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**Working Paper**

## Uncertainty in Global Sourcing: Learning, Sequential Offshoring, and Selection Patterns

CESifo Working Paper, No. 10043

**Provided in Cooperation with:**

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

*Suggested Citation:* Larch, Mario; Navarro, Leandro (2022) : Uncertainty in Global Sourcing: Learning, Sequential Offshoring, and Selection Patterns, CESifo Working Paper, No. 10043, Center for Economic Studies and ifo Institute (CESifo), Munich

This Version is available at:

<https://hdl.handle.net/10419/267276>

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## **Impressum:**

CESifo Working Papers

ISSN 2364-1428 (electronic version)

Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH

The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute

Poschingerstr. 5, 81679 Munich, Germany

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Editor: Clemens Fuest

<https://www.cesifo.org/en/wp>

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# Uncertainty in Global Sourcing: Learning, Sequential Offshoring, and Selection Patterns

## 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 spatial probit structural 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 analysis, transition analysis, spatial probit.

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October 17, 2022

We thank Paola Conconi, Hartmut Egger, Christian Fischer-Thöne, Victor Gimenez-Perales, Philipp Harms, Philipp Herkenhoff, Andrea Lassmann, Mathieu Parenti, Ariell Reshef, Philip Sauré, Stephen Yeaple and all participants at the CESifo and AUEB-LINER conference on 'The Role of Institutions and Policies in Firm Exporting', ETSG 2019 conference, the 12th FIW conference in International Economics, VfS 2021 conference, the 2nd Workshop on 'Shaping Globalization – Economic Consequences and Policy Responses' at the Johannes Gutenberg University Mainz, the 3rd TRISTAN Workshop at the University of Bayreuth, and seminars at the Johannes Gutenberg University Mainz, University of Buenos Aires and National University of Singapore for their valuable comments and discussions. All errors are our own.

# 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.<sup>1</sup> An important share of the global sourcing literature has focused on how institutions affect firms’ organisational and technology choices, the location of intermediate input suppliers across countries, and countries’ comparative advantages.<sup>2</sup> 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.<sup>3</sup>

When deciding on relocations of suppliers to new foreign countries, firms usually face uncertainty about institutions in those new locations. This uncertainty may affect the firm’s exploration decisions regarding the offshoring potential in new locations, especially when the latter involves initial irreversible investments.<sup>4</sup> A clear case of uncertainty arises when firms consider sourcing from locations where they have never been active before.<sup>5</sup> But institutional uncertainty may also emerge for 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 true scope of the reform. Under these circumstances, 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 the production of 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, the model shows that the information spillovers affect firms’ offshoring location choices. Thus, a selection

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<sup>1</sup>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).

<sup>2</sup>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).

<sup>3</sup>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).

<sup>4</sup>The exploration of the offshoring potential in new locations may require that the firm afford (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 costs 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).

<sup>5</sup>For example, firms may have incomplete knowledge of the environmental or labour regulations, property rights and foreign investment protection, imports and exports regulations, local taxes, sector- or input-specific regulations, etc.

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

We begin with a simple baseline 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.<sup>6</sup> We define a model with multiple differentiated sectors, where each sector has a continuum of heterogeneous final-good producers (namely, firms). As in Antràs and Helpman (2004), the final-good producers are located in the North. The production of the final-good varieties in the differentiated sectors requires one manufactured intermediate input, which 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 per-period offshoring operational fixed costs. For simplicity, the initial conditions are defined by a situation where it is not profitable for any firm in the market to explore offshoring in the South.<sup>7</sup> In  $t = 0$ , there is an institutional reform in the South—i.e., an *information shock*—which introduces uncertainty about the new southern institutional fundamentals. In each period  $t$ , firms under domestic sourcing face a trade-off: they can explore their offshoring potential or wait. If they decide to explore it, they have to pay an offshoring sunk cost and the institutional fundamentals in the South are revealed to them. The offshoring sunk cost 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.<sup>8</sup> After paying this sunk cost, firms learn the true conditions in the South—that is, they learn the true per-period offshoring fixed costs—and, thus, have no remaining uncertainty. However, this information

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<sup>6</sup>The main reference for a perfect information North–South model is Antràs and Helpman (2004). The extension of our model to multiple countries also complements the approaches of Grossman and Helpman (2005), Grossman and Rossi-Hansberg (2008), Harms et al. (2012), Harms et al. (2016) and Antràs et al. (2017). The model can be extended to a context of incomplete contracts or partially contractible investments, assuming that firms decide only in terms of the location of suppliers. For the case of incomplete contracts and the effects of institutional uncertainty on the organisational dimension of sourcing decisions—i.e., on the allocation of property rights—see Navarro (2021).

<sup>7</sup>The initial condition could be defined in a more general way allowing for an initial steady state—previous to an institutional shock—where some firms offshore from the South. The main features and results of the model are robust to this change in the initial conditions. We discuss this further in section 2.

<sup>8</sup>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, as well as search costs for suitable intermediate-input suppliers (as in Grossman and Helpman, 2005).

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. If they wait, they receive new information by observing offshoring firms and updating their priors, which reduces their offshoring-exploration risk. However, they reduce this risk at the 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.<sup>9</sup> 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 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’.<sup>10</sup>

In section 3 we test the theoretical predictions of the baseline North–South model using manufacturing firm-level Colombian data for the period 2004–2018. In particular, we focus on two predictions: i) the offshoring exploration is sequential in productivity, ii) the role of general information spillovers on the timing of firms’ offshoring exploration decisions.<sup>11</sup> We begin with 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) approach to test for the timing dimension of the theoretical predictions.<sup>12</sup> The main findings related to the latter are 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 offshore earlier the more information is revealed about general offshoring conditions.<sup>13</sup> We conclude the empirical analysis of the baseline model with the derivation of a structural conditional probit model, which estimates the

<sup>9</sup>Firms can learn about conditions abroad through their own experience, through the interaction with local agents, or by observing the behaviour of other firms that are active in those locations.

<sup>10</sup>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.

<sup>11</sup>The main role of (country-specific) information spillovers driving offshoring location choices is analysed later in the multi-country extension of the model.

<sup>12</sup>See for some applications of transition or survival analysis in international trade Besedeš and Prusa (2006), Nitsch (2009), Bergstrand et al. (2016), and Monarch et al. (2017). Some good general references on the topic are Lancaster (1990), Jenkins (2005), Cameron and Trivedi (2005), and Wooldridge (2010).

<sup>13</sup>We find that a 10 units 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%).

trade-off function that explains the offshoring exploration decisions of domestic-sourcing firms in each period  $t$ , and also produces evidence in line with our hypotheses.

From the model's perspective, the information spillovers not only affect the timing of the exploration decisions, but also affect 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 firms' location choices in offshoring exploration.<sup>14</sup> 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 location choices that lead to multiple equilibria. The allocation of production across countries in the steady state may differ from the optimal perfect information equilibrium defined by the institutional fundamentals. Thus, prior beliefs and information spillovers affect the location choices and thus the sectoral specialisation of countries. Hence, our model complements the literature on institutions and countries' comparative advantages (Acemoglu et al., 2007; Levchenko, 2007; Costinot, 2009), extending it to understand the role that information spillovers play in the offshoring decisions under uncertainty about sourcing conditions in foreign locations, and its consequences in terms of the allocation of production across countries—that is, countries' *revealed* comparative advantages—and welfare.<sup>15</sup>

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. It brings new insights into the underlying determinants of the offshoring decisions and characterises the conditions that must be considered by the governments when they implement reforms to promote the entry of domestic intermediate-input suppliers in global value chains. We show that 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 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 analyse the policy instruments that a Social Planner (SP) may implement to achieve the perfect information steady state in one period in a sector. We complement the SP analysis with the study of decentralised policies with a particular focus on the role of Free Trade Agreements (FTAs) and

<sup>14</sup>We introduce heterogeneous countries defined in terms of fundamentals and beliefs.

<sup>15</sup>We use the term *revealed comparative advantages* in a different sense as Balassa (1965) and Balassa and Noland (1989). We use it to refer to the comparative advantages of each country 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 in section 4.



Multilateral Agreements (MAs). We characterise them as exogenous institutional information shocks that affect firms' prior beliefs about institutional conditions in foreign countries and thus firms' offshoring decisions.<sup>16</sup> It is well known that FTAs incorporate a set of rules and regulations that define the institutional framework in the agreement, such as intellectual property and property rights protection, foreign investment, dispute resolution mechanisms, environmental regulation, labour market regulation and mobility.<sup>17</sup> The ratification of an FTA reveals a commitment of the signing governments to provide an institutional environment that meets the set of rules specified in the agreement. If those rules are observable by the final-good producers, a new FTA is more likely to (positively) affect the institutional beliefs about a partner country when the previous priors were relatively pessimistic. Similarly, the MAs—such as the WTO membership—reveal the country's commitment to a common set of rules that define a general institutional framework in areas such as trade policy, intellectual property, and dispute settlement.<sup>18</sup> Thus, the commitment to these rules revealed by WTO membership may influence the prior beliefs that foreign firms have about that country.

In sections 4.3–4.6, we test the theoretical predictions of the multi-country model. In section 4.4, 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 from other locations. For the latter, we test the exploration decisions of new countries for potential relocations of offshored suppliers. We extend the reduced-form models in section 4.5 to identify the learning mechanism and incorporate measures for the institutional priors and the information spillovers and estimate their effects on the location choice of the 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 0.012 percentage points for domestic-sourcing firms, and ii) by about 0.03 percentage points for offshoring firms from other locations.<sup>19</sup> 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

<sup>16</sup>We show that these shocks may potentially trigger the exploration of new locations and relocation dynamics of intermediate-input suppliers across foreign countries.

<sup>17</sup>See for example Maggi (1999); Dür et al. (2014); Limão (2016). For examples of regulatory agreements involved in FTAs, see NAFTA: [www.naftanow.org](http://www.naftanow.org), EU: [europa.eu](http://europa.eu), Pacific Alliance: [alianzapacifico.net/en](http://alianzapacifico.net/en), MERCOSUR: [www.mercosur.int](http://www.mercosur.int), China-Australia (ChAFTA): [www.dfat.gov.au/trade/agreements/in-force/chafta/Pages/australia-china-fta](http://www.dfat.gov.au/trade/agreements/in-force/chafta/Pages/australia-china-fta).

<sup>18</sup>The WTO provides an institutional framework for the General Agreement on Tariffs and Trade (GATT), the General Agreement on Trade in Services (GATS), and the Treaty on Trade-Related Aspects on Intellectual Property Rights (TRIPS) (Felbermayr et al., 2020). The WTO agreements cover goods, services and intellectual property, and among others, they set procedures for settling disputes and monitoring trade policies (WTO's official website).

<sup>19</sup>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%.

points by domestic-sourcing firms, and ii) 0.02–0.117 percentage points by offshoring firms from other locations. We also derive a structural spatial probit model in section 4.6, which identifies the offshoring exploration decisions in a multi-country setup.<sup>20</sup> The structural spatial probit approach allows us to identify how the offshoring exploration decisions to a country are affected by the information revealed about the alternative sourcing locations and not only by the information revealed about this location itself.

**Literature review.** We build on the literature on global sourcing with heterogeneous firms. In particular, the closest reference to our baseline model is the global sourcing model developed by Antràs and Helpman (2004). The main departure from the latter 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).

As already mentioned, we also relate and contribute to the literature on trade in intermediate inputs and comparative advantages (Eaton and Kortum, 2002; Acemoglu et al., 2007; Costinot, 2009). Acemoglu et al. (2007) and Costinot (2009) define the differences in the fundamentals of contractual institutions as the source of comparative advantages. Our model, instead, remarks the importance of both dimensions—beliefs and fundamentals—in the definition of the countries’ comparative advantages. In other words, not only the differences in institutional fundamentals matter. As key drivers of the offshoring flows, firms’ prior beliefs and information spillovers play an important role in defining the sectoral specialisation of countries. In that sense, we incorporate a relevant dimension for the determinants of the countries’ comparative advantages identified by Eaton and Kortum (2002). We find that when firms face uncertainty about institutional conditions, information spillovers play a key role in driving the location choices for intermediate input suppliers, and thus the specialisation of countries.

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, 2016; Kohler and Kukharskyy, 2019).<sup>21</sup> 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

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<sup>20</sup>Close references for the structural model are Egger and Larch (2008); Das et al. (2007); Dickstein and Morales (2018), and the general literature on spatial probit models (LeSage and Pace, 2009).

<sup>21</sup>Carballo (2016) examines how the various organisational types of global sourcing respond differently to demand shocks. Kohler and Kukharskyy (2019), on the other hand, analyse the 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.

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.<sup>22</sup> However, as discussed in the literature, sourcing choices show fundamental differences in comparison to export decisions.<sup>23</sup>

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).<sup>24</sup>

The paper is organised as follows. Section 2 introduces the theoretical North-South model and derives its main predictions, whereas section 3 presents the respective empirical models. Section 4 extends the theoretical model to multiple countries and introduces the respective empirical models. We summarise the main conclusions in section 5.

## 2 The two-country model: North-South

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

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

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 the moment, 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.

The per-period aggregate consumption in a differentiated sector  $j$  is given by:

$$Q_{j,t} = \left[ \int_{i \in I_{j,t}} q_{j,t}(i)^{\alpha_j} di \right]^{1/\alpha_j}, \quad 0 < \alpha_j < 1, \quad (2)$$

<sup>22</sup>See, for example, Segura-Cayuela and Vilarrubia (2008); Albornoz et al. (2012); Nguyen (2012); Aeberhardt et al. (2014); Araujo et al. (2016).

<sup>23</sup>See, for example, Antràs et al. (2017).

<sup>24</sup>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); Sutton and Barto (2018).

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:

$$p_{j,t}(i) = \gamma_j E Q_{j,t}^{-\alpha_j} q_{j,t}(i)^{\alpha_j - 1}, \quad (3)$$

where  $E$  denotes the per period total (world) expenditure and the price index in each differentiated sector  $j$  in period  $t$  is defined as:

$$P_{j,t} \equiv \left[ \int_{i \in I_{j,t}} p_{j,t}(i)^{1-\sigma_j} di \right]^{\frac{1}{1-\sigma_j}}. \quad (4)$$

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

$$q_{j,t}(i) = \theta \left( \frac{x_{h,j,t}(i)}{\eta_j} \right)^{\eta_j} \left( \frac{x_{m,j,t}(i)}{1 - \eta_j} \right)^{1-\eta_j}, \quad \text{with } \eta_j \in (0, 1), \quad (5)$$

where  $\theta$  represents the firm's productivity level, which varies across firms. We assume complete contracts, that is, investments are fully contractible.<sup>25</sup> The inputs are the final-good producer services,  $x_{h,j,t}$ , and the intermediate input,  $x_{m,j,t}$ . They are respectively supplied by the final-good producer,  $H$ , and the intermediate-input supplier,  $M$ .<sup>26</sup> 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 sector has a constant-returns-to-scale technology given by  $q_{0,t} = A_{0,l} \ell_{0,t}$ , where  $A_{0,l} > 0$  is a productivity parameter in country  $l$ . We assume that  $\gamma_0$  is large enough such that the homogeneous good is produced in every country. Thus, relative wages are defined by the relative productivity in the homogeneous sector.

**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  $\theta$ , which is drawn from a c.d.f. denoted by  $G(\theta)$ .<sup>27</sup>

<sup>25</sup>We introduce this simplifying assumption to focus on the location dimension of the sourcing decisions. For a model of institutional uncertainty under incomplete contracts, with a focus on the organisational dynamics, see Navarro (2021).

<sup>26</sup>We refer to the final-good producer alternatively as the firm or  $H$ .

<sup>27</sup>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.

In the remainder of the section, we focus on the firms' dynamics of 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 the Antràs and Helpman (2004) with two main differences. First, we assume perfectly contractible investments, instead of incomplete contracts.<sup>28</sup> Second, we introduce offshore market research sunk cost  $s^r$ , measured in northern labour units, which must be paid in advance by those firms who want to offshore. The offshoring sunk cost can be interpreted as the market research costs and feasibility studies that northern firms have to afford when they want to explore their offshoring conditions and search for potential suppliers in different locations.<sup>29</sup> Figure 1 illustrates the timing of events under perfect information.

For simplicity of notation, we drop the subscript  $t$  in the characterisation of the perfect information equilibrium. We introduce it back in section 2.2 when we analyse the North–South dynamic model with institutional uncertainty.

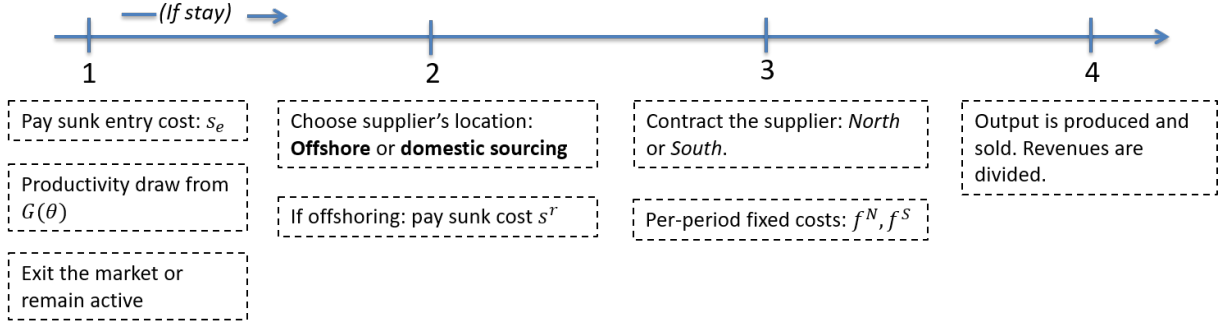


Figure 1: Timing of events

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

Intuitively, Assumption A.2 implies that offshoring has higher operational fixed costs than domestic sourcing. As in Antràs and Helpman (2004), we assume that per-period fixed costs are defined in northern labour units.<sup>30</sup>

<sup>28</sup>As mentioned earlier, this assumption reduces the sourcing decision to the location dimension. For the solution of the model under perfect information, see Appendix A.

<sup>29</sup>Two considerations about the characterisation of the offshoring sunk cost. First, the offshoring sunk cost  $s^r$  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 the firms to explore their offshoring potential under uncertainty. Second, given that the offshoring sunk cost is related to market and feasibility studies performed by northern firms to study conditions in foreign locations, we value them in northern labour units. Nevertheless, the valuation in southern labour units or in composite of northern and southern labour units would lead to the same model's predictions.

<sup>30</sup>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.** The firm must choose whether to source the intermediate input domestically or from a supplier in the South. We define the *per-period offshoring profit premium* of a firm with productivity  $\theta$  as:

$$\pi^{S,prem}(\theta) \equiv \pi^S(\theta) - \pi^N(\theta) = \frac{r^N(\theta)}{\sigma} \left[ \left( \frac{w^N}{w^S} \right)^{(1-\eta)(\sigma-1)} - 1 \right] - w^N [f^S - f^N]. \quad (6)$$

The firms choose the sourcing location that maximizes their lifetime profits. Under perfect information, this is equivalent to choosing the sourcing location that maximizes the per-period profits. Using equation (6), 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:

$$\pi^{S,prem}(\theta) \begin{cases} < (1-\lambda)w^N s^r & \text{if } \theta < \theta^{S,*} \Rightarrow \text{firm } \theta \text{ sources domestically,} \\ \geq (1-\lambda)w^N s^r & \text{if } \theta \geq \theta^{S,*} \Rightarrow \text{firm } \theta \text{ offshores,} \end{cases} \quad (7)$$

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

Figure 2 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  $\theta$  above the offshoring productivity cutoff.

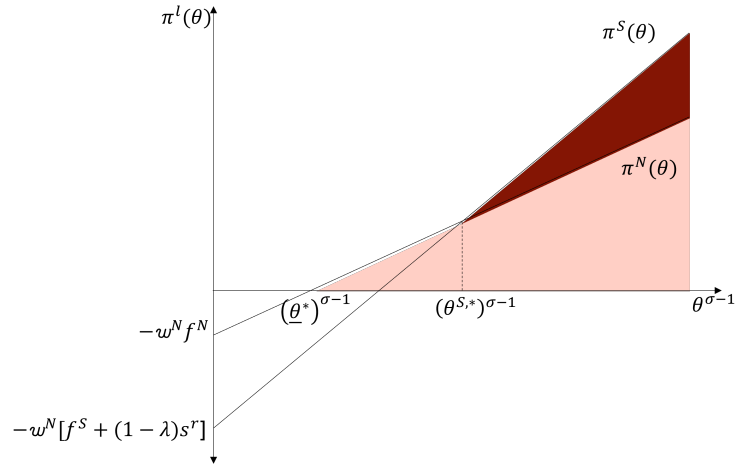


Figure 2: Per-period offshoring profit premium

## 2.2 The North–South global sourcing dynamic model with uncertainty

We 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 the option value of waiting. This leads to delaying the offshoring exploration decision 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.<sup>31</sup>

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 final-good producers can only source with domestic suppliers,<sup>32</sup> 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.<sup>33</sup>

In  $t = 0$ , there is an unexpected institutional information shock that makes offshoring in the South potentially feasible, 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.<sup>34</sup> 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.<sup>35</sup> We discuss this further in section 2.2.3.

### 2.2.1 Timing of events

Figure 3 illustrates the timing of events after the intermediate-input market opens up to trade. At any period  $t$  after the institutional reform has been implemented, domestic-sourcing firms can choose whether to explore their offshoring potential in the South or wait for new information to be revealed. If a firm

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<sup>31</sup>Close references for the exploration decisions and learning are Rob (1991) and Segura-Cayuela and Vilarrubia (2008).

<sup>32</sup>The final goods are still tradable in the world market, as above.

<sup>33</sup>This assumption 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 offshore from the South in periods before  $t = 0$ , due to a pre-reform weak institutional environment in the South that leads to high 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 F.1, where we also analyse the case of a sequence of institutional reforms.

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

<sup>35</sup>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.

