)
FEs		j, t, l	j, t, l	j, t, l	j, t, l	j, l	j, l	j, l	j, l

Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Transition analysis models include the year of entry of the firm into the sample as a control. *Exp. sign* column reports the expected sign from our theoretical model for the main coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

As predicted by the theory, the probability of exploring the offshoring potential in country l for domestic-sourcing firms is increasing in the productivity of the firm. Both specifications show theory-consistent results for the information spillovers: as more information is revealed from country l relative to all alternative non-explored locations, the probability that non-offshoring firms will explore the offshoring potential in country l in period t increases.[114]

Transition (survival) model. We define the hazard rate for a firm i in sector j to transition from domestic sourcing to offshoring status in country l in period t as:

$$\Lambda_{i,s,j,t}\left(t \middle| cos_{i,j,t-1} = 0\right) = 1 - \exp[-\exp(\boldsymbol{x}'_{i,l,j,t}\boldsymbol{\beta} + \delta_t)],$$

where δ_t denotes the general time-trend, $\boldsymbol{x}'_{i,l,j,t}\boldsymbol{\beta} = \beta_0 + \beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(ris^{W}_{i,l,j,t}) + \beta_3 entry_i + \gamma_l + \gamma_j$, and the relative information spillovers are defined, as before, by equations (11) and (12).

Columns (5)–(8) of Table A9 report the results. In all the specifications, the table shows that the most productive domestic-sourcing firms experience a faster transition to offshoring from l. These results are consistent with the theoretical predictions of Proposition 1.[115] Regarding the role of the relative information spillovers in the

[114]For the average marginal effects, see Table A11 in Appendix D.4.3. Appendix D.4.4 reports the respective results for models with alternative information spillovers measures. The results remain robust across all the specifications and alternative information-spillover measures.

[115]From the average marginal effects related to the model in column (5), we observe that an average increase of 10% in

location choices, the table shows theory-consistent results in all specifications. Domestic-sourcing firms tend to explore their offshoring potential first in those locations where more relative information has been revealed.[116]

Offshoring firms. We introduce first the probit models and then the respective transition (or survival) models.

Conditional probit model. The probability of exploring country l in period t for an offshoring firm i of sector j that up to and in $t-1$ has already explored the offshoring potential from other locations $l' \neq l$ is given by:

$$\Pr\left(os_{i,l,j,t} = 1 \middle| cos_{i,l,j,t-1} = 0, cos_{i,j,t-1} = 1\right) = \Phi\Big(\beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(ris^{W}_{i,l,j,t}) + \gamma_l + \gamma_j + \gamma_t\Big), \quad \text{(A49)}$$

where i, l, j denote the firm, country and sector, respectively. The variable $cos_{i,l,j,t-1}$ is already defined in section 4.4. The other variables are already defined above.

Table A10: Models with country fixed effects. Offshoring firms

Model:		**Conditional Probit Model**				**Transition (survival) Model**			
Sample:		*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	Exp. sign	(1) $os_{i,l,j,t}$	(2) $os_{i,l,j,t}$	(3) $os_{i,l,j,t}$	(4) $os_{i,l,j,t}$	(5) $\Lambda_{i,l,j,t}$	(6) $\Lambda_{i,l,j,t}$	(7) $\Lambda_{i,l,j,t}$	(8) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.256***	0.245***	0.253***	0.242***	0.583***	0.591***	0.577***	0.582***
		(0.00690)	(0.00611)	(0.00876)	(0.00784)	(0.0190)	(0.0164)	(0.0246)	(0.0211)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-	-0.0581***		-0.0610***		-0.133***		-0.143***	
		(0.00529)		(0.00687)		(0.0122)		(0.0159)	
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$	+		0.109***		0.120***		0.245***		0.283***
			(0.0128)		(0.0205)		(0.0269)		(0.0451)
$\ln(t)$						-0.588***	-0.488***	-0.575***	-0.481***
						(0.0401)	(0.0348)	(0.0533)	(0.0469)
FEs		j,t,l	j,t,l	j,t,l	j,t,l	j,l	j,l	j,l	j,l

Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Transition analysis models include the year of entry of the firm into the sample as a control. *Exp. sign* column reports the expected sign from our theoretical model for the main coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

As predicted by the theory, columns (1)–(4) of Table A10 show that the most productive offshoring firms are more likely to explore new locations. Regarding the effects of the relative information spillovers, the table shows theory-consistent results: information spillovers are potential drivers of the location choices for relocation processes of the offshore supply chains. The more information is revealed about a country relative to the alternative non-explored locations, the more likely it is that a relocation towards that country will occur.[117]

Transition (survival) model. The hazard rate for firm i of sector j to transition from offshoring from other locations $l' \neq l$ to offshore from l in period t is given by:

$$\Lambda_{i,l,j,t}\left(t \middle| cos_{i,l,j,t-1} = 0, cos_{i,j,t-1} = 1\right) = 1 - \exp[-\exp(\boldsymbol{x}'_{i,l,j,t}\boldsymbol{\beta} + \delta_t)],$$

productivity increases the hazard rate of domestic-sourcing firms to offshore from country l by 0.0202 percentage points. For report of the average marginal effects, see Table A11 in Appendix D.4.3. Appendix D.4.4 reports the respective results for models with alternative information-spillovers measures. The results remain robust across all specifications.

[116] From a quantitative perspective, an average reduction of 10% in the minimum productivity of offshoring firms in country l relative to the weighted mean of minimum productivities in alternative offshoring locations increases the hazard rate to transition to offshoring from country l in t by 0.00503 percentage points. Similarly, from Column (6), an average increase of 10% in the standard deviation of offshoring firms productivities in $t-1$ from country l relative to the weighted mean of alternative non-explored locations increases the hazard rate to offshore from l in period t by 0.00373 p.p.

[117] For report of the average marginal effects, see Table A12 in Appendix D.4.3. Appendix D.4.4 reports the respective results for models with alternative information spillovers measures. The results remain robust across all specifications.

where δ_t denotes the general time-trend, $\boldsymbol{x}'_{i,l,j,t}\boldsymbol{\beta} = \beta_0 + \beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(ris^{W}_{i,l,j,t}) + \beta_3 entry_i + \gamma_l + \gamma_j$, and the relative information spillovers are defined, as before, by equations (11) and (12).

In columns (5)–(8) of Table A10, we report the results.[118] The empirical evidence shows that the most productive offshoring firms explore new locations earlier, which reflects a leading role in the exploration of new countries. This is consistent with the theoretical predictions of the model. Regarding the role of the information spillovers, the results show that the offshoring firms explore first those countries where more information has been revealed relative to the non-explored locations. Therefore, as predicted by the theory, information spillovers play an important role in defining the sequence in which the offshoring firms decide to explore new countries for potential relocation decisions.[119]

D.4.3 Empirical reduced-form models: Marginal effects of basic model

Tables A11 and A12 report the average marginal effects of the basic model.

Table A11: Non-offshoring firms. Average marginal effects for models in Table A9.

Model:		**Conditional Probit Model**				**Transition (survival) Model**			
Sample:		*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	Exp.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	sign	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.00191***	0.00117***	0.00173***	0.00120***	0.00202***	0.00125***	0.00178***	0.00126***
		(0.000155)	(0.0000935)	(0.000167)	(0.000113)	(0.000156)	(0.0000952)	(0.000149)	(0.000103)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-	-0.000445***		-0.000337***		-0.000503***		-0.000380***	
		(0.000112)		(0.0000889)		(0.000115)		(0.0000983)	
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$	+		0.000355***		0.000268***		0.000373***		0.000282**
			(0.000102)		(0.000103)		(0.000106)		(0.000114)
FEs		j,t,l	j,t,l	j,t,l	j,t,l	j,l	j,l	j,l	j,l

Average marginal effects for the models reported in Table A9. Standard errors are clustered at the sector level and reported in parenthesis. Transition analysis models include the year of entry of the firm into the sample as a control. *Exp. sign* column reports the expected sign from our theoretical model for the main coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.4.4 Empirical reduced-form models: Alternative information-spillover measures

The two alternative relative spillover indices used are:

$$\ln(ris\_minta^{W^{max}}_{i,l,j,t}) \equiv \ln\left(\frac{minta_{l,j,t-1}}{\min\{minta_{i,s,j,t-1} | s \in S_{i,j,t-1}\}}\right), \tag{A50}$$

$$\ln(ris\_minta^{W^{mean}}_{i,l,j,t}) \equiv \ln\left(\frac{minta_{l,j,t-1}}{S^{-1}_{i,j,t-1}\sum_{s=1}^{S_{i,j,t-1}} minta_{s,j,t-1}}\right). \tag{A51}$$

The first measure given in equation (A50) compares the information revealed in country l relative to the country s with the highest information revealed. The second measure given in equation (A51) compares it relative to the

[118] For report of the average marginal effects and average effects at the mean, see Table A12 in Appendix D.4.3. Appendix D.4.4 reports the respective results for models with alternative information spillovers measures. The results remain robust across all specifications.

[119] The average marginal effects related to column (5) show that an average increase of 10% in productivity increases the hazard rate to offshore from country l in period t by 0.0911 percentage points. Regarding the information spillovers, a reduction of 10% in the minimum productivity of firms offshoring from country l in period $t-1$ relative to the weighted mean minimum productivity of firms offshoring from alternative non-explored locations increases the hazard rate to offshore from country l in period t by 0.0208 percentage points. In terms of the alternative spillover measure in column (6), an average increase of 10% in the standard deviation of the productivities of firms offshoring in country l in period $t-1$ relative to the weighted mean standard deviation of productivities in all alternative non-explored offshoring locations increases the hazard rate to offshore in country l in period t by 0.0116 p.p.

Table A12: Offshoring firms. Average marginal effects for models in Table A10.

Model:		**Conditional Probit Model**				**Transition (survival) Model**			
Sample:		*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	Exp. sign	(1) $os_{i,l,j,t}$	(2) $os_{i,l,j,t}$	(3) $os_{i,l,j,t}$	(4) $os_{i,l,j,t}$	(5) $\Lambda_{i,l,j,t}$	(6) $\Lambda_{i,l,j,t}$	(7) $\Lambda_{i,l,j,t}$	(8) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.00902***	0.00274***	0.00830***	0.00277***	0.00911***	0.00280***	0.00832***	0.00281***
		(0.000232)	(0.0000646)	(0.000275)	(0.0000845)	(0.000282)	(0.0000738)	(0.000337)	(0.0000968)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-	-0.00204***		-0.00200***		-0.00208***		-0.00205***	
		(0.000187)		(0.000227)		(0.000191)		(0.000229)	
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$	+		0.00121***		0.00137***		0.00116***		0.00137***
			(0.000143)		(0.000235)		(0.000127)		(0.000218)
FEs		j,t,l	j,t,l	j,t,l	j,t,l	j,l	j,l	j,l	j,l

Average marginal effects for the models reported in Table A10. Standard errors are clustered at the sector level and reported in parenthesis. Transition analysis models include the year of entry of the firm into the sample as a control. *Exp. sign* column reports the expected sign from our theoretical model for the main coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

mean information revealed in all non-explored locations. For the alternative theory-consistent measure, we have:

$$\ln(ris\_sdta^{W^{max}}_{i,l,j,t}) \equiv \ln\left(1 + \frac{sdta_{l,j,t-1}}{\max\left\{sdta_{s,j,t-1} | s \in S_{i,j,t-1}\right\}}\right), \quad \text{(A52)}$$

$$\ln(ris\_sdta^{W^{mean}}_{i,l,j,t}) \equiv \ln\left(1 + \frac{sdta_{l,j,t-1}}{S^{-1}_{i,j,t}\sum_{s=1}^{S_{i,j,t-1}} sdta_{s,j,t-1}}\right). \quad \text{(A53)}$$

Tables A13 and A14 show the results for domestic-sourcing firms. Tables A15 and A16 show the equivalent results for offshoring firms. Our results are robust to the alternative information spillover measures, both for domestic-sourcing firms and for offshoring firms.

Table A13: Alternative information spillover measures: W^{max}. Non-offshoring firms

Model:		**Conditional Probit Model**				**Transition (survival) Model**			
Sample:		*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	Exp. sign	(1) $os_{i,l,j,t}$	(2) $os_{i,l,j,t}$	(3) $os_{i,l,j,t}$	(4) $os_{i,l,j,t}$	(5) $\Lambda_{i,l,j,t}$	(6) $\Lambda_{i,l,j,t}$	(7) $\Lambda_{i,l,j,t}$	(8) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.239***	0.236***	0.225***	0.222***	0.674***	0.680***	0.628***	0.632***
		(0.0198)	(0.0193)	(0.0223)	(0.0214)	(0.0536)	(0.0542)	(0.0542)	(0.0537)
$\ln(ris\_minta^{W^{max}}_{i,l,j,t})$	-	-0.0467***		-0.0430***		-0.120***		-0.105***	
		(0.0143)		(0.0142)		(0.0390)		(0.0363)	
$\ln(ris\_sdta^{W^{max}}_{i,l,j,t})$	+		0.225***		0.106		0.613**		0.255
			(0.0830)		(0.0819)		(0.247)		(0.257)
$\ln(t)$						-1.054***	-0.992***	-1.003***	-0.951***
						(0.0980)	(0.105)	(0.0990)	(0.109)
FEs		j,t,l	j,t,l	j,t,l	j,t,l	j,l	j,l	j,l	j,l

Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Columns (5)–(8) also include the year of entry of the firm into the sample as a control. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A14: Alternative information spillover measures: W^{mean}. Non-offshoring firms

Model:		**Conditional Probit Model**				**Transition (survival) Model**			
Sample:		*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	Exp. sign	(1) $os_{i,l,j,t}$	(2) $os_{i,l,j,t}$	(3) $os_{i,l,j,t}$	(4) $os_{i,l,j,t}$	(5) $\Lambda_{i,l,j,t}$	(6) $\Lambda_{i,l,j,t}$	(7) $\Lambda_{i,l,j,t}$	(8) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.240***	0.236***	0.225***	0.222***	0.673***	0.679***	0.627***	0.632***
		(0.0200)	(0.0193)	(0.0224)	(0.0214)	(0.0544)	(0.0542)	(0.0545)	(0.0538)
$\ln(ris\_minta^{W^{mean}}_{i,l,j,t})$	-	-0.0573***		-0.0461***		-0.171***		-0.137***	
		(0.0143)		(0.0119)		(0.0390)		(0.0350)	
$\ln(ris\_sdta^{W^{mean}}_{i,l,j,t})$	+		0.0712***		0.0472***		0.204***		0.135**
			(0.0199)		(0.0180)		(0.0578)		(0.0555)
$\ln(t)$						-1.072***	-0.977***	-1.015***	-0.938***
						(0.101)	(0.106)	(0.101)	(0.109)
FEs		j,t,l	j,t,l	j,t,l	j,t,l	j,l	j,l	j,l	j,l

Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Columns (5)–(8) also include the year of entry of the firm into the sample as a control. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A15: Alternative information spillover measures: W^{max}. Offshoring firms

Model:		**Conditional Probit Model**				**Transition (survival) Model**			
Sample:		*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	Exp. sign	(1) $os_{i,l,j,t}$	(2) $os_{i,l,j,t}$	(3) $os_{i,l,j,t}$	(4) $os_{i,l,j,t}$	(5) $\Lambda_{i,l,j,t}$	(6) $\Lambda_{i,l,j,t}$	(7) $\Lambda_{i,l,j,t}$	(8) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.252***	0.251***	0.249***	0.248***	0.575***	0.604***	0.571***	0.595***
		(0.00687)	(0.00646)	(0.00874)	(0.00848)	(0.0185)	(0.0179)	(0.0239)	(0.0236)
$\ln(ris\_minta^{W^{max}}_{i,l,j,t})$	-	-0.0624***		-0.0652***		-0.138***		-0.149***	
		(0.00510)		(0.00639)		(0.0122)		(0.0138)	
$\ln(ris\_sdta^{W^{max}}_{i,l,j,t})$	+		0.334***		0.301***		0.714***		0.649***
			(0.0508)		(0.0728)		(0.110)		(0.159)
$\ln(t)$						-0.601***	-0.477***	-0.602***	-0.475***
						(0.0352)	(0.0338)	(0.0465)	(0.0459)
FEs		j,t,l	j,t,l	j,t,l	j,t,l	j,l	j,l	j,l	j,l

Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Columns (5)–(8) also include the year of entry of the firm into the sample as a control. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A16: Alternative information spillover measures: W^{mean}. Offshoring firms

Model:		**Conditional Probit Model**				**Transition (survival) Model**			
Sample:		*w/at least 50 firms*		*w/at least 100 firms*		*w/at least 50 firms*		*w/at least 100 firms*	
	Exp. sign	(1) $os_{i,l,j,t}$	(2) $os_{i,l,j,t}$	(3) $os_{i,l,j,t}$	(4) $os_{i,l,j,t}$	(5) $\Lambda_{i,l,j,t}$	(6) $\Lambda_{i,l,j,t}$	(7) $\Lambda_{i,l,j,t}$	(8) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.256***	0.245***	0.252***	0.242***	0.583***	0.589***	0.577***	0.579***
		(0.00690)	(0.00608)	(0.00874)	(0.00779)	(0.0190)	(0.0164)	(0.0245)	(0.0211)
$\ln(ris\_minta^{W^{mean}}_{i,l,j,t})$	-	-0.0586***		-0.0616***		-0.133***		-0.142***	
		(0.00529)		(0.00684)		(0.0120)		(0.0156)	
$\ln(ris\_sdta^{W^{mean}}_{i,l,j,t})$	+		0.115***		0.124***		0.262***		0.295***
			(0.0135)		(0.0215)		(0.0295)		(0.0490)
$\ln(t)$						-0.586***	-0.476***	-0.574***	-0.467***
						(0.0397)	(0.0329)	(0.0528)	(0.0438)
FEs		j,t,l	j,t,l	j,t,l	j,t,l	j,l	j,l	j,l	j,l

Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Columns (5)–(8) also include year of entry of firm into the sample. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.4.5 Reduced-form models: Marginal effects

We report here the average marginal effects for the models in section 4.4. We report first the marginal effects for the conditional probit models, and then for transition (or survival) models.