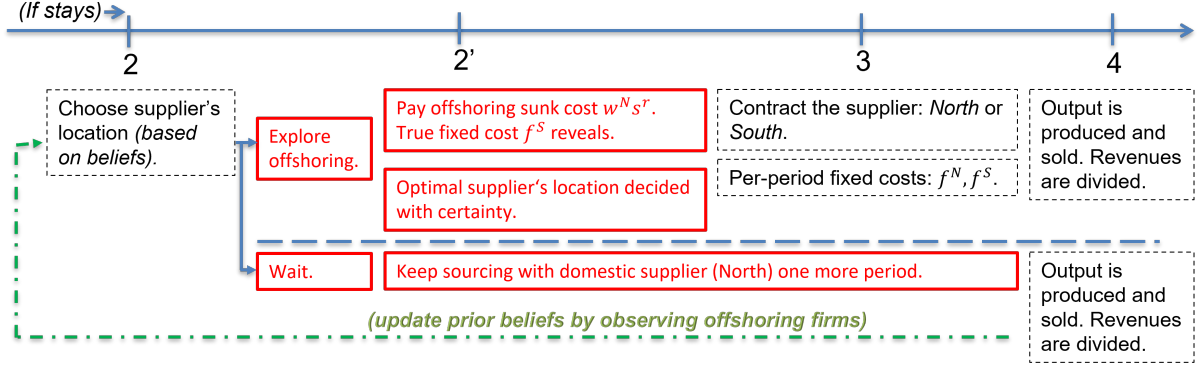


Figure 3: Timing of events—Uncertainty

chooses to explore its offshoring potential, the offshoring sunk cost  $w^N s^r$  is paid and the true fixed cost  $f^S$  is discovered, which remains private information. Thus, this firm can decide the optimal sourcing strategy with complete certainty.<sup>36</sup> If, instead, a firm decides to wait for more information to be revealed, it keeps sourcing domestically with a northern 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

By Assumption A.1, the price charged by a firm with productivity  $\theta$  under domestic sourcing is higher than under offshoring. Therefore, comparing the *n.t.i.* and perfect-information steady states, we have:<sup>37</sup>

$$P^{n.t.i.} > P^* \quad ; \quad Q^{n.t.i.} < Q^* \quad ; \quad \underline{\theta}^{n.t.i.} < \underline{\theta}^*, \quad (8)$$

where superscript *n.t.i.* indicates the equilibrium value for non-tradable intermediate inputs, and  $*$  refers to the equilibrium variables under perfect information with tradable intermediate inputs.

A comparison between the *n.t.i.* and the  $*$  steady states shows the welfare gains from offshoring that are represented by the first two expressions in (8). 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.<sup>38</sup>

<sup>36</sup>In terms of the Markov process, exploration is an absorbing state for the firm.

<sup>37</sup>For expressions of the perfect information equilibrium  $*$ , see Appendix A.3. For characterisation of *n.t.i.* steady state and proofs, see Appendix B. 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 defined in equation (8) still hold. All results of the model are robust to this generalisation of the initial conditions. For a detailed discussion, see Appendix F.1.

<sup>38</sup>In other words,  $P^*$  is decreasing in  $\chi^*$ , where the latter denotes the share of offshoring firms in the steady state  $*$ . See



### 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) knowledge 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:

$$f^S \sim Y(f^S) \quad \text{with} \quad f^S \in [\underline{f}^S, \bar{f}^S], \quad (9)$$

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

Figure 4 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 we characterise the conditions under which the steady state converges to the perfect-information equilibrium.<sup>39</sup>

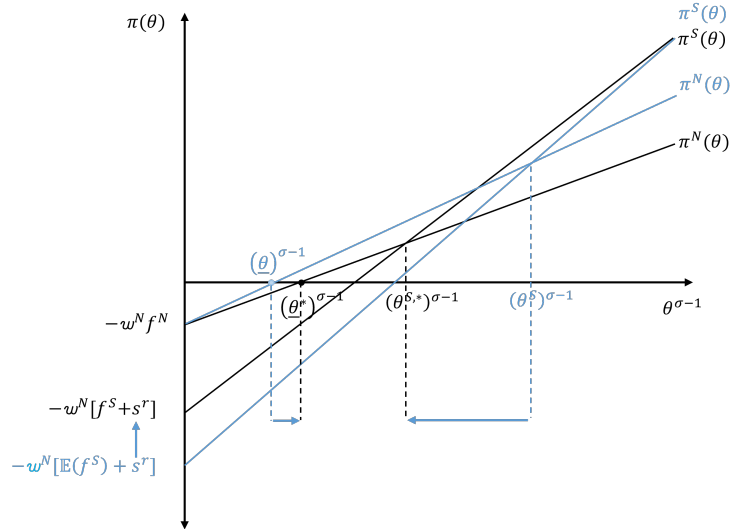


Figure 4: Perfect information and static equilibrium with uncertainty

The dynamic model is characterised as a Markov decision process, where firms learn by exploiting

Appendix A.3.3 for proofs and further discussions. In section 2.2.4, we show that the initial higher price index allows lower productive firms to remain active in the market after entry, which is represented by a lower market productivity cutoff  $\underline{\theta}^{n.t.i.}$ . When offshoring becomes profitable for some firms, the least productive firms in the market are not able to face the higher intensity competition in the final-good market that comes from the reduction in the price index. Thus, they must sequentially leave the market as more firms offshore. 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).

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

the information externalities that emerge from other firms' behaviour.<sup>40</sup> The state of the Markov process has two dimensions: *beliefs* and *physical*. The first refers to the Bayesian learning mechanism through which firms update their beliefs and reduce their prior uncertainty. The second 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 offshoring firms. We define next both state dimensions.

**‘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  $\theta$ . This implies that under this per-period fixed cost, a firm with productivity  $\theta$  would earn zero per-period offshoring profit premium, that is:

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

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

We define  $\theta_t$  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,  $w^N s^r$ , firms with productivity greater than or equal to  $\theta_t$  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  $\theta_t$ . This revealed upper bound is denoted as  $f_t^S$  and it is given by:

$$f_t^S \equiv f^S(\theta_t) = \frac{r^N(\theta_t, Q_t)}{\sigma w^N} \left[ \left( \frac{w^N}{w^S} \right)^{(1-\eta)(\sigma-1)} - 1 \right] + f^N. \quad (10)$$

Finally, we define  $\tilde{\theta}_t$  as the productivity of the least productive firms exploring offshoring in  $t - 1$ . Therefore,  $\tilde{f}_t^S \equiv f^S(\tilde{\theta}_t)$  represents the expected revealed upper bound in  $t$ , 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  $\theta_t$ , 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.<sup>41</sup>

<sup>40</sup>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 her competitors. These elements, together with the known wages at each location, allow the firms to infer the productivity level of each competitor.

<sup>41</sup>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.** As already mentioned, the initial prior in  $t = 0$  is given by equation (9). 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:

$$f^S \sim \begin{cases} Y(f^S | f^S \leq f_t^S) = \frac{Y(f^S | f^S \leq f_{t-1}^S)}{Y(f_t^S | f^S \leq f_{t-1}^S)} & \text{if } \tilde{f}_t^S = f_t^S < f_{t-1}^S, \\ f_t^S & \text{if } \tilde{f}_t^S < f_t^S, \end{cases} \quad (11)$$

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 the offshoring potential in the South, 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 (11). In other words, as firms with lower productivity explore their offshoring potential in the South, 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 (11) 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  $f^S$ .<sup>42</sup> 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 her offshoring potential by paying the offshoring sunk cost or waiting for new information. This ‘explore or wait’-trade-off characterises firms’ offshoring exploration decisions.

<sup>42</sup>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.

Formally, firms solve the value function  $\mathcal{V}_t(\theta; \theta_t)$ :

$$\mathcal{V}_t(\theta; \theta_t) = \max \{V_t^o(\theta; \theta_t); V_t^w(\theta; \theta_t)\},$$

with  $V_t^o(\theta; \cdot)$  and  $V_t^w(\theta; \cdot)$  denoting, respectively, the value of offshoring and the value of waiting in period  $t$  for a firm with productivity  $\theta$ .

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 sunk cost  $w^N s^r$ , or a loss equivalent to the 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  $\theta$  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  $\theta$  is given by:

$$V_t^w(\theta; \theta_t) = 0 + \lambda \mathbb{E}_t [\mathcal{V}_{t+1}(\theta; \theta_{t+1})].$$

The first term on the right-hand side means that the firm remains to do domestic sourcing 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. The Bellman equation is given by:

$$\mathcal{V}_t(\theta; \theta_t) = \max \{V_t^o(\theta; \theta_t); \lambda \mathbb{E}_t [\mathcal{V}_{t+1}(\theta; \theta_{t+1})]\}.$$

**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 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.,  $V_t^{w,1}(\cdot)$ —dominates waiting for a longer period. Therefore, the One-Step-Look-Ahead (OSLA) rule is the optimal policy.<sup>43</sup> Thus, we

<sup>43</sup>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.

derive a *trade-off function*, which defines the offshoring exploration decision at any period  $t$  for any domestic-sourcing firm with productivity  $\theta$  and it is given by:

$$\mathcal{D}_t(\theta; \theta_t, \tilde{\theta}_{t+1}) = V_t^o(\theta; \theta_t, \tilde{\theta}_{t+1}) - V_t^{w,1}(\theta; \theta_t, \tilde{\theta}_{t+1}), \quad (12)$$

where the first argument of  $\mathcal{D}_t(\cdot)$  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  $t$ , i.e., the least productive firms that will attempt offshoring in  $t$ .

At any time  $t$ , the firm's offshoring exploration decision is based on:

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

**Proposition 1** (Sequential offshoring). *Firms with higher productivity have an incentive to explore their offshoring potential earlier:*

$$\frac{\partial \mathcal{D}_t(\theta; \theta_t, \tilde{\theta}_{t+1})}{\partial \theta} \geq 0.$$

**Proof.** See Appendix C.4. □

Using Proposition 1, the trade-off function becomes:<sup>44</sup>

$$\mathcal{D}_t(\theta; \theta_t, \tilde{\theta}_{t+1}) = \max \left\{ 0; \mathbb{E}_t \left[ \pi_t^{S, prem}(\theta) \middle| f^S \leq f_t^S \right] \right\} - w^N s^r \left[ 1 - \lambda \frac{Y(f_{t+1}^S)}{Y(f_t^S)} \right], \quad (13)$$

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.** *At least the most productive firm in the market finds it profitable to offshore, given the prior knowledge at  $t = 0$ . That is:*

$$\mathcal{D}_{t=0}(\bar{\bar{\theta}}; \bar{\bar{\theta}}, \bar{\bar{\theta}}) > 0,$$

where  $\bar{\bar{\theta}}$  refers to the most productive firm 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

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<sup>44</sup>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.

necessary to trigger the offshoring exploration sequence.<sup>45</sup>

**Lemma 1** (Per-period offshoring exploration productivity cutoff). *The offshoring exploration productivity cutoff at any period  $t$ ,  $\tilde{\theta}_{t+1} \equiv \tilde{\theta}_{t+1}^S$ , is given by:*

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

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:

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

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. See Appendix C.5.  $\square$

**Long-run properties of the trade-off function: convergence analysis.** We concentrate now on the characterisation of the steady state and the conditions under which it converges to the information equilibrium defined in section 2.1. First, in the long run, it is easy to see that 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.<sup>46</sup> Second, Proposition 2 characterises the steady states.

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

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

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

*Hysteresis takes places, that is, the convergence produces some ‘excess’ of offshoring, when:*

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

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

<sup>45</sup>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.

<sup>46</sup>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  $t \rightarrow \infty$ .

with  $\theta^{S,*} > \theta_\infty^S > \theta^{S,-r}$ , and  $\theta^{S,-r}$  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, which is given by:

$$\mathcal{D}(\theta_\infty; \theta_\infty, \theta_\infty) = 0 \Rightarrow \mathbb{E} \left[ \pi^{S,prem}(\theta_\infty^S) \mid f^S \leq f_\infty^S \right] = w^N s^r (1 - \lambda).$$

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 ( $f^S = \underline{f}^S$ ), 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 prior is initially ‘too optimistic’,<sup>47</sup> leading to the full revelation of the true fixed cost  $f^S$  in a finite number of periods. Thus, the offshoring productivity cutoff initially converges to  $\theta_t^S \xrightarrow{t < \infty} \theta^{S,-r}$ . 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.,  $\theta_t^S \xrightarrow{t \rightarrow \infty} \theta^{S,*}$ ). In the other two cases, 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 5 illustrates these convergence points. Case IV corresponds to any point between Case I and III, and Case II to any point below Case III.

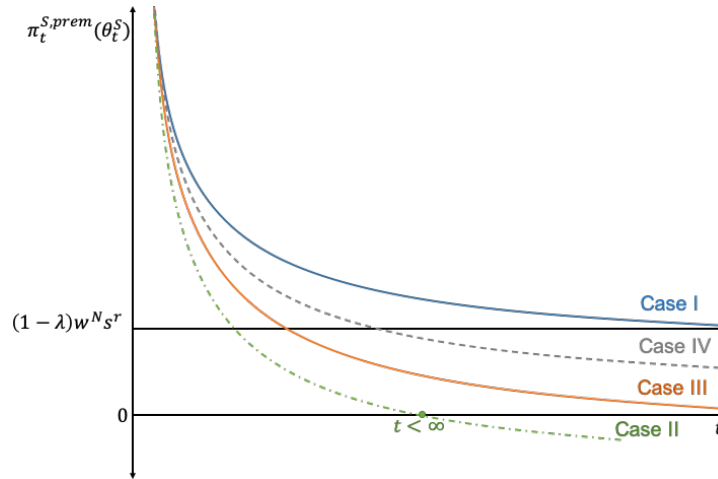


Figure 5: Convergence paths

To conclude, the equilibrium path of the offshoring productivity cutoff defines a respective path of

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

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.<sup>48</sup>

**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—i.e., excessive offshoring—due to the presence of the offshoring sunk costs. This implies that the price index converges to a lower level compared to  $P^*$ , 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.<sup>49</sup>

### 3 Empirics: Two-country model

In this section, 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) analysis models. In section 3.3, we conclude with the derivation of a structural empirical model of the trade-off function in equation (13).

In the case of the reduced-form conditional probit models, we test for the determinants of the offshoring exploration decisions. In particular, we centre attention on the effects of firm productivity and the information spillovers on the offshoring exploration decisions.<sup>50</sup>

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 in the previous year. As an alternative measure, we use the standard deviation of the productivity of

<sup>48</sup>For further discussions about the effect on the market productivity cutoff, see Antràs et al. (2017) and Navarro (2021).

<sup>49</sup>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.

<sup>50</sup>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 aggregation 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.



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.

We use transition or survival analysis 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.<sup>51</sup> Given the dynamic nature of the exploration decision, this approach drives us closer to the identification of the predictions in Proposition 1.

Finally, in section 3.3, we derive a structural conditional probit model for the trade-off function.<sup>52</sup>

### 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 sectoral classification of the firms by ISIC (4 digits).<sup>53</sup> The National Statistics Office (Dirección Nacional de Estadística - DANE) provides data on imports by firms at the product level and country of origin.<sup>54</sup>

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 North–South model, Colombia represents the North—that is, the location of the final-good producers—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 (4 digits). 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.<sup>55</sup>

<sup>51</sup>For the role of the information spillovers in the location choices, see the multi-country extension in section 4.

<sup>52</sup>Close references for the identification of the trade-off function are Das et al. (2007) and Dickstein and Morales (2018).

<sup>53</sup>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.

<sup>54</sup>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).

<sup>55</sup>For further details on the data, see Appendix D.1.

**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 of USD. Second, the offshoring status of a firm  $i$  in sector  $j$  in period  $t$  is indicated by the dummy variable  $os_{i,j,t} = 1$ . The latter 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:  $is_{j,t} = sdta_{j,t-1} \equiv sd_i(ta_{i,j,t-1} | os_{i,j,t-1} = 1)$ . It refers to the standard deviation of the productivity of offshoring firms in sector  $j$  in the previous year.

## 3.2 Reduced-form models

### 3.2.1 Conditional probit model

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

$$\Pr \left( os_{i,j,t} = 1 \middle| cos_{i,j,t-1} = 0 \right) = \Phi \left( \beta_1 \ln(ta_{i,j,t}) + \beta_2 is_{j,t} + \gamma_j + \gamma_t \right), \quad (14)$$

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  $t - 1$ , that is, 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., sources with domestic supplier). Finally,  $\gamma_j$  and  $\gamma_t$  represent sector and year fixed effects, respectively.

**Results.** Columns (1)–(4) of Table 1 report the results of the empirical model given in equation (14). Columns (1)–(2) report the estimated coefficients for the case of the sample including all sectors with at least 50 firms, whereas columns (3)–(4) refer to a sample including all sectors with at least 100 firms. In all 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.<sup>56</sup> We illustrate the quantitative effects by considering the specification in column (2). An average increase

<sup>56</sup>The results are also consistent with the steady-state equilibrium shown in Figure 2 and with the selection of firms into offshoring based on productivity in Antràs et al. (2017).

of 10% in productivity increases the probability of offshoring in  $t$  by 0.487 percentage points.<sup>57</sup>

Regarding the information spillovers, the results show non-significant coefficients at the reported levels for the direct spillover measure, whereas the alternative measure shows significant and theory-consistent results. The interpretation of the latter result is the following. 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.<sup>58</sup>

Table 1: Non-offshoring firms. Offshoring exploration decisions

Model:	Conditional Probit Model					Transition (survival) Analysis			
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*** (0.0273)	0.337*** (0.0276)	0.329*** (0.0329)	0.329*** (0.0337)	0.612*** (0.0448)	0.614*** (0.0451)	0.593*** (0.0496)	0.594*** (0.0505)
$minta_{j,t-1}$	-	-0.0290 (0.0943)		0.0556 (0.111)		-0.190 (0.174)		-0.0529 (0.205)	
$sdtat_{j,t-1}$	+		0.00303*** (0.00111)		0.00314** (0.00158)		0.00351* (0.00200)		0.00350 (0.00250)
$\ln(t)$						-0.871*** (0.0958)	-0.963*** (0.0806)	-0.868*** (0.119)	-0.940*** (0.0941)
$const$		-1.614*** (0.105)	-1.806*** (0.124)	-1.698*** (0.123)	-1.844*** (0.157)	-1.787*** (0.143)	-1.986*** (0.188)	-1.846*** (0.154)	-2.006*** (0.227)
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. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

To sum up, we find strong supportive evidence for the prediction that the probability of exploring offshoring by domestic-sourcing firms increases the productivity of the firm. Moreover, the increasing

<sup>57</sup> Average marginal effects and marginal effects at the mean are reported in Tables A5 and A6 in Appendix D.2.3, respectively.

<sup>58</sup> 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 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.

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) analysis

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.<sup>59</sup> Thus, the hazard rate for a firm  $i$  in sector  $j$  to transition from domestic sourcing to offshoring status in period  $t$  is:

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

with  $\mathbf{x}'_{i,j,t}\boldsymbol{\beta} = \beta_0 + \beta_1 \ln(ta_{i,j,t}) + \beta_2 is_{j,t} + \beta_3 entry_i + \gamma_j$ .

The information spillovers are defined by the two alternative measures described above,  $entry_i$  indicates the year in which the firm  $i$  enters the sample, and  $\delta_t$  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.<sup>60</sup>

**Results.** Columns (5)–(8) of Table 1 report the results of the empirical model given in equation (15). We observe that the most productive domestic-sourcing firms transition faster to an offshoring status. 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, the empirical evidence supports that the offshoring equilibrium path is led by the most productive firms in the sector.<sup>61</sup> To quantify the effect of a productivity change, we consider the average marginal effects related to column (6). 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-significant (but theory-consistent signs) estimated coefficients. The alternative measure, instead, shows a theory-consistent sign in all specifications and significant results for sectors with at least 50 firms.<sup>62</sup> 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-

<sup>59</sup>The grouped nature comes from the underlying continuous process but with discrete time data collection.

<sup>60</sup>The estimation results for the non-parametric approach are reported in Table A3 in Appendix D.2.2.

<sup>61</sup>Average marginal effects and marginal effects at the mean are reported in Tables A5 and A6 in Appendix D.2.3, respectively.

<sup>62</sup>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.

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

### 3.3 Structural model

We next describe the main steps and features of our structural empirical model. For the complete formal derivation of the structural model and proofs, as well as the underlying assumptions, see Appendix D.3. We can express the trade-off function (13) for a domestic-sourcing firm  $i$  in sector  $j$  in period  $t$  as:

$$\mathcal{D}_{i,j,t}(\theta; \mathcal{I}_{i,j,t}) = \max \left\{ 0; \mathbb{E} \left[ \pi_{j,t}^{S,prem}(\theta) \middle| \mathcal{I}_{i,j,t} \right] \right\} - w^N s_j^r [1 - \lambda_j Y(f_{t+1}^S | \mathcal{I}_{i,j,t})], \quad (16)$$

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 the non-offshoring firms—that is, domestic-sourcing firms—the information set is defined by the past firm-specific information and the information spillover.<sup>63</sup>

From the trade-off function (16), we derive the conditional probit model:

$$\Pr \left( d_{i,j,t}^S = 1 \middle| d_{i,j,t-1}^S = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^S \theta^{\sigma_j-1} \middle| \mathcal{I}_{i,j,t} \right] - w^N [\mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - f_j^N] - w^N s_j^r [1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t})] \right) \right], \quad (17)$$

with  $d_{i,j,t}^S$  defined as a dummy variable that indicates the offshoring status of the firm  $i$  in sector  $j$  and period  $t$ ,  $\Sigma$  denoting variance-covariance matrix, and  $z_{j,t}^S$  given by:

$$z_{j,t}^S \equiv \left[ \left( \frac{w^N}{w^S} \right)^{(1-\eta_j)(\sigma_j-1)} - 1 \right] \left[ \frac{\sigma_j - 1}{\sigma_j} \right]^{\sigma_j-1} (\gamma_j E)^{\sigma_j} Q_{j,t}^{1-\sigma_j} (w^N)^{1-\sigma_j}. \quad (18)$$

---

<sup>63</sup>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 the information revealed up to period  $t$ , is given by:

$$w^N [\mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - f_j^N] = \gamma_j - \gamma_1 is_{j,t} + v_{i,j,t}, \quad (19)$$

where  $is_{j,t}$  is alternatively defined by  $minta_{j,t-1}$  and  $sda_{j,t-1}$ . 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, that is, the fixed-cost differential based on initial priors.

**Identification of expected gains from waiting.** The last term of the trade-off function, given by the expression  $w^N s_j^r [1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t})]$ , captures the expected information to be revealed at the end of the period. Therefore, 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. As a first step, we estimate the empirical AR(1) model given by:

$$is_{j,t+1} = \rho_{1,j} is_{j,t} + \epsilon_{j,t} \Rightarrow \mathbb{E}[is_{j,t+1}] = \rho_{1,j} is_{j,t}, \quad (20)$$

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:

$$w^N s_j^r [1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t})] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j} \hat{is}_{j,t+1} + e_{j,t}, \quad (21)$$

where  $\tilde{\gamma}_j$  is a sector fixed effect that captures the first term on the left-hand side, the variable  $\hat{is}_{j,t+1}$  refers to the predicted values of the estimated AR (1) model defined in equation (20), 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  $t$ .

As robustness, we also estimate the models with information spillovers in natural logarithms. Figure A1 in Appendix D.3.3 reports the estimation results for the coefficients  $\rho_{1,j}$  of the AR(1) model defined in

equation (20) for both specifications (i.e., in levels and logs) and for both information spillover measures. The figure shows a theory-consistent positive estimated coefficient for each sector for both measures of information spillovers and both specifications.<sup>64</sup>

### 3.3.1 Structural probit models: Identification and results

In this subsection, we introduce a set of empirical models for the structural framework. We begin with a ‘reduced-form’ version of the structural model, where we ignore the differential effects in the main variables at the sector and time level. We then 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 by an extension that allows for time-varying wages, which goes beyond the theoretical model.<sup>65</sup>

**‘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:

$$\Pr \left( d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \Gamma_1 \ln(ta_{i,j,t}) - \Gamma_j + \Gamma_2 is_{j,t} - \Gamma_3 \hat{is}_{j,t+1} \right) \right]. \quad (22)$$

Columns (1) and (2) of Table 2 report the estimated coefficients of the probit model defined in equation (22). Columns (3) and (4) report the results of an extension of the theoretical model that allows for time-varying wages and total expenditure. For details on the latter, see Appendix D.3.2.<sup>66</sup>

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.<sup>67</sup>

Regarding the role of the information spillovers, the results in columns (1) and (2) don’t 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.<sup>68</sup> As already discussed, the infor-

<sup>64</sup>Figure A2 in Appendix D.3.3 reports the respective results for the sample with sectors with at least 200 firms.