Table A17: Conditional Probit Model. Non-offshoring firms. Average marginal effects

Institutional Index:	GE	RQ	RL	GE	RQ	RL
	(1)	(2)	(3)	(4)	(5)	(6)
	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.00173***	0.00173***	0.00173***	0.00120***	0.00120***	0.00120***
	(0.000167)	(0.000167)	(0.000167)	(0.000113)	(0.000113)	(0.000113)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-0.000334***	-0.000337***	-0.000332***			
	(0.0000882)	(0.0000888)	(0.0000885)			
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$				0.000268***	0.000266***	0.000268***
				(0.000103)	(0.000102)	(0.000102)
$\ln(rel\_inst^{W^{dist}}_{i,l,j,t})$	-0.00133	0.000593	-0.00193	-0.000108	0.00163**	0.000553
	(0.000865)	(0.00111)	(0.00180)	(0.000859)	(0.000766)	(0.00147)
FEs	j,t,l	j,t,l	j,t,l	j,t,l	j,t,l	j,t,l

Sample: Sectors with at least 100 firms. Reported effects are average marginal effects. Standard errors are clustered at the sector level and reported in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A18: Conditional Probit Model. Offshoring firms. Average Marginal Effects

Institutional Index:	GE	RQ	RL	GE	RQ	RL
	(1)	(2)	(3)	(4)	(5)	(6)
	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.00817***	0.00823***	0.00818***	0.00273***	0.00275***	0.00273***
	(0.000278)	(0.000279)	(0.000284)	(0.0000831)	(0.0000841)	(0.0000842)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-0.00200***	-0.00201***	-0.00200***			
	(0.000235)	(0.000231)	(0.000231)			
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$				0.00136***	0.00136***	0.00136***
				(0.000236)	(0.000234)	(0.000234)
$\ln(rel\_inst^{W^{dist}}_{i,l,j,t})$	0.0117***	0.00853***	0.0110***	0.00593***	0.00315***	0.00666***
	(0.00235)	(0.00177)	(0.00288)	(0.000729)	(0.000487)	(0.000915)
FEs	j,t,l	j,t,l	j,t,l	j,t,l	j,t,l	j,t,l

Sample: Sectors with at least 100 firms. Reported effects are average marginal effects. Standard errors are clustered at the sector level and reported in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A19: Transition (Survival) Model: Non-offshoring firms

Institutional Index:	GE	RQ	RL	GE	RQ	RL
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.00179***	0.00178***	0.00179***	0.00126***	0.00126***	0.00126***
	(0.000149)	(0.000149)	(0.000148)	(0.000103)	(0.000103)	(0.000103)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-0.000380***	-0.000380***	-0.000380***			
	(0.0000980)	(0.0000983)	(0.0000980)			
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$				0.000281**	0.000278**	0.000281**
				(0.000114)	(0.000113)	(0.000114)
$\ln(rel\_inst^{W^{dist}}_{i,l,j,t})$	-0.000896	0.000222	-0.00172	0.000578	0.00113	0.00116
	(0.00107)	(0.00100)	(0.00198)	(0.000705)	(0.000818)	(0.00170)
FEs	j,l	j,l	j,l	j,l	j,l	j,l

Sample: Sectors with at least 100 firms. Reported effects are average marginal effects. Standard errors are clustered at the sector level and reported in parenthesis. Controls: logarithmic time trend ($\ln(t)$) and year of entry of firm in the sample. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A20: Transition (Survival) Model: Offshoring firms

Institutional Index:	**GE**	**RQ**	**RL**	**GE**	**RQ**	**RL**
	(1)	(2)	(3)	(4)	(5)	(6)
	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.00820***	0.00826***	0.00821***	0.00278***	0.00279***	0.00277***
	(0.000339)	(0.000342)	(0.000350)	(0.0000950)	(0.0000970)	(0.0000974)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-0.00206***	-0.00207***	-0.00205***			
	(0.000240)	(0.000233)	(0.000234)			
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$				0.00135***	0.00136***	0.00135***
				(0.000217)	(0.000216)	(0.000217)
$\ln(rel\_inst^{W^{dist}}_{i,l,j,t})$	0.0141***	0.0101***	0.0117***	0.00665***	0.00382***	0.00755***
	(0.00206)	(0.00186)	(0.00280)	(0.000662)	(0.000553)	0.00755***
FEs	j,l	j,l	j,l	j,l	j,l	j,l

Sample: Sectors with at least 100 firms. Reported effects are average marginal effects. Standard errors are clustered at the sector level and reported in parenthesis. Controls: logarithmic time trend ($\ln(t)$) and year of entry of firm in the sample. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.4.6 Reduced-form models: Robustness checks

Table A21 reports the result of the empirical model in equation (14), where the country fixed effects are replaced by country-level control variables. Results are robust concerning the specification of the models with country fixed effects. The main difference consists of apparent theory-inconsistent evidence for the effects of institutional indices on offshoring decisions of domestic-sourcing firms. However, the results become theory-consistent after controlling for country fixed effects.

Table A21: Conditional Probit Model. Non-offshoring firms

Institutional Index:	**GE**	**RQ**	**RL**	**GE**	**RQ**	**RL**
	(1)	(2)	(3)	(4)	(5)	(6)
	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.221***	0.221***	0.221***	0.214***	0.214***	0.214***
	(0.0219)	(0.0219)	(0.0218)	(0.0205)	(0.0204)	(0.0204)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-0.0909***	-0.0917***	-0.0901***			
	(0.0121)	(0.0123)	(0.0118)			
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$				0.161***	0.160***	0.160***
				(0.0221)	(0.0221)	(0.0224)
$\ln(rel\_inst^{W^{dist}}_{i,l,j,t})$	-0.203***	-0.140**	-0.230***	-0.124**	-0.0488	-0.169***
	(0.0557)	(0.0555)	(0.0536)	(0.0563)	(0.0499)	(0.0515)
FEs	j,t	j,t	j,t	j,t	j,t	j,t

Sample: Sectors with at least 100 firms. Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Other controls: market thickness, income per capita (mean), common language, and distance. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A22 reports the result of the empirical model in equation (16) and, as before, the country fixed effects are replaced by country-level control variables. For offshoring firms, the results remain robust and consistent with the specifications with country fixed effects.

Table A22: Conditional Probit Model. Offshoring firms

Institutional Index:	GE	RQ	RL	GE	RQ	RL
	(1)	(2)	(3)	(4)	(5)	(6)
	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.238***	0.239***	0.239***	0.220***	0.220***	0.220***
	(0.00844)	(0.00839)	(0.00842)	(0.00698)	(0.00697)	(0.00700)
$\ln(ris\_minta^{W^{dist}}_{i,l,j,t})$	-0.102***	-0.102***	-0.103***			
	(0.00821)	(0.00817)	(0.00802)			
$\ln(ris\_sdta^{W^{dist}}_{i,l,j,t})$				0.211***	0.210***	0.219***
				(0.0220)	(0.0211)	(0.0220)
$\ln(rel\_inst^{W^{dist}}_{i,l,j,t})$	0.120***	0.142***	0.0337	0.200***	0.219***	0.0869***
	(0.0367)	(0.0350)	(0.0243)	(0.0373)	(0.0328)	(0.0303)
FEs	j, t	j, t	j, t	j, t	j, t	j, t

Sample: Sectors with at least 100 firms. Reported effects are estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. Other controls: market thickness, income per capita (mean), common language, and distance. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.5 Multi-country model: Structural model

We develop the structural model of the exploration decisions for domestic sourcing and offshoring firms as characterised by the theoretical multi-country model described in section 4.

D.5.1 Identification of the bilateral trade-off function: General identification

Offshoring revenue premium. The revenue of firm i with productivity θ in sector j potentially offshoring in country l in terms of the revenues of that firm currently sourcing from location $l' \neq l$ is given by:

$$r^l_{i,j,t} \equiv r^l_{j,t}(\theta) = \left(\frac{w^{l'}}{w^l}\right)^{(1-\eta_j)(\sigma_j-1)} r^{l'}_{j,t}(\theta), \tag{A54}$$

where $l' = N$ means that firm i sources domestically, and the respective revenue of a domestic-sourcing firm i with productivity θ in period t is given by:

$$r^N_{i,j,t} \equiv r^N_{j,t}(\theta) = \left[\frac{\sigma_j - 1}{\sigma_j}\right]^{\sigma_j-1} \theta^{\sigma_j-1}(\gamma_j E)^{\sigma_j} Q^{1-\sigma_j}_{j,t} (w^N)^{1-\sigma_j}. \tag{A55}$$

Domestic-sourcing firms. For a domestic-sourcing firm i in sector j and period t, we have:

$$r^l_{i,j,t} \equiv r^l_{j,t}(\theta) = \left(\frac{w^N}{w^l}\right)^{(1-\eta_j)(\sigma_j-1)} r^N_{j,t}(\theta). \tag{A56}$$

From this expression, the offshoring revenue premium of country l relative to domestic sourcing is $r^{l/N,\text{prem}}_{i,j,t} \equiv r^{l/N,\text{prem}}_{j,t}(\theta) = \left[\left(\frac{w^N}{w^l}\right)^{(1-\eta_j)(\sigma_j-1)} - 1\right] r^N_{j,t}(\theta)$. Replacing with $r^N_{j,t}(\theta)$ from (A55), we have that $r^{l/N,\text{prem}}_{i,j,t} \equiv r^{l/N,\text{prem}}_{j,t}(\theta) = z^{l/N}_{j,t}\theta^{\sigma_j-1}$, with $z^{l/N}_{j,t} \equiv \left[\left(\frac{w^N}{w^l}\right)^{(1-\eta_j)(\sigma_j-1)} - 1\right] \left[\frac{\sigma_j-1}{\sigma_j}\right]^{\sigma_j-1} (\gamma_j E)^{\sigma_j} Q^{1-\sigma_j}_{j,t} \left(w^N\right)^{1-\sigma_j}$.

Offshoring firms. For a firm currently offshoring from country l', the offshoring revenue premium from relocating offshoring from l' to l is $r^{l/l',\text{prem}}_{i,j,t} \equiv r^{l/l',\text{prem}}_{j,t}(\theta) = \left[\left(\frac{w^{l'}}{w^l}\right)^{(1-\eta_j)(\sigma_j-1)} - 1\right] r^{l'}_{j,t}(\theta)$. Using equation (A56) for $r^{l'}_{j,t}(\theta)$ and replacing $r^N_{j,t}(\theta)$ with (A55), we have that $r^{l/l',\text{prem}}_{i,j,t} \equiv r^{l/l',\text{prem}}_{j,t}(\theta) = z^{l/l'}_{j,t}\theta^{\sigma_j-1}$, with $z^{l/l'}_{j,t} \equiv \left[\left(\frac{w^{l'}}{w^l}\right)^{(1-\eta_j)(\sigma_j-1)} - 1\right] \left(\frac{w^N}{w^{l'}}\right)^{(1-\eta_j)(\sigma_j-1)} \left[\frac{\sigma_j-1}{\sigma_j}\right]^{\sigma_j-1} (\gamma_j E)^{\sigma_j} Q^{1-\sigma_j}_{j,t} \left(w^N\right)^{1-\sigma_j}$.

Information set and expected offshoring profits. Recall that $\mathcal{I}_{i,j,t}$ refers to the information set that firm i in sector j possesses at t. For domestic-sourcing firms, it is defined by the information spillover and past firm-specific information. For firms that have already explored their offshoring potential in some countries, the information set additionally includes the institutional fundamentals (i.e., true fixed costs) of all countries already explored in the past by this firm. The expected offshoring profit premium in country l in t for firm i in sector j that is currently sourcing from l' is given by:

$$\mathbb{E}\left[\pi_{i,j,t}^{l/l',\text{prem}}|\mathcal{I}_{i,j,t}\right] = \sigma_j^{-1}\mathbb{E}\left[z_{j,t}^{l/l'}\theta^{\sigma_j-1}|\mathcal{I}_{i,j,t}\right] - w^N\left[\mathbb{E}(f_j^l|\mathcal{I}_{i,j,t}) - f_j^{l'}\right], \tag{A57}$$

with $\mathbb{E}\left[r_{i,j,t}^{l/l',\text{prem}}|\mathcal{I}_{i,j,t}\right] = \mathbb{E}\left[z_{j,t}^{l/l'}\theta^{\sigma_j-1}|\mathcal{I}_{i,j,t}\right]$, and $l' = N$ if the firm sources domestically.

General identification of bilateral trade-off function. We define $d_{i,j,t}^l = \{0,1\}$ as the offshoring status from l of firm i in sector j in period t. The probability of a firm exploring the offshoring potential in t in country l, conditional on the information set in t, can be represented as $\Pr\left[d_{i,j,t}^l = 1\middle|d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t}\right]$, with $d_{i,j,t}^l\Big|_{d_{i,j,t-1}^l=0,\mathcal{I}_{i,j,t}} = \mathbb{1}\left\{\mathcal{D}_{i,j,t}^{l/l'}(\theta;\mathcal{I}_{i,j,t}) \geq 0\right\}$. Replacing with the expression for the trade-off function and $\mathbb{E}\left[\pi_{i,j,t}^{l/l',prem}\middle|\mathcal{I}_{i,j,t}\right]$ with the expression given in equation (A57), we have:

$$\begin{aligned} d_{i,j,t}^l\Big|_{d_{i,j,t-1}^l=0,\mathcal{I}_{i,j,t}} = \mathbb{1}\Big\{ &\max\left\{0; \sigma_j^{-1}\mathbb{E}\left[z_{j,t}^{l/l'}\theta^{\sigma_j-1}|\mathcal{I}_{i,j,t}\right] - w^N\left[\mathbb{E}(f_j^l|\mathcal{I}_{i,j,t}) - f_j^{l'}\right]\right\} \\ &- w^N s_j^r\left[1 - \lambda_j Y(f_{j,t+1}^l|\mathcal{I}_{i,j,t})\right] \geq 0\Big\}. \end{aligned} \tag{A58}$$

D.5.2 Bilateral trade-off function: Identification of expected fixed-cost differential and information spillovers

From our theory, the expected fixed-cost differential relative to country l for a firm i in period t currently sourcing from country $l' \neq l$ is given by:

$$w^N\left[\mathbb{E}\left(f_j^l|\mathcal{I}_{i,j,t}\right) - f_j^{l'}\right] = w^N\mathbb{E}\left(f_j^l|\mathcal{I}_{i,j,t}\right) - w^N f_j^{l'}. \tag{A59}$$

Domestic-sourcing firms. We identify the terms on the right-hand side of equation (A59). By including country fixed effects (i.e., γ_l) and sector fixed effects (i.e., γ_j), we absorb all time-invariant country l-specific and sector-specific variables, leading to $w^N\mathbb{E}\left(f_j^l|\mathcal{I}_{i,j,t}\right) = \gamma_l - \gamma_2 \textit{inst}_{l,j,t}^{\textit{posterior}} + \gamma_j$, where $\textit{inst}_{l,j,t}^{\textit{posterior}}$ identifies the changes in the expected fixed costs of offshoring in country l for firms in sector j due to changes in beliefs about institutional conditions in country l. As we discuss below, this is a function of the prior beliefs and the learning mechanism characterised by the model (i.e., information spillovers).[120] In addition, we introduce $\textit{FTA}_{l,t}$, which is a dummy that takes the value one if there is a FTA between country l and Colombia in year t, to capture unobserved changes in the fundamentals at the bilateral level (e.g., removal of non-tariff barriers) due to the implementation of the agreement.[121] The second term in equation (A59) is given by $w^N f_j^N = \gamma_j$. Therefore, the expected fixed-cost differential in period t is given by:

$$w^N\left[\mathbb{E}\left(f_j^l|\mathcal{I}_{i,j,t}\right) - f_j^{l'}\right] = \gamma_l - \gamma_1 \textit{FTA}_{l,t} - \gamma_2 \textit{inst}_{l,j,t}^{\textit{posterior}} + \gamma_j + v_{i,l,j,t}.$$

Including year fixed effects, we capture movements in domestic wages and domestic-sourcing fixed costs.

[120]Instead, in the model without country fixed effect, we identify this terms as $w^N\mathbb{E}\left(f_j^l|\mathcal{I}_{i,j,t}\right) = \gamma_{11}\ln(\textit{dist}_l) - \gamma_{12}\textit{lang}_l - \gamma_{13}\ln(\overline{\textit{mkt\_thick}_l}) + \gamma_{14}\ln(\overline{\textit{inc\_pc}_l}) - \gamma_1 \textit{inst}_{l,j,t}^{\textit{posterior}} + \gamma_j$. We define the expected fixed cost of offshoring from country l to be increasing in distance ($\textit{dist}_l$), income per capita ($\textit{inc\_pc}_l$ as proxy for country l's wages) and decreasing in common language ($\textit{lang}_l$) and market thickness ($\textit{mkt\_thick}_l$).

[121]FTA that are active during the entire sample period are not included, as they are absorbed by the introduction of country fixed effects.

Offshoring firms. In the case of offshoring firms, the first term on the right-hand side of equation (A59) is defined as before, but the identification of the second term differs. It is given by $w^N f_j^{l'} = \textbf{source\_st}'_{i,l',j,t-1}\gamma_3 + \gamma_j$, where l' represents the sourcing structure of firm i in period $t-1$. We approximate it by $\textbf{source\_st}_{i,l',j,t-1}$, which is a vector of control variables that corresponds to a vector of country-level variables relative to the sourcing location l'.[122] Hence, the values in the vector $\textbf{source\_st}_{i,l',j,t-1}$ correspond to the mean value of the respective variable across the foreign sourcing locations of firm i in $t-1$. In the main specifications we do not control for it, and thus it is absorbed in the error term. In Appendix D.6.4 we report the results adding these controls and compare the results with the main specification. The robustness of the results shows that they are not affected by the omission in controlling for $\textbf{source\_st}'_{i,l',j,t-1}$. In the following paragraphs we continue deriving the model for the case where we control for $\textbf{source\_st}'_{i,l',j,t-1}$ to obtain a complete identification of the model.

Hence, using equation (A59), we identify the expected fixed-cost differential in period t for a firm offshoring from l', where l' denotes the sourcing structure of the firm in the period $t-1$, as follows:

$$w^N \left[\mathbb{E}\left(f_j^l|\mathcal{I}_{i,j,t}\right) - f_j^{l'}\right] = \gamma_l - \gamma_1 FTA_{l,t} - \gamma_2 inst_{l,j,t}^{posterior} + \textbf{source\_st}'_{i,l',j,t-1}\gamma_3 + \gamma_j + v_{i,l,j,t}.$$

In the models without country fixed effect, we include $\textbf{controls}'_l$, which indicates a vector of the time-invariant country l-specific variables mentioned above.

Identification of posterior beliefs. From our theory, we know that the posterior beliefs about institutional conditions in country l in period t for firms in sector j are a positive function of the prior beliefs and the information spillovers. Therefore, we use both measures as a proxy for the posterior beliefs; that is:

$$inst_{l,j,t}^{posterior} = \rho_1 is_{l,j,t} + \rho_2 inst_{l,t}, \tag{22 revisited}$$

where the information spillovers, $is_{l,j,t}$, are modelled by: i) $minta_{l,j,t-1}$, and ii) $sdta_{l,j,t-1}$. We use the institutional index of country l in year t—e.g., *GE, RQ* or *RL*—as a proxy for the prior beliefs. The underlying assumption is that exogenous priors—identified by the institutional indices—are homogeneous across sectors; that is, the variable $inst_{l,t}$ does not vary in the j dimension.

Empirical identification of expected fixed-cost differential. Using equation (22), the expected fixed-cost differential for offshoring firms becomes:

$$w^N \left[\mathbb{E}\left(f_j^l|\mathcal{I}_{i,j,t}\right) - f_j^{l'}\right] = \gamma_l - \gamma_1 FTA_{l,t} - \gamma_{21} is_{l,j,t} - \gamma_{22} inst_{l,t} + \textbf{source\_st}'_{i,l',j,t-1}\gamma_3 + \gamma_j + v_{i,l,j,t}.$$

For domestic-sourcing firms, it is given by:

$$w^N \left[\mathbb{E}\left(f_j^l|\mathcal{I}_{i,j,t}\right) - f_j^{l'}\right] = \gamma_l - \gamma_1 FTA_{l,t} - \gamma_{21} is_{l,j,t} - \gamma_{22} inst_{l,t} + \gamma_j + v_{i,l,j,t}.$$

D.5.3 Bilateral trade-off function: Identification of the expected gains from waiting

The expected gains from waiting in period t are a positive function of the expected posterior beliefs in $t+1$. We characterise them as:

$$w^N s_j^r - \lambda_j w^N s_j^r Y(f_{j,t+1}^l|\mathcal{I}_{i,j,t}) = \tilde{\gamma}_j + \tilde{\gamma}_{1,j}\mathbb{E}\left[inst_{l,j,t+1}^{posterior}|\mathcal{I}_{i,j,t}\right] + e_{l,j,t}, \tag{24 revisited}$$

[122]We include: distance ($dist_{l'}$), mean income per capita ($inc\_pc_{l'}$ as proxy for country l''s wages), common language ($lang_{l'}$) and market thickness ($mkt\_thick_{l'}$).

where the term $w^N s_j^r$ on the left-hand side is identified by the sector fixed effect $\tilde{\gamma}_j$, and the second term on the left-hand side is identified by $\mathbb{E}\left[inst^{posterior}_{l,j,t+1}|\mathcal{I}_{i,j,t}\right]$ and $\tilde{\gamma}_{1,j}$. Finally, $\mathbb{E}\left[inst^{posterior}_{l,j,t+1}|\mathcal{I}_{i,j,t}\right]$ represents the expression $Y(f^l_{j,t+1}|\mathcal{I}_{i,j,t})$, which refers to the expected posterior beliefs of firms in sector j about country l in $t+1$ conditional on the information set that those firms posses in period t. The expected posterior beliefs are not observable. The parameter $\tilde{\gamma}_{1,j}$ identifies the differential effect at the sector level given by $\lambda_j w^N s_j^r$.

From our theory, the expected posterior beliefs of firms in sectors j about country l in $t+1$ are a function of the respective expected information spillovers. Based on the theory, we identify the expected gains from waiting as follows. We begin by defining an AR(1) model that estimates the expected information spillovers in $t+1$ about each country l for firms in sector j conditional on the information set they posses in t, which is given by $Y(f^l_{j,t+1}) = \rho_{1,j} Y(f^l_{j,t}) + \epsilon_{l,j,t}$, where $\epsilon_{l,j,t}$ is a white noise error term. Therefore, the expected new information to be revealed during t given the information set at the beginning of period t is $Y(f^l_{j,t+1}|\mathcal{I}_{i,j,t}) \equiv \mathbb{E}[Y(f^l_{j,t+1})] = \rho_{1,j} Y(f^l_{j,t})$. Replacing with the information spillover measures, we estimate the AR(1) model given by $is_{l,j,t+1} = \rho_{1,j} is_{l,j,t} + \epsilon_{l,j,t}$ and use the predicted values to identify $\mathbb{E}\left[is_{l,j,t+1}\right]$. In a second step, we identify the expected gains from waiting as:

$$w^N s_j^r \left[1 - \lambda_j Y(f^l_{j,t+1}|\mathcal{I}_{i,j,t})\right] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j}\widehat{is}_{l,j,t+1} + e_{l,j,t}, \qquad \text{(26 revisited)}$$

where $\tilde{\gamma}_{1,j}$ captures the interaction of the expected new information and the sector's death shock rates and offshoring sunk cost. Intuitively, an increase in the expected new information to be revealed, which represents an improvement in the expected future posterior beliefs, increases the gains from waiting.

D.5.4 Bilateral trade-off function: Probit model

Back to the expression in equation (A58), the conditional probability model is given by:

$$\Pr\left(d^l_{i,j,t} = 1 \middle| d^l_{i,j,t-1} = 0, \mathcal{I}_{i,j,t}\right) = \int_v \mathbb{1}\left\{\mathcal{D}^{l/l'}_{i,j,t}(\theta; \mathcal{I}_{i,j,t}) \geq 0\right\} \frac{1}{\Sigma}\phi\left(\frac{v}{\Sigma}\right) dv,$$

$$\Pr\left(d^l_{i,j,t} = 1 \middle| d^l_{i,j,t-1} = 0, \mathcal{I}_{i,j,t}\right) = \Phi\Big[\Sigma^{-1}\Big(\sigma_j^{-1}\mathbb{E}\Big[z^{l/l'}_{j,t}\theta^{\sigma_j-1}\Big|\mathcal{I}_{i,j,t}\Big] - w^N\left[\mathbb{E}(f^l_j|\mathcal{I}_{i,j,t}) - f^{l'}_j\right] - w^N s_j^r\left[1 - \lambda_j Y(f^l_{j,t+1}|\mathcal{I}_{i,j,t})\right]\Big)\Big].$$

Replacing with the respective expressions for the expected fixed-cost differential and the expected gains from waiting (using country fixed effects), and reorganising the variables, we obtain the following probit model:

$$\Pr\left(d^l_{i,j,t} = 1 \middle| d^l_{i,j,t-1} = 0, \mathcal{I}_{i,j,t}\right) = \Phi\Big[\Sigma^{-1}\Big(\sigma_j^{-1}\mathbb{E}\Big[z^{l/l'}_{j,t}\theta^{\sigma_j-1}\Big|\mathcal{I}_{i,j,t}\Big] - \Gamma_l - \Gamma_j + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 is_{l,j,t} + \Gamma_{5,j}\widehat{is}_{l,j,t+1} + \mathbf{source\_st'_{i,l',j,t-1}}\boldsymbol{\Gamma_6}\Big)\Big].$$

For domestic-sourcing firms, the probit model is given by:

$$\Pr\left(d^l_{i,j,t} = 1 \middle| d^l_{i,j,t-1} = 0, \mathcal{I}_{i,j,t}\right) = \Phi\Big[\Sigma^{-1}\Big(\sigma_j^{-1}\mathbb{E}\Big[z^{l/N}_{j,t}\theta^{\sigma_j-1}\Big|\mathcal{I}_{i,j,t}\Big] - \Gamma_l - \Gamma_j + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 is_{l,j,t} + \Gamma_{5,j}\widehat{is}_{l,j,t+1}\Big)\Big].$$

We show below the identification of the term $\sigma_j^{-1}\mathbb{E}\Big[z^{l/N}_{j,t}\theta^{\sigma_j-1}\Big|\mathcal{I}_{i,j,t}\Big]$.

D.5.5 Spatial probit: SMOPEC

We introduce first the specification of the SMOPEC structural model for domestic-sourcing firms, and we follow with the respective specification of the model for offshoring firms.

Domestic-sourcing firms.

$$\mathcal{D}^{l/N}_{i,j,t}(\theta;\mathcal{I}_{i,j,t}) = \psi \boldsymbol{W_{i,j}\mathcal{D}^{/N}_{i,j,t}(\theta;\mathcal{I}_{i,j,t})} + \Gamma_{1,j}\frac{\ln(ta_{i,j,t})}{w^l} - \Gamma_l - \Gamma_j + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 is_{l,j,t} + \Gamma_{5,j}\widehat{is}_{l,j,t+1}. \tag{A60}$$

Offshoring firms.

$$\mathcal{D}^{l/l'}_{i,j,t}(\theta;\mathcal{I}_{i,j,t}) = \psi \boldsymbol{W_{i,j,t}\mathcal{D}^{/l'}_{i,j,t}(\theta;\mathcal{I}_{i,j,t})} + \Gamma_{1,j}\left(\frac{w^{l'}_{i,j,t-1}}{w^l}\right)\ln(ta_{i,j,t}) - \Gamma_l - \Gamma_j + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 is_{l,j,t} + \Gamma_{5,j}\widehat{is}_{l,j,t+1} + \mathbf{source\_st'_{i,l',j,t-1}\Gamma_6}. \tag{A61}$$

where $w^{l'}_{i,j,t-1}$ denotes the offshoring structure—i.e., mean marginal cost of offshoring—of firm i in sector j in period $t-1$. This is approximated by the weighted mean income per capita of the sourcing countries of firm i in period $t-1$, with the weights defined by the import share of each country in the total imports of the firm. When the value is missing, it is replaced with the mean income per capita of Colombia.[123]

D.5.6 Spatial probit: Full structural model

As in section D.5.5, we introduce first the specification of the full structural model for domestic-sourcing firms, and we follow with the respective specification of the model for offshoring firms.

Domestic-sourcing firms.

$$\mathcal{D}^{l/N}_{i,j,t}(\theta;\mathcal{I}_{i,j,t}) = \psi \boldsymbol{W_{i,j}\mathcal{D}^{/N}_{i,j,t}(\theta;\mathcal{I}_{i,j,t})} + \Gamma_{1,j,t}\frac{\ln(ta_{i,j,t})}{w^l} - \Gamma_l - \Gamma_j + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 is_{l,j,t} + \Gamma_{5,j}\widehat{is}_{l,j,t+1}. \tag{A62}$$

Offshoring firms.

$$\mathcal{D}^{l/l'}_{i,j,t}(\theta;\mathcal{I}_{i,j,t}) = \psi \boldsymbol{W_{i,j,t}\mathcal{D}^{/l'}_{i,j,t}(\theta;\mathcal{I}_{i,j,t})} + \Gamma_{1,j,t}\left(\frac{w^{l'}_{i,j,t-1}}{w^l}\right)\ln(ta_{i,j,t}) - \Gamma_l - \Gamma_j + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 is_{l,j,t} + \Gamma_{5,j}\widehat{is}_{l,j,t+1} + \mathbf{source\_st'_{i,l',j,t-1}\Gamma_6}. \tag{A63}$$

D.6 Multi-country model: Results for the structural spatial probit models

Before introducing the results of all alternative specifications of the structural model, we briefly summarise them. We have considered different specifications that combine: i) different information spillover measures (i.e., *minta* and *sdta*); ii) different institutional indices (namely, *GE, RQ* and *RL*); and iii) models with and without country fixed effects.[124] The models show strong support in all the specifications regarding the role of productivity in offshoring-exploration decisions, as predicted by the theory.

In terms of the role of information spillovers in driving firms' offshoring location choices, the results provide strong supportive evidence for the specifications with the direct measure (i.e., *minta*). In particular, we observe that more information revealed up to period t about a location l increases the probability of exploring offshoring in country l in period t, decreases the probability of exploring offshoring in t in other locations, and increases overall the probability that the firm offshores in t. In regard to the specifications with alternative measure (i.e., *sdta*), the results show non-significant effects. We alternatively estimated the models with the information spillover

[123]The missing value in $w^{l'}_{i,j,t-1}$ represents the case of a firm that does not offshore in $t-1$ but offshored in previous periods.
[124]In the case of models without country fixed effects, we control instead for different country-level variables.

measures expressed in natural logarithms, and we find that the results remain robust for the direct measure (i.e., *minta*) and mixed—mostly non-significant effects—for the alternative measure (i.e., *sdta*).[125] Regarding the role of priors, we observe theory-consistent and significant results for the models without country fixed effects and—as expected from the theory—the effects are stronger for offshoring firms than for domestic-sourcing firms. The significance of these effects vanishes when country fixed effects are included.

Finally, the results show consistently a negative and significant spatial correlation coefficient, which is consistent with the substitutability of locations from the firm's sourcing perspective. The estimation of this spatial effect in sourcing decisions is one of the advantages of the identification of the trade-off function in the multi-country model by a spatial probit. We report and analyse all the results in the following subsections.

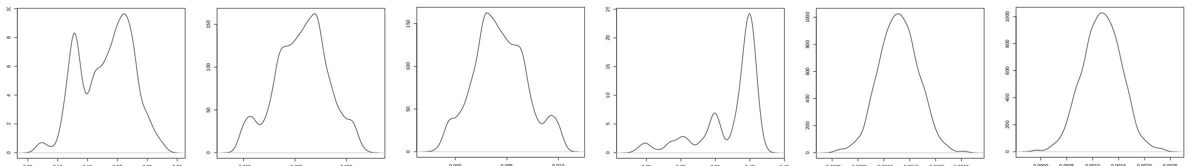
D.6.1 Main specification: Alternative institutional indices and weighting matrix

Main specification with W^{dist}. Table A23 reports the results of the models reported in Table 4 replacing the weighting matrix with $W^{dist}_{i,j,t}$.

Table A23: Complementary table to Table 4 - Weighting matrix $W^{dist}_{i,j,t}$.

	Domestic sourcing firms					Offshoring firms				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000457	-0.000210	0.000247	0.180866	0.000000	0.003554	-0.001674	0.001881	0.372296	0.000000
$minta_{l,j,t-1}$	-0.000011	0.000005	-0.000006	-0.004360	0.046800	-0.000012	0.000005	-0.000006	-0.001215	0.001800
$\widehat{minta}_{l,j,t+1}$	0.000011	-0.000005	0.000006	0.004341	0.047200	0.000011	-0.000005	0.000006	0.001177	0.002200
$RQ_{l,t}$	0.000164	-0.000073	0.000091	0.066032	0.304200	0.000030	-0.000014	0.000016	0.003143	0.499400
ψ				-0.846190	0.000000				-0.877101	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA. Weighting matrix: $W^{dist}_{i,j,t}$.



(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{l,j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0 (d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $minta_{l,j,t-1}$. Exp. sign < 0 (f) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0

Figure A17: Coefficients: RQ and $W^{dist}_{i,j,t}$ - Domestic-sourcing firms [*a), b), c)*] and Offshoring firms [*d), e), f)*].

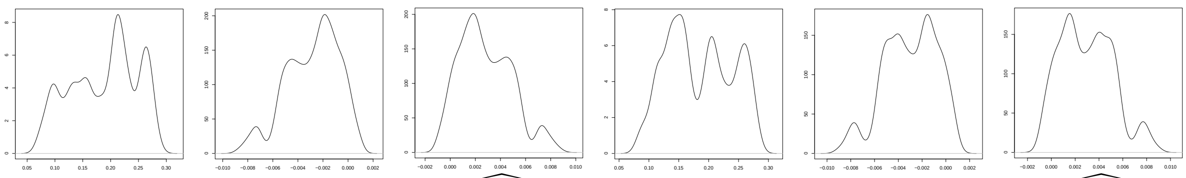
Main specification: Models with GE. Tables A24 and A25 report the results for domestic-sourcing and offshoring firms, respectively, using government efficiency (GE) as institutional index.

Table A24: Domestic-sourcing Firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000473	-0.000228	0.000245	0.188034	0.000000	0.000471	-0.000218	0.000253	0.184968	0.000000
$minta_{l,j,t-1}$	-0.000007	0.000003	-0.000004	-0.002834	0.069000	-0.000007	0.000003	-0.000004	-0.002981	0.077800
$\widehat{minta}_{l,j,t+1}$	0.000007	-0.000003	0.000004	0.002820	0.070000	0.000007	-0.000003	0.000004	0.002968	0.078600
$GE_{l,t}$	-0.000193	0.000097	-0.000096	-0.085640	0.180600	-0.000091	0.000047	-0.000044	-0.040943	0.310800
ψ				-0.920850	0.000000				-0.855840	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

[125] See footnote 78 for discussion on the limitations of the *sdta* as information spillover measure.