<sup>65</sup>Appendix D.3.1 shows the derivation of the empirical models with fixed wages, whereas Appendix D.3.2 does it for the extension of the empirical models that allow for time-varying wages.

<sup>66</sup>For the results with the information spillover variables in natural logarithms, see Table A7 in Appendix D.3.4.

<sup>67</sup>For average marginal effects and marginal effects at the mean, see Tables A8 and A9 in Appendix D.3.4.

<sup>68</sup>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 2: Non-offshoring firms. ‘Reduced-form’ model

<i>Sample</i>	<i>Exp. sign</i>	<i>sectors w/ at least 100 firms</i>			
		(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*** (0.0375)	0.296*** (0.0295)	0.307*** (0.0310)	0.316*** (0.0304)
$mint_{j,t-1}$	-	-0.257 (0.335)		-0.547 (0.340)	
$\widehat{mint}_{j,t+1}$	+	-0.667** (0.299)		0.361 (0.470)	
$sdt_{j,t-1}$	+		-0.00568 (0.00380)		0.00203 (0.00158)
$\widehat{sdt}_{j,t+1}$	-		-0.0100** (0.00454)		-0.0162*** (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. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

mation spillovers in the two-country setup correspond to general offshoring conditions (i.e., not country-specific). As we show in section 4, 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.

**Summary of results for additional specifications of structural model.** As shown in Appendix D.3, we start with a model that assumes a *Small Open Economy* (SMOPEC) with fixed wages (as defined by the theory),<sup>69</sup> and then we extend it to time-varying wages and total expenditure.<sup>70</sup> We follow by relaxing the SMOPEC assumption and we identify a *full structural* model, first with fixed wages and then we extend it to time-varying wages. For the respective regression equations and results of the SMOPEC models see Appendix D.3.5, whereas for the *full structural* models see Appendix D.3.6. We summarise now the results under these structural specifications of the model.

All specifications of the structural model show 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 empirical results show that the probability of exploring the offshoring potential for the first time in period  $t$  is increasing in the probability of the domestic-sourcing firms. That means that the offshoring

<sup>69</sup>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,  $z_{j,t}^S = z_j^S \forall t$ .

<sup>70</sup>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  $t$ . See for further discussion Appendix D.3.2.



exploration is sequential in productivity, as predicted by Proposition 1.

Regarding the role of the information spillovers, the empirical evidence does not provide strong support for either of the two components of the trade-off function: that is, the expected fixed-cost differential—which depends on the current information revealed—and the expected new information to be revealed at the beginning of next period. The empirical results show 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 (North–South) setup. However, if the information spillovers are more related to country-specific offshoring conditions, the scope of the North-South setup is too narrow to identify the influence of the former on the offshoring decisions. Therefore, the multi-country extension in section 4 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 which are perceived to have better institutions but are not those with the 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 (i.e., non-efficient allocation of intermediate input production across countries) and welfare costs.

To achieve a more complete understanding of 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?; ii) What are the welfare consequences in the steady state?

### 4.1 Theory extension to multiple countries

We assume a world economy with three countries: North ( $N$ ), East ( $E$ ), and South ( $S$ ). The final-good producers 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. As before, they refer to costs related to market

research and feasibility studies to set up a supply chain of intermediate inputs in a foreign location. For simplicity, both are expressed in northern labour units and we assume that  $s^{r,S} = s^{r,E} = s^r$ .<sup>71</sup>

**Assumption A. 5.** *Institutional fundamentals are better in the South than in the East:  $f^S < f^E$ .*<sup>72</sup>

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 North–South model, we define the initial conditions by the *n.t.i* equilibrium.<sup>73</sup> In  $t = 0$ , there is a simultaneous institutional information shock (e.g. institutional reforms) in the East and the South. These shocks introduce uncertainty about institutional fundamentals in each of those countries, represented as before as prior uncertainty about the offshoring per-period fixed costs. Formally, the prior uncertainty is defined as:

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

Firms can update their prior beliefs by exploiting the information spillovers generated by firms offshoring in each foreign country, according to the learning mechanism characterised 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.** In any period  $t$ , firms sourcing in the North decide whether to explore their offshoring potential or wait. If they decide to explore, they have two options: South or East. Therefore,

<sup>71</sup>Assuming  $s^{r,S} = s^{r,E} = s^r$  allows us to reduce the taxonomy of equilibrium paths characterised below. 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.

<sup>72</sup>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 process about conditions abroad and how location choices are affected by it, we prefer to put focus on a simpler version of the model with deterministic fundamentals.

<sup>73</sup>In Appendix F.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.

the decision in  $t$  for any domestic-sourcing firm with productivity  $\theta$  takes the following form:

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

where  $\mathcal{I}_{i,j,t}$  refers to the information set that domestic-sourcing firms possess in period  $t$ . Defining  $V_t^{o,l}(\theta; \mathcal{I}_{i,j,t})$  as the solution to the  $\max \left\{ V_t^{o,S}(\theta; \mathcal{I}_{i,j,t}); V_t^{o,E}(\theta; \mathcal{I}_{i,j,t}) \right\}$ , with  $l = E$  or  $l = S$ , the decision becomes:

$$\mathcal{V}_t(\theta; \cdot) = \max \left\{ V_t^{o,l}(\theta; \cdot); V_t^{w,1,l}(\theta; \cdot) \right\},$$

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  $\theta$  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 trade-off function:

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

where  $\mathcal{I}_{i,j,t} = \{\theta_t, \tilde{\theta}_{t+1}\}$ , with  $\theta_t = \{\theta_t^S, \theta_t^E\}$  and  $\tilde{\theta}_{t+1} = \{\tilde{\theta}_{t+1}^S, \tilde{\theta}_{t+1}^E\}$ . Intuitively, the process can be thought of as a two-stage decision. In the first stage, firms choose the preferred location (in expectation at  $t$ ) among all available foreign locations. In the second stage, firms decide whether to explore offshoring in the chosen location or wait.

**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:

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

with  $\mathcal{I}_{i,j,t} = \{\theta_t, \tilde{\theta}_{t+1}, f^{l'}\}$ . An important difference to the information set of domestic-sourcing firms is that in the case of firms offshoring in country  $l'$ , 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  $\theta$  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  $\mathbb{E}_t \left[ \pi_t^{l/l', prem}(\theta) \middle| \mathcal{I}_{i,j,t} \right]$  denotes the expected relocation profit premium in country  $l$  in period  $t$  for a firm with productivity  $\theta$  that currently offshores in  $l'$ .

#### 4.1.2 Dynamic equilibrium paths and multiple equilibria

Under uncertainty, as before, the final-good producers 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 firms offshoring from 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. We show that 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, i.e.  $w^E = w^S$ . Therefore, the steady state under perfect information implies that firms will offshore only from the South.<sup>74</sup>

In the remainder of this section, we refer as convergence to the '*perfect information equilibrium*' or the '*perfect information steady state*' to the situation where the offshoring productivity cutoff in the South converges to any of the steady states defined in Proposition 2 of section 2.2.3 and firms offshore only in the South.<sup>75</sup>

$$\theta_t^E \rightarrow \infty \text{ and } \theta_t^S \downarrow \theta^{S,*} \Rightarrow P_t \downarrow P^* \Rightarrow Q_t \uparrow Q^*.$$

**Dynamic equilibrium paths.** We describe now the general features of different types of equilibrium paths, and we follow with 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. See Appendix E.2 for a detailed analysis and formal characterisation of the equilibrium paths under symmetric beliefs, and see Appendix E.3 for the respective equilibrium paths under asymmetric beliefs.

<sup>74</sup>This is a simplifying assumption that, as in the previous case, allows us to reduce the number of cases to analyse. We introduce heterogeneous wages in Appendix G.

<sup>75</sup>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.

When initial beliefs are symmetric across foreign countries, firms are indifferent between exploring offshoring in the East or the South in period  $t = 0$ . 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’—that is, 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, i.e., 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 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. 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.<sup>76</sup>

**Proposition 3** (Countries’ sectoral specialisation: multiple equilibria). *The sector converges to a steady*

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<sup>76</sup>The proofs of the respective propositions follow from sections E.2 and E.3.

state with

1. *specialisation of countries according to fundamentals when:*<sup>77</sup>

(a) *the prior beliefs are symmetric and ‘optimistic’.*

(b) *the prior beliefs are asymmetric and in favour of the country with the best fundamentals.*

(c) *the prior beliefs are asymmetric and in favour of a country with worse fundamentals, but with sufficiently ‘optimistic’ priors about that country.*

2. *an inefficient specialisation of countries when:*

(a) *the prior beliefs are symmetric and ‘pessimistic’.*

(b) *the prior beliefs are asymmetric and in favour of a country without the best fundamentals (except in 1c).*

**Proposition 4** (Welfare effects). *In the long run, the welfare gains from offshoring*

1. *are fully achieved when:*<sup>78</sup>

(a) *the prior beliefs are symmetric.*

(b) *the prior beliefs are asymmetric and in favour of the country with the best fundamentals.*

2. *are not fully realised when the prior beliefs are asymmetric and in favour of a country without the best fundamentals (except in 1c of Proposition 3).*

## 4.2 Policy implications

### 4.2.1 Social Planner

We define a Social Planner (SP) that 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 direct firms to the perfect-information steady state through tax and subsidy policies.

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<sup>77</sup>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. We come back to this issue in the Social Planner section.

<sup>78</sup>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. We come back to this issue in the Social Planner section.

We discuss this further in Appendix H, where we characterise alternative policy strategies that allow the SP to achieve the perfect information steady state in  $t = 0$  in a sector. In general terms, the SP's subsidy policy encourages firms to explore their offshoring potential in the initial period—by eliminating the risk of the exploration decision—, while the SP's tax policy discourages the exploration by firms with productivity lower than the perfect information offshoring productivity cutoff. Through the tax policy the SP avoids the excessive offshoring—i.e., hysteresis—characterised in cases II–IV in section 2.2.4 and Proposition 2.

#### 4.2.2 Institutional reforms: unilateral and multilateral decentralised policies

We begin by characterising the role of Free Trade Agreements (FTAs) and Multilateral Agreements (MAs) as exogenous institutional information shocks that may impact firms' prior beliefs.<sup>79</sup> Hence, in addition to the endogenous learning mechanism characterised above, we introduce an exogenous learning source coming from the implementation of these types of institutional reforms. We briefly show how these shocks may affect the prior beliefs that northern firms possess about potential foreign sourcing locations and thus create incentives to explore the offshoring potential in those countries.

**FTAs.** The implementation of an FTA usually goes beyond reductions in tariffs and incorporates institutional aspects (Maggi, 1999; Dür et al., 2014; Limão, 2016). Therefore, the signature of an FTA reveals a commitment of the governments to provide an institutional environment that meets the set of specified rules. When an FTA between the North and a foreign location (i.e., East or South) is signed, the institutional framework is observable by the northern firms. Thus, if the institutional priors about the partner country were ex-ante relatively pessimistic, the FTA may positively affect the beliefs.

**MAs.** The access of a country to a multilateral agreement (e.g., WTO membership) reveals information regarding regulations that members of the organisation must follow. Therefore, as before, it may affect the prior beliefs that northern firms possess about the institutional conditions in that location.

**Modelling the effects of FTAs and MAs on prior beliefs.** We assume that initially—that is, before any shock takes place—the prior beliefs of northern firms in sector  $j$  about country  $l$ 's institutions are given (as before) by:

$$f_j^l \sim Y_j(f_j^l) \quad \text{with} \quad f_j^l \in [\underline{f}_j^l, \bar{f}_j^l].$$

<sup>79</sup>We define them as exogenous information shocks in the sense that they are exogenous to firms' decisions and the offshoring equilibrium path.

As already mentioned, FTAs and MAs are institutional shocks that reveal information about rules that the government of country  $l$  has committed to enforcing. In other words, it reveals information about minimal institutional conditions in country  $l$ . In the model, this is introduced by a reduction in the upper bound defined by the initial prior beliefs, only when they were ex-ante relatively pessimistic in terms of the upper bound of the prior distribution. Formally, the prior institutional uncertainty at any period  $t$  is given by:

$$f_j^l \sim Y_j(f_j^l) \quad \text{with} \quad f_j^l \in [\underline{f}_j^l, \bar{f}_j^l - \mathbf{I}_{j,t}^l],$$

where  $\bar{f}_j^l$  refers to the initial upper bound of the prior distribution, and  $\mathbf{I}_{j,t}^l$  refers to the institutional information revealed by FTA and MA shocks experienced by a non-explored location  $l$  up to period  $t$ . The variable  $\mathbf{I}_{j,t}^l$  is defined as:

$$\mathbf{I}_{j,t}^l \equiv \max \{ \mathbb{1} [d_{l,t}^{FTA} = 1] FTA_l^{inst}; \mathbb{1} [d_{l,t}^{MA} = 1] MA \},$$

where  $d_{l,t}^{FTA}$  is a dummy that refers to the existence of an FTA between the North and country  $l$  in period  $t$ , and  $d_{l,t}^{MA}$  is a dummy that indicates the MA membership (e.g., WTO membership) of country  $l$  in period  $t$ . The variable  $FTA_l^{inst}$  refers to the institutional information revealed by an FTA between the North and country  $l$ , that is, by the institutional commitment revealed by the agreement. The variable  $MA$ , instead, denotes the upper bound defined by the MA institutional framework (e.g., WTO regulations). All these variables are defined in  $[0, \infty)$ , and they are increasing in the information revealed by the agreements.

**Summary on decentralised policies (FTAs and MAs).** The model introduces some new questions in the discussion about the effectiveness of institutional reforms. We show that a change in the institutional fundamentals in a country may not have the expected results when firms do not fully believe in the scope of the reform.<sup>80</sup> As a consequence, high uncertainty prevails after the reform.

We show that information spillovers produce an increasing differentiation between countries in terms of beliefs or perceptions. Thus, as this process advances, a successful reform that aims to redirect the offshoring exploration flow to a new location requires an increasingly deeper impact on firms' beliefs. It becomes harder to break established patterns by an institutional reform as the offshoring sequence progresses and countries become increasingly differentiated.<sup>81</sup>

<sup>80</sup>That is, the prior beliefs are not sufficiently affected by the announcement of the reform.

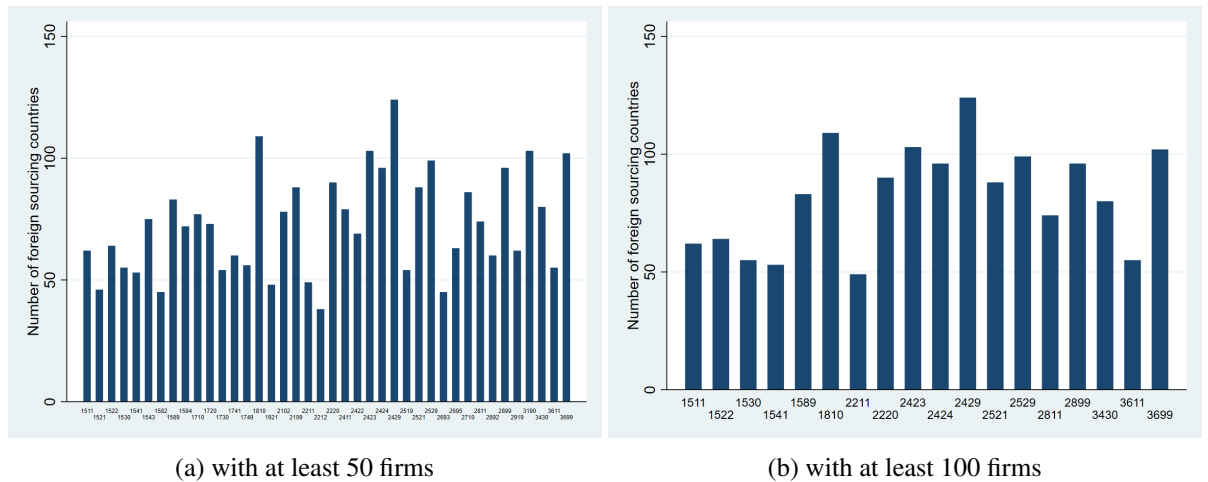
<sup>81</sup>In the cases of strong sector-specific institutions, the scope of the information spillovers may extend only to a sector-specific effect, as characterised in the model, and therefore lead to different sectoral specialisation paths in each differentiated sector. Under this situation, the sequential offshoring process in one differentiated sector  $j$  is separable from the dynamic of other differentiated industries. However, when the scope of the information spillovers is larger, that is, the externalities spill across sectors, this may lead to a more extensive or across-sectors effect. In the case of sector-specific spillovers, the countries



Moreover, the goal of the institutional reforms may depend on the specific path that the sector shows and the country implementing the reform. For example, consider the case of convergence to a ‘non-efficient’ equilibrium. On the one hand side, the country that has been hurt by the information spillovers but possesses better fundamentals (namely, the South in the model above) must implement a reform that targets firms’ institutional beliefs about that country. It is more effective to introduce policies mainly defined as signals oriented to change firms’ perceptions.<sup>82</sup> On the other hand side, the countries receiving the offshoring flows but with worse institutional fundamentals—that is, those who benefit from the information spillovers (namely, the East in the model above)—have an incentive to concentrate the effort on inducing reforms in the institutional fundamentals in the long run. The reforms must be oriented to avoid the stop of the offshoring inflows and the potential relocation processes to the efficient steady state.

### 4.3 Empirical models: Data and 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  $l = 1, \dots, l, \dots, S$ , where the subindex  $l$  denotes one particular foreign country. Figure 6 shows the mean number of countries of origin by sector, for each of the samples defined. The sample including all sectors with at least 50 firms defines a set  $S$  with 173 potential foreign countries, whereas in the case of the sample including all sectors with at least 100 firms, the set  $S$  includes 167 potential foreign locations.



**Data.** In addition to the Colombian data already described, we use the following data: income per capita and GDP from the World Bank, 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 (distance between capitals) 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), where the authors show that the thickness of the market is an important determinant of the location choices for offshoring.<sup>83</sup>

**Definition of main variables.** We identify the 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. In other words, we analyse the first-time exploration decision of these firms. Formally, the set of non-offshoring firms at the beginning of period  $t$  in sector  $j$  is defined as  $\{i \in I_j : \text{cos}_{i,j,t-1} = 0\}$  with  $\text{cos}_{i,j,t-1} = 0 \Leftrightarrow \text{cos}_{i,l,j,t-1} = 0 \forall l \in S$ , where  $\text{cos}_{i,l,j,t-1}$  is a dummy variable that indicates the cumulative offshoring status of firm  $i$  in sector  $j$  and country  $l$  up to period  $t - 1$ .<sup>84</sup>
- Offshoring firms in  $t$  are defined as firms that up to  $t - 1$  have imported from at least one country. We characterise the exploration decision of new countries by already offshoring firms for a potential relocation of offshore suppliers. Formally, the set of offshoring firms is defined as  $\{i \in I_j : \text{cos}_{i,j,t-1} = 1\}$  with  $\text{cos}_{i,j,t-1} = 1 \Leftrightarrow \text{cos}_{i,l,j,t-1} = 1$  for at least one country  $l \in S$ .

We define  $S_{i,j,t}$  as the set of countries that has not been explored by 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 has already explored the offshoring potential in all countries up to period  $t$ .

Finally, the variable  $\ln(\text{ris}_{i,l,j,t}^W)$  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  $W^{\text{dist}}$ ). As robustness, in Appendix D.4.1, we use the simple mean (denoted by  $W^{\text{mean}}$ ) and the maximum information revealed (denoted by  $W^{\text{max}}$ ) among alternative non-explored locations.

<sup>83</sup>As a control variable, it also allows us to account for potential scale economies or agglomeration economies that may influence the location choices.

<sup>84</sup> $\text{cos}_{i,l,j,t-1} = 0$  when firm  $i$  in sector  $j$  has never imported from country  $l$  up to and in period  $t - 1$ , and one otherwise.

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

$$\ln(ris\_minta_{i,l,j,t}^{W^{dist}}) \equiv \ln \left( \frac{minta_{l,j,t-1}}{\sum_{s=1}^{S_{i,j,t-1}} minta_{s,j,t-1} \times weight_{i,s,t}} \right), \quad (23)$$

where, in this case, the weights are defined by the distance to Colombia of 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 sector  $j$  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.<sup>85</sup>

The alternative measure,  $sdt_{i,l,j,t}$ , allows us to keep the locations from which no information has been revealed in the sample, by defining  $sdt_{i,l,j,t} = 0$  for a location  $l$  where no firm in sector  $j$  registers imports in period  $t$ .<sup>86</sup> The equivalent relative information-spillover index for this measure is:

$$\ln(ris\_sdt_{i,l,j,t}^{W^{dist}}) \equiv \ln \left( 1 + \frac{sdt_{l,j,t-1}}{\sum_{s=1}^{S_{i,j,t-1}} sdt_{s,j,t-1} \times weight_{i,s,t}} \right). \quad (24)$$

In this case, the weights are defined by the inverse of the distance to Colombia 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.

## 4.4 Empirical reduced-form models

### 4.4.1 Non-offshoring (domestic-sourcing) firms: First-time exploration decision

We now investigate the first-time exploration decision, which refers to the 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

<sup>85</sup> As already mentioned, we define in Appendix D.4.1 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  $W^{max}$ ).

<sup>86</sup> A drawback from this replacement is that the variable  $sdt_{i,l,j,t} = 0$  when no firm offshores from  $l$  in sector  $j$  and period  $t$ —i.e., no information revealed about that country for firms in that sector—but also when only one firm offshores from  $l$  in sector  $j$  and period  $t$ , and thus some information has been revealed about that location for firms in that sector.

revealed. Thus, 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:

$$\Pr \left( os_{i,l,j,t} = 1 \middle| cos_{i,j,t-1} = 0 \right) = \Phi \left( \beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(ris_{i,l,j,t}^W) + \gamma_l + \gamma_j + \gamma_t \right), \quad (25)$$

where  $i, l, j$  denote the firm, country and sector, respectively. The variable  $cos_{i,j,t-1}$ , as before, is 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  $l$  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.