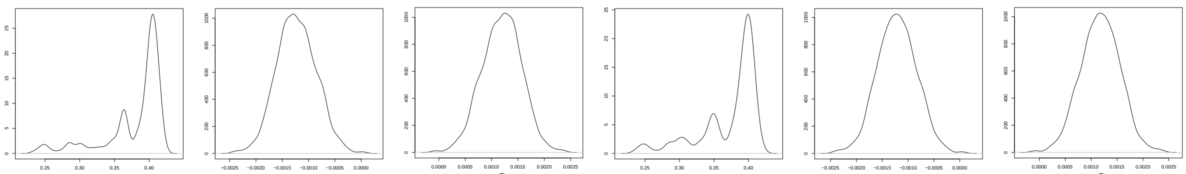
(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{l,j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0 (d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $minta_{l,j,t-1}$. Exp. sign < 0 (f) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0

Figure A18: Coefficients: Models w/ GE. Domestic-sourcing firms - $W^{mean}_{i,j,t}$ [*a), b), c)*] and $W^{dist}_{i,j,t}$ [*d), e), f)*].

Table A25: Offshoring firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003662	-0.001810	0.001852	0.379165	0.000000	0.003554	-0.001674	0.001880	0.372186	0.000000
$minta_{l,j,t-1}$	-0.000012	0.000006	-0.000006	-0.001230	0.001600	-0.000012	0.000005	-0.000006	-0.001215	0.001800
$\widehat{minta}_{l,j,t+1}$	0.000012	-0.000006	0.000006	0.001192	0.001800	0.000011	-0.000005	0.000006	0.001177	0.002200
$GE_{l,t}$	-0.000097	0.000048	-0.000049	-0.010407	0.374000	-0.000049	0.000024	-0.000025	-0.005578	0.420000
ψ				-0.966186	0.000000				-0.877118	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.



(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{l,j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0 (d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $minta_{l,j,t-1}$. Exp. sign < 0 (f) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0

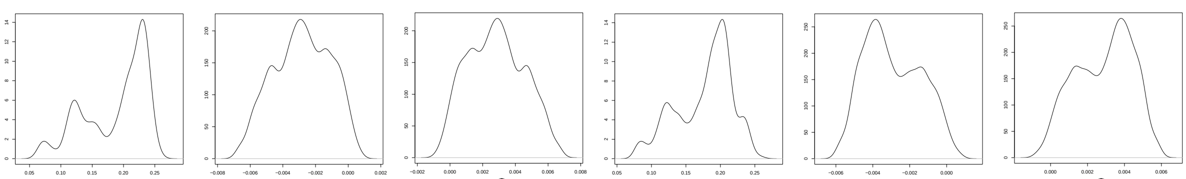
Figure A19: Coefficients: Models w/ GE. Offshoring firms - $W^{mean}_{i,j,t}$ [*a), b), c)*] and $W^{dist}_{i,j,t}$ [*d), e), f)*].

Main specification: Models with RL. Tables A26 and A27 report the results for domestic-sourcing and offshoring firms, respectively, using rule of law (RL) as institutional index

Table A26: Domestic-sourcing Firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000487	-0.000232	0.000255	0.187514	0.000000	0.000470	-0.000211	0.000259	0.177441	0.000000
$minta_{l,j,t-1}$	-0.000007	0.000003	-0.000004	-0.002831	0.034200	-0.000007	0.000003	-0.000004	-0.002892	0.024800
$\widehat{minta}_{l,j,t+1}$	0.000007	-0.000003	0.000004	0.002814	0.035600	0.000007	-0.000003	0.000004	0.002876	0.025400
$RL_{l,t}$	-0.000488	0.000236	-0.000252	-0.217712	0.176000	-0.000328	0.000156	-0.000172	-0.152488	0.241800
ψ				-0.900675	0.000000				-0.817888	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.



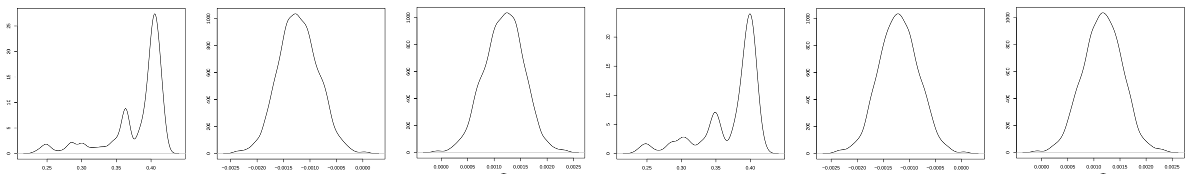
(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{l,j,t-1}$. Exp. sign < 0 (c) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0 (d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $minta_{l,j,t-1}$. Exp. sign < 0 (f) $\widehat{minta}_{l,j,t+1}$. Exp. sign > 0

Figure A20: Coefficients: Models w/ RL. Domestic-sourcing firms - $W^{mean}_{i,j,t}$ [*a), b), c)*] and $W^{dist}_{i,j,t}$ [*d), e), f)*].

Table A27: Offshoring firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003661	-0.001809	0.001852	0.379082	0.000000	0.003551	-0.001670	0.001881	0.371995	0.000000
$minta_{l,j,t-1}$	-0.000012	0.000006	-0.000006	-0.001219	0.001600	-0.000012	0.000005	-0.000006	-0.001204	0.001800
$\widehat{minta_{l,j,t+1}}$	0.000011	-0.000006	0.000006	0.001181	0.002000	0.000011	-0.000005	0.000006	0.001166	0.002200
$RL_{l,t}$	-0.001613	0.000797	-0.000815	-0.167644	0.002600	-0.001586	0.000747	-0.000839	-0.166912	0.005400
ψ				-0.965868	0.000000				-0.875260	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.



(a) $\ln(ta_{i,j,t})$. Exp. sign > 0 (b) $minta_{l,j,t-1}$. Exp. sign < 0 (c) $\widehat{minta_{l,j,t+1}}$. Exp. sign > 0 (d) $\ln(ta_{i,j,t})$. Exp. sign > 0 (e) $minta_{l,j,t-1}$. Exp. sign < 0 (f) $\widehat{minta_{l,j,t+1}}$. Exp. sign > 0

Figure A21: Coefficients: Models w/ RL. Offshoring firms - $W^{mean}_{i,j,t}$ [*a), b), c)*] and $W^{dist}_{i,j,t}$ [*d), e), f)*].

D.6.2 Alternative specifications: Information spillover as *sdta*

We report the results using the alternative information spillover measure (i.e., *sdta*). We find non-significant estimated coefficients for both terms related to the information spillovers; that is, the coefficients associated to $sdta_{l,j,t-1}$ and $\widehat{sdta_{l,j,t+1}}$.[126] Tables A28 and A29 report the coefficients and marginal effects for domestic-sourcing and offshoring firms, respectively, using government efficiency (GE) as institutional index and *sdta* as information spillover measure.

Table A28: Domestic-sourcing firms - Information spillover: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000483	-0.000227	0.000256	0.189960	0.000000	0.000472	-0.000209	0.000263	0.181086	0.000000
$sdta_{l,j,t-1}$	-0.000007	0.000003	-0.000004	-0.002673	0.141400	-0.000007	0.000003	-0.000004	-0.002441	0.148400
$\widehat{sdta_{l,j,t+1}}$	0.000007	-0.000003	0.000003	0.002576	0.206000	0.000006	-0.000003	0.000003	0.002357	0.219400
$GE_{l,t}$	-0.000000	0.000001	0.000001	-0.003137	0.463400	0.000113	-0.000050	0.000063	0.038179	0.377400
ψ				-0.888145	0.000000				-0.803491	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A29: Offshoring firms - Information spillover: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003655	-0.001806	0.001850	0.378362	0.000000	0.003542	-0.001662	0.001881	0.370977	0.000000
$sdta_{l,j,t-1}$	-0.000001	0.000000	-0.000000	-0.000074	0.451400	-0.000002	0.000001	-0.000001	-0.000158	0.410800
$\widehat{sdta_{l,j,t+1}}$	0.000002	-0.000001	0.000001	0.000169	0.428800	0.000003	-0.000001	0.000001	0.000267	0.395400
$GE_{l,t}$	-0.000029	0.000014	-0.000014	-0.003412	0.445000	0.000018	-0.000008	0.000011	0.001462	0.502800
ψ				-0.964757	0.000000				-0.870718	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

[126] See footnote 78 for discussion on the limitations of the *sdta* as information spillover measure.

Tables A30 and A31 report the coefficients and marginal effects for domestic-sourcing and offshoring firms, respectively, using regulatory quality (RQ) as institutional index and *sdta* as information spillover measure.

Table A30: Domestic-sourcing firms - Information spillover: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000482	-0.000232	0.000251	0.186430	0.000000	0.000477	-0.000216	0.000261	0.179958	0.000000
$sdta_{l,j,t-1}$	-0.000004	0.000002	-0.000002	-0.001618	0.271800	-0.000003	0.000002	-0.000002	-0.001383	0.288000
$\widehat{sdta}_{l,j,t+1}$	0.000003	-0.000002	0.000002	0.001477	0.329400	0.000003	-0.000001	0.000002	0.001278	0.347600
$RQ_{l,t}$	0.000210	-0.000101	0.000109	0.079296	0.283200	0.000232	-0.000106	0.000126	0.082747	0.265200
ψ				-0.916305	0.000000				-0.830622	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A31: Offshoring Firms - Information Spillover Measure: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003656	-0.001806	0.001850	0.378502	0.000000	0.003543	-0.001662	0.001881	0.371128	0.000000
$sdta_{l,j,t-1}$	-0.000001	0.000000	-0.000000	-0.000075	0.449200	-0.000002	0.000001	-0.000001	-0.000160	0.410800
$\widehat{sdta}_{l,j,t+1}$	0.000002	-0.000001	0.000001	0.000172	0.430600	0.000003	-0.000001	0.000001	0.000270	0.395400
$RQ_{l,t}$	-0.000004	0.000002	-0.000002	-0.000412	0.470400	0.000045	-0.000021	0.000024	0.004692	0.480800
ψ				-0.964921	0.000000				-0.870481	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Tables A32 and A33 report the coefficients and marginal effects for domestic-sourcing and offshoring firms, respectively, using rule of law (RL) as institutional index and *sdta* as information spillover measure.

Table A32: Domestic-Sourcing Firms - Information Spillover Measure: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000468	-0.000226	0.000243	0.191146	0.000000	0.000460	-0.000213	0.000247	0.185170	0.000000
$sdta_{l,j,t-1}$	-0.000007	0.000003	-0.000004	-0.002785	0.193400	-0.000005	0.000002	-0.000003	-0.002158	0.222200
$\widehat{sdta}_{l,j,t+1}$	0.000007	-0.000003	0.000004	0.002778	0.244000	0.000005	-0.000002	0.000003	0.002048	0.287600
$RL_{l,t}$	-0.000736	0.000359	-0.000378	-0.321384	0.091000	-0.000570	0.000268	-0.000302	-0.245261	0.124400
ψ				-0.922357	0.000000				-0.864048	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A33: Offshoring Firms - Information Spillover Measure: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003654	-0.001805	0.001849	0.378264	0.000000	0.003540	-0.001658	0.001882	0.370836	0.000000
$sdta_{l,j,t-1}$	-0.000001	0.000001	-0.000001	-0.000102	0.438200	-0.000002	0.000001	-0.000001	-0.000188	0.398400
$\widehat{sdta}_{l,j,t+1}$	0.000002	-0.000001	0.000001	0.000217	0.410200	0.000003	-0.000001	0.000002	0.000318	0.381400
$RL_{l,t}$	-0.001661	0.000821	-0.000840	-0.172585	0.001600	-0.001636	0.000768	-0.000869	-0.172169	0.003600
ψ				-0.964342	0.000000				-0.868531	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

D.6.3 Models without country fixed effects

We report the results of the models with the information spillovers identified by *minta* without controlling for country fixed effects. Instead, we control for time-invariant country-level variables. The results are robust in comparison to the main specification (i.e., with country fixed effects). In addition, we find supportive evidence for the role of exogenous changes in the prior beliefs on the offshoring-exploration decisions. That is, an increase in the institutional index in a country l increases the probability of exploring the offshoring potential in that country, reduces the probability of exploring it in alternative countries, and increases the probability of exploring offshoring in total. As expected by the theory, the effects are stronger for offshoring firms than for domestic-sourcing firms.[127] Tables A34 and A35 report the coefficients and marginal effects for the models with government efficiency (GE) as institutional index for domestic-sourcing and offshoring firms, respectively.

Table A34: Domestic-sourcing firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000469	-0.000213	0.000256	0.176062	0.000000	0.000407	-0.000108	0.000299	0.207772	0.000000
$minta_{l,j,t-1}$	-0.000029	0.000013	-0.000016	-0.010992	0.000000	-0.000034	0.000008	-0.000026	-0.018308	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000029	-0.000013	0.000016	0.010959	0.000000	0.000034	-0.000008	0.000026	0.018251	0.000000
$GE_{l,t}$	0.000134	-0.000063	0.000072	0.053368	0.078800	0.000120	-0.000030	0.000091	0.067480	0.074400
ψ				-0.830978	0.000000				-0.365238	0.050600

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Table A35: Offshoring firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003326	-0.001429	0.001897	0.343143	0.000000	0.003232	-0.001322	0.001910	0.335182	0.000000
$minta_{l,j,t-1}$	-0.000039	0.000017	-0.000022	-0.003975	0.000000	-0.000038	0.000016	-0.000023	-0.003914	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000038	-0.000017	0.000022	0.003904	0.000000	0.000037	-0.000015	0.000022	0.003842	0.000000
$GE_{l,t}$	0.002319	-0.000996	0.001324	0.239752	0.000000	0.002246	-0.000919	0.001327	0.233167	0.000000
ψ				-0.746708	0.000000				-0.685369	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Tables A36 and A37 report the coefficients and marginal effects for the models with regulatory quality (RQ) as institutional index for domestic-sourcing and offshoring firms, respectively.

Table A36: Domestic-sourcing firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000470	-0.000213	0.000256	0.176052	0.000000	0.000423	-0.000132	0.000290	0.199547	0.000000
$minta_{l,j,t-1}$	-0.000030	0.000013	-0.000016	-0.011248	0.000000	-0.000034	0.000011	-0.000024	-0.016484	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000030	-0.000013	0.000016	0.011213	0.000000	0.000034	-0.000011	0.000023	0.016438	0.000000
$RQ_{l,t}$	0.000024	-0.000013	0.000011	0.011361	0.336600	0.000036	-0.000012	0.000024	0.018567	0.291200
ψ				-0.829873	0.000000				-0.450414	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

[127] The results and conclusions for the models with *sdta* as information spillover measures are equivalent to the respective models with country fixed effects.

Table A37: Offshoring firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003353	-0.001469	0.001884	0.345731	0.000000	0.003251	-0.001354	0.001897	0.337227	0.000000
$minta_{l,j,t-1}$	-0.000042	0.000019	-0.000024	-0.004298	0.000000	-0.000041	0.000017	-0.000024	-0.004212	0.000000
$\widehat{minta_{l,j,t+1}}$	0.000041	-0.000018	0.000023	0.004225	0.000000	0.000040	-0.000017	0.000024	0.004138	0.000000
$RQ_{l,t}$	0.002341	-0.001024	0.001317	0.242321	0.000000	0.002282	-0.000950	0.001332	0.237242	0.000000
ψ				-0.772063	0.000000				-0.706022	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Tables A38 and A39 report the coefficients and marginal effects for the models with rule of law (RL) as institutional index for domestic-sourcing and offshoring firms, respectively.

Table A38: Domestic-sourcing firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000470	-0.000214	0.000256	0.176303	0.000000	0.000432	-0.000147	0.000286	0.193453	0.000000
$minta_{l,j,t-1}$	-0.000030	0.000014	-0.000016	-0.011418	0.000000	-0.000035	0.000012	-0.000023	-0.015670	0.000000
$\widehat{minta_{l,j,t+1}}$	0.000030	-0.000014	0.000016	0.011381	0.000000	0.000035	-0.000012	0.000023	0.015626	0.000000
$RL_{l,t}$	-0.000125	0.000056	-0.000069	-0.046679	0.186000	-0.000149	0.000050	-0.000098	-0.067392	0.106600
ψ				-0.832593	0.000000				-0.507397	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Table A39: Offshoring firms - Information spillover: *minta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003347	-0.001465	0.001882	0.343984	0.000000	0.003253	-0.001357	0.001896	0.336336	0.000000
$minta_{l,j,t-1}$	-0.000042	0.000019	-0.000024	-0.004301	0.000000	-0.000041	0.000017	-0.000024	-0.004206	0.000000
$\widehat{minta_{l,j,t+1}}$	0.000042	-0.000018	0.000023	0.004227	0.000000	0.000040	-0.000017	0.000024	0.004132	0.000000
$RL_{l,t}$	0.002296	-0.001005	0.001291	0.236161	0.000000	0.002274	-0.000949	0.001325	0.235222	0.000000
ψ				-0.771055	0.000000				-0.708263	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Alternative specification: information spillover as *sdta*. We report the results for the models with the alternative information spillover measures.