Table 3: Non-offshoring firms

Model: Sample:	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	
	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*** (0.0199)	0.236*** (0.0193)	0.225*** (0.0224)	0.222*** (0.0214)	0.673*** (0.0543)	0.679*** (0.0540)	0.626*** (0.0544)	0.632*** (0.0537)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-	-0.0557*** (0.0141)		-0.0440*** (0.0116)		-0.168*** (0.0383)		-0.133*** (0.0345)	
$\ln(ris\_sdta_{i,l,j,t}^{W^{dist}})$	+		0.0713*** (0.0203)		0.0495*** (0.0188)		0.202*** (0.0570)		0.142** (0.0572)
$\ln(t)$						-1.072*** (0.102)	-0.990*** (0.107)	-1.014*** (0.102)	-0.943*** (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. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

The results are reported in columns (1)–(4) of Table 3. 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. Regarding the effects of the relative information spillovers, both specifications show theory-consistent results: 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. In other words, the information spillovers affect the location choices of domestic-sourcing firms when they decide to explore their offshoring potential for the first time.<sup>87</sup>

<sup>87</sup> For the average marginal effects and marginal effects at the mean, see Tables A14 and A15 in Appendix D.4.2, respectively. Table A22 in Appendix D.4.3 shows the results of the models where we relaxed the specification by replacing the country fixed effects by country-level control variables. Appendix D.4.1 reports the respective results for models with alternative information spillovers measures. The results remain robust across all the specifications and alternative information spillover measures.

**Transition (survival) analysis.** 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 given by:

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

where  $\delta_t$  denotes the general time-trend,

$$\mathbf{x}'_{i,l,j,t} \boldsymbol{\beta} = \beta_0 + \beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(ris_{i,l,j,t}^W) + \beta_3 entry_i + \gamma_l + \gamma_j,$$

and the relative information spillovers are defined, as before, by equations (23) and (24).

Columns (5)–(8) of Table 3 report the results. In all the specifications, the table shows that the most productive domestic-sourcing firms experience a faster transition to offshoring from  $l$ . In other words, among the domestic-sourcing firms, the most productive ones explore their offshoring potential in country  $l$  earlier. These results are consistent with the theoretical predictions of Proposition 1. From the average marginal effects related to the model in column (5), we observe that an average increase of 10% in productivity increases the hazard rate of domestic-sourcing firms to offshore from country  $l$  by 0.0202 percentage points.<sup>88</sup>

Regarding the role of the relative information spillovers in the 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. These results show strong support for the theoretical predictions of the multi-country model. In particular, they support the prediction that the first exploration choices are strongly driven to the locations where more information has been revealed by the offshoring firms. 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.<sup>89</sup>

<sup>88</sup>For report of the average marginal effects and average effects at the mean, see Tables A14 and A15 in Appendix D.4.2. Table A22 in Appendix D.4.3 shows the results of the models where we relaxed the specification by replacing the country fixed effects by country-level control variables. Appendix D.4.1 reports the respective results for models with alternative information spillovers measures. The results above remain robust across all specifications and alternative measures.

<sup>89</sup>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 percentage points.

#### 4.4.2 Offshoring firms

We next analyse the exploration decisions of new foreign locations by offshoring firms. The model aims to capture the determinants of the exploration decisions of a new location that may trigger a potential relocation of the supply chain across foreign countries. As before, we analyse the sequential exploration in productivity, but we focus mainly on the role of information spillovers as drivers of the location choices.

**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:

$$\Pr \left( os_{i,l,j,t} = 1 \mid cos_{i,l,j,t-1} = 0, cos_{i,j,t-1} = 1 \right) = \Phi \left( \beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(ris_{i,l,j,t}^W) + \gamma_l + \gamma_j + \gamma_t \right), \quad (26)$$

where  $i, l, j$  denote the firm, country and sector, respectively. As before, the variable  $cos_{i,j,t-1}$  refers to the cumulative offshoring status of the firm and it is defined as a dummy variable that takes the value 1 if the firm  $i$  in sector  $j$  has imported up to and in period  $t - 1$  from any country. 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 1 if the firm  $i$  in sector  $j$  has imported from country  $l$  up to and in period  $t - 1$ . Finally,  $os_{i,l,j,t}$  refers to the offshoring status of firm  $i$  in sector  $j$  and country  $l$  in period  $t$ .

Table 4: Models with country fixed effects. Offshoring firms

Model:	Conditional Probit Model					Transition (survival) Analysis			
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	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$	$\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.256*** (0.00690)	0.245*** (0.00611)	0.253*** (0.00876)	0.242*** (0.00784)	0.583*** (0.0190)	0.591*** (0.0164)	0.577*** (0.0246)	0.582*** (0.0211)
$\ln(ris\_minta_{i,l,j,t}^{Wdist})$	-	-0.0581*** (0.00529)		-0.0610*** (0.00687)		-0.133*** (0.0122)		-0.143*** (0.0159)	
$\ln(ris\_sdt_{i,l,j,t}^{Wdist})$	+		0.109*** (0.0128)		0.120*** (0.0205)		0.245*** (0.0269)		0.283*** (0.0451)
$\ln(t)$						-0.588*** (0.0401)	-0.488*** (0.0348)	-0.575*** (0.0533)	-0.481*** (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 4 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 rest of the alternative non-explored locations, the more likely it is that a relocation of intermediate input suppliers will occur towards that country.* In other words, the probability of observing a relocation process towards a country increases in the information revealed about that country relative to the other potential non-explored locations.<sup>90</sup>

**Transition (survival) analysis.** 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:

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

where  $\delta_t$  denotes the general time-trend,

$$\mathbf{x}'_{i,l,j,t} \boldsymbol{\beta} = \beta_0 + \beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(ris_{i,l,j,t}^W) + \beta_3 entry_i + \gamma_l + \gamma_j,$$

and the relative information spillovers are defined, as before, by equations (23) and (24).

In columns (5)–(8) of Table 4, we report the results.<sup>91</sup> 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 in the location choices, the table shows theory-consistent evidence. 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.

From a quantitative analysis, we observe that the predicted effects are significantly larger than for domestic-sourcing firms, which is consistent with the exploration of new locations as an offshore-suppliers relocation process led by the most productive firms in the market. The average marginal effects

<sup>90</sup>For report of the average marginal effects and average effects at the mean, see Tables A16 and A17 in Appendix D.4.2. Table A23 in Appendix D.4.3 shows the results of the models where we relaxed the specification by replacing the country fixed effects by country-level control variables. Appendix D.4.1 reports the respective results for models with alternative information spillovers measures. The results above remain robust across all specifications and alternative measures.

<sup>91</sup>For report of the average marginal effects and average effects at the mean, see Tables A16 and A17 in Appendix D.4.2. Table A23 in Appendix D.4.3 shows the results of the models where we relaxed the specification by replacing the country fixed effects by country-level control variables. Appendix D.4.1 reports the respective results for models with alternative information spillovers measures. The results above remain robust across all specifications and alternative measures.

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.<sup>92</sup>

#### 4.5 Empirical reduced-form model: Institutional measures and learning mechanism.

We go one step further by introducing 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 and the information spillovers. Thus, we introduce a measure of relative prior beliefs on institutional conditions together with the relative information spillover measures defined above.

**Definition of main variables and identification of prior and posterior institutional beliefs.** We use as a measure of the prior beliefs about the institutional conditions the institutional indices from the Worldwide Governance Indicators of the World Bank: *Government Efficiency (GE)*, *Regulatory Quality (RQ)* and *Rule of Law (RL)*. As these indices are built based on surveys instead of being a direct measure of the institutional fundamentals, they are closer to capturing the perceptions (i.e., prior beliefs) about the institutional conditions in each country.<sup>93</sup> Thus, we use them as proxies for the *prior* beliefs about the institutional conditions in each location.

For all institutional indices, we use the ‘estimate’ measures. We take the exponential values of the original indices, such that they are defined in the range  $(0, \infty)$ . As we did for the information spillovers, we define a relative institutional index that captures the beliefs about the institutional conditions in country  $l$  relative to the beliefs about the institutional conditions in third non-explored countries, and it is

<sup>92</sup>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 percentage points.

<sup>93</sup>‘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).



given by:

$$\ln(\text{rel\_inst}_{i,l,j,t}^{W^{dist}}) \equiv \ln \left( \frac{\text{inst}_{l,t-1}}{\sum_{s=1}^{S_{i,j,t-1}} \text{inst}_{s,t-1} \times \text{weight}_s} \right). \quad (27)$$

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.<sup>94</sup>

As defined by the theory, information spillovers refer to the information received by each firm when they observe the behaviour of offshoring firms in the same sector. In other words, the measure of information spillovers identifies the *physical state* of the learning mechanism defined earlier.

#### 4.5.1 Non-offshoring firms

The probability of a domestic-sourcing firm exploring the offshoring potential in country  $l$  in period  $t$  is given by:

$$\Pr \left( \text{os}_{i,l,j,t} = 1 \mid \text{cos}_{i,j,t-1} = 0 \right) = \Phi \left( \beta_1 \ln(\text{ta}_{i,j,t}) + \beta_2 \ln(\text{rel\_inst}_{i,l,j,t}^{W^{dist}}) + \beta_3 \ln(\text{ris}_{i,l,j,t}^{W^{dist}}) + \gamma_l + \gamma_j + \gamma_t \right), \quad (28)$$

where  $\text{rel\_inst}_{i,l,j,t}^{W^{dist}}$  indicate the prior beliefs about country  $l$  institutional conditions relative to the weighted mean prior of all alternative sourcing countries,  $\text{ris}_{i,l,j,t}^{W^{dist}}$  refers to the information spillovers about country  $l$  offshoring conditions relative to the weighted mean of information spillovers in all alternative sourcing countries, and  $\gamma_l$ ,  $\gamma_j$  and  $\gamma_t$  indicate country, sector and year fixed effects, respectively.

**Results.** Table 5 reports the results of the empirical model in equation (28). The Table shows strong supportive evidence for the effect of productivity on the probability of exploring the offshoring potential of domestic-sourcing firms. Higher productivity increases the probability of exploring the offshoring potential in period  $t$  by a domestic-sourcing firm, which is consistent with the theoretical prediction in Proposition 1.<sup>95</sup>

Regarding the role of information spillovers, the empirical model shows also strong support for the predictions from the theoretical model in all specifications. 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

<sup>94</sup>The variable  $\text{rel\_inst}_{i,l,j,t}^{W^{dist}}$  alternatively refers to  $\text{rel\_GEst}_{i,l,j,t}^{W^{dist}}$ ,  $\text{rel\_RQEst}_{i,l,j,t}^{W^{dist}}$ ,  $\text{rel\_RLest}_{i,l,j,t}^{W^{dist}}$ , depending on the institutional index used.

<sup>95</sup>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. For average marginal effects and marginal effects at the mean, see Tables A18 and A19 in Appendix D.4.2, respectively. Table A24 in Appendix D.4.3 shows the results of the models where we relaxed the specification by replacing the country fixed effects by country-level control variables.

Table 5: Conditional Probit Model: Prior beliefs and information spillovers. Non-offshoring firms

<b>Institutional Index:</b>	<b>GEest</b>	<b>RQest</b>	<b>RLest</b>	<b>GEest</b>	<b>RQest</b>	<b>RLest</b>
	(1)	(2)	(3)	(4)	(5)	(6)
	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.225*** (0.0224)	0.225*** (0.0224)	0.225*** (0.0224)	0.222*** (0.0214)	0.222*** (0.0214)	0.222*** (0.0214)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-0.0436*** (0.0115)	-0.0440*** (0.0116)	-0.0434*** (0.0115)			
$\ln(ris\_sdt_{i,l,j,t}^{W^{dist}})$				0.0495*** (0.0188)	0.0490*** (0.0188)	0.0494*** (0.0188)
$\ln(rel\_inst_{i,l,j,t}^{W^{dist}})$	-0.174 (0.113)	0.0774 (0.145)	-0.252 (0.234)	-0.0198 (0.158)	0.300** (0.141)	0.102 (0.271)
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 estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

potential in  $t$  in country  $l$ .<sup>96</sup>

Finally, the empirical results show that exogenous changes in institutional indices do not affect the probability of offshoring exploration 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.

#### 4.5.2 Offshoring firms

The probability of exploring the offshoring potential in country  $l$  in period  $t$  for an offshoring firm that has not explored the offshoring potential in country  $l$  in any previous period is given by:

$$\Pr \left( os_{i,l,j,t} = 1 \mid cos_{i,l,j,t-1} = 0, cos_{i,j,t-1} = 1 \right) = \Phi \left( \beta_1 \ln(ta_{i,j,t}) + \beta_2 \ln(rel\_inst_{i,l,j,t}^{W^{dist}}) + \beta_3 \ln(ris_{i,l,j,t}^{W^{dist}}) + \gamma_l + \gamma_j + \gamma_t \right), \quad (29)$$

where  $rel\_inst_{i,l,j,t}^{W^{dist}}$  indicate the prior beliefs about country  $l$  institutional conditions relative to the weighted mean prior of all non-explored countries by firm  $i$  up to period  $t$ , that is, all countries in  $S_{i,j,t-1}$ . The variable  $ris_{i,l,j,t}^{W^{dist}}$  refers to the information spillovers about country  $l$  offshoring conditions relative to the weighted mean of information spillovers in all non-explored countries by firm  $i$  up to period  $t$ . Finally,  $\gamma_l$ ,  $\gamma_j$  and  $\gamma_t$  indicate country, sector and year fixed effects, respectively.

<sup>96</sup>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 percentage points (column 1).

**Results.** Table 6 reports the result of the empirical model in equation (29). The tables provide 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. That is, it is consistent with the prediction that relocation dynamics to new locations are led by the most productive firms in the market.<sup>97</sup>

Table 6: Conditional Probit Model: Prior beliefs and information spillovers. Offshoring firms

<b>Institutional Index:</b>	<b>GEest</b>	<b>RQest</b>	<b>RLest</b>	<b>GEest</b>	<b>RQest</b>	<b>RLest</b>
	(1)	(2)	(3)	(4)	(5)	(6)
	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.249*** (0.00884)	0.251*** (0.00887)	0.249*** (0.00899)	0.239*** (0.00770)	0.241*** (0.00779)	0.239*** (0.00777)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-0.0610*** (0.00712)	-0.0613*** (0.00699)	-0.0610*** (0.00699)			
$\ln(ris\_sdt_{i,l,j,t}^{W^{dist}})$				0.119*** (0.0206)	0.119*** (0.0204)	0.119*** (0.0205)
$\ln(rel\_inst_{i,l,j,t}^{W^{dist}})$	0.355*** (0.0719)	0.260*** (0.0539)	0.334*** (0.0881)	0.519*** (0.0635)	0.275*** (0.0425)	0.583*** (0.0803)
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 estimated coefficients. Standard errors are clustered at the sector level and reported in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Regarding the role of information spillovers, the empirical results show strong supportive evidence for the predictions of the model in all specifications. 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  $l$ .<sup>98</sup>

Finally, concerning the role of the prior beliefs, the empirical results provide 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 of exploring the offshoring potential in country  $l$  in period  $t$ . In other words, exogenous positive shocks in prior beliefs (e.g., institutional reforms) that may lead to the exploration of new locations have a higher impact on the most productive firms in the market. Thus, the exploration of new locations after an institutional shock, con-

<sup>97</sup>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). For average marginal effects and marginal effects at the mean see Tables A20 and A21 in Appendix D.4.2, respectively.

<sup>98</sup>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).

sistently with the theoretical model, is led by the most productive firms under offshoring. The results are robust across specifications in robustness checks (see Appendix D.4.3).<sup>99</sup>

## 4.6 Empirical structural model

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

$$\mathcal{D}_{i,j,t}^{*l/l'}(\theta; \mathcal{I}_{i,j,t}) = \max \left\{ \mathcal{D}_{i,j,t}^{1/l'}(\theta; \mathcal{I}_{i,j,t}); \dots; \mathcal{D}_{i,j,t}^{S_{i,j,t-1}/l'}(\theta; \mathcal{I}_{i,j,t}) \right\}, \quad (30)$$

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

$$\mathcal{D}_{i,j,t}^{l/l'}(\theta; \mathcal{I}_{i,j,t}) = \max \left\{ 0; \mathbb{E}_t \left[ \pi_{j,t}^{l/l', prem}(\theta) | \mathcal{I}_{i,j,t} \right] \right\} - w^N s_j^r \left[ 1 - \lambda_j \frac{Y(f_{j,t+1}^l)}{Y(f_{j,t}^l)} \right]. \quad (31)$$

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

First, we introduce the empirical identification of the bilateral trade-off function (31) for each  $l \in S_{i,j,t-1}$  in section 4.6.1. We follow with the characterisation of a spatial probit model to identify the exploration decision defined in equation (30). For proofs, see Appendix D.5.

### 4.6.1 Bilateral trade-off function

From equation (31), we derive the conditional probit:

$$\Pr \left( d_{i,j,t}^l = 1 \mid d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^{l/l'} \theta^{\sigma_j-1} | \mathcal{I}_{i,j,t} \right] - w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] - w^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t}) \right] \right) \right], \quad (32)$$

with

$$z_{j,t}^{l/l'} \equiv \left[ \left( \frac{w^{l'}}{w^l} \right)^{(1-\eta_j)(\sigma_j-1)} - 1 \right] \left( \frac{w^N}{w^{l'}} \right)^{(1-\eta_j)(\sigma_j-1)} \left[ \frac{\sigma_j - 1}{\sigma_j} \right]^{\sigma_j-1} (\gamma_j E)^{\sigma_j} Q_{j,t}^{1-\sigma_j} (w^N)^{1-\sigma_j}.$$

<sup>99</sup>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).

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:

$$w^N \left[ \mathbb{E} \left( f_j^l | \mathcal{I}_{i,j,t} \right) - f_j^{l'} \right] = \mathbf{controls}_l' \gamma_1 - \gamma_2 inst_{l,j,t}^{posterior} + \gamma_j + v_{i,l,j,t}, \quad (33a)$$

$$= \gamma_l - \gamma_2 inst_{l,j,t}^{posterior} + \gamma_j + v_{i,l,j,t}, \quad (33b)$$

where  $\mathbf{controls}_l$  refers to a vector of time-invariant country  $l$  level variables such as market thickness ( $\ln(\overline{mkt\_thick}_l)$ ), mean income per capita ( $\ln(\overline{inc\_pc}_l)$ ), common language ( $common\_lang_l$ ), and distance ( $\ln(\overline{dist}_l)$ ). The country fixed effects  $\gamma_l$  in equation (33b) absorb all these country-level time-invariant variables of the specification in equation (33a). Finally, the variable  $inst_{l,j,t}^{posterior}$  refers to the posterior beliefs of firms in sector  $j$  in year  $t$  about the institutional conditions of country  $l$ , and  $\gamma_j$  denotes sector fixed effects.

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 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:

$$inst_{l,j,t}^{posterior} = \rho_1 is_{l,j,t} + \rho_2 inst_{l,t} + \rho_3 FTA_{l,t} + \rho_4 FTA_{l,t}^{inst}, \quad (34)$$

where the information spillovers—that is,  $is_{l,j,t}$ —are modelled by the two measures defined earlier: i)  $minta_{l,j,t-1}$ , and ii)  $sdt_{l,j,t-1}$ .

We use the institutional index of country  $l$  in year  $t$ —e.g., *Government Efficiency*, *Regulatory Quality* or *Rule of Law*—as a proxy measure for the prior beliefs. The underlying assumption is that the priors are homogenous across sectors, i.e. the variable  $inst_{l,t}$  does not vary in the  $j$  dimension. The variable  $FTA_{l,t}$  represents a dummy variable that identifies whether country  $l$  has an FTA with Colombia in period  $t$ .<sup>100</sup> Additionally, we create a continuous variable  $FTA_{l,t}^{inst} \in [0, \infty)$  that measures the institutional information

<sup>100</sup>The model could also identify the effects of multilateral agreements (MAs) such as WTO membership. However, considering the relatively late and short period covered by our data, we do not include WTO membership as an exogenous shock on priors beliefs. Nevertheless, an empirical model with a sample period that covers earlier years may include a dummy variable  $WTO_{l,t}$  that would take the value one since the year country  $l$  becomes a WTO member.

shock component of these agreements.<sup>101</sup>

Therefore, using equation (34), the expected fixed-cost differential from equation (33) becomes:

$$w^N \left[ \mathbb{E} \left( f_j^l | \mathcal{I}_{i,j,t} \right) - f_j^{l'} \right] = \mathbf{controls}_i' \gamma_1 - \gamma_{21} is_{l,j,t} - \gamma_{22} inst_{l,t} - \gamma_{23} FTA_{l,t} - \gamma_{24} FTA_{l,t}^{inst} + \gamma_j + v_{i,l,j,t}, \quad (35a)$$

$$= \gamma_l - \gamma_{21} is_{l,j,t} - \gamma_{22} inst_{l,t} - \gamma_{23} FTA_{l,t} - \gamma_{24} FTA_{l,t}^{inst} + \gamma_j + v_{i,l,j,t}. \quad (35b)$$

Intuitively, an exogenous improvement in the prior beliefs about institutions in country  $l$  reduces the expected fixed costs of offshoring in that location.<sup>102</sup> In the empirical model, the exogenous improvement in institutional prior beliefs is identified by the changes in the institutional index—i.e., in the direct measure of prior beliefs—and institutional information shocks from institutional reforms.<sup>103</sup>

**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:

$$w^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t}) \right] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j} \mathbb{E} \left[ inst_{l,j,t+1}^{posterior} | \mathcal{I}_{i,j,t} \right] + e_{l,j,t}, \quad (36)$$

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. Thus, we follow the same approach as above.<sup>104</sup>

From theory, the expected posterior beliefs about country  $l$  in  $t + 1$  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., 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. As in section 3.3, 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

<sup>101</sup> See Appendix D.5.2 for the empirical identification of the institutional information component of FTAs.

<sup>102</sup> 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.

<sup>103</sup> That is, the latter refers to information shocks from FTAs or, when it is possible to identify it, from multilateral agreements such as WTO membership.

<sup>104</sup> For proofs and details, see Appendix D.5.3.

set they possess in  $t$ .<sup>105</sup>

$$is_{l,j,t+1} = \rho_{1,j} is_{l,j,t} + \epsilon_{l,j,t} \Rightarrow \mathbb{E}[is_{l,j,t+1}] = \rho_{1,j} is_{l,j,t}. \quad (37)$$

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

$$w^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t}) \right] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j} \widehat{is}_{l,j,t+1} + e_{l,j,t}, \quad (38)$$

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 posteriors, increases the gains from waiting.

**Empirical identification of the bilateral trade-off function.** Back to equation (32), replacing with expressions from equations (35) and (38), the model is given by:<sup>106</sup>

$$\Pr \left( d_{i,j,t}^l = 1 \mid d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^{l/l'} \theta^{\sigma_j-1} \mid \mathcal{I}_{i,j,t} \right] - \Gamma_l - \Gamma_j + \Gamma_1 inst_{l,t} \right. \right. \\ \left. \left. + \Gamma_2 FTA_{l,t} + \Gamma_3 FTA_{l,t}^{inst} + \Gamma_4 is_{l,j,t} - \Gamma_{5,j} \widehat{is}_{l,j,t+1} \right) \right]. \quad (39)$$

#### 4.6.2 Multi-country trade-off function

We define as  $\mathcal{D}_{i,j,t}^{l/l'}(\theta; \mathcal{I}_{i,j,t})$  the vector of trade-off functions for locations  $l \in S_{i,t-1}$  that constitute the arguments of the max function in equation (30). The spatial Probit is given by:

$$\mathcal{D}_{i,j,t}^{l/l'}(\theta; \mathcal{I}_{i,j,t}) = \psi \mathbf{W}_{i,j,t} \mathcal{D}_{i,j,t}^{l/l'}(\theta; \mathcal{I}_{i,j,t}) + \left[ \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^{l/l'} \theta^{\sigma_j-1} \mid \mathcal{I}_{i,j,t} \right] - \Gamma_l - \Gamma_j - \Gamma_t \right. \\ \left. + \Gamma_1 inst_{l,t} + \Gamma_2 FTA_{l,t} + \Gamma_3 FTA_{l,t}^{inst} + \Gamma_4 is_{l,j,t} - \Gamma_{5,j} \widehat{is}_{l,j,t+1} \right], \quad (40)$$

where  $\mathbf{W}_{i,j,t}$  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,  $\mathbf{I}_{i,j,t}$  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  $\mathbf{W}_{i,j,t}$  has a

<sup>105</sup> As in the structural specification for the North-South model, we also estimate (as robustness) the models with information spillovers in natural logarithms.

<sup>106</sup> We report here the model that includes country fixed effects. Based on equation (39), it is straightforward to obtain the expression that explicitly includes time-invariant country  $l$  level variables instead of country fixed effects.

constant dimension  $S \times S$  for each year  $t$ , 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 period  $t$  (not including countries explored in  $t$ ). Therefore, the matrix is firm-specific and changes over time, as new locations are explored by firm  $i$ .<sup>107</sup> Thus, the weighting matrix for offshoring firm  $i$  in period  $t$  (i.e.,  $W_{i,j,t}$ ) has a dimension  $S_{i,t-1} \times S_{i,t-1}$ .

**Definition of weighting matrix.** We use a weighting matrix with equal weights among all non-explored locations in the main specification. The off-diagonal elements of the matrix take the value one, and then we row-normalise the matrix to one. Thus, this is equivalent to taking the simple mean among alternative sourcing countries. We denote this matrix by  $W_{i,j,t} = W_{i,j,t}^{mean}$ .

The argument for using the matrix  $W_{i,j,t}^{mean}$  in the main specification is that after considering the effect of distance in the bilateral trade-off functions, firms' choices among alternative locations are not affected by distance. Nevertheless, as robustness, we report the results for models that define the off-diagonal elements by the inverse of the distance to Colombia (row-normalised to one). We denote this alternative matrix as  $W_{i,j,t} = W_{i,j,t}^{dist}$ .

**Sample definition.** For computational reasons, we reduce the dimension of the weighting matrix  $W_{i,j,t}$  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 comments.** 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.

Due to computational reasons, we simplify the model from equation (40) and estimate a 'reduced-form' of the spatial structural model, which is given by:

$$\begin{aligned} \mathcal{D}_{i,j,t}^{l/l'}(\theta; \mathcal{I}_{i,j,t}) = & \psi W_{i,j,t} \mathcal{D}_{i,j,t}^{l/l'}(\theta; \mathcal{I}_{i,j,t}) + \left[ \Gamma_1 \ln(ta_{i,j,t}) - \Gamma_l - \Gamma_j - \Gamma_t \right. \\ & \left. + \Gamma_1 inst_{l,t} + \Gamma_2 FTA_{l,t} + \Gamma_3 FTA_{l,t}^{inst} + \Gamma_4 is_{l,j,t} - \Gamma_5 \widehat{is}_{l,j,t+1} \right]. \end{aligned} \quad (41)$$

This reduced form 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 (40), and ii) the expected new informa-

<sup>107</sup> As the firm  $i$  explores new locations, the dimension of the weighting matrix reduces its dimension for that firm  $i$ .



tion defined by coefficient  $\Gamma_{5,j}$  in equation (40).<sup>108</sup>

**Results: Analysis of main effects.** Table 7 reports the results for domestic-sourcing firms, whereas Table 8 reports the results for 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 indices are *Regulatory Quality* and *Rule of Law*.<sup>109</sup>

We focus the analyses of the results in light of the 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.

Table 7: Domestic-Sourcing Firms - Information Spillover Measure:  $minta$

	inst: RQ					inst: RL				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000477	-0.000232	0.000245	0.19497	0.0000	0.000454	-0.00022	0.000234	0.185672	0.0000
$minta_{l,j,t-1}$	-0.000008	0.000004	-0.000004	-0.002813	0.0014	-0.000007	0.000004	-0.000004	-0.003187	0.0342
$\widehat{minta}_{l,j,t+1}$	0.000008	-0.000004	0.000004	0.002792	0.0022	0.000007	-0.000004	0.000004	0.003169	0.0348
$inst_{l,t}$	0.000208	-0.000101	0.000107	0.083196	0.2272	-0.000472	0.00023	-0.000242	-0.189148	0.052
$FTA_{l,t}$	0.000505	-0.000247	0.000258	0.22227	0.1706	0.000255	-0.000126	0.000129	0.120546	0.2334
$FTA_{l,t}^{inst}$	-0.00034	0.000165	-0.000175	-0.14067	0.0374	-0.000245	0.000119	-0.000126	-0.099888	0.0612
$\psi$				-0.935494	0.0000				-0.934742	0.0000

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

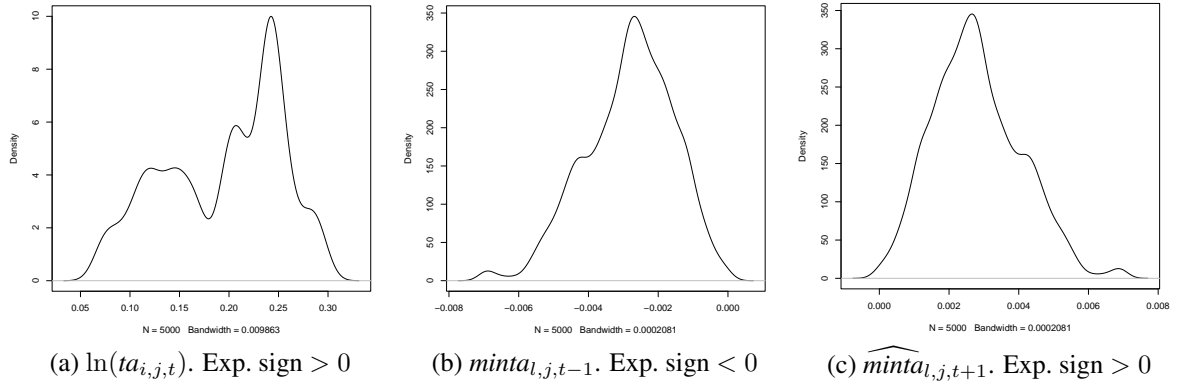


Figure 7: Coefficients: Domestic-Sourcing Firms - Model w/ Regulatory Quality and  $W_{i,j,t}^{mean}$

<sup>108</sup> Nevertheless, the estimated simplified version in equation (41) represents a more conservative structure than the one based on equation (40). 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.

<sup>109</sup> For the results with Government Efficiency index, as well as for all results of the robustness checks, see Appendix D.6.

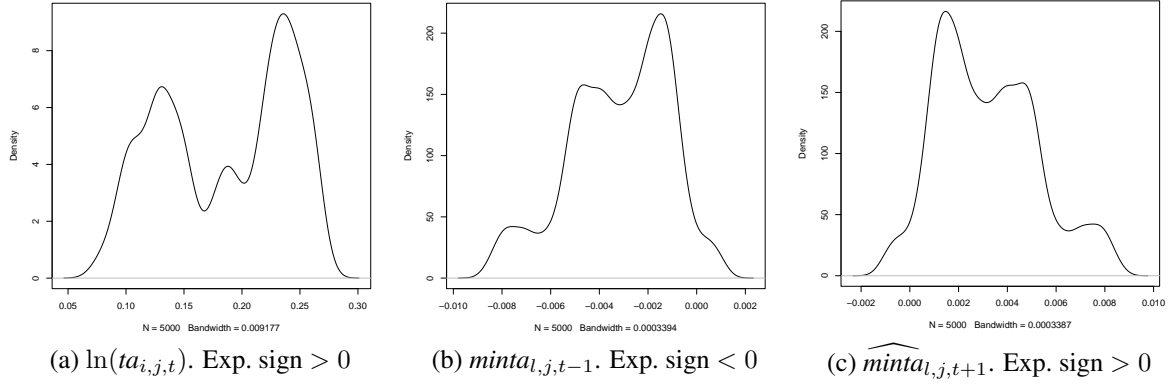


Figure 8: Coefficients: Domestic-Sourcing Firms - Model w/ Rule of Law and  $W_{i,j,t}^{mean}$

However, before that, we analyse the spatial coefficient. The respective tables show a negative spatial effect ( $\psi < 0$ ) revealing that exploration decisions on new sourcing locations behave as substitutes. In other words, as predicted by the theory, 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. 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.

Table 8: Offshoring Firms - Information Spillover Measure: *minta*

	inst: RQ					inst: RL				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003650	-0.001803	0.001846	0.376619	0.0000	0.003683	-0.001821	0.001862	0.383691	0.0000
$\widehat{minta}_{l,j,t-1}$	-0.000012	0.000006	-0.000006	-0.001214	0.0038	-0.000012	0.000006	-0.000006	-0.001221	0.0000
$\widehat{minta}_{l,j,t+1}$	0.000012	-0.000006	0.000006	0.001177	0.0042	0.000011	-0.000006	0.000006	0.001184	0.0000
$inst_{l,t}$	-0.000071	0.000035	-0.000036	-0.007202	0.4352	-0.001626	0.000802	-0.000824	-0.168544	0.0000
$FTA_{l,t}$	-0.000321	0.000158	-0.000163	-0.032695	0.2844	-0.000753	0.000372	-0.000381	-0.078475	0.0366
$FTA_{l,t}^{inst}$	-0.000328	0.000162	-0.000166	-0.033719	0.0430	-0.000154	0.000076	-0.000078	-0.015794	0.1676
$\psi$				-0.964509	0.0000				-0.967959	0.0000

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

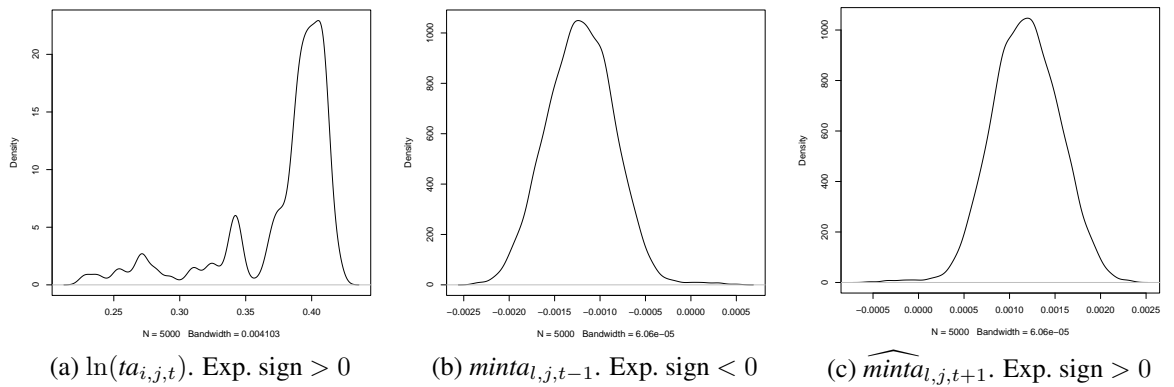


Figure 9: Coefficients: Offshoring Firms - Model w/ Regulatory Quality and  $W_{i,j,t}^{mean}$

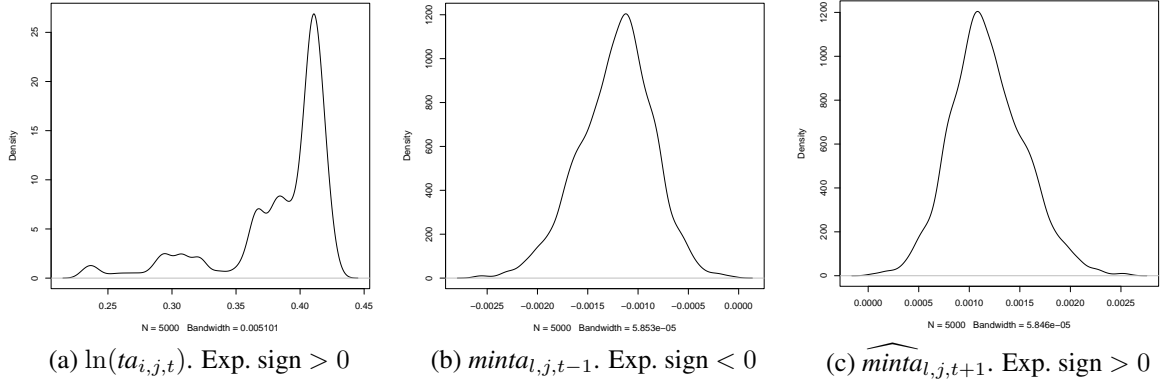


Figure 10: Coefficients: Offshoring Firms - Model w/ Rule of Law and  $W_{i,j,t}^{mean}$

Concerning Proposition 1, the results in both tables 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  $t$ —i.e., 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 tables show theory-consistent and significant effects for both coefficients. That is, the current information revealed about offshoring conditions in country  $l$  ( $\widehat{minta}_{l,j,t-1}$ ) 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  $\widehat{minta}_{l,j,t-1}$ . They show that an increase in the current information revealed about country  $l$  (i.e., a reduction in  $\widehat{minta}_{l,j,t-1}$ ) 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  $l$  (i.e., 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 total negative 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 and institutional information shocks from institutional reforms (e.g., FTAs), the results show mixed evidence concerning the model's predictions. In particular, by comparing the results from the tables above to the tables in Appendix D.6 where country fixed effects are not included, it is clear that empirical results provide mixed evidence about the effects of these exogenous shocks on priors, and thus on offshoring exploration decisions.

## 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 countries, particularly about locations where they have never been active before, or countries that have implemented deep institutional reforms and the firms do not fully believe in the real scope of the changes announced by the foreign governments. In the latter sense, the institutional reforms induce also uncertainty about the true conditions in those locations.

In a model with two countries (North-South), we showed that firms can exploit information externalities that emerge from other firms' behaviour, and thus better assess 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 northern firms can choose among different foreign locations for offshoring. We showed that a selection pattern emerges when firms do not possess perfect information about the true conditions in foreign countries, with multiple equilibria driven by information spillovers. Therefore, the prior beliefs and the differences in institutional fundamentals across countries may lead the economy to the perfect information equilibrium or may push the economy 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 achieves a steady state with non-optimal specialisation of countries and welfare gains from offshoring that may not be fully achieving the welfare gains accruing under perfect information.

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.

The scope of the information spillovers defines or drives the sectoral specialisation of each country. If the institutions (or the spillovers) are sector-specific, the sequential offshoring path narrows its effects to a sectoral dynamic, which may lead to a sectoral specialisation of the countries. However, if the scope

of the spillovers is larger, i.e. externalities spill across sectors, it leads to a more extensive effect.

We test the model using firm-level data of manufacturing Colombian firms and 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.

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# Online Appendix for

## ‘Uncertainty in Global Sourcing: Learning, Sequential Offshoring, and Selection Patterns’

by Mario Larch and Leandro Navarro

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## A Perfect information model

### A.1 Consumer's problem

To obtain the variety  $i$  demand function  $q_j(i)$ , we maximize the utility subject to the following budget constraint:

$$p_0 q_0 + \sum_{j=1}^J \int_{i \in I_j} p_j(i) q_j(i) di \leq E.$$

From the first-order conditions (FOCs) for two different varieties  $i, i'$  in sector  $j$ :

$$\left[ \frac{q_j(i)}{q_j(i')} \right]^{\alpha_j - 1} = \frac{p_j(i)}{p_j(i')} \Leftrightarrow q_j(i) = \left[ \frac{p_j(i')}{p_j(i)} \right]^{\frac{1}{1-\alpha_j}} q_j(i').$$

Given the Cobb-Douglas utility function,  $\gamma_j E$  refers to the expenditure in differentiated sector  $j$ 's goods. Plugging the expression above for  $q_j(i)$  into the budget constraint leads to:

$$\gamma_j E = \int_{i \in I_j} p_j(i) q_j(i) di \Leftrightarrow q_j(i') = \frac{\gamma_j E}{P_j} \left[ \frac{p_j(i')}{P_j} \right]^{-\sigma_j}.$$

This expression holds for any variety  $i$ , thus

$$q_j(i) = \frac{\gamma_j E}{P_j} \left[ \frac{p_j(i)}{P_j} \right]^{-\sigma_j}.$$

Or equivalently, from the FOCs, we can obtain:

$$q_j(i) = \left[ \gamma_j E Q_j^{-\alpha} p_j(i)^{-1} \right]^{\sigma_j}.$$

To conclude, the demand for homogenous good  $q_0$  is given by:

$$q_0 = \frac{\gamma_0 E}{p_0}.$$

### A.2 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 expression from equation (3), and replacing with the production function (5):

$$\begin{aligned} r_j(i) &= \gamma_j E Q_j^{-\alpha} q_j(i)^{\alpha_j} \\ \Rightarrow r_j(i) &= \gamma_j E Q_j^{-\alpha_j} \left[ \theta \left( \frac{x_{h,j}(i)}{\eta_j} \right)^{\eta_j} \left( \frac{x_{m,j}(i)}{1 - \eta_j} \right)^{1-\eta_j} \right]^{\alpha_j}. \end{aligned}$$

**Solution to producer's problem.** Given that all investments are contractible, the final-good producer solves the following optimization problem.

$$\max_{x_{h,j}(i), x_{m,j}(i)} \pi_j = r_j(i) - w^N x_{h,j}(i) - w^l x_{m,j}(i) - w^N f_j^l,$$

where  $l = \{N, S\}$  refers to the location of the input's supplier.

By solving the FOCs, we end up with:

$$\begin{aligned} x_{h,j}(i) &= \frac{\alpha_j \eta_j}{w^N} r_j(i), \\ x_{m,j}(i) &= \frac{\alpha_j (1 - \eta_j)}{w^l} r_j(i). \end{aligned}$$

Dividing the two equations above, and plugging them into the FOCs, the final-good producer's optimal investments are:

$$x_{h,j}^*(i) = \frac{\alpha_j \eta_j}{w^N} r_j^{l,*}(\theta), \quad (\text{A1})$$

with  $r_j^{l,*}(\theta)$  given by:

$$r_j^{l,*}(\theta) \equiv \alpha_j^{\sigma_j-1} \theta^{\sigma_j-1} (\gamma_j E)^{\sigma_j} Q_j^{1-\sigma_j} \left[ (w^N)^{\eta_j} (w^l)^{1-\eta_j} \right]^{1-\sigma_j}. \quad (\text{A2})$$

Equivalently, the optimal supplier's investments are:

$$x_{m,j}^*(i) = \frac{\alpha_j (1 - \eta_j)}{w^l} r_j^{l,*}(\theta). \quad (\text{A3})$$

Plugging the optimal investments into (5), we get the optimal production for a firm with productivity  $\theta$ :

$$q_j^*(i) = \theta^{\sigma_j} \alpha_j^{\sigma_j} (\gamma_j E)^{\sigma_j} Q_j^{1-\sigma_j} \left[ (w^N)^{\eta_j} (w^l)^{1-\eta_j} \right]^{-\sigma_j}. \quad (\text{A4})$$

Consequently, the optimal price for a variety produced by a firm with productivity  $\theta$  with a supplier from location  $l$  is:

$$p_j^*(i) = \theta^{-1} \alpha_j^{-1} (w^N)^{\eta_j} (w^l)^{1-\eta_j}.$$

Finally, the profits realised by a firm with productivity  $\theta$  for each sourcing strategy, i.e. domestic sourcing and offshoring, are:

$$\pi_j^l(\theta, Q_j, \eta_j, f_j^l, w^l) = r_j^{l,*}(\theta) - w^N x_{h,j}^*(i) - w^l x_{m,j}^*(i) - w^N f_j^l.$$

Replacing with the expressions above for optimal investments:

$$\pi_j^l(\theta, .) = \frac{r_j^{l,*}(\theta)}{\sigma_j} - w^N f_j^l.$$

Therefore, plugging the solution for revenues,

$$\pi_j^l(\theta, .) = \theta^{\sigma_j-1} (\gamma_j E)^{\sigma_j} Q_j^{1-\sigma_j} \psi_j^l - w^N f_j^l, \quad (\text{A5})$$

with  $l = \{N, S\}$ , and  $\psi_j^l$  is defined as:

$$\psi_j^l \equiv \frac{\alpha_j^{\sigma_j-1}}{\sigma_j [(w^N)^{\eta_j} (w^l)^{1-\eta_j}]^{\sigma_j-1}}.$$

### A.3 Perfect information equilibrium

#### A.3.1 Firm's prices: domestic sourcing and offshoring

By assumption A.1 the price of a firm with productivity  $\theta$  under domestic sourcing is higher than under offshoring:

$$p(\theta) = \frac{w^N}{\alpha\theta} > \frac{(w^N)^\eta (w^S)^{1-\eta}}{\alpha\theta} = p^{\text{off}}(\theta),$$

where  $p^{\text{off}}(\theta)$  refers to the price of a firm with productivity  $\theta$  under offshoring, while  $p(\theta)$  denotes the price of the same firm under domestic sourcing.

#### A.3.2 Offshoring premiums: revenues and profits

The revenues for a firm with productivity  $\theta$  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:

$$\frac{r^{S,*}(\theta)}{r^{N,*}(\theta)} = \left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} \Leftrightarrow r^{S,*}(\theta) = \left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} r^{N,*}(\theta).$$

Subtracting on both sides  $r^{N,*}(\theta)$ , we obtain the offshoring premium in revenues received by a firm with productivity  $\theta$  when the firm decides to offshore:

$$r^{S,\text{prem}}(\theta) \equiv r^{S,*}(\theta) - r^{N,*}(\theta) = \left[ \left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1 \right] r^{N,*}(\theta). \quad (\text{A6})$$

Equivalently, the per period offshoring premium in profits for a firm with productivity  $\theta$  (without considering the market research sunk cost) is given by:

$$\pi^{S,\text{prem}}(\theta) \equiv \pi^S(\theta) - \pi^N(\theta),$$

$$\pi^{S,\text{prem}}(\theta) = \frac{\alpha^{\sigma-1} \theta^{\sigma-1} (\gamma E)^\sigma Q^{1-\sigma}}{\sigma} \left[ \frac{(w^N)^{(1-\eta)(\sigma-1)} - (w^S)^{(1-\eta)(\sigma-1)}}{[(w^S)^{(1-\eta)} w^N]^{(\sigma-1)}} \right] - w^N [f^S - f^N].$$

Thus, the per period offshoring premium in profits for a firm with productivity  $\theta$ , without considering the market research sunk cost, can be equivalently expressed as<sup>110</sup>:

$$\Leftrightarrow \pi^{S,\text{prem}}(\theta) = \frac{r^{N,*}(\theta)}{\sigma} \left[ \left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1 \right] - w^N [f^S - f^N]. \quad (\text{A7})$$

Let's define  $\bar{\theta}^S$  as the average productivity of the firms doing offshoring. Formally,

$$\bar{\theta}^S \equiv \left[ \frac{1}{1 - G(\theta^{S,*})} \int_{\theta^{S,*}}^{\infty} \theta^{\sigma-1} g(\theta) d\theta \right]^{\frac{1}{\sigma-1}}. \quad (\text{A8})$$

On the other hand, the variable  $\bar{\theta}$  is still defined as:

$$\bar{\theta} \equiv \left( \int_0^{\infty} \theta^{\sigma-1} \mu(\theta) d\theta \right)^{\frac{1}{\sigma-1}} = \left( \frac{1}{1 - G(\underline{\theta})} \int_{\underline{\theta}}^{\infty} \theta^{\sigma-1} g(\theta) d\theta \right)^{\frac{1}{\sigma-1}}. \quad (\text{A9})$$

<sup>110</sup>It is straightforward to see that this offshoring profit premium can be positive or negative depending on the productivity level of the firm.