Table A40: Domestic-sourcing firms - Information spillover: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000469	-0.000212	0.000257	0.174589	0.000000	0.000344	-0.000013	0.000331	0.194613	0.000000
$sdta_{l,j,t-1}$	-0.000002	0.000001	-0.000001	-0.000933	0.351800	0.000000	0.000000	0.000001	0.000494	0.375000
$\widehat{sdta_{l,j,t+1}}$	0.000005	-0.000002	0.000003	0.002085	0.214000	0.000003	0.000000	0.000003	0.001749	0.285600
$GE_{l,t}$	0.000302	-0.000138	0.000164	0.115638	0.001200	0.000490	0.000088	0.000577	0.313948	0.001600
ψ				-0.825685	0.000000				-0.072345	0.432400

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Table A41: Offshoring firms - Information spillover: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003128	-0.001193	0.001935	0.320244	0.000000	0.003057	-0.001115	0.001942	0.313887	0.000000
$sdta_{l,j,t-1}$	0.000001	-0.000001	0.000001	0.000145	0.416600	0.000001	0.000000	0.000000	0.000067	0.460200
$\widehat{sdta}_{l,j,t+1}$	0.000016	-0.000006	0.000010	0.001593	0.032400	0.000017	-0.000006	0.000011	0.001706	0.023000
$GE_{l,t}$	0.003443	-0.001312	0.002131	0.352646	0.000000	0.003381	-0.001233	0.002148	0.347272	0.000000
ψ				-0.612168	0.000000				-0.569810	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Tables A42 and A43 report the coefficients and marginal effects for the models with regulatory quality (RQ) as institutional index for domestic-sourcing and offshoring firms, respectively.

Table A42: Domestic-sourcing firms - Information spillover: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000470	-0.000212	0.000257	0.174688	0.000000	0.000368	-0.000041	0.000327	0.204954	0.000000
$sdta_{l,j,t-1}$	-0.000002	0.000001	-0.000001	-0.000885	0.360200	0.000000	0.000000	0.000000	0.000248	0.410000
$\widehat{sdta}_{l,j,t+1}$	0.000006	-0.000003	0.000003	0.002180	0.200800	0.000004	0.000000	0.000004	0.002070	0.247000
$RQ_{l,t}$	0.000161	-0.000074	0.000086	0.061797	0.033000	0.000170	-0.000010	0.000161	0.100648	0.021800
ψ				-0.822565	0.000000				-0.159304	0.298200

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Table A43: Offshoring firms - Information spillover: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003147	-0.001223	0.001924	0.321892	0.000000	0.003071	-0.001142	0.001928	0.315336	0.000000
$sdta_{l,j,t-1}$	0.000001	0.000000	0.000000	0.000071	0.462000	0.000000	0.000000	0.000000	-0.000019	0.488600
$\widehat{sdta}_{l,j,t+1}$	0.000018	-0.000007	0.000011	0.001845	0.013600	0.000019	-0.000007	0.000012	0.001969	0.010400
$RQ_{l,t}$	0.003302	-0.001282	0.002020	0.338203	0.000000	0.003259	-0.001212	0.002047	0.334818	0.000000
ψ				-0.630781	0.000000				-0.587360	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Tables A44 and A45 report the coefficients and marginal effects for the models with rule of law (RL) as institutional index for domestic-sourcing and offshoring firms, respectively.

Table A44: Domestic-sourcing firms - Information spillover: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000470	-0.000212	0.000258	0.174764	0.000000	0.000365	-0.000037	0.000327	0.202701	0.000000
$sdta_{l,j,t-1}$	-0.000002	0.000001	-0.000001	-0.000839	0.365800	0.000000	0.000000	0.000000	0.000119	0.433400
$\widehat{sdta}_{l,j,t+1}$	0.000006	-0.000003	0.000003	0.002153	0.199400	0.000004	0.000000	0.000004	0.002112	0.242400
$RL_{l,t}$	0.000105	-0.000049	0.000056	0.040310	0.191600	0.000290	0.000042	0.000331	0.195239	0.091600
ψ				-0.822075	0.000000				-0.147199	0.332800

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

Table A45: Offshoring firms - Information spillover: *sdta*.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003149	-0.001231	0.001918	0.320668	0.000000	0.003083	-0.001160	0.001923	0.315199	0.000000
$sdta_{l,j,t-1}$	-0.000001	0.000000	0.000000	-0.000080	0.454400	-0.000002	0.000001	-0.000001	-0.000162	0.407800
$\widehat{sdta}_{l,j,t+1}$	0.000019	-0.000008	0.000012	0.001971	0.009600	0.000020	-0.000008	0.000013	0.002075	0.008400
$RL_{l,t}$	0.003708	-0.001450	0.002259	0.377625	0.000000	0.003702	-0.001393	0.002309	0.378305	0.000000
ψ				-0.636929	0.000000				-0.597965	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t. Other controls: FTA, country l's mean income per capita, distance to country l, common language, market thickness in country l.

D.6.4 Offshoring firms: Approximation of control by current sourcing structure

Tables A46 to A48 report the results of the models where we control by the marginal cost of the sourcing structure in the previous year, i.e., the marginal cost of each firm i in sector j in year $t-1$. As discussed above, we proxy the latter by the weighted mean income per capita of the sourcing countries of each offshoring firm i in the previous year, where the weights are defined by the share of each country in the total imports of the firm in that year.[128] This variable is defined as $\ln(\overline{inc\_pc}_{l',i,j,t-1}) \equiv \sum_{l=1}^{S} shr_{i,j,l,t-1}\overline{inc\_pc}_l$, where $\overline{inc\_pc}_s$ denotes, as before, the mean income per capita of country l during the sample period, and $shr_{i,j,l,t-1}$ refers to the import share of firm i in sector j from country l in year $t-1$.[129] We report the results for the models with the direct information spillover measure (i.e., *minta*) and compare the results to the main specifications where we omit controlling for the sourcing structure (i.e. marginal cost) when deciding on exploring a new location.

From the comparison, the estimated coefficients and the marginal effects of the main variables, as well as the respective p-values, remain generally robust across specifications.[130] Moreover, the marginal effects of the new control variable show theory-consistent results. An increase in the marginal cost of the previous offshoring sourcing structure increases the probability of exploring a new location l in year t (*direct effect*), as firms have stronger incentives to look for higher marginal costs gains from offshoring in lower wage locations (*total effect*).

Table A46: Offshoring firms - Information spillover: *minta*. Inst: GE.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003642	-0.001799	0.001844	0.379187	0.000000	0.003534	-0.001669	0.001865	0.371945	0.000000
$minta_{l,j,t-1}$	-0.000012	0.000006	-0.000006	-0.001249	0.000000	-0.000012	0.000006	-0.000006	-0.001228	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000012	-0.000006	0.000006	0.001211	0.000000	0.000011	-0.000005	0.000006	0.001190	0.000000
$GE_{l,t}$	-0.000115	0.000056	-0.000059	-0.011619	0.352600	-0.000057	0.000026	-0.000031	-0.005847	0.426000
$\ln(\overline{inc\_pc}_{i,j,l',t-1})$	0.000662	-0.000327	0.000335	0.068706	0.000000	0.000667	-0.000314	0.000352	0.069924	0.000000
ψ				-0.965367	0.000000				-0.882546	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

[128]For missing values, which are related to firms that offshored in previous years but not in $t-1$, we assume that firms have sourced domestically in that year and thus replace the missing value by the mean income per capita of Colombia.
[129]That is, the imports of firm i in sector j from country l in $t-1$ divided by the total imports of that firm in the same year.
[130]One difference is a stronger (theory-consistent) effect of productivity in some specifications.

Table A47: Offshoring firms - Information spillover: *minta*. Inst: RQ.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003642	-0.001799	0.001843	0.379172	0.000000	0.003534	-0.001669	0.001865	0.371980	0.000000
$minta_{l,j,t-1}$	-0.000012	0.000006	-0.000006	-0.001249	0.000000	-0.000012	0.000006	-0.000006	-0.001228	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000012	-0.000006	0.000006	0.001211	0.000000	0.000011	-0.000005	0.000006	0.001190	0.000000
$RQ_{l,t}$	-0.000058	0.000028	-0.000030	-0.006086	0.454800	0.000014	-0.000007	0.000007	0.001447	0.475600
$\ln(\overline{inc\_pc}_{i,j,l',t-1})$	0.000661	-0.000326	0.000335	0.068573	0.000000	0.000665	-0.000314	0.000352	0.069798	0.000000
ψ				-0.965407	0.000000				-0.882571	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A48: Offshoring firms - Information spillover: *minta*. Inst: RL.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003640	-0.001797	0.001843	0.379028	0.000000	0.003531	-0.001665	0.001866	0.371721	0.000000
$minta_{l,j,t-1}$	-0.000012	0.000006	-0.000006	-0.001238	0.000000	-0.000012	0.000005	-0.000006	-0.001217	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000012	-0.000006	0.000006	0.001200	0.000000	0.000011	-0.000005	0.000006	0.001179	0.000000
$RL_{l,t}$	-0.001679	0.000827	-0.000852	-0.173648	0.000000	-0.001624	0.000764	-0.000860	-0.169682	0.000000
$\ln(\overline{inc\_pc}_{i,j,l',t-1})$	0.000662	-0.000327	0.000336	0.068751	0.000000	0.000667	-0.000314	0.000353	0.069976	0.000000
ψ				-0.964617	0.000000				-0.880516	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

D.6.5 Alternative specifications: Models with information spillovers in natural logarithms

In the theory, we show that the information spillover enter the trade-off function in levels. However, as robustness, we report the results of the models with the information spillover in natural logarithms. First, we report first the results for the direct measure (i.e., *minta*) and then for the alternative measure (i.e., *sdta*). Focusing on the role of information spillovers, the models with the direct measure show robust and theory-consistent results in all specifications, whereas the models with the alternative measure show non-significant results in most specifications.[131]

Table A49: Domestic-sourcing firms - Information spillover: $\ln(minta)$. Inst: GE.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000474	-0.000229	0.000246	0.188828	0.000000	0.000472	-0.000218	0.000253	0.185742	0.000000
$\ln(minta_{l,j,t-1})$	-0.000342	0.000163	-0.000179	-0.131740	0.000600	-0.000350	0.000160	-0.000191	-0.134811	0.000200
$\ln(\widehat{minta}_{l,j,t+1})$	0.000299	-0.000143	0.000157	0.114075	0.002400	0.000309	-0.000140	0.000169	0.118219	0.001200
$GE_{l,t}$	-0.000187	0.000094	-0.000093	-0.083205	0.186800	-0.000087	0.000045	-0.000042	-0.039243	0.320600
ψ				-0.920855	0.000000				-0.855626	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A50: Domestic-sourcing firms - Information spillover: $\ln(minta)$. Inst: RQ.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000474	-0.000228	0.000245	0.188736	0.000000	0.000471	-0.000218	0.000253	0.185636	0.000000
$\ln(minta_{l,j,t-1})$	-0.000343	0.000164	-0.000179	-0.132086	0.001000	-0.000350	0.000159	-0.000191	-0.134800	0.000200
$\ln(\widehat{minta}_{l,j,t+1})$	0.000301	-0.000143	0.000157	0.114592	0.002800	0.000309	-0.000141	0.000169	0.118372	0.001200
$RQ_{l,t}$	0.000059	-0.000025	0.000034	0.014325	0.435600	0.000075	-0.000030	0.000045	0.023486	0.389200
ψ				-0.920584	0.000000				-0.855729	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

[131] See footnote 78 for discussion on the limitations of the *sdta* as information spillover measure.

Table A51: Domestic-sourcing firms - Information spillover: $\ln(minta)$. Inst: RL.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000474	-0.000228	0.000245	0.188678	0.000000	0.000472	-0.000218	0.000253	0.185679	0.000000
$\ln(minta_{l,j,t-1})$	-0.000344	0.000164	-0.000180	-0.132453	0.001000	-0.000351	0.000160	-0.000191	-0.135087	0.000400
$\ln(\widehat{minta_{l,j,t+1}})$	0.000301	-0.000144	0.000158	0.115084	0.003000	0.000310	-0.000141	0.000169	0.118748	0.001200
$RL_{l,t}$	-0.000557	0.000274	-0.000282	-0.239591	0.078800	-0.000396	0.000191	-0.000205	-0.167034	0.113200
ψ				-0.920918	0.000000				-0.855681	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A52: Offshoring firms - Information spillover: $\ln(minta)$. Inst: GE.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003675	-0.001814	0.001860	0.381053	0.000000	0.003561	-0.001669	0.001892	0.373703	0.000000
$\ln(minta_{l,j,t-1})$	-0.001032	0.000508	-0.000524	-0.105665	0.000000	-0.001011	0.000472	-0.000540	-0.104981	0.000000
$\ln(\widehat{minta_{l,j,t+1}})$	0.000615	-0.000302	0.000313	0.062549	0.000000	0.000594	-0.000277	0.000318	0.061289	0.000000
$GE_{l,t}$	-0.000035	0.000017	-0.000017	-0.004051	0.439200	0.000011	-0.000004	0.000006	0.000646	0.510800
ψ				-0.963797	0.000000				-0.869127	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A53: Offshoring firms - Information spillover: $\ln(minta)$. Inst: RQ.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003675	-0.001815	0.001861	0.381159	0.000000	0.003561	-0.001669	0.001893	0.373772	0.000000
$\ln(minta_{l,j,t-1})$	-0.001032	0.000508	-0.000524	-0.105715	0.000000	-0.001011	0.000472	-0.000540	-0.104976	0.000000
$\ln(\widehat{minta_{l,j,t+1}})$	0.000615	-0.000303	0.000313	0.062601	0.000000	0.000594	-0.000277	0.000318	0.061287	0.000000
$RQ_{l,t}$	-0.000086	0.000042	-0.000044	-0.008953	0.396400	-0.000039	0.000018	-0.000021	-0.004147	0.439800
ψ				-0.963829	0.000000				-0.868874	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A54: Offshoring firms - Information spillover: $\ln(minta)$. Inst: RL.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003673	-0.001813	0.001860	0.380920	0.000000	0.003558	-0.001665	0.001893	0.373413	0.000000
$\ln(minta_{l,j,t-1})$	-0.001027	0.000505	-0.000521	-0.105166	0.000000	-0.001006	0.000469	-0.000537	-0.104457	0.000000
$\ln(\widehat{minta_{l,j,t+1}})$	0.000611	-0.000300	0.000310	0.062107	0.000000	0.000590	-0.000274	0.000316	0.060809	0.000000
$RL_{l,t}$	-0.001549	0.000765	-0.000784	-0.161305	0.003800	-0.001527	0.000716	-0.000812	-0.161061	0.007200
ψ				-0.963159	0.000000				-0.866784	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A55: Domestic-sourcing firms - Information spillover: $\ln(1 + sdta)$. Inst: GE.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000473	-0.000228	0.000245	0.190021	0.000000	0.000471	-0.000218	0.000253	0.186722	0.000000
$\ln(1 + sdta_{l,j,t-1})$	0.000202	-0.000101	0.000101	0.099181	0.271600	0.000196	-0.000097	0.000099	0.083771	0.278400
$\ln(1 + \widehat{sdta_{l,j,t+1}})$	-0.000149	0.000077	-0.000073	-0.080706	0.322400	-0.000138	0.000071	-0.000066	-0.062299	0.351600
$GE_{l,t}$	-0.000189	0.000095	-0.000094	-0.085111	0.182200	-0.000086	0.000045	-0.000041	-0.039115	0.315400
ψ				-0.921351	0.000000				-0.855270	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A56: Domestic-sourcing firms - Information spillover: $\ln(1+sdta)$. Inst: RQ.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000473	-0.000228	0.000245	0.189953	0.000000	0.000470	-0.000218	0.000253	0.186876	0.000000
$\ln(1+sdta_{l,j,t-1})$	0.000205	-0.000103	0.000102	0.100467	0.269000	0.000197	-0.000098	0.000099	0.084689	0.277000
$\ln(1+\widehat{sdta_{l,j,t+1}})$	-0.000152	0.000078	-0.000074	-0.082069	0.320000	-0.000138	0.000072	-0.000067	-0.063173	0.349800
$RQ_{l,t}$	0.000097	-0.000044	0.000054	0.030593	0.349200	0.000113	-0.000048	0.000065	0.039155	0.302200
ψ				-0.921277	0.000000				-0.856748	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A57: Domestic-sourcing firms - Information spillover: $\ln(1+sdta)$. Inst: RL.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000473	-0.000228	0.000245	0.189691	0.000000	0.000471	-0.000218	0.000253	0.186749	0.000000
$\ln(1+sdta_{l,j,t-1})$	0.000204	-0.000102	0.000102	0.099716	0.270400	0.000197	-0.000097	0.000099	0.084325	0.277600
$\ln(1+\widehat{sdta_{l,j,t+1}})$	-0.000150	0.000077	-0.000073	-0.080729	0.323000	-0.000138	0.000071	-0.000066	-0.062457	0.351000
$RL_{l,t}$	-0.000583	0.000287	-0.000296	-0.252922	0.076000	-0.000422	0.000203	-0.000219	-0.179154	0.098800
ψ				-0.921083	0.000000				-0.856249	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A58: Offshoring firms - Information spillover: $\ln(1+sdta)$. Inst: GE.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003673	-0.001814	0.001859	0.380797	0.000000	0.003557	-0.001664	0.001892	0.373194	0.000000
$\ln(1+sdta_{l,j,t-1})$	-0.000602	0.000296	-0.000306	-0.060448	0.184400	-0.000634	0.000295	-0.000339	-0.064495	0.182000
$\ln(1+\widehat{sdta_{l,j,t+1}})$	0.001239	-0.000610	0.000629	0.125912	0.040800	0.001269	-0.000591	0.000677	0.130599	0.047000
$GE_{l,t}$	-0.000043	0.000021	-0.000022	-0.004867	0.427200	-0.000000	0.000001	0.000001	-0.000457	0.473000
ψ				-0.963889	0.000000				-0.866891	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A59: Offshoring firms - Information spillover: $\ln(1+sdta)$. Inst: RQ.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003674	-0.001814	0.001860	0.380965	0.000000	0.003558	-0.001665	0.001893	0.373385	0.000000
$\ln(1+sdta_{l,j,t-1})$	-0.000602	0.000296	-0.000306	-0.060417	0.184800	-0.000634	0.000295	-0.000339	-0.064464	0.182200
$\ln(1+\widehat{sdta_{l,j,t+1}})$	0.001239	-0.000610	0.000628	0.125900	0.041000	0.001268	-0.000591	0.000677	0.130594	0.047000
$RQ_{l,t}$	0.000013	-0.000007	0.000007	0.001394	0.509800	0.000057	-0.000027	0.000031	0.005973	0.461200
ψ				-0.964074	0.000000				-0.867084	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

Table A60: Offshoring firms - Information spillover: $\ln(1+sdta)$. Inst: RL.