The *light* area of Figure 2, below the  $\pi^N(\theta)$  function, can be computed in a similar way as in the case where domestic sourcing was the only available option:

$$\pi^N(\bar{\theta}) = w^N f^N \left[ \left( \frac{\bar{\theta}}{\underline{\theta}^*} \right)^{\sigma-1} - 1 \right].$$

On the other hand, the per period offshoring premium in profits, without considering the offshoring market research sunk cost, of the average productivity firm offshoring is represented by:

$$\pi^{S,prem}(\bar{\theta}^S) \equiv \pi^S(\bar{\theta}^S) - \pi^N(\bar{\theta}^S),$$

with the aggregate offshoring profit premium given by the *dark* area in Figure 2 between both profit functions.

Replacing in the previous equation the respective profit equations evaluated at  $\bar{\theta}^S$  leads to:

$$\Leftrightarrow \pi^{S,prem}(\bar{\theta}^S) = \frac{r^{N,*}(\bar{\theta}^S)}{\sigma} \left[ \left( \frac{w^N}{w^S} \right)^{(1-\eta)(\sigma-1)} - 1 \right] - w^N [f^S - f^N]. \quad (A10)$$

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

$$\begin{aligned} \bar{\pi} &= \pi^N(\bar{\theta}) + \chi^* [\pi^{S,prem}(\bar{\theta}^S) - (1-\lambda)w^N s^r] \\ &= w^N f^N \left[ \left( \frac{\bar{\theta}}{\underline{\theta}^*} \right)^{\sigma-1} - 1 \right] + \chi^* [\pi^{S,prem}(\bar{\theta}^S) - (1-\lambda)w^N s^r], \end{aligned} \quad (A11)$$

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:

$$\begin{aligned} \bar{r} &= r^N(\bar{\theta}) + \chi^* [r^S(\bar{\theta}^S) - r^N(\bar{\theta}^S)] \\ &= r^N(\bar{\theta}) + \chi^* \left[ \left( \frac{w^N}{w^S} \right)^{(\sigma-1)(1-\eta)} - 1 \right] r^N(\bar{\theta}^S). \end{aligned} \quad (A12)$$

Finally, the offshoring profit premium for the firm with the offshoring productivity cutoff is given by:

$$\begin{aligned} \pi^{S,prem}(\theta^{S,*}) - (1-\lambda)w^N s^r &= 0 \\ \Rightarrow r^{N,*}(\theta^{S,*}) &= \sigma w^N [f^S + (1-\lambda)s^r - f^N] \left[ \left( \frac{w^N}{w^S} \right)^{(1-\eta)(\sigma-1)} - 1 \right]^{-1}. \end{aligned}$$

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

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

Also, by using the equivalent of equation (A41), it is possible to derive the following relationship:

$$\frac{r^{N,*}(\theta^{S,*})}{r^{N,*}(\underline{\theta}^*)} = \left( \frac{\theta^{S,*}}{\underline{\theta}^*} \right)^{\sigma-1}. \quad (A13)$$

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

$$\begin{aligned} \left(\frac{\theta^{S,*}}{\underline{\theta}^*}\right)^{\sigma-1} &= \left(\frac{f^S + (1-\lambda)s^r}{f^N} - 1\right) \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right]^{-1} \\ \Rightarrow \theta^{S,*} &= \left(\frac{f^S + (1-\lambda)s^r}{f^N} - 1\right)^{\frac{1}{\sigma-1}} \left[\left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1\right]^{\frac{1}{1-\sigma}} \underline{\theta}^*. \end{aligned} \quad (\text{A14})$$

### A.3.3 Price index in sector $j$

The price of a variety  $i$  produced by a firm with productivity  $\theta$  which sources only domestically is given by:

$$p(\theta) = \frac{w^N}{\alpha\theta}. \quad (\text{A15})$$

Meanwhile, the price of a variety  $i$  produced by a firm with productivity  $\theta$  which offshores is:

$$p^{\text{off}}(\theta) = \frac{(w^N)^\eta (w^S)^{1-\eta}}{\alpha\theta}. \quad (\text{A16})$$

By subtracting equation (A15) from (A16), we get the price differential of an offshoring firm with productivity  $\theta$ :

$$p^{\text{off}}(\theta) - p(\theta) = \frac{(w^N)^\eta [(w^S)^{1-\eta} - (w^N)^{1-\eta}]}{\alpha\theta}. \quad (\text{A17})$$

If  $w^S < w^N$ , as defined by Assumption A.1,  $p^{\text{off}}(\theta) - p(\theta) < 0$ , i.e. offshoring firms can charge a lower price for a given productivity  $\theta$ .

Moreover, the offshoring price of a firm with productivity  $\theta$  as a function of its domestic sourcing price is given by:

$$p^{\text{off}}(\theta) = \left(\frac{w^S}{w^N}\right)^{1-\eta} p(\theta). \quad (\text{A18})$$

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

$$P^{\text{off}} \equiv \left[ \int_{\theta^{S,*}}^{\infty} [p^{\text{off}}(\theta)]^{1-\sigma} H \frac{g(\theta)}{1 - G(\theta^{S,*})} d\theta \right]^{\frac{1}{1-\sigma}}, \quad (\text{A19})$$

$$P^{\text{off}|n.t.i.} \equiv \left[ \int_{\theta^{S,*}}^{\infty} [p(\theta)]^{1-\sigma} H \frac{g(\theta)}{1 - G(\theta^{S,*})} d\theta \right]^{\frac{1}{1-\sigma}}. \quad (\text{A20})$$

Finally, we obtain the sectoral price index:

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

Therefore, the price index is

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

Furthermore, using equation (A18), the sectoral price index for the tradable intermediate input equilibrium,  $P$ , is given by the following expression:

$$P^{1-\sigma} = (P^{n.t.i.})^{1-\sigma} + \chi^* \left[ \left( \frac{w^N}{w^S} \right)^{(1-\eta)(\sigma-1)} - 1 \right] (P^{\text{off}[n.t.i.]})^{1-\sigma}. \quad (\text{A21})$$

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, i.e. more firms choosing to offshore, lead to reductions in the price index of that sector.

Moreover, as  $\theta^{S,*} \rightarrow \infty$ , the share of offshoring firms goes to zero, i.e.  $\chi^* \rightarrow 0$ . Therefore, the second term of the right-hand side of equation (A21) vanishes and the first term shows  $P^{n.t.i.}(\underline{\theta}^*) \uparrow P^{n.t.i.}(\underline{\theta}^{n.t.i.})$  and  $\underline{\theta}^* \downarrow \underline{\theta}^{n.t.i.}$ . In other words,  $P \downarrow P^{n.t.i.}$ , where the last term corresponds to the price index of the *n.t.i.* model.

### A.3.4 Aggregate consumption in sector $j$

Using the relation  $Q = \frac{\gamma E}{P}$ , and the price index from equation (A21), the sectoral aggregate consumption is:

$$Q = \gamma E \left[ (P^{n.t.i.})^{1-\sigma} + \chi^* \left[ \left( \frac{w^N}{w^S} \right)^{(1-\eta)(\sigma-1)} - 1 \right] (P^{\text{off}[n.t.i.]})^{1-\sigma} \right]^{\frac{1}{\sigma-1}}. \quad (\text{A22})$$

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

### A.3.5 Firm entry and exit

We derive now the Zero Cutoff Profit Condition (ZCPC) and the Free Entry Condition (FEC) for the sector with tradable intermediate inputs.

**Zero Cutoff Profit Condition (ZCPC).** The firm's value function is still represented by:

$$v(\theta) = \max \{0; v^l(\theta)\}, \quad \text{with} \quad v^l(\theta) = \max \left\{ 0; \sum_{t=0}^{\infty} \lambda^t \pi^l(\theta) \right\} = \max \left\{ 0; \frac{\pi^l(\theta)}{1-\lambda} \right\}.$$

As before, the market productivity cutoff denoted as  $\underline{\theta}^*$  is implicitly defined by the zero cutoff profit condition (ZCPC),  $\pi^N(\underline{\theta}^*) = 0$ . Solving this expression for  $\underline{\theta}^*$ , the market productivity cutoff is:

$$\underline{\theta}^* = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q \left[ \frac{w^N f^N}{\psi^N} \right]^{\frac{1}{\sigma-1}}. \quad (\text{A23})$$

As before, from the ZCPC we get the same expression (A40). Dividing  $\bar{r}$  from equation (A12) by the cutoff firm's revenues (A40), we can express the average revenues as a function of the cutoff firm's revenues:

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

Replacing the first and second terms of the right-hand side by equivalent expressions from equation (A41),

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

Solving for  $\bar{r}$ , and replacing  $r(\underline{\theta}^*)$  with its expression from equation (A40):

$$\bar{r} = \left[ \left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} + \chi^* \left[ \left(\frac{w^N}{w^S}\right)^{(\sigma-1)(1-\eta)} - 1 \right] \left(\frac{\bar{\theta}^S}{\underline{\theta}^*}\right)^{\sigma-1} \right] \sigma w^N f^N. \quad (\text{A24})$$

Taking the average profits from equation (A11), and plugging it into equation (A10):

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

Finally, replacing  $r^{N,*}(\bar{\theta}^S)$ , the ZCPC is given by:

$$\begin{aligned} \bar{\pi} &= w^N f^N \left[ \left[ \left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} - 1 \right] + \chi^* \left[ \left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1 \right] \left(\frac{\bar{\theta}^S}{\underline{\theta}^*}\right)^{\sigma-1} \right] \\ &\quad - \chi^* w^N [f^S + (1-\lambda)s^r - f^N]. \end{aligned} \quad (\text{A25})$$

**Free Entry Condition (FEC).** The (FEC) is given by the following expression:

$$v_e = p_{in} \frac{\bar{\pi}}{1-\lambda} - w^N s_e = 0 \Rightarrow \bar{\pi} = \frac{(1-\lambda)w^N s_e}{1-G(\underline{\theta}^*)}. \quad (\text{A26})$$

**Number of firms.** As before, by putting the ZCPC and FEC together, we can obtain the sectoral equilibrium productivity cutoff and the average profits in the sector.

From the ZCPC and FEC, we get:

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

with

$$\begin{aligned} W(w^N, w^S) &\equiv \left(\frac{w^N}{w^S}\right)^{(1-\eta)(\sigma-1)} - 1, \\ F(f^N, f^S, s^r) &\equiv \left(\frac{f^S + (1-\lambda)s^r}{f^N}\right) - 1. \end{aligned} \quad (\text{A27})$$

Solving for  $\bar{\theta}$  leads to:

$$\Rightarrow \bar{\theta} = \left[ \frac{(1-\lambda)s_e}{[1-G(\underline{\theta}^*)]f^N} + \chi^* \left[ F(.) - W(.) \left(\frac{\bar{\theta}^S}{\underline{\theta}^*}\right)^{\sigma-1} \right] + 1 \right]^{\frac{1}{\sigma-1}} \underline{\theta}^*. \quad (\text{A28})$$

Finally, we obtain the number of active firms, i.e. the number of final-good producers, in the differentiated sector.

For this, we consider as before:

$$H^* = \frac{\gamma E}{\bar{r}}.$$

Using  $\bar{r}$  from equation (A24), we can write:

$$H^* = \frac{\gamma E}{\left[ \left(\frac{\bar{\theta}}{\underline{\theta}^*}\right)^{\sigma-1} + \chi^* \left[ \left(\frac{w^N}{w^S}\right)^{(\sigma-1)(1-\eta)} - 1 \right] \left(\frac{\bar{\theta}^S}{\underline{\theta}^*}\right)^{\sigma-1} \right] \sigma w^N f^N}. \quad (\text{A29})$$

It is easy to see 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 and thus leads to stronger competition in the final-good market.

### A.3.6 Offshoring productivity cutoff

The firm at the offshoring productivity cutoff is indifferent between offshoring and domestic sourcing. Therefore,

$$\frac{\pi^S(\theta^{S,*})}{1-\lambda} - w^N s^r = \frac{\pi^N(\theta^{S,*})}{1-\lambda}.$$

The offshoring productivity cutoff is thus given by:

$$\theta^{S,*} = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q \left[ \frac{w^N [f^S - f^N + (1-\lambda)s^r]}{\psi^S - \psi^N} \right]^{\frac{1}{\sigma-1}}. \quad (\text{A30})$$

Equivalently, the offshoring productivity cutoff can be expressed in terms of the market productivity cutoff:

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

## B Initial conditions: 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 production, price and per-period profits for a firm with productivity  $\theta$  in the steady state of the non-tradable intermediate inputs (n.t.i.) sector are given by:

$$q_t^{n.t.i.}(\theta) = \left( \frac{\theta \alpha \gamma E (Q^{n.t.i.})^{-\alpha_j}}{w^N} \right)^\sigma, \quad (\text{A31})$$

$$p_t^{n.t.i.}(\theta) = \frac{w^N}{\alpha \theta}, \quad (\text{A32})$$

$$\pi_t^N(\cdot) = \theta^{\sigma-1} (\gamma E)^\sigma (Q^{n.t.i.})^{1-\sigma} \psi^N - w^N f^N, \quad (\text{A33})$$

with  $\psi^N \equiv \sigma^{-1} \left[ \frac{\alpha}{w^N} \right]^{\sigma-1}$ .

### B.1 Sectoral price index

The price index can be represented as:

$$P^{n.t.i.} = \left[ \int_{i \in I} p(i)^{1-\sigma} di \right]^{\frac{1}{1-\sigma}} \Leftrightarrow P^{n.t.i.} = \left[ \int_0^\infty p(\theta)^{1-\sigma} H^{n.t.i.} \mu(\theta) d\theta \right]^{\frac{1}{1-\sigma}}, \quad (\text{A34})$$

where  $H^{n.t.i.}$  refers to the total number of final-good producers active in the market in this sector, and  $\mu(\theta)$  denotes the ex-post distribution of firm productivities in the market.

$$\mu(\theta) = \begin{cases} \frac{g(\theta)}{1-G(\underline{\theta}^{n.t.i.})} & \text{if } \theta \geq \underline{\theta}^{n.t.i.}, \\ 0 & \text{if } \theta < \underline{\theta}^{n.t.i.}. \end{cases} \quad (\text{A35})$$

By plugging equation (A32) into (A34), we get the price index of the differentiated sector in terms of the average productivity in that sector:

$$P^{n.t.i.} = (H^{n.t.i.})^{\frac{1}{1-\sigma}} \frac{w^N}{\alpha} \left[ \left( \int_0^\infty \theta^{\sigma-1} \mu(\theta) d\theta \right)^{\frac{1}{\sigma-1}} \right]^{-1}.$$

Defining  $\bar{\theta}^{n.t.i.}$  as the average productivity in the sector, we have:

$$\bar{\theta}^{n.t.i.} \equiv \left( \int_0^\infty \theta^{\sigma-1} \mu(\theta) d\theta \right)^{\frac{1}{\sigma-1}} = \left( \frac{1}{1 - G(\underline{\theta}^{n.t.i.})} \int_{\underline{\theta}^{n.t.i.}}^\infty \theta^{\sigma-1} g(\theta) d\theta \right)^{\frac{1}{\sigma-1}}, \quad (\text{A36})$$

Replacing the equation (A36) into the price index, we end up with:

$$P^{n.t.i.} = (H^{n.t.i.})^{\frac{1}{1-\sigma}} \frac{w^N}{\alpha \bar{\theta}^{n.t.i.}} \Rightarrow P^{n.t.i.} = (H^{n.t.i.})^{\frac{1}{1-\sigma}} p(\bar{\theta}^{n.t.i.}). \quad (\text{A37})$$

## B.2 Sectoral aggregate consumption

The aggregate consumption in terms of the quantities produced by the average active firm is given by:

$$\begin{aligned} Q^{n.t.i.} &= \left[ \int_{i \in I} q(i)^\alpha di \right]^{1/\alpha} \Leftrightarrow Q^{n.t.i.} = \left[ \int_0^\infty q(\theta)^{\frac{\sigma-1}{\sigma}} H^{n.t.i.} \mu(\theta) d\theta \right]^{\frac{\sigma}{\sigma-1}}, \\ Q^{n.t.i.} &= (H^{n.t.i.})^{\frac{\sigma}{\sigma-1}} \left[ \frac{\alpha \gamma E}{w^N} \right]^\sigma (Q^{n.t.i.})^{1-\sigma} \left[ \int_0^\infty \theta^{\sigma-1} \mu(\theta) d\theta \right]^{\frac{\sigma}{\sigma-1}}, \\ Q^{n.t.i.} &= (H^{n.t.i.})^{\frac{\sigma}{\sigma-1}} q(\bar{\theta}^{n.t.i.}) \Rightarrow Q^{n.t.i.} = (H^{n.t.i.})^{\frac{1}{\sigma-1}} \frac{\alpha \gamma E}{w^N} \bar{\theta}^{n.t.i.}. \end{aligned} \quad (\text{A38})$$

## B.3 Zero Cutoff Profit Condition (ZCPC)

The firm's value function is:

$$v^{n.t.i.}(\theta) = \max \{0; v^{N,n.t.i.}(\theta)\},$$

with

$$v^{N,n.t.i.}(\theta) = \max \left\{ 0; \sum_{t=0}^\infty \lambda^t \pi^{N,n.t.i.}(\theta) \right\} = \max \left\{ 0; \frac{\pi^{N,n.t.i.}(\theta)}{1 - \lambda} \right\}.$$

where  $\lambda$  refers to the per period survival probability to an exogenous negative shock.

Using the zero cutoff profit condition (ZCPC), the market productivity cutoff, denoted as  $\underline{\theta}^*$ , 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:

$$\begin{aligned} \Pi^N = 0 &\Leftrightarrow \frac{\pi_t^N}{1 - \lambda} = 0 \Leftrightarrow \pi_t^N = 0 \\ &\Leftrightarrow \underline{\theta}^{n.t.i.} = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q^{n.t.i.} \left[ \frac{w^N f^N}{\psi^N} \right]^{\frac{1}{\sigma-1}}. \end{aligned} \quad (\text{A39})$$

Also, by using the ZCPC, we get the revenue level for the cutoff productivity firm  $r^{N,n.t.i.}(\underline{\theta}^{n.t.i.})$ :

$$\pi_t^N(\underline{\theta}^{n.t.i.}) = 0 \Rightarrow r^N(\underline{\theta}^{n.t.i.}) = \sigma w^N f^N. \quad (\text{A40})$$

Furthermore, the revenues of the average firm as a function of the cutoff firm revenues are given by:

$$\frac{r^N(\bar{\theta}^{n.t.i.})}{r^N(\underline{\theta}^{n.t.i.})} = \left( \frac{\bar{\theta}^{n.t.i.}}{\underline{\theta}^{n.t.i.}} \right)^{\sigma-1} \Rightarrow r^N(\bar{\theta}^{n.t.i.}) = \left( \frac{\bar{\theta}^{n.t.i.}}{\underline{\theta}^{n.t.i.}} \right)^{\sigma-1} r^N(\underline{\theta}^{n.t.i.}). \quad (\text{A41})$$

The average revenues are:

$$\bar{r}^{n.t.i.} \equiv r^N(\bar{\theta}^{n.t.i.}) = \left( \frac{\bar{\theta}^{n.t.i.}}{\underline{\theta}^{n.t.i.}} \right)^{\sigma-1} \sigma w^N f^N. \quad (\text{A42})$$

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 (A42), we obtain the ZCPC:

$$\bar{\pi}^{n.t.i.} \equiv \pi^N(\bar{\theta}^{n.t.i.}) = w^N f^N \left[ \left( \frac{\bar{\theta}^{n.t.i.}}{\underline{\theta}^{n.t.i.}} \right)^{\sigma-1} - 1 \right]. \quad (\text{A43})$$

#### B.4 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:

$$\bar{v} = \int_{\underline{\theta}^{n.t.i.}}^{\infty} v(\theta) \mu(\theta) d\theta = \frac{\bar{\pi}^{n.t.i.}}{1 - \lambda}.$$

On the other hand, 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,

$$\bar{\pi}^{n.t.i.} = \frac{(1 - \lambda) s_e w^N}{1 - G(\underline{\theta}^{n.t.i.})}. \quad (\text{A44})$$

#### B.5 Equilibrium: number of firms

From ZCPC and FEC:

$$\bar{\theta}^{n.t.i.} = \left[ \frac{(1 - \lambda) s_e}{[1 - G(\underline{\theta}^{n.t.i.})] f^N} + 1 \right]^{\frac{1}{\sigma-1}} \underline{\theta}^{n.t.i.}. \quad (\text{A45})$$

The number of active firms is given by:

$$H^{n.t.i.} = \frac{R^{n.t.i.}}{\bar{r}^{n.t.i.}} \Leftrightarrow H^{n.t.i.} = \frac{\gamma E}{\bar{r}^{n.t.i.}}.$$

Using  $\bar{r}^{n.t.i.} = \sigma [\bar{\pi}^{n.t.i.} + w^N f^N]$ , the number of active firms in sector  $j$  is:

$$H^{n.t.i.} = \frac{\gamma E}{\sigma [\bar{\pi}^{n.t.i.} + w^N f^N]}.$$

Replacing  $\bar{\pi}^{n.t.i.}$  with (ZCPC), the number of active firms is:

$$H^{n.t.i.} = \frac{\gamma E}{\sigma w^N f^N} \left( \frac{\underline{\theta}^{n.t.i.}}{\bar{\theta}^{n.t.i.}} \right)^{\sigma-1}. \quad (\text{A46})$$

## C Uncertainty - dynamic model: tradable intermediate inputs

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 market research sunk cost  $s^r$ .

At time  $t$ , the present value of the expected offshoring profit premium for a firm with productivity  $\theta$ , who is currently sourcing domestically, is given by:

$$\mathbb{E}_t [\Pi^{S,\text{prem}}(\theta) | f^S \leq f_t^S] = \mathbb{E}_t \left[ \sum_{\tau=t}^{\infty} \lambda^{\tau-t} \pi_{\tau}^{S,\text{prem}}(\theta, f_{\tau}^S, Q(f_{\tau}^S), f^N, w^N, w^S) \mid f^S \leq f_t^S \right].$$

From the equation above, 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 denote  $\pi_t^{S,\text{prem}}(\theta, f_t^S, Q(f_t^S), f^N, w^N, w^S) \equiv \pi_t^{S,\text{prem}}(\theta)$ , while  $\pi^{S,\text{prem}}(\theta)$  refers to the per-period offshoring profit premium when there is no remaining uncertainty in the industry, i.e. when the true fixed cost has been revealed.

### C.1 Proofs regarding Bayesian learning mechanism

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

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

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 characterized by 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  $t$ , then this reveals that this firm has made a mistake. After paying the sunk cost, this firm learned that the true fixed cost in the South is too high for it, i.e. the firm would obtain a negative per-period offshoring profit premium.



Therefore, given the assumption of a continuum of firms, this situation implies that the true fixed cost in the South has been revealed and it corresponds to the maximum affordable fixed cost in the South of the least productive firms doing offshoring in  $t$ .

As a summary, the knowledge that firms have before taking the offshoring decision in period  $t$  is given by:

$$f^S \sim \begin{cases} Y(f^S) & \text{with } f^S \in [\underline{f}^S, \bar{f}^S] \text{ for } t = 0, \\ Y(f^S | f^S \leq \tilde{f}_t^S) & \text{if } \tilde{f}_t^S = f_t^S < f_{t-1}^S \text{ for } t > 0, \\ f_t^S & \text{if } \tilde{f}_t^S < f_t^S \text{ for } t > 0. \end{cases} \quad (\text{A47})$$

## C.2 Proof of the OSLA rule as optimal policy

The Bellman equation takes the form:

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

The goal is to find the optimal policy, which defines how many periods it is optimal to wait given the information set at  $t$ .

$$\begin{aligned} a \in \arg \max_{a \in \{0,1\}} \mathcal{V}_t(\theta; \theta_t) &= a \left[ \mathbb{E}_t \left[ \max \left\{ 0; \sum_{\tau=t}^{\infty} \lambda^{\tau-t} \pi_{\tau}^{S, prem}(\theta) \right\} \middle| f^S \leq f_t^S \right] - w^N s^r \right] \\ &\quad + (1-a) \lambda \mathbb{E}_t [\mathcal{V}_{t+1}(\theta; \theta_{t+1}, a')], \end{aligned}$$

where  $a = 1$  denotes the action of trying offshoring in period  $t$ , while  $a = 0$  refers to waiting.

**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, the firms know they can obtain gains 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, the 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.

Let's define as  $V_t^{w,1}(\cdot), \dots, V_t^{w,n}(\cdot)$  the value of waiting in  $t$  for  $1, \dots, n$  periods, respectively.

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

It is straightforward to see that:

$$\lim_{n \rightarrow \infty} V_t^{w,n}(\theta; \theta_t, \theta_{t+n}) = 0.$$

The relevant analysis consists in the case when a firm  $\theta$  faces a trade-off in its decision. This situation takes place when the value of offshoring for the firm  $\theta$  in period  $t$  is non-negative, i.e.  $V_t^o(\theta; \cdot) \geq 0$ , and the firm can reduce the risk of exploring offshoring in  $t$  by waiting  $n$  periods for new incoming information<sup>111</sup>. In this situation, considering the decision characterised in section 2.2.3, the firm  $\theta$  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, i.e.  $V_t^o(\theta; \cdot) \geq 0$ , it is easy to see that for each of these firms the value of waiting for any period  $n = 1, \dots, \infty$  is non-negative, i.e.  $V_t^{w,n}(\theta; \cdot) \geq 0 \forall n$ .

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  $\theta$  finds optimal to wait. In this regard, following a similar argument as Segura-Cayuela and Vilarrubia (2008), we begin with the case of the marginal firm which compares the value of exploring offshoring now with the value of waiting for one period and explore in the next one, i.e.  $\mathcal{D}_t(\theta; \cdot) = V_t^o(\theta; \cdot) - V_t^{w,1}(\theta; \cdot) = 0$ .

The argument of the proof is as follows. The value of waiting for  $n$  periods before exploring the offshoring potential falls at a rate of  $\lambda^n$  for firms that weakly prefer exploring the offshore 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 the additional new information revealed in further periods is less. Therefore, to characterise the optimal equilibrium path it is only necessary to consider those firms who are deciding between exploring the offshoring potential in the current period or waiting for one period.

<sup>111</sup>Otherwise, the firms who have a negative value of offshoring in  $t$ , i.e.  $V_t^o(\theta; \cdot) < 0$ , 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.

We start by comparing the value of waiting for one period with the value of waiting for two periods, i.e.  $V_t^{w,1}(\theta; \cdot); V_t^{w,2}(\theta; \cdot)$ . As mentioned above, we focus the analysis on the marginal firm, i.e. the firm that is indifferent between offshoring today or waiting for one period. Formally<sup>112</sup>,

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

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

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

We consider the case in which the third term of the right-hand side is zero for both trade-off functions.<sup>113</sup> Therefore, the trade-off functions become:

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

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

$$\begin{aligned} V_t^0(\theta; \cdot) - V_t^{w,1}(\theta; \cdot) - \left[ V_t^0(\theta; \cdot) - V_t^{w,2}(\theta; \cdot) \right] &\stackrel{!}{<} 0 \\ \Leftrightarrow V_t^{w,2}(\theta; \cdot) - V_t^{w,1}(\theta; \cdot) &\stackrel{!}{<} 0. \end{aligned}$$

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

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

From the marginal firm condition above, we know:

$$\mathbb{E}_t \left[ \pi_t^{S,prem}(\theta) \middle| f^S \leq f_t^S \right] = w^N s^r \left[ 1 - \lambda \frac{Y(f_{t+1}^S)}{Y(f_t^S)} \right].$$

By Assumption A.3,

$$1 - \lambda Y(f_{t+1}^S | f^S \leq f_t^S) > Y(f_{t+1}^S | f^S \leq f_t^S) - \lambda Y(f_{t+2}^S | f^S \leq f_t^S),$$

<sup>112</sup>We show the derivation of the trade-off function in the main part of the paper, and the respective proofs are in Appendix C.3.

<sup>113</sup>This assumption allows us to focus on the most restrictive condition. It can be easily shown that if the value of waiting for one period is optimal in this case, it is also optimal in the other cases.

and thus,

$$\begin{aligned} \mathbb{E}_t \left[ \pi_{t+1}^{S, prem}(\theta) \middle| f^S \leq f_t^S \right] &> w^N s^r \left[ \frac{Y(f_{t+1}^S)}{Y(f_t^S)} - \lambda \frac{Y(f_{t+2}^S)}{Y(f_t^S)} \right] \\ \Rightarrow V_t^{w,2}(\theta; \cdot) - V_t^{w,1}(\theta; \cdot) &< 0. \end{aligned}$$

From the result above, it is easy to see that  $V_t^{w,n}(\theta; \cdot) > V_t^{w,n+1}(\theta; \cdot)$  for any period  $n$ . Therefore,

$$V_t^{w,1}(\theta; \cdot) > V_t^{w,2}(\theta; \cdot) > \dots > V_t^{w,n}(\theta; \cdot).$$

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  $t$ , we consider it is sufficient to focus on the case for which  $V_t^o(\theta; \cdot) \geq 0$ , i.e. when firms face a non-negative value of offshoring<sup>114</sup>.

Thus, using the result that OSLA is the optimal rule under this condition, the optimal value function takes the following expression:

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

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

### C.3 Derivation of the trade-off function

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

Decomposing the value of offshoring leads to:

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

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.

<sup>114</sup>We show here that there is no degeneration in firms’ choices when  $V_t^o(\theta; \cdot) < 0$ . 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  $V_t^o(\theta; \cdot) < 0$ . If  $V_t^{w,n}(\theta; \cdot) \geq 0$ , then the trade-off function  $\mathcal{D}(\theta; \cdot)$  is negative for any waiting period  $n$  with a positive value of waiting.

On the other hand, it is possible to think that if  $V_t^{w,n}(\theta; \cdot) < 0$  this may result in a positive value for the trade-off function  $\mathcal{D}(\theta; \cdot)$ . It is easy to see that in these cases  $|V_t^o(\theta; \cdot)| > |V_t^{w,n}(\theta; \cdot)|$ . 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  $V_t^{w,n}(\theta; \cdot) < 0 \forall n$ , 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.

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:

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

The probability of true value revealed and above the maximum affordable fixed cost for the firm  $\theta$  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:

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

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

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

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

$$\begin{aligned} \mathcal{D}_t(\theta; \cdot) = & \max \left\{ 0; \mathbb{E}_t \left[ \pi_t^{S,prem}(\theta) \middle| f^S \leq f_t^S \right] \right\} - w^N s^r \left[ 1 - \lambda \frac{Y(f_{t+1}^S)}{Y(f_t^S)} \right] \\ & + \frac{[Y(f_t^S) - Y(f_{t+1}^S)]}{Y(f_t^S)} \lambda \mathbb{E}_t \left[ \max \left\{ 0; \frac{\pi_t^{S,prem}(\theta)}{1-\lambda} \right\} \right. \\ & \left. - \max \left\{ 0; \frac{\pi_t^{S,prem}(\theta)}{1-\lambda} - w^N s^r \right\} \middle| f_{t+1}^S < f^S \leq f_t^S \right] \Rightarrow \end{aligned} \quad (\text{A48})$$

$$\begin{aligned}
\mathcal{D}_t(\theta; \cdot) = & \max \left\{ 0; \mathbb{E}_t \left[ \pi_t^{S, prem}(\theta) \middle| f^S \leq f_t^S \right] \right\} - w^N s^r \left[ 1 - \lambda \frac{Y(f_{t+1}^S)}{Y(f_t^S)} \right] \\
& + \frac{[Y(f(\theta)) - Y(f_{t+1}^S)]}{Y(f_t^S)} \lambda \mathbb{E}_t \left[ \frac{\pi_t^{S, prem}(\theta)}{1 - \lambda} \right. \\
& \left. - \max \left\{ 0; \frac{\pi_t^{S, prem}(\theta)}{1 - \lambda} - w^N s^r \right\} \middle| f_{t+1}^S < f^S \leq f^S(\theta) \right].
\end{aligned} \tag{A49}$$

Proposition 1 implies that the probability of the true value being revealed below the maximum affordable fixed cost for firm  $\theta$  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  $\theta$ , which is not possible due to Proposition 1. In other words, given the sequential shape of the offshoring equilibrium path led by the most productive firms in the market, a firm  $\theta$  will discover its positive offshoring potential by waiting with probability zero.

Therefore, the trade-off function becomes:

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

#### C.4 Proof of Proposition 1

From section 2.1, it is clear that the offshoring profit premium  $\pi_t^{S, prem}(\theta)$  is increasing in  $\theta$ . Taking the trade-off function expression from equation (A48), 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, the trade-off function is strictly increasing in productivity.

#### C.5 Proof of Lemma 1

$$\mathcal{D}_t(\tilde{\theta}_{t+1}; \theta_t, \tilde{\theta}_{t+1}) = 0,$$

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

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 (A5) leads to:

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

#### C.6 Proof of Proposition 2

By Assumption A.4, we have:

$$\mathcal{D}_t(\bar{\theta}; \bar{\theta}, \bar{\theta}) > 0,$$

$$\mathbb{E}_t[\pi_t^{S, prem}(\bar{\theta}) | f^S \leq \bar{f}^S] - w^N s^r (1 - \lambda) > 0,$$

$$\frac{r_t^{N,*}(\bar{\theta})}{\sigma} W(\cdot) - w^N E_t(f^S | f^S \leq \bar{f}^S) - w^N [s^r (1 - \lambda) - f^N] > 0.$$

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

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

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

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

By equation (10),  $f_\infty^S$  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.

By Assumption A.3 we have:

$$\begin{aligned} \frac{\partial [f_t^S - E(f^S | f^S \leq f_t^S)]}{\partial f_t^S} &> 0 \Rightarrow 1 - \frac{\partial E(f^S | f^S \leq f_t^S)}{\partial f_t^S} > 0 \\ &\Rightarrow \frac{\partial E(f^S | f^S \leq f_t^S)}{\partial f_t^S} < 1. \end{aligned}$$

Using this assumption, the expression in brackets is given by:

$$\left[ 1 - \frac{\partial E(f^S | f^S \leq f_\infty^S)}{\partial f_\infty^S} \right] > 0.$$

Only in the limit, when the distribution collapses at the lower bound, we end up with:

$$\frac{\partial E(f^S | f^S \leq f_t^S)}{\partial f_t^S} = 1 \Rightarrow \mathcal{D}(\theta_\infty; \theta_\infty, \theta_\infty) = 0.$$

Therefore, 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 product and firm level, identified by the tax ID number (NIT), for the period 2004–2018. We normalise the product classification by the concordance tables provided by DANE. Then, we aggregate the imports by 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 losing 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, or the GDP data from the World Bank. Thus, in the multi-country models, we have a sample with 182 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 North-South model: reduced-form models

### D.2.1 North-South model: Summary statistics

Table A1: Summary statistics: Information spillovers. Sample of 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
$sdt a_{j,t}$	44.1458	46.6864	0.0000	347.0329

Table A2: Summary statistics: Information spillovers. Sample of 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
$sdt a_{j,t}$	38.5549	28.2175	0.0000	212.4403



## D.2.2 North-South model: Robustness checks

Table A3 reports the estimated coefficients of the non-parametric general time trend survival model.

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

<i>Sample:</i>	<i>w/at least 50 firms</i>		<i>w/at least 100 firms</i>	
	(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*** (0.0452)	0.616*** (0.0459)	0.593*** (0.0492)	0.594*** (0.0506)
$minta_{j,t-1}$	-0.0739 (0.170)		0.0922 (0.200)	
$sda_{j,t-1}$		0.00580*** (0.00208)		0.00581** (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 reports the results for models with a discrete productivity measure (quintiles) and the interaction term between the latter and the information spillovers. The conditional probability model estimation results are reported in columns (1)–(4), and the results for the transition analysis are in columns (5)–(8). The latter refer to the specification where the general time-trend is defined in logarithmic form.

Table A4: Non-Offshoring firms. Discrete productivity measure

Model: Sample:	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)
	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$
$ta_{i,j,t}$ : q2	0.503*** (0.0777)	0.403*** (0.0887)	0.545*** (0.0858)	0.495*** (0.119)	1.013*** (0.144)	0.810*** (0.169)	1.082*** (0.151)	1.001*** (0.204)
$ta_{i,j,t}$ : q3	0.778*** (0.0773)	0.720*** (0.0983)	0.814*** (0.0880)	0.851*** (0.136)	1.546*** (0.143)	1.419*** (0.184)	1.619*** (0.154)	1.662*** (0.231)
$ta_{i,j,t}$ : q4	0.975*** (0.0755)	0.818*** (0.0838)	1.004*** (0.0845)	0.868*** (0.102)	1.940*** (0.147)	1.647*** (0.156)	1.982*** (0.155)	1.749*** (0.178)
$ta_{i,j,t}$ : q5	1.160*** (0.146)	0.983*** (0.172)	1.155*** (0.162)	1.011*** (0.217)	2.318*** (0.235)	2.051*** (0.273)	2.334*** (0.257)	2.153*** (0.327)
$minta_{j,t-1}$	0.0229 (0.139)		0.150 (0.146)		0.0262 (0.320)		0.264 (0.286)	
$ta_{i,j,t}$ : q2 $\times$ $minta_{j,t-1}$	-0.0550 (0.153)		-0.162 (0.151)		-0.140 (0.321)		-0.316 (0.266)	
$ta_{i,j,t}$ : q3 $\times$ $minta_{j,t-1}$	-0.0485 (0.138)		-0.155 (0.120)		-0.119 (0.293)		-0.322 (0.216)	
$ta_{i,j,t}$ : q4 $\times$ $minta_{j,t-1}$	-0.133 (0.118)		-0.181 (0.124)		-0.270 (0.272)		-0.366 (0.238)	
$ta_{i,j,t}$ : q5 $\times$ $minta_{j,t-1}$	-0.280* (0.167)		-0.261* (0.155)		-0.486 (0.314)		-0.514* (0.268)	
$sdta_{j,t-1}$		0.00137 (0.00145)		0.00282* (0.00157)		0.000145 (0.00297)		0.00330 (0.00305)
$ta_{i,j,t}$ : q2 $\times$ $sdta_{j,t-1}$		0.00217 (0.00167)		-0.0000670 (0.00220)		0.00417 (0.00340)		-0.000541 (0.00362)
$ta_{i,j,t}$ : q3 $\times$ $sdta_{j,t-1}$		0.00103 (0.00200)		-0.00269 (0.00274)		0.00225 (0.00412)		-0.00450 (0.00497)
$ta_{i,j,t}$ : q4 $\times$ $sdta_{j,t-1}$		0.00289** (0.00124)		0.00232 (0.00182)		0.00529** (0.00235)		0.00343 (0.00315)
$ta_{i,j,t}$ : q5 $\times$ $sdta_{j,t-1}$		0.00172 (0.00306)		0.00152 (0.00413)		0.00219 (0.00511)		0.000113 (0.00637)
$\ln(t)$					-0.481*** (0.103)	-0.552*** (0.0939)	-0.464*** (0.127)	-0.509*** (0.111)
$cons$	-2.191*** (0.132)	-2.299*** (0.152)	-2.302*** (0.161)	-2.416*** (0.192)	-3.296*** (0.209)	-3.298*** (0.247)	-3.435*** (0.230)	-3.498*** (0.304)
FEs	$j, t$	$j, t$	$j, t$	$j, t$	$j$	$j$	$j$	$j$
Observations	11985	11985	9002	9002	11985	11985	9002	9002
Pseudo $R^2$	0.089	0.089	0.085	0.086				

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 as a control. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

### D.2.3 North-South 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*** (0.00367)	0.0487*** (0.00372)	0.0485*** (0.00452)	0.0485*** (0.00462)	0.0464*** (0.00255)	0.0478*** (0.00289)	0.0462*** (0.00289)	0.0470*** (0.00330)
$minta_{j,t-1}$	-0.00420 (0.0137)		0.00819 (0.0164)		-0.0144 (0.0129)		-0.00412 (0.0159)	
$scta_{j,t-1}$		0.000439*** (0.000161)		0.000462** (0.000232)		0.000273* (0.000158)		0.000277 (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 analysis includes the year of entry of the firm into the sample as a control. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A6: Conditional Probit Model - Non-offshoring firms. Marginal Effects at the Mean

	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)
	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$	$\Lambda_{i,j,t}$
$\ln(ta_{i,j,t})$	0.0473*** (0.00332)	0.0480*** (0.00354)	0.0476*** (0.00420)	0.0478*** (0.00443)	0.0464*** (0.00255)	0.0478*** (0.00289)	0.0462*** (0.00289)	0.0470*** (0.00330)
$minta_{j,t-1}$	-0.00408 (0.0132)		0.00805 (0.0162)		-0.0144 (0.0129)		-0.00412 (0.0159)	
$scta_{j,t-1}$		0.000432*** (0.000160)		0.000456** (0.000231)		0.000273* (0.000158)		0.000277 (0.000199)
FEs	$j, t$	$j, t$	$j, t$	$j, t$	$j$	$j$	$j$	$j$

Marginal effects at the mean reported. Standard errors are clustered at the sector level and reported in parenthesis. Controls: market thickness, income per capita (mean), common language, distance. Survival analysis 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 North-South model: structural empirical model

In this appendix, we derive the structural models that estimate the offshoring exploration decisions of domestic-sourcing firms characterised by the trade-off function from the North-South model of section 2. In section D.3.1 we define the setup and main variables, we introduce notation and general assumptions, and we derive conditional probability models from the trade-off function. Then we relax this assumption in section D.3.2 and derive the respective structural conditional probit model for the case of time-varying northern and southern 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 section D.3.3 we present the estimation results for the AR(1) model, while section D.3.4 contains the result for the ‘reduced-form’ version of the structural model. Section D.3.5

presents the results from the structural model for the small open economy, and section D.3.6 for the full structural model.

### D.3.1 Structural Model: Identification, notation and proofs

The variable  $\mathcal{I}_{i,j,t}$  refers to the information set that firm  $i$  in sector  $j$  possesses at  $t$  when the firm decides whether to explore offshoring or wait. For non-offshoring firms, it is defined by the information spillover and firm-specific past information. For firms that have already explored their offshoring potential, it is defined by the fundamentals (i.e., the true value of  $f_j^S$ ).

**Offshoring revenue premium.** The revenue of a domestic-sourcing firm  $i$  with productivity  $\theta$  in period  $t$  and sector  $j$  is given by:

$$r_{i,j,t}^N \equiv r_{j,t}^N(\theta) = \left[ \frac{\sigma_j - 1}{\sigma_j} \right]^{\sigma_j - 1} \theta^{\sigma_j - 1} (\gamma_j E)^{\sigma_j} Q_{j,t}^{1 - \sigma_j} (w^N)^{1 - \sigma_j}. \quad (\text{A50})$$

The respective revenue of an offshoring firm  $i$  with productivity  $\theta$  is given by:

$$r_{i,j,t}^S \equiv r_{j,t}^S(\theta) = \left( \frac{w^N}{w^S} \right)^{(1 - \eta_j)(\sigma_j - 1)} r_{j,t}^N(\theta).$$

The revenue premium from offshoring for a firm  $i$  with productivity  $\theta$  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  $r_{j,t}^N(\theta)$  with the expression given in equation (A50), we get:

$$r_{i,j,t}^{S,\text{prem}} \equiv r_{j,t}^{S,\text{prem}}(\theta) = \left[ \left( \frac{w^N}{w^S} \right)^{(1 - \eta_j)(\sigma_j - 1)} - 1 \right] \left[ \frac{\sigma_j - 1}{\sigma_j} \right]^{\sigma_j - 1} \theta^{\sigma_j - 1} (\gamma_j E)^{\sigma_j} Q_{j,t}^{1 - \sigma_j} (w^N)^{1 - \sigma_j}.$$

For ease of notation, we define:

$$z_{j,t}^S \equiv \left[ \left( \frac{w^N}{w^S} \right)^{(1 - \eta_j)(\sigma_j - 1)} - 1 \right] \left[ \frac{\sigma_j - 1}{\sigma_j} \right]^{\sigma_j - 1} (\gamma_j E)^{\sigma_j} Q_{j,t}^{1 - \sigma_j} (w^N)^{1 - \sigma_j}. \quad (\text{A51})$$

Thus, the offshoring revenue premium is:

$$r_{i,j,t}^{S,\text{prem}} \equiv r_{j,t}^{S,\text{prem}}(\theta) = z_{j,t}^S \theta^{\sigma_j - 1}. \quad (\text{A52})$$

**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:

$$\begin{aligned} \mathbb{E} \left[ \pi_{i,j,t}^{S,\text{prem}} | \mathcal{I}_{i,j,t} \right] &= \sigma_j^{-1} \mathbb{E} \left[ r_{i,j,t}^{S,\text{prem}} | \mathcal{I}_{i,j,t} \right] - w^N \left[ \mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - f_j^N \right] \\ &= \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^S \theta^{\sigma_j - 1} | \mathcal{I}_{i,j,t} \right] - w^N \left[ \mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - f_j^N \right]. \end{aligned} \quad (\text{A53})$$

**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 (13). 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:<sup>115</sup>

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

Firm  $i$  in sector  $j$  with productivity  $\theta$  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

$$\begin{aligned} d_{i,j,t}^S \middle|_{d_{i,j,t-1}^S=0} &= \mathbb{1} \{ \mathcal{D}_{j,t}(\theta; \mathcal{I}_{i,j,t}) \geq 0 \}, \\ d_{i,j,t}^S \middle|_{d_{i,j,t-1}^S=0} &= \mathbb{1} \left\{ \mathbb{E} \left[ \pi_{i,j,t}^{S,prem} \middle| \mathcal{I}_{i,j,t} \right] - w^N s_j^r [1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t})] \geq 0 \right\}. \end{aligned}$$

Replacing  $\mathbb{E} \left[ \pi_{i,j,t}^{S,prem} \middle| \mathcal{I}_{i,j,t} \right]$  with the expression given in equation (A53), we have:

$$\begin{aligned} d_{i,j,t}^S \middle|_{d_{i,j,t-1}^S=0} &= \mathbb{1} \left\{ \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^S \theta^{\sigma_j-1} \middle| \mathcal{I}_{i,j,t} \right] - w^N [\mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - f_j^N] \right. \\ &\quad \left. - w^N s_j^r [1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t})] \geq 0 \right\}. \end{aligned} \tag{A54}$$

**Modelling of expected fixed-cost differential and information spillovers.** We have:

$$w^N [\mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - f_j^N] = w^N \mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - w^N f_j^N.$$

Thus, the empirical identification of the equation above is:

$$w^N [\mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - f_j^N] = \gamma_j - \gamma_1 is_{j,t} + v_{i,j,t}, \tag{19 revisited}$$

where  $is_{j,t}$  indicates the information spillover in sector  $j$  in period  $t$ ,  $v_{i,j,t} | \mathcal{I}_{i,j,t} \sim \mathcal{N}(0, \Sigma^2)$ , and  $\gamma_j$  denotes sector fixed effects. The information spillover  $is_{j,t}$  is modelled by the two alternative measures defined above: i)  $minta_{j,t-1}$ , and ii)  $sdata_{j,t-1}$ .