	W^{mean}					W^{dist}				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003672	-0.001813	0.001859	0.380706	0.000000	0.003554	-0.001661	0.001893	0.372970	0.000000
$\ln(1+sdta_{l,j,t-1})$	-0.000623	0.000306	-0.000316	-0.062596	0.172000	-0.000655	0.000305	-0.000351	-0.066764	0.171000
$\ln(1+\widehat{sdta_{l,j,t+1}})$	0.001264	-0.000622	0.000641	0.128501	0.036600	0.001295	-0.000603	0.000692	0.133355	0.043600
$RL_{l,t}$	-0.001727	0.000853	-0.000874	-0.179682	0.000800	-0.001708	0.000799	-0.000909	-0.180027	0.002200
ψ				-0.963422	0.000000				-0.864830	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: j, t, l. Other controls: FTA.

E Uncertainty: Multi-country model

E.1 Offshoring profit premium: Definition

We consider now the difference between the offshoring profit premium with perfect information between firms sourcing from the South and East. For a firm with productivity θ, it is given by $\pi^{S,prem}(\theta) - \pi^{E,prem}(\theta) = \frac{r^N(\theta)}{\sigma}(w^N)^{(1-\eta)(\sigma-1)}\left[\frac{(w^E)^{(1-\eta)(\sigma-1)}-(w^S)^{(1-\eta)(\sigma-1)}}{(w^E w^S)^{(1-\eta)(\sigma-1)}}\right] - w^N\left[f^S - f^E\right]$. Under uncertainty, this expression in period t for a firm with productivity θ currently sourcing in the East is:

$$\mathbb{E}_t[\pi^{S,prem}(\theta)|f^S \leq f_t^S] - \pi_t^{E,prem}(\theta) = \frac{r^N(\theta, Q_t)}{\sigma}(w^N)^{(1-\eta)(\sigma-1)}\left[\frac{(w^E)^{(1-\eta)(\sigma-1)} - (w^S)^{(1-\eta)(\sigma-1)}}{(w^E w^S)^{(1-\eta)(\sigma-1)}}\right] - w^N\left[\mathbb{E}_t(f^S|f^S \leq f_t^S) - f^E\right].$$

E.2 Case A: Equilibria with symmetric initial beliefs

We assume that both countries are fully symmetric in terms of beliefs.[132] Therefore, in $t = 0$, firms exploring the offshoring potential randomise their location choice. Due to the continuum of firms, they are divided equally into the East and the South. The exploration continues in both countries in future periods as long as the symmetry in beliefs remains unbroken; that is until the true fixed cost in one of the locations is revealed. By Assumption A.5, the exploration in both locations continues until the fundamentals in the East are revealed. However, this event may not take place in any finite time. In Proposition 2, we show that the transition path and the steady state depend on whether the prior beliefs about the eastern institutions are 'optimistic' or 'pessimistic'. We analyse both situations below.

E.2.1 Case A-I: Stable steady state with equally distributed offshoring across foreign countries

We characterise now the equilibrium path when prior beliefs about eastern institutions are 'pessimistic'. First, we define the condition for 'pessimistic beliefs' and then we show that the equilibrium path leads to a sectoral steady state where the welfare gains from offshoring are fully realised, but a non-efficient allocation of suppliers across countries remains in the long run. In other words, the steady state shows a non-optimal specialisation of countries.

Pessimistic beliefs. We define the priors as *pessimistic* when the lower bound of the distribution is close enough to the true value f^E. This corresponds to the cases I, III and IV of Proposition 2, where the institutional fundamentals in East (f^E) are not revealed in any finite time. Formally, this situation is defined by the condition: $\underline{f} + (1-\lambda)s^r \geq f^E \geq \underline{f}$. Intuitively, it implies that the difference in institutional fundamentals between South and East is relatively small [i.e., $0 < f^E - f^S \leq (1-\lambda)s^r$]. Therefore, the offshoring flow continues indefinitely to both countries and it converges to a steady state where both foreign locations produce intermediate inputs. Thus, the steady state diverges from the optimal sectoral specialisation defined by the institutional fundamentals.

From a welfare perspective, the price index and aggregate consumption index converge in the long run to the perfect information steady state. Therefore, the welfare gains from offshoring are fully achieved in the long run, but with a slow and costly transition phase: $\theta_t^S \searrow \theta_\infty^S = \theta^{S,*}$ and $\theta_t^E \searrow \theta_\infty^E < \infty \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$.

[132] Symmetry in beliefs implies: $\underline{f}^S = \underline{f}^E = \underline{f}$ and $\bar{f}^S = \bar{f}^E = \bar{f}$ and in the distribution $Y(.)$.

E.2.2 Cases A-II and A-III: Equilibrium paths with and without relocation to the South and optimal specialisation in the long run

We characterise now the equilibrium paths when prior beliefs about eastern institutions are 'optimistic'. First, we define the condition for 'optimistic beliefs' and then we show that the sector convergences in the long run to an efficient allocation of suppliers across foreign countries. However, the sector achieves the steady state through different paths depending on the priors and differences in institutional fundamentals.

Optimistic beliefs. The prior beliefs about the East are relatively *optimistic* when the institutional fundamentals in the East are revealed in a finite time. This represents the situation characterised by Case II of Proposition 2 for the East. Formally, the condition for optimistic beliefs is given by: $\underline{f} + (1-\lambda)s^r < f^E$. As we show below, different relocation dynamics across foreign countries may emerge. First, we characterise the transition phase up to the revelation period, and then we define the conditions under which the relocation processes from one offshoring location to the other may take place.

Revelation period of eastern fixed cost. We define $\hat{t}$ as the period in which f^E is revealed, and $\theta^E_{\hat{t}}$ as the productivity level of the marginal firms that remain offshoring in East in $\hat{t}$. For $t > \hat{t}$, the new firms exploring offshoring concentrate in the South following a sequential dynamic path as described in section 2.2.3. Under such conditions, the sector converges to a steady state where the welfare gains from offshoring are fully achieved in the long run: $\theta^S_t \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$.

From the perspective of countries' specialisation, it may be possible that some firms keep sourcing from the East for some periods, even though the southern institutions have been already revealed as better than the eastern ones. Different types of relocation processes may take place as the share of offshoring firms in the South increases. We discuss this below.

Relocation dynamic of least productive firms offshoring in the East. A relocation process of the least productive firms offshoring in the East starts unfailingly as soon as the share of offshoring firms in the sector keeps increasing after $\hat{t}$. The offshoring sequential dynamic pushes the price index further down, driving the least productive firms offshoring in the East to earn negative offshoring profit premiums if they remain to source from that country. Starting with the least productive firms, they sequentially relocate their supply chain from the East to the South.[133] Considering the relocation decision of the least productive firms offshoring from the East, the steady state is (temporarily) characterised by: $\theta^E_{t>\hat{t}} \nearrow \theta^E_\infty < \infty$ and $\theta^S_t \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$, where some firms remain offshoring in the East (i.e. $\theta^E_\infty < \infty$).

Before analysing the other potential relocation decisions, we provide more intuition on the relocation dynamics of the least productive offshoring firms in the East after $\hat{t}$. For any period $t > \hat{t}$, the model shows that $P_t < P_{\hat{t}}$ and $Q_t > Q_{\hat{t}}$. Therefore, The offshoring productivity cutoff in the East for any $t > \hat{t}$ (before other relocation takes place) is $\theta^E_t = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q_t \left[\frac{w^N[f^E - f^N]}{\psi^E - \psi^N}\right]^{\frac{1}{\sigma-1}} > \theta^E_{\hat{t}}$. As new firms keep exploring their offshoring potential in

[133] We derive the offshoring productivity cutoff in the East for any $t > \hat{t}$ below.

the South, the reduction in the price index pushes up the offshoring productivity cutoff in the East. The convergence of the sector's offshoring productivity cutoff is defined by θ^S_∞. The latter determines P_∞ and Q_∞, and thus defines the steady-state level of θ^E_∞.[134] Therefore, the offshoring productivity cutoff in the East—considering only this relocation process—would be given by:[135]

$$\theta^E_\infty = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q_\infty \left[\frac{w^N \left[f^E - f^N \right]}{\psi^E - \psi^N} \right]^{\frac{1}{\sigma-1}} .$$

However, this is not the only relocation that can take place, and thus it does not represent the steady-state offshoring productivity cutoff in the East when the most productive offshoring firms in the East decide to relocate the intermediate-input suppliers from the East to the South. We discuss this below.

Relocation decision of most productive firms offshoring in the East. When the difference in the institutional fundamentals is large enough to compensate for the payment of the offshoring sunk cost in the South, a second kind of relocation process (from the East to the South) takes place. The firms offshoring in the East with productivity $\theta > \theta^E_\infty$ will not be relocated by the mechanism described above. They still find it more profitable to source from eastern suppliers than to relocate the supply chain to domestic or southern suppliers. However, they will consider relocating to the South when the following condition holds:

$$\mathbb{E}_t \left[\sum_{\tau=t}^{\infty} \lambda^{\tau-t} \pi^{S,prem}_\tau(\theta) | f^S \le f^S_t \right] - \mathbb{E}_t \left[\sum_{\tau=t}^{\infty} \lambda^{\tau-t} \pi^{E,prem}_\tau(\theta) | f^S \le f^S_t \right] - w^N s^r \ge 0.$$

Intuitively, it means that the expected lifetime gains from relocation from the East to the South are large enough to recover the offshoring sunk cost to relocate to the South, as the relocation of the supply chain involves a new payment of the offshoring sunk cost to discover the offshoring potential in the new location. Solving this equation leads to the following condition: $f^E - \mathbb{E}_t \left[f^S | f^S \le f^S_t \right] \ge (1-\lambda) s^r$. Hence, whenever the expected institutional quality in the South is good enough compared to eastern institutional fundamentals, the remaining firms offshoring in the East will change their suppliers' location to the South.[136] We show below that there are two different transition phases depending on whether the second relocation process takes place or not. We define them as *Case A-II* and *Case A-III*.

Case A-II: transition phase without relocation. This refers to the situation in which differences in institutional fundamentals between South and East are not large enough; that is: $f^E - f^S < (1-\lambda)s^r$. Thus, the firms already offshoring in the East with productivity $\theta > \theta^E_\infty$ do not relocate to the South in any period t. The steady state, without considering the exogenous death shock effect, is given by: $\theta^E_t \to \theta^E_\infty < \infty$ and $\theta^S_t \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$. Thus, the sector shows a suboptimal specialisation of countries. However, after the institutional fundamentals in the East are revealed, the 'death shock effect' pushes the sector to the optimal production allocation by washing out the firms offshoring in the East in the long run. Therefore, the perfect information steady state is achieved in the long run: $\theta^E_t \to \infty$ and $\theta^S_t \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$.

[134] In this regard, the sector's offshoring productivity cutoff θ^S_∞ is defined as in section 2.2.3 with the corresponding price index and aggregate consumption steady-state levels $P_\infty \equiv P(\theta^S_\infty)$ and $Q_\infty \equiv Q(\theta^S_\infty)$.

[135] This characterisation considers only the relocation of the least productive firms in the East. Therefore, it may not represent the true sectoral steady state. Below we incorporate another type of relocation that may arise in the sector, as well as the long-run effect of the death shock.

[136] A specific feature of the setting of the model is that this relocation is decided by all firms at the same time. This comes from the simplified definition of firms' sourcing choices. Nevertheless, the main features of the model are consistent with more complex scenarios.

Case A-III: transition phase with relocation. When differences in institutional fundamentals between the South and the East are large enough; that is, $f^E - f^S \geq (1-\lambda)s^r$, the firms already offshoring in the East with productivity $\theta > \theta^E_\infty$ relocate to the South. The relocation period $t < \infty$ is defined by the following condition: $f^E - \mathbb{E}_t\left[f^S | f^S \leq f^S_t\right] = (1-\lambda)s^r$. Thus, the sector converges to the perfect information equilibrium as defined in section 2.2.3. Firms only offshore from the South and welfare gains from offshoring are fully realised: $\theta^E_t \to \infty$ and $\theta^S_t \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$. The main difference to the *Case A-II* is that here the optimal specialisation is achieved in a finite time.

E.3 Equilibria with asymmetric initial beliefs

We characterise the equilibria when the first movers coordinate to the efficient equilibrium or the non-efficient equilibrium. To that end, we introduce asymmetric beliefs about institutions in the East and the South, inducing an initial coordinated movement in favour of offshoring exploration to one of the countries. We define the conditions under which the coordinated movement of the first explorers to the efficient or the non-efficient equilibrium leads to a persistent offshoring pattern (i.e., a stable equilibrium path) into the initially chosen location. We also define the cases where the equilibrium path pushes the offshoring sequence out of the initially chosen location.

E.3.1 Case B: Coordination to the efficient equilibrium

Firms' prior beliefs about institutions in the South are better than the priors on institutions in the East. For simplicity, we assume that the lower bound of the prior uncertainty is the same across countries. Thus, the asymmetry comes from the difference in the upper bound of the prior distributions; that is:

$$\underline{f}^S = \underline{f}^E = \underline{f} \text{ and } \bar{f}^S = \bar{f}^E - \delta; \text{ with } \delta > 0 \quad \Rightarrow \quad E_{t=0}(f^S | f^S \leq \bar{f}^S) < E_{t=0}(f^E | f^E \leq \bar{f}^E).$$

In period $t = 0$, the favourable beliefs about the South induce the most productive firms to explore their offshoring potential in this location. Information externalities emerge concerning the southern institutions, whereas no new information about eastern institutions is revealed.[137] Due to the effect of information externalities, the strategy of exploring the offshoring potential in the South increasingly dominates exploring it in the East. Therefore, the sequential offshoring equilibrium path concentrates in the South, whereas the East remains producing only the homogeneous good, and the sector converges to the perfect-information steady state. However, whether the sector reaches the steady state in a finite or infinite time depends on the conditions defined by Proposition 2. Thus, we have:[138] $\theta^E_t \to \infty \; \forall t$ and $\theta^S_t \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$, with $\theta^E_t \to \infty \; \forall t$ denoting the fact that no firm offshores in the East in any period t.

Additional considerations to Case B. In period $t = 0$, the favourable beliefs about the South induce the most productive firms to explore their offshoring potential in this location. In consequence, information externalities

[137] See below (*Additional considerations to Case B*) for the learning mechanism, the law of motion of beliefs about southern and eastern institutions, and the trade-off function.

[138] There is a special case when δ is relatively close to zero and the prior beliefs about southern institutions are extremely optimistic. It refers to the situation when the true value f^S is revealed in $t = 0$; that is, when the first explorers go to the South. A subset of those firms that have failed to explore in the South may explore their offshoring potential in the East in $t = 1$. Formally, this takes place if $\mathcal{D}^E_t(\theta^S_{t=1}; \bar{\bar{\theta}}^E, \bar{\bar{\theta}}^E) > 0$. Nevertheless, the explorers in the East will immediately discover that offshoring in that location is not profitable for them either, and they will continue to source domestically. In this situation, both fixed costs f^S and f^E are revealed in the first two periods, and the sector achieves the perfect-information steady state.

emerge concerning the southern country, while no new information about eastern institutions is revealed. Therefore, the beliefs about institutions in each country evolve in the following way:

$$f^E \sim Y(f^E) \text{ with } f^E \in [\underline{f}^E, \bar{f}^E],$$

$$f^S \sim \begin{cases} Y(f^S | f^S \leq f_t^S) & \text{if } \tilde{f}_t^S = f_t^S < f_{t-1}^S, \\ f_t^S & \text{if } \tilde{f}_t^S < f_t^S. \end{cases}$$

The decision at any period t of a non-offshoring firm θ is given by $\mathcal{V}_t(\theta;.) = \max\left\{V_t^{o,S}(\theta;.); V_t^{w,1,S}(\theta;.)\right\}$, and the respective trade-off function is:

$$\mathcal{D}_t^S(\theta; \theta_t^S, \tilde{\theta}_{t+1}^S) = \max\left\{0; \mathbb{E}_t\left[\pi_t^{S,prem}(\theta)\Big| f^S \leq f_t^S\right]\right\} - w^N s^r \left[1 - \lambda \frac{Y(f_{t+1}^S)}{Y(f_t^S)}\right]. \tag{A64}$$

E.3.2 Case C: Coordination to the non-efficient equilibrium

We assume now that firms believe that the eastern institutions are better than southern (i.e., $\delta < 0$):

$$\underline{f}^S = \underline{f}^E = \underline{f} \text{ and } \bar{f}^S = \bar{f}^E - \delta; \text{ with } \delta < 0 \quad \Rightarrow \quad E_{t=0}(f^S | f^S \leq \bar{f}^S) > E_{t=0}(f^E | f^E \leq \bar{f}^E).$$

The coordination to the non-efficient equilibrium may be stable or unstable depending on the institutional fundamentals in the East, the size of δ and how optimistic the prior beliefs of the eastern institutions concerning the fundamentals are. We characterise below all possible cases.

Case C-I: stable non-efficient equilibrium path. Using the definitions of *'pessimistic'* and *'optimistic'* beliefs from above, we show below the two possible paths and the respective steady states.

Pessimistic beliefs. This represents the situation in which the institutional fundamentals are not revealed in finite time. Accordingly, the sequential offshoring process continues in the long run and it concentrates on the eastern country. In consequence, the offshoring productivity cutoff—represented by $\theta_\infty^E > \theta^{S,*}$—puts the sector in a steady state with a higher price index P_∞ and lower aggregate consumption index Q_∞. That is, $\theta_t^S \to \infty \ \forall t$ and $\theta_t^E \searrow \theta_\infty^E > \theta^{S,*} \Rightarrow P_t \searrow P_\infty > P^* \Rightarrow Q_t \nearrow Q_\infty < Q^*$, with $\theta_t^S \to \infty \ \forall t$ referring to the fact that no firm offshores in the South in any period t. In other words, the sector converges to a non-efficient steady state where the supply chain is organised under a suboptimal allocation of production across countries,[139] and the potential welfare gains from offshoring are not fully realised in the long run.

Optimistic beliefs. The institutional fundamentals in the East will be revealed in a finite time. We define again $\hat{t}$ as the period when the true value f^E is revealed.[140] At any period $t \leq \hat{t}$, the strategy of exploring the offshoring potential in the East dominates the exploration in the South. Therefore, the offshoring flow concentrates in the East, whereas the South remains exclusively specialised in the production of the homogeneous good.

At period $\hat{t}$, the beliefs about institutional conditions are:

$$f^S \sim Y(f^S) \text{ with } f^S \in [\underline{f}^S, \bar{f}^S],$$

$$f^E = f^E(\theta_{\hat{t}}^E),$$

with $\theta_{\hat{t}}^E$ denoting the least productive firms offshoring in East in period $\hat{t}$.

[139] That is, the South remains producing only the homogeneous good while all offshored production of intermediate inputs has been located in the East.

[140] When $f^E - \underline{f}^E \leq (1-\lambda)s^r$, then $\hat{t} \to \infty$.

Consider that $|\delta|$ is large enough such that the following condition holds: $\mathcal{D}^S_{\hat{t}}(\theta^E_{\hat{t}};\bar{\bar{\theta}}^S,\bar{\bar{\theta}}^S) < 0$.[141] This means that the most productive domestic-sourcing firms at $\hat{t}+1$ do not find it attractive to explore the offshoring potential in the South.[142] Therefore, no exploration of the South takes place and the sector converges to a steady state where the specialisation of countries is suboptimal and the welfare gains from offshoring are not fully realised. That is, $\theta^S_t \to \infty\ \forall t$ and $\theta^E_t \searrow \theta^E_\infty > \theta^{S,*} \Rightarrow P_t \searrow P_\infty > P^* \Rightarrow Q_t \nearrow Q_\infty < Q^*$.

Additional considerations to Case C-I: Stable non-efficient equilibrium path. For optimistic beliefs, we defined $\hat{t}$ as the period when the true value f^E is revealed. For any $t \leq \hat{t}$, the beliefs evolve according to:

$$f^S \sim Y(f^S) \text{ with } f^S \in [\underline{f}^S, \bar{f}^S],$$

$$f^E \sim \begin{cases} Y(f^E | f^E \leq f^E_t) & \text{if } \tilde{f}^E_t = f^E_t < f^E_{t-1}, \\ f^E_t & \text{if } \tilde{f}^E_t < f^E_t. \end{cases}$$

The decision at any period $t < \hat{t}$ of a non-offshoring firm θ is given by $\mathcal{V}_t(\theta;.) = \max\left\{V^{o,E}_t(\theta;.); V^{w,1,E}_t(\theta;.)\right\}$, and the respective trade-off function is represented by:

$$\mathcal{D}^E_t(\theta;\theta^E_t,\tilde{\theta}^E_{t+1}) = \max\left\{0; \mathbb{E}_t\left[\pi^{E,prem}_t(\theta)\middle| f^E \leq f^E_t\right]\right\} - w^N s^r \left[1 - \lambda\frac{Y(f^E_{t+1})}{Y(f^E_t)}\right]. \quad \text{(A65)}$$

In the case of pessimistic beliefs, the learning mechanism and the trade-off function defined above hold for any period t.

Case C-II: early explorers shifting path. There is a special case where the equilibrium path starts in the non-efficient path and is pushed towards the efficient steady state. It arises when δ is relatively close to zero and the priors about eastern institutions are optimistic enough, such that f^E is revealed in the first period and thus some of the first explorers (in $t = 0$) find it unprofitable to offshore in the East after paying the sunk cost. Optimistic enough priors about eastern institutions imply that $f^E > f^E(\tilde{\theta}^E_{t=1}) \equiv \tilde{f}^E_{t=1}$, where $\tilde{\theta}^E_{t=1}$ indicates the least productive firms that have explored the offshoring potential in the East in period $t = 0$, and $\theta^E_{t=1}$ refers to the least productive firms that remained sourcing from the East.

Those firms with productivity $\theta \in [\tilde{\theta}^E_{t=1}, \theta^E_{t=1})$, that explored their offshoring potential in the East in period $t = 0$, discovered that it is not profitable for them to offshore in the East. Thus, if $|\delta|$ is small enough such that firms $\theta \in [\tilde{\theta}^E_{t=1}, \theta^E_{t=1})$ find it profitable to explore their offshoring potential in the South in $t = 1$, a sequential offshoring process to the South is triggered by those firms. The exploration of the South takes place when: $\mathcal{D}_{t=1}(\theta^E_{t=1};\bar{\bar{\theta}}^S,\bar{\bar{\theta}}^S) > 0$. This implies that at least the most productive firms among those who have failed offshoring from the East must find it profitable to explore the offshoring potential in the South. Once the emergence of information externalities about southern conditions has been triggered, it leads the sector towards the perfect information steady state where the welfare gains from offshoring are fully achieved in the long run. However, the transition phase can take two different paths that we characterise below as *Case C-IIa* and *Case C-IIb*.

[141] Equivalently, it is possible to consider that fundamentals in the East are good enough such that the true value does not reveal in the first period. Therefore, firms sourcing domestically will not find it profitable to explore their offshoring potential in the South after the true value f^E is revealed.

[142] That is, firms marginally less productive than the offshoring productivity cutoff in the East do not find it attractive to explore the offshoring potential in the South.

Case C-IIa: transition phase without relocation. It refers again to the situation where differences in institutional fundamentals between South and East are not large enough such that firms have an incentive to relocate at any period t (i.e., $f^E - f^S < (1-\lambda)s^r$). Thus, firms already offshoring in the East with productivity $\theta > \theta^E_{t=1}$ do not relocate to the South in any period t. In consequence, the steady state, without considering the exogenous death shock effect, is given by: $\theta^E_\infty = \theta^E_{t=1} < \infty$ and $\theta^S_t \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$.

As shown above, although the sector remains temporarily under a suboptimal sectoral specialisation of countries, the 'death shock effect' pushes the industry to the optimal production allocation in the long run. Therefore, the steady state, in the long run, is finally characterised by: $\theta^E_t \nearrow \infty$ and $\theta^S_t \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$.

Case C-IIb: transition phase with relocation. When differences in institutional fundamentals between the South and the East are large enough (i.e., $f^E - f^S \geq (1-\lambda)s^r$), firms already offshoring in the East with productivity $\theta > \theta^E_{t=1}$ will relocate to the South in period $t < \infty$ defined by the following condition: $f^E - \mathbb{E}_t\left[f^S | f^S \leq f^S_t\right] = (1-\lambda)s^r$. Thus, the sector converges to the perfect information steady state where firms exclusively offshore in the South and welfare gains from offshoring are fully achieved in the long run. The main difference to the previous transition phase is that the optimal specialisation is achieved in a finite time by relocation, whereas in the other case it is realised in the long run through the death shock effect: $\theta^E_t \nearrow \infty$ and $\theta^S_t \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*$.

Additional considerations to Case C-II: learning mechanism and trade-off function. After the initial period, the beliefs about the institutional conditions in both foreign countries at each period t is represented by:

$$f^E = f^E_{t=1},$$

$$f^S \sim \begin{cases} Y(f^S | f^S \leq f^S_t) & \text{if } \tilde{f}^S_t = f^S_t < f^S_{t-1}, \\ f^S_t & \text{if } \tilde{f}^S_t < f^S_t, \end{cases}$$

and firm's decision at any period $t \geq 1$ is given by the trade-off function in equation (A64) in Appendix E.3.1.

F Social planner analysis

We assume that the Social Planner (SP) has perfect knowledge of the prior beliefs of the northern firms and the offshoring conditions (i.e., institutional fundamentals) in every country. The SP can influence northern firms' behaviour by implementing a policy of taxes and subsidies. In other words, the SP cannot directly allocate resources, but it can indirectly lead firms to the perfect information steady state through tax and subsidy policies. We discuss this further for the two-country model in section F.1, and we extend it to the multi-country setup in section F.2.

F.1 Social planner: Two-country model

We define two alternative SP's policy strategies: *SP's Policy A* and *SP's Policy B*. In both cases, the SP achieves the perfect information steady state in $t = 0$.

F.1.1 SP's policy A

The SP eliminates all uncertainty about f^S by announcing an arbitrary per-period fixed cost of offshoring $f^{S,SP}$. This per-period fixed cost is guaranteed by the SP by implementing a policy of contingent lump-sum taxes and subsidies on the per-period fixed costs of offshoring. Under this policy regime, when the true fixed cost f^S is lower than $f^{S,SP}$ (i.e., $f^S < f^{S,SP}$), the SP implements a per-period tax $T = f^{S,SP} - f^S$, where $T > 0$ represents a lump-sum tax. Instead, when the true fixed cost f^S is larger than $f^{S,SP}$, i.e. $f^S > f^{S,SP}$, the SP commits to grant a per-period subsidy $T = f^{S,SP} - f^S$, where $T < 0$ represents a subsidy. [143] Therefore, the SP's optimal tax-subsidy policy $T(f^S)$, illustrated in Figure A22, is given by:

$$T(f^S) = f^{S,SP} - f^S \begin{cases} > 0 & \text{if } f^S < f^{S,SP}, \\ = 0 & \text{if } f^S = f^{S,SP}, \\ < 0 & \text{if } f^S > f^{S,SP}. \end{cases} \tag{A66}$$

This SP's policy eliminates the uncertainty about the offshoring fixed costs and collapses the prior distribution on the value $f^{S,SP}$ arbitrarily defined by the SP. If the SP defines a policy scheme that commits to per-period offshoring fixed cost (i.e., $f^{S,SP} = f^S$), the prior uncertainty collapses around the true f^S and the sector converges immediately to the perfect information steady state.[144] Moreover, it is easy to see that, ex-post, the SP does neither pay subsidies nor collect taxes at any period t.[145] Lemma 2 summarises the results of SP's policy A.

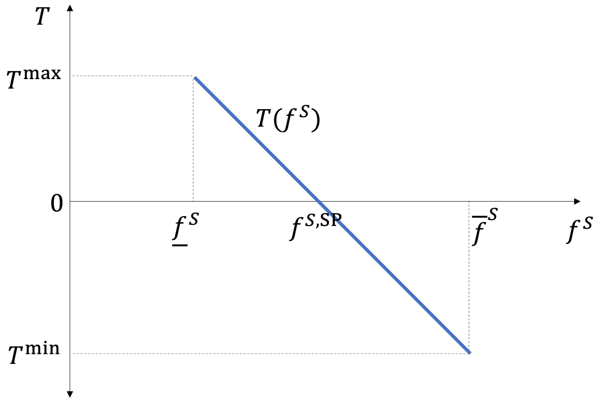


Figure A22: SP's Tax-Subsidy Policy

Lemma 2 (**Convergence under SP's policy A**). *The SP's tax-subsidy regime $T(f^S)$ defined in equation (A66) leads the sector to the perfect information steady state from period $t = 0$ onwards.*

Proof. Follows from the text above. □

F.1.2 SP's policy B

The SP's policy consists of a combination of a one-time (at $t = 0$) contingent subsidy—denoted as $X(\theta)$—on the offshoring sunk cost, and a contingent per-period tax T. In this regime, the SP announces a per-period tax given by:

$$T(f^S) = \begin{cases} \underline{f}^{S,SP} - f^S > 0 & \text{if } f^S < \underline{f}^{S,SP}, \\ 0 & \text{if } f^S \geq \underline{f}^{S,SP}, \end{cases} \tag{A67}$$

[143]It is straightforward to see that the maximum tax that the SP may collect—from firms' prior beliefs perspective—is given by $T^{\max} = f^{S,SP} - \underline{f}^S$. In a similar way, the maximum subsidy (i.e., minimum T) that the SP may have to afford—from firms' prior beliefs perspective—is given by $T^{\min} = f^{S,SP} - \bar{f}^S$.

[144]If the SP only defines the subsidy, this policy will lead to excessive offshoring when the priors are defined as in cases II to IV in Proposition 2. In Case I, where $\underline{f}^S = f^S$, the tax $T^{\max} = 0$.

[145]This last feature comes from considering that the institutional fundamentals are deterministic—i.e., they are not stochastic—and the SP commits to hold a regime that corresponds to the true f^S. Under stochastic fundamentals, the SP could still eliminate the uncertainty by committing to a fixed cost equal to the true $\mathbb{E}(f^S)$, by implementing taxes or subsidies in each period depending on the realisation of f^S.

where $\underline{f}^{S,SP}$ defines a new lower bound for the prior belief distribution guaranteed by the SP. Under this tax policy, the SP defines the tax T such that the lower bound of the prior distribution equals the true value f^S, placing the sector under Case I conditions. This implies that by introducing the tax, the SP eliminates the excessive offshoring—i.e., hysteresis—from the steady state by discouraging firms with productivity $\theta < \theta^{S,*}$ from exploring the offshoring potential.[146] The new prior distribution of offshoring fixed costs beliefs under the SP regime is denoted as $Y^{\text{SP}}(f^S)$, with $f^S \in [\underline{f}^{S,SP}, \bar{f}^S]$. Figure A23 illustrates the SP's tax policy.

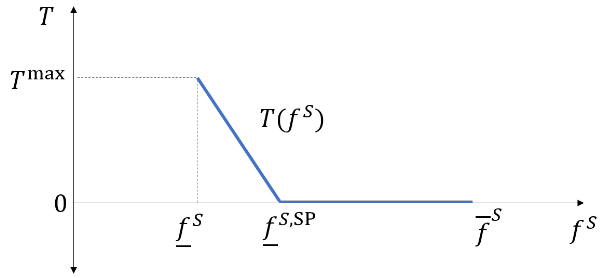


Figure A23: SP's contingent tax policy.

The SP ensures that the sector converges to the perfect-information steady state, but only in the long run. We characterise now the optimal SP's contingent subsidy policy to promote the offshoring exploration in $t = 0$ by all firms with productivity $\theta \geq \theta^{S,*}$. Intuitively, this subsidy policy consists of a SP's commitment to compensate the potential losses that these firms may face after exploring their offshoring potential in $t = 0$. Thus, the trade-off function at $t = 0$ under SP regime is given by:

$$\mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) = \max\left\{0; \mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta) \,\middle|\, f^S \leq \bar{f}^S, T\right]\right\} - w^N s^r \left[1 - \lambda \frac{Y^{\text{SP}}(f^S_{t=1})}{Y^{\text{SP}}(\bar{f}^S)}\right], \tag{A68}$$

with $\mathcal{I}^{\text{SP}}_{i,j,t=0} \equiv \{\bar{\bar{\theta}}, \tilde{\theta}^{\text{SP}}_{t=1}\}$, and $\tilde{\theta}^{\text{SP}}_{t=1}$ denoting the expected state at the beginning of $t = 1$ under SP intervention.

Assuming that the SP wants to achieve the perfect-information steady state in $t = 0$, we have that $\tilde{\theta}^{\text{SP}}_{t=1} = \theta^{S,*}$.[147] The SP must shift upwards the trade-off function such that $\mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) \geq 0$ for all firms with productivity $\theta \geq \theta^{S,*}$. From equation (A68), we observe that the first term on the right-hand side has a minimum at zero.[148] Therefore, the SP's policy must only compensate the expected losses from the second term on the right-hand side (i.e., from the offshoring sunk costs). The optimal firm-specific SP's subsidy policy at $t = 0$—denoted as $X(\theta)$—for all firms with productivity $\theta \geq \theta^{S,*}$ is given by:[149]

$$X(\theta) \begin{cases} = 0 & \text{if } A, \text{ for } \theta \geq \theta_A, \\ = X^{\max} \equiv w^N s^r \left[1 - \lambda \frac{Y^{\text{SP}}(f^{S,\text{SP}}_{t=1})}{Y^{\text{SP}}(\bar{f}^S)}\right] & \text{if } \neg A \wedge B, \text{ for } \theta \in [\theta^{S,*}, \theta_B], \\ 0 < X(\theta) < X^{\max} & \text{if } \neg A \wedge C, \text{ for } \theta \in (\theta_B, \theta_A), \end{cases} \tag{A69}$$

where $\theta^{S,*} < \theta_B < \theta_A < \bar{\bar{\theta}}$, $f^{S,\text{SP}}_{t=1} \equiv f^S(\theta^{S,*})$, and

[146] Notice that when the priors are already defined by Case I conditions—i.e., $\underline{f}^S = f^S$, then the optimal $T = 0$. In other words, the subsidy policy defined below is sufficient to achieve the perfect information steady state in $t = 0$.

[147] Starting from the trade-off function (8) and Lemma 1, we know that without SP intervention, the offshoring exploration productivity cutoff in $t = 0$ is given by $\mathcal{D}_t(\tilde{\theta}_{t+1}; \theta_t, \tilde{\theta}_{t+1}) = 0$. *Ceteris paribus*, the SP contingent subsidy increases the expected gains from waiting, as $\tilde{\theta}^{\text{SP}}_{t=1} < \tilde{\theta}_{t=1}$, where the latter reflects the expected state without SP intervention.

[148] That is because firms know that if after exploration they discover that the per-period offshoring profit premium is negative, they can remain under domestic sourcing.

[149] Considering that ex-post the SP must not compensate any firm, a simpler SP policy would define a homogenous—i.e., not firm-specific—contingent subsidy for all firms. We discuss this further in Appendix F.3.2.

$$A \equiv \mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) \geq 0, \qquad \text{with } \theta_A : \mathcal{D}_{t=0}(\theta_A; \mathcal{I}^{\text{SP}}_{i,j,t=0}) = 0, \tag{A70a}$$

$$B \equiv \mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta) \middle| f^S \leq \bar{f}^S, T\right] \leq 0, \qquad \text{with } \theta_B : \mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta_B) \middle| f^S \leq \bar{f}^S, T\right] = 0, \tag{A70b}$$

$$C \equiv \mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta) \middle| f^S \leq \bar{f}^S, T\right] > 0. \tag{A70c}$$

For proofs on contingent subsidy policy, see Appendix F.3.1.

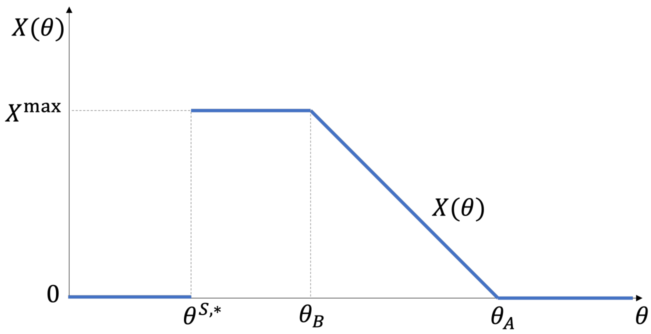


Figure A24: SP's contingent subsidy policy by productivity.

Intuitively, equation (A69) characterises the optimal contingent subsidy policy illustrated in Figure A24. First, firms with productivity $\theta \geq \theta_A$ have incentives to explore their offshoring potential in $t = 0$ independently of any subsidy offered to them by the SP. Therefore, the SP offers no contingent subsidy to these firms. Second, firms with productivity $\theta \in [\theta^{S,*}, \theta_B]$ have negative expected per-period offshoring profit premium. Therefore, to promote the offshoring exploration of these firms, the SP planner must offer a maximum contingent subsidy—denoted as $X^{\max}$—to make these firms indifferent between exploring their offshoring potential in $t = 0$ and wait.[150] Finally, firms with productivity $\theta \in (\theta_B, \theta_A)$ face a positive expected offshoring profit premium. Therefore, the SP must only partially compensate these firms to make them indifferent between exploring the offshoring potential in $t = 0$ or waiting. Given that the expected offshoring profit premiums are increasing in productivity, the contingent subsidy is decreasing in θ.[151]

Summing up, the trade-off function under the SP regime at $t = 0$ for firms with $\theta \geq \theta^{S,*}$ is $\mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) \geq 0$ for $\theta \geq \theta_A$ and $\mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) + X(\theta) = 0$ for $\theta \in [\theta^{S,*}, \theta_A)$, which implies that all firms with productivity $\theta \geq \theta^{S,*}$ explore the offshoring potential in $t = 0$.

We conclude by analysing firms' offshoring exploration decisions in periods $t > 0$ for firms with productivity $\theta < \theta^{S,*}$. We show that these firms do not find it profitable to explore their offshoring potential at any period $t > 0$. First, we show that the per-period tax T implemented by SP produces a left truncation of the initial prior distribution, raising it to $\underline{f}^{S,SP} = f^S$. Second, the offshoring productivity cutoff at the beginning of period $t =$ 1—that is, the least productive firms exploring offshoring in $t = 0$, denoted as $\theta^S_{t=1} = \theta^{S,*}$—provides information to the domestic-sourcing firms about the maximum affordable fixed cost for that firm [$f^S_{t=1} = f(\theta^{S,*})$], as defined by equation (5). Thus, from the learning mechanism characterised in section 2.2.3, we know that it defines the

[150] Recall that when the expected offshoring profit premium is negative, the first term of the right-hand side of the trade-off function (A68) takes the value zero. After exploring offshoring, firms have the option to remain under domestic sourcing when they discover that it is not profitable for them to offshore.

[151] As shown in Figure A24, the SP offers no subsidy to firms with productivity $\theta < \theta^{S,*}$. The intuition is straightforward, as it is not optimal for these firms to offshore, the SP does not want to encourage the offshoring exploration of these firms.

upper bound of the posterior distribution in $t = 1$. However, from the definition of the offshoring profit premium and equations (3) and (5), it is easy to see that $f^S(\theta^{S,*}) = f^S_{t=1} = (1-\lambda)s^r + f^S > f^S$.[152] By defining the lower bound $\underline{f}^{S,SP}$ at the true value, the SP discourages the offshoring exploration of firms with productivity $\theta < \theta^{S,*}$ at any period $t > 0$.[153] That is, the sector achieves the perfect information steady state at $t = 0$, where the offshoring productivity cutoff is given by $\theta^{S,*}$. Lemma 3 summarises the results of SP's policy B under two-country model.[154]

Lemma 3 (**Convergence under SP's policy B**). *The joint SP's optimal contingent subsidy $X(\theta)$ and tax policies $T(f^S)$—given by equations (A67) and (A69), respectively—achieve the perfect information steady state in the sector from period $t = 0$ onwards.*

Proof. Follows from the text above. □

Ex-post analysis of SP's policy B. On the one hand, at the end of period $t = 0$, all firms with productivity $\theta \geq \theta^{S,*}$ explore their offshoring potential in the South. After exploration, they realise that the discounted expected offshoring profit premium over the firm's lifetime is enough to recover the offshoring sunk cost. Therefore, the SP does not have to compensate any of these firms, according to the subsidy policy described above.[155] On the other hand, after exploration, all offshoring firms discover that the true fixed cost $f^S = \underline{f}^{S,\text{SP}}$. Therefore, the SP charges a zero per-period tax (i.e., $T = 0$) to the offshoring firms.

F.2 Social planner: Multi-country model

We analyse the SP's policies from Appendix F.1 in the multi-country model. The SP regime promotes offshoring exploration in the South by firms with productivity $\theta \geq \theta^{S,*}$, whereas it discourages firms to explore their offshoring potential in the East. We define SP's policy regimes that hold under any of the cases of initial prior beliefs as defined in section 4.1.2; that is, with symmetric and asymmetric initial prior beliefs.

F.2.1 SP's policy A

The SP defines differential policies for firms offshoring in the South and the East. Concerning firms offshoring in the South, the SP announces an offshoring fixed cost in the South $f^{S,\text{SP}}$, which is implemented by a tax-subsidy policy—denoted here by $T^S(f^S)$—similar to the underlying policy in Lemma 2. As before, the SP sets the fixed costs equal to the true value of the per-period fixed costs of offshoring in the South—i.e., $f^{S,\text{SP}} = f^S$—, collapsing the prior uncertainty related to the South around the true value f^S.

[152] Equation (5) defines a condition at which the firm $\theta^{S,*}$ realises zero per-period offshoring profit premium. That is, at those per-period offshoring fixed costs, the discounted lifetime offshoring profit premiums are not enough to recover the offshoring sunk cost.

[153] Firms with productivity $\theta < \theta^{S,*}$ know with certainty that they will not be able to recover the offshoring sunk cost at any per-period fixed cost $f^S \geq \underline{f}^{S,SP}$.

[154] In Appendix F.3.2, we discuss a possible alternative policy regime based on SP's Policy B. In this alternative specification, the SP subsidy policy targets only the firms with productivity $\theta^{S,*}$. Under this regime, the perfect information steady state is achieved in $t = 1$.

[155] The subsidy policy applies only to period $t = 0$. Firms that enter the market at any period $t > 0$ with a productivity $\theta \geq \theta^{S,*}$ do not have access to the subsidy policy. Nevertheless, by observing the offshoring firms they know that it is profitable for them to pay the offshoring sunk cost and explore their offshoring potential.

In addition, the SP defines a minimum per-period fixed cost of offshoring in the East—denoted as $\underline{f}^{E,\text{SP}}$—for firms offshoring in the East. From Assumption A.5, we know that $f^S < f^E$. Therefore, a sufficient condition to discourage offshoring exploration in the East is given by the SP setting $\underline{f}^{E,\text{SP}} = f^E$. The SP's tax policy to the East is given by:[156]

$$T^E(f^E) = \begin{cases} \underline{f}^{E,SP} - f^E > 0 & \text{if } f^E < \underline{f}^{E,SP}, \\ 0 & \text{if } f^E \geq \underline{f}^{E,SP}. \end{cases} \tag{A71}$$

Under this SP regime, firms with productivity $\theta \geq \theta^{S,*}$ explore offshoring in $t = 0$ in the South, whereas firms with productivity $\theta < \theta^{S,*}$ remain under domestic sourcing at any period t. Moreover, as no firm finds it profitable to explore offshoring in the East at any period t, the East remains fully specialised in the production of the homogenous good. Lemma 4 summarises the results of SP's policy A under the multi-country model.

Lemma 4 (**Multi-country: convergence under SP's policy A**). *The joint implementation of SP's optimal tax-subsidy policy to the South, $T^S(f^S)$, and optimal tax policy to the East, $T^E(f^E)$—given by equations (A66) and (A71), respectively—achieve the perfect information steady-state in the sector from period $t = 0$ onwards.*

Proof. Follows from the text above. □

F.2.2 SP's policy B

As in the previous case, the SP defines differential policies for offshoring in the South and the East. For the East, the SP defines the same tax policy $T^E(f^E)$ as above. This tax policy ensures a minimum cost of offshoring in the East that—combined with the policy targeted to the South—discourages offshoring exploration of the East by any firm at any period t. Regarding the policy target to offshoring in the South, the SP implements a similar policy scheme as in section F.1.2. It combines a per-period tax for offshoring firms in the South with a one-time contingent subsidy on the exploration sunk cost. The per-period tax policy $T^S(f^S)$ announced by the SP for offshoring firms in the South is given by equation (A67), whereas the SP's contingent subsidy policy—here defined as $X^S(\theta)$—is given by equation (A69). Lemma 5 summarises the results of SP's policy B.

Lemma 5 (**Multi-Country: Convergence under SP's Policy B**). *The joint implementation of SP's optimal tax policy to the South and East, $T^S(f^S)$ and $T^E(f^E)$, and the optimal contingent subsidy policy for offshoring exploration in the South, $X^S(\theta)$ achieves the perfect information steady-state in sector from period $t = 0$ onwards.*

Proof. Follows from the text above. □

F.3 Additional considerations and proofs on SP's analysis

F.3.1 Derivation of SP's contingent subsidy policy in the two-country model.

We start from the trade-off function under the SP regime given by equation (A68). The offshoring exploration productivity cutoff at $t = 0$, as before, is characterised by the fixed point of the trade-off function defined by firm θ_A, which is indifferent between exploring offshoring and waiting (see Lemma 1). Moreover, as the trade-off function is increasing in productivity (see Proposition 1), all firms with productivity $\theta > \theta_A$ have a positive

[156]The SP can alternatively define a similar policy as in the South and thus eliminate all uncertainty about the East. However, this is not necessary to achieve the perfect information steady state.

trade-off function. Therefore, the SP does not have to provide any exploration incentive to firms with productivity $\theta \geq \theta_A$. Thus, the SP defines a contingent subsidy $X(\theta) = 0$ for all firms with productivity $\theta \geq \theta_A$.

For firms with productivity $\theta \in [\theta^{S,*}, \theta_A)$, $\mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) < 0$. Thus, the SP defines a contingent subsidy policy that makes each of these firms indifferent between exploring offshoring and waiting under domestic sourcing; that is, $\mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) = 0$. We divide the characterisation of the subsidy policy in two groups, starting with firms with productivity $\theta \in [\theta^{S,*}, \theta_B]$ for which $\mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta) \middle| f^S \leq \bar{f}^S, T\right] \leq 0$. The productivity θ_B is defined by firms with $\mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta_B) \middle| f^S \leq \bar{f}^S, T\right] = 0$.

We define the condition B as $B \equiv \mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta) \middle| f^S \leq \bar{f}^S, T\right] \leq 0$. This implies that the first term on the right-hand side of equation (A68) equals zero. Thus, for these firms, we have that $\mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) = -w^N s^r \left[1 - \lambda \frac{Y^{\text{SP}}(f^S_{t=1})}{Y^{\text{SP}}(f^S)}\right] < 0$. Therefore, to achieve a trade-off function net of contingent subsidy equal to zero, the SP must commit to a subsidy policy $X(\theta)$ such that $X(\theta) + \mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) = 0$, and $X^{\max} \equiv X(\theta) = w^N s^r \left[1 - \lambda \frac{Y^{\text{SP}}(f^S_{t=1})}{Y^{\text{SP}}(f^S)}\right]$, for every firm with productivity $\theta \in [\theta^{S,*}, \theta_B]$. It is easy to see that the subsidy is constant for all firms $\theta \in [\theta^{S,*}, \theta_B]$—i.e., it is not firm-specific—and it is denoted as $X^{\max}$, as it represents the maximum level of subsidy that the SP must commit.

Finally, firms with productivity $\theta \in (\theta_B, \theta_A)$ have a positive expected offshoring profit premium—i.e., $\mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta) \middle| f^S \leq \bar{f}^S, T\right] > 0$—but still a negative trade-off function. Therefore, they do not have incentives to explore offshoring in $t = 0$ as the gains from waiting overcome the gains from exploring. Thus, the SP must offer a subsidy to promote the exploration of these firms in $t = 0$. However, as they have positive expected offshoring profit premiums, the subsidy offered by the SP to these firms reduces as the former are larger. For these firms, as already mentioned, we have that $\mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta) \middle| f^S \leq \bar{f}^S, T\right] > 0$, but the trade-off function at $t = 0$ is $\mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) < 0$. Thus, the optimal policy subsidy $X(\theta)$ is $X(\theta) + \mathcal{D}_{t=0}(\theta; \mathcal{I}^{\text{SP}}_{i,j,t=0}) = 0$, such that $X(\theta) = w^N s^r \left[1 - \lambda \frac{Y^{\text{SP}}(f^S_{t=1})}{Y^{\text{SP}}(f^S)}\right] - \mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta) \middle| f^S \leq \bar{f}^S, T\right]$. From the last expression, we observe two features. First, as the second term on the right-hand side is positive, the subsidy is smaller than in the previous case (i.e., $X(\theta) < X^{\max}$). Second, as the second term increases in the productivity of the firm, the subsidy decreases in θ as well. Therefore, the subsidy policy is a function of firms' productivities.

F.3.2 Alternative SP policy regime

We describe the general features of one possible alternative regime where the SP subsidy targets only the firms with productivity $\theta^{S,*}$; that is, the cutoff offshoring firms under perfect information. This policy regime achieves the perfect information steady state one period later (i.e., in $t = 1$).

Subsidy policy targeted to least productive offshoring firms. The tax policy is still defined as in section F.1.2. Thus, the lower bound of the prior distribution under the SP regime is given by $\underline{f}^{S,\text{SP}} = f^S$. As before, it discourages the offshoring exploration by firms with productivity $\theta < \theta^{S,*}$. In the previous cases, the SP offers a contingent subsidy to a subset or to all firms in the market. In this case, instead, the SP offers the subsidy only to all (or a share of) the firms with productivity $\theta^{S,*}$. The subsidy X to these firms is given by $X + \mathcal{D}_{t=0}(\theta^{S,*}; \mathcal{I}^{\text{SP}}_{i,j,t=0}) = 0$, such that $X = w^N s^r \left[1 - \lambda \frac{Y^{\text{SP}}(f^S_{t=1})}{Y^{\text{SP}}(\bar{f}^S)}\right] - \mathbb{E}_{t=0}\left[\pi_t^{S,prem}(\theta^{S,*}) \middle| f^S \leq \bar{f}^S, T\right]$. If

$\mathbb{E}_{t=0}\left[\pi_t^{S,prem}\left(\theta^{S,*}\right)\middle|f^S \leq \bar{f}^S, T\right] < 0$, then we have that $X = X^{\max}$, as defined above.

Under this SP regime, firms with a productivity $\theta \geq \theta_A$ explore their offshoring potential in $t = 0$, where θ_A is given by $\mathcal{D}_{t=0}(\theta_A; \mathcal{I}_{i,j,t=0}^{\text{SP}}) = 0$. That is, all firms that find it profitable to explore the offshoring potential in $t = 0$ without any subsidy from the SP. In addition, due to the contingent subsidy offered to firms with productivity $\theta^{S,*}$, these firms also explore the offshoring potential in $t = 0$. However, firms with productivity $\theta \in (\theta^{S,*}, \theta_A)$ remain under domestic sourcing in $t = 0$. In $t = 1$, firms with productivity $\theta \in (\theta^{S,*}, \theta_A)$ observe that firms with productivity $\theta^{S,*}$ have remained under offshoring after exploration. Therefore, they know with certainty that it is also profitable for them to offshore in the South. Thus, they explore the offshoring potential in $t = 1$, and the sector achieves the perfect information steady state.