From our theory, an increase in the information revealed in period  $t$ , represented by a reduction in the productivity of the least productive firm offshoring in  $t-1$  or by an increase in the standard deviation of the productivities of offshoring firms in  $t-1$ , reduces the expected fixed costs of offshoring. This leads to a reduction in the expected fixed-cost differential of offshoring relative to domestic sourcing. The initial fixed-cost differential, defined by the prior beliefs about southern institutions, is captured by the sector fixed effects.

<sup>115</sup>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 (13) is positive.

**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  $w^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t}) \right]$ . This term 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 the offshoring potential in the next period with reduced uncertainty. Thus, we have:

$$w^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t}) \right] = w^N s_j^r - w^N s_j^r \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t}). \quad (\text{A55})$$

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:

$$is_{j,t+1} = \rho_{1,j} is_{j,t} + \epsilon_{j,t} \Rightarrow \mathbb{E}[is_{j,t+1}] = \rho_{1,j} is_{j,t}. \quad (\text{20 revisited})$$

Back to equation (A55), the empirical identification of the expected gains from waiting is given by:

$$w^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t}) \right] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j} \hat{is}_{j,t+1} + e_{j,t}, \quad (\text{21 revisited})$$

where  $\tilde{\gamma}_j$  is a sector fixed effect that captures the first term on the right-hand side, the variable  $\hat{is}_{j,t+1}$  refers to the predicted values of the estimated AR(1) model defined in equation (20 revisited) and  $\tilde{\gamma}_{1,j}$  captures the differential effect from the interaction of the expected new information and the sector level variables (i.e.,  $w^N s_j^r \lambda_j$ ).

From our theory, this implies that an increase in the expected new information to be revealed, represented by an expected lower productivity of the least productive offshoring firm in  $t$  or by an expected higher standard deviation of productivities of offshoring firms in  $t$ , increases the expected gains from waiting.

**Second stage regression: probit model.** In a first stage, we estimate the model defined by equation (20). It represents the expected new information to be revealed at the end of the period. Back to equation (A54), we derive a probit model for the trade-off function.

Using the expressions (A54), (19) and (21), the conditional probit model is given by:

$$\begin{aligned} \Pr \left[ d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right] &= \int_v \mathbb{1} \{ \mathcal{D}_{j,t}(\theta; \mathcal{I}_{i,j,t}) \geq 0 \} \frac{1}{\Sigma} \phi \left( \frac{v}{\Sigma} \right) dv, \\ \Pr \left( d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right) &= \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ r_{i,j,t}^{s,\text{prem}} \mid \mathcal{I}_{i,j,t} \right] - w^N \left[ \mathbb{E}(f_j^s | \mathcal{I}_{i,j,t}) - f_j^N \right] \right. \right. \\ &\quad \left. \left. - w^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t}) \right] \right) \right], \\ \Pr \left( d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right) &= \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ r_{i,j,t}^{s,\text{prem}} \mid \mathcal{I}_{i,j,t} \right] - \left[ \gamma_j - \gamma_1 is_{j,t} \right] - \left[ \tilde{\gamma}_j + \tilde{\gamma}_{1,j} \hat{is}_{j,t+1} \right] \right) \right]. \end{aligned}$$

Reorganising the variables, we get the probit model:

$$\Pr \left( d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^S \theta^{\sigma_j-1} \mid \mathcal{I}_{i,j,t} \right] - \Gamma_j + \Gamma_2 i s_{j,t} - \Gamma_{3,j} \hat{i} s_{j,t+1} \right) \right], \quad (\text{A56})$$

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  $z_{j,t}^S$  is defined by the aggregate consumption index that increases as more firms offshore. This, together with  $\sigma_j^{-1}$ , 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.

The first model 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. Thus, the model is given by:

$$\Pr \left( d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \Gamma_1 \ln(ta_{i,j,t}) - \Gamma_j + \Gamma_2 i s_{j,t} - \Gamma_{3,j} \hat{i} s_{j,t+1} \right) \right]. \quad (22 \text{ revisited})$$

Results for this model are presented in section D.3.4. We progressively relax the assumptions of the model in equation (22 revisited) and define models under more general conditions. First, we identify a *small open economy* (see Appendix D.3.5). Second, we relax further the assumptions and identify a *full structural model* (see Appendix D.3.6). Before we go into these details, we derive a first-order Taylor approximation of the structural model with time-varying wages in section D.3.2 and present AR(1) estimation results in section D.3.3.

### D.3.2 Structural model with time-varying wages: first-order Taylor approximation

We now introduce an extension that allows for a more flexible empirical approach by allowing for changes in the northern and southern wages and time-varying total expenditure. When the northern wages do not respond to sector  $j$  offshoring dynamics, firms cannot predict future changes in northern wages based on the information set that they possess 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.

Now, the revenues of firm  $i$  with productivity  $\theta$  in sector  $j$  in period  $t$  is given by:

$$r_{i,j,t}^N \equiv r_{j,t}^N(\theta) = \left[ \frac{\sigma_j - 1}{\sigma_j} \right]^{\sigma_j-1} \theta^{\sigma_j-1} (\gamma_j E_t)^{\sigma_j} Q_{j,t}^{1-\sigma_j} (w_t^N)^{1-\sigma_j}. \quad (\text{A57})$$

The respective revenue of an offshoring firm  $i$  with productivity  $\theta$  is given by:

$$r_{i,j,t}^S \equiv r_{j,t}^S(\theta) = \left( \frac{w_t^N}{w_t^S} \right)^{(1-\eta_j)(\sigma_j-1)} r_{j,t}^N(\theta).$$

Define  $z_{j,t}^S$  as:

$$z_{j,t}^S \equiv \left[ \left( \frac{w_t^N}{w_t^S} \right)^{(1-\eta_j)(\sigma_j-1)} - 1 \right] \left[ \frac{\sigma_j - 1}{\sigma_j} \right]^{\sigma_j-1} (\gamma_j E_t)^{\sigma_j} Q_{j,t}^{1-\sigma_j} (w_t^N)^{1-\sigma_j}. \quad (\text{A58})$$

The offshoring revenue premium is:

$$r_{i,j,t}^{S,\text{prem}} \equiv r_{j,t}^{S,\text{prem}}(\theta) = z_{j,t}^S \theta^{\sigma_j-1}. \quad (\text{A59})$$

**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:

$$\mathbb{E} \left[ \pi_{i,j,t}^{S,\text{prem}} | \mathcal{I}_{i,j,t} \right] = \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^S \theta^{\sigma_j - 1} | \mathcal{I}_{i,j,t} \right] - w_t^N \left[ \mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - f_j^N \right]. \quad (\text{A60})$$

**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  $(w_0^N, \mathbb{E}(f_j^S | \mathcal{I}_{i,j,0}))$ :

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

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

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

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:

$$w_t^N \left[ \mathbb{E}(f_j^S | \mathcal{I}_{i,j,t}) - f_j^N \right] = \gamma_j + \gamma_t - \gamma_1 i s_{j,t} + v_{i,j,t}. \quad (\text{A61})$$

**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  $w_t^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t}) \right]$ . Applying first-order Taylor approximation around  $(w_0^N, Y(f_{j,1}^S | \mathcal{I}_{i,j,0}))$ , we get:

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

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:

$$w_t^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^S | \mathcal{I}_{i,j,t}) \right] = \tilde{\gamma}_j + \tilde{\gamma}_t + \tilde{\gamma}_{1,j} \hat{i} s_{j,t+1} + e_{j,t}. \quad (\text{A62})$$



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

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

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

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

$$\Pr \left( d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^S \theta^{\sigma_j-1} \mid \mathcal{I}_{i,j,t} \right] - \Gamma_j - \Gamma_t + \Gamma_2 i s_{j,t} - \Gamma_{3,j} \hat{i} s_{j,t+1} \right) \right], \quad (\text{A63})$$

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

As before, the *reduced-form version of the structural model* is given by:

$$\Pr \left( d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \Gamma_1 \ln(ta_{i,j,t}) - \Gamma_j - \Gamma_t + \Gamma_2 i s_{j,t} - \Gamma_{3,j} \hat{i} s_{j,t+1} \right) \right]. \quad (\text{A64})$$

We progressively relax the assumptions of the model above and define it under more general conditions. As before, we identify first a *small open economy* (see Appendix D.3.5), and we continue with a *full structural model* (see Appendix D.3.6).

### D.3.3 AR(1) estimation results.

The estimation results for the AR(1) model defined in equation (20) are reported in Figure A1. The figure shows positive coefficients consistent with a persistent and sequential offshoring exploration process. Figure A2 reports the respective results for sectors with at least 200 firms, also showing positive coefficients.

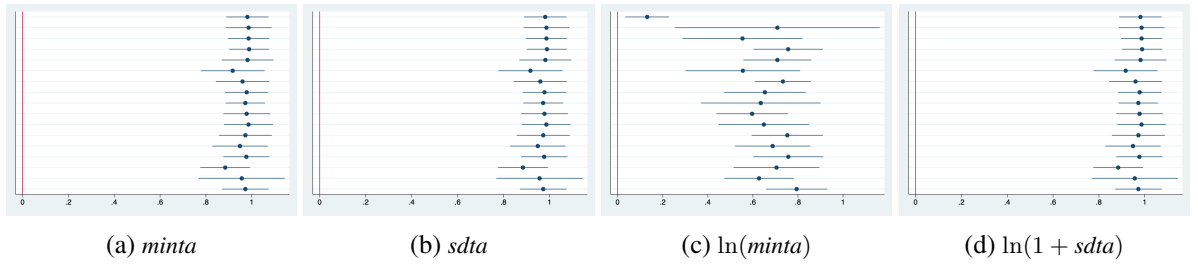


Figure A1: Sectors with at least 100 firms. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals

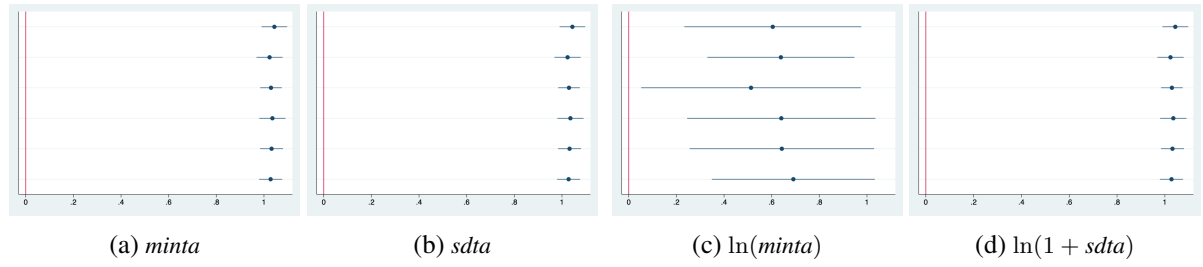


Figure A2: Sectors with at least 200 firms. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals

### D.3.4 ‘Reduced-form’ version of structural model

**Model with variables in natural logarithm.** Table A7 reports the results for the models with information spillovers in natural logarithm.

Table A7: Non-offshoring firms. ‘Reduced-form’ model in natural logarithms

<i>Sample</i>	<i>Exp. sign</i>	<i>w/ at least 100 firms</i>			
		(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*** (0.0601)	0.305*** (0.0307)	0.310*** (0.0311)	0.323*** (0.0316)
$\ln(\widehat{minta}_{j,t-1})$	-	0.274* (0.144)		0.337 (0.281)	
$\ln(\widehat{minta}_{j,t+1})$	+	-0.349** (0.170)		-0.357 (0.398)	
$\ln(1 + \widehat{sdta}_{j,t-1})$	+		-0.735*** (0.190)		2.941*** (0.975)
$\ln(1 + \widehat{sdta}_{j,t+1})$	-		0.361* (0.185)		-3.338*** (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.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Marginal effects.** Table A8 reports the average marginal effects and the marginal effects at the mean for the models reported in Table 2.

Table A8: Non-offshoring firms. Structural ‘Reduced-form’ model

	Average Marginal Effects				Marg. Effects at Mean			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$
$\ln(ta_{i,j,t})$	0.0456*** (0.00544)	0.0453*** (0.00433)	0.0469*** (0.00496)	0.0477*** (0.00452)	0.0439*** (0.00490)	0.0450*** (0.00405)	0.0458*** (0.00458)	0.0475*** (0.00437)
$\widehat{minta}_{j,t-1}$	-0.0410 (0.0527)		-0.0835* (0.0503)		-0.0395 (0.0502)		-0.0817* (0.0493)	
$\widehat{minta}_{j,t+1}$	-0.107** (0.0461)		0.0551 (0.0713)		-0.103** (0.0431)		0.0539 (0.0703)	
$\widehat{sda}_{j,t-1}$		-0.000868 (0.000584)		0.000307 (0.000238)		-0.000862 (0.000577)		0.000305 (0.000237)
$\widehat{sda}_{j,t+1}$		-0.00153** (0.000685)		-0.00245*** (0.000404)		-0.00152** (0.000687)		-0.00243*** (0.000409)
FEs	$j$	$j$	$j, t$	$j, t$	$j$	$j$	$j, t$	$j, t$

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

Table A9 shows the marginal effects for the models with information spillovers in natural logarithm.

Table A9: Non-offshoring firms. Structural ‘Reduced-form’ model with info. spillovers in logs

	Average Marginal Effects				Marg. Effects at Mean			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$	$os_{i,j,t}$
$\ln(ta_{i,j,t})$	0.0415*** (0.00918)	0.0457*** (0.00434)	0.0474*** (0.00505)	0.0481*** (0.00443)	0.0411*** (0.00850)	0.0448*** (0.00398)	0.0468*** (0.00492)	0.0522*** (0.00511)
$\ln(\widehat{minta}_{j,t-1})$	0.0446* (0.0236)		0.0516 (0.0423)		0.0442* (0.0237)		0.0510 (0.0413)	
$\ln(\widehat{minta}_{j,t+1})$	-0.0569** (0.0273)		-0.0546 (0.0601)		-0.0563** (0.0265)		-0.0540 (0.0589)	
$\ln(1 + \widehat{sda}_{j,t-1})$		-0.110*** (0.0282)		0.437*** (0.144)		-0.108*** (0.0273)		0.475*** (0.172)
$\ln(1 + \widehat{sda}_{j,t+1})$		0.0541** (0.0275)		-0.496*** (0.146)		0.0531** (0.0268)		-0.539*** (0.176)
FEs	$j$	$j$	$j, t$	$j, t$	$j$	$j$	$j, t$	$j, t$

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

### D.3.5 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,  $z_{j,t}^S = z_j^S$

$\forall t$ . Under these conditions, we have:

$$\Pr \left( d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \Gamma_{1,j} \ln(ta_{i,j,t}) - \Gamma_j + \Gamma_2 is_{j,t} - \Gamma_{3,j} \widehat{is}_{j,t+1} \right) \right]. \quad (\text{A65})$$

We report in Figure A3 the estimation results of the model above for the direct and alternative information spillover measures. Figure A4 reports the respective results for the models with information spillovers in natural logarithm. Finally, Figures A5 and A6 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<sup>116</sup>, other specifications show a non-significant effect or theory-inconsistent evidence. Concerning the effect of expected new information, the results show substantial heterogeneity.

Figures A7–A10 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,<sup>117</sup> but the evidence is still not supportive for the role of information spillovers.

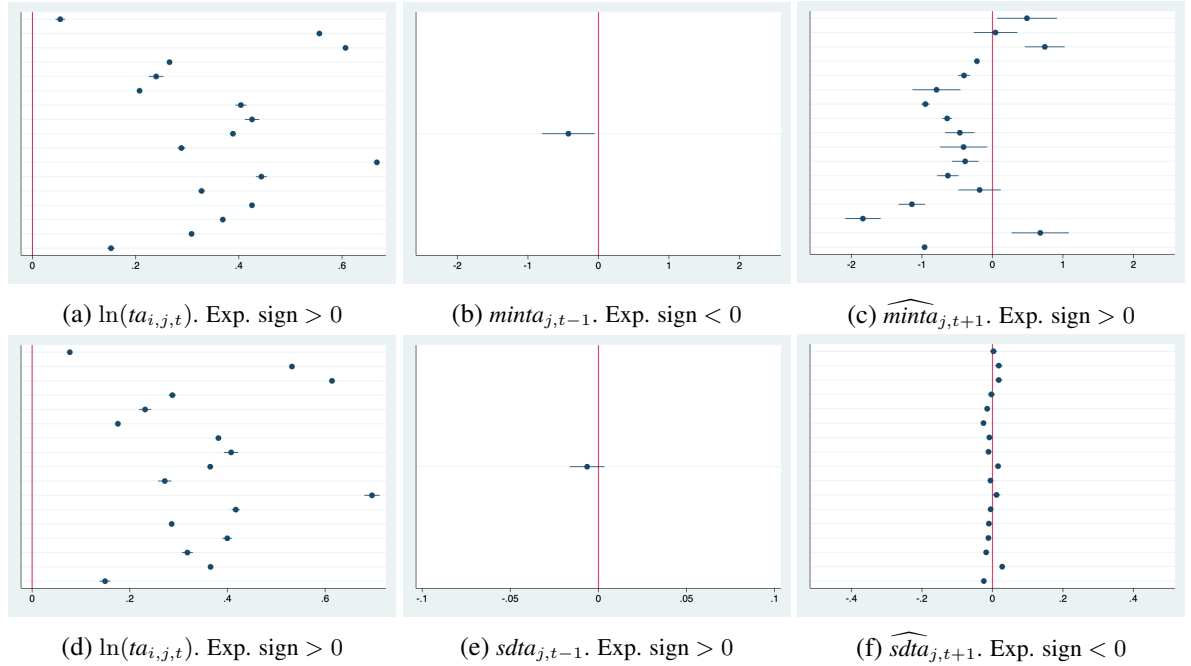


Figure A3: Structural Model for Small Open Economy (SMOPEC). Sectors with at least 100 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

<sup>116</sup>For instance, the direct measure  $\text{minta}$  in Figure A3.

<sup>117</sup>That is, the trade-off function—and thus the probability of exploration—is increasing in productivity.

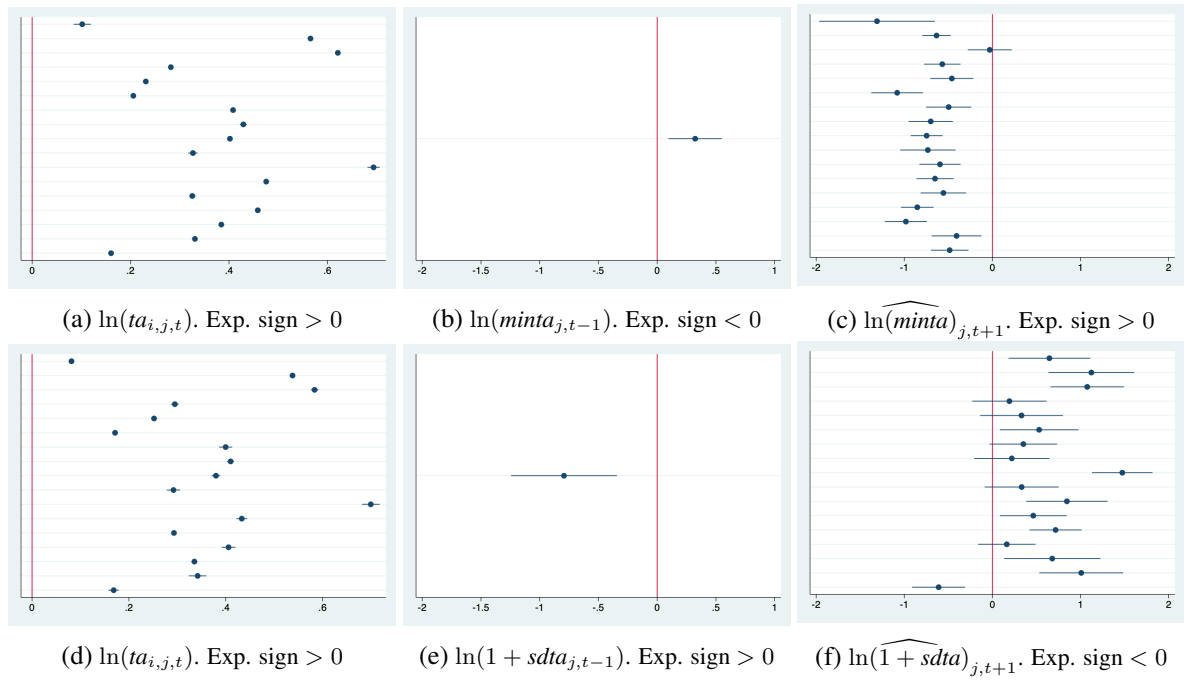


Figure A4: Structural Model for Small Open Economy (SMOPEC). Sectors with at least 100 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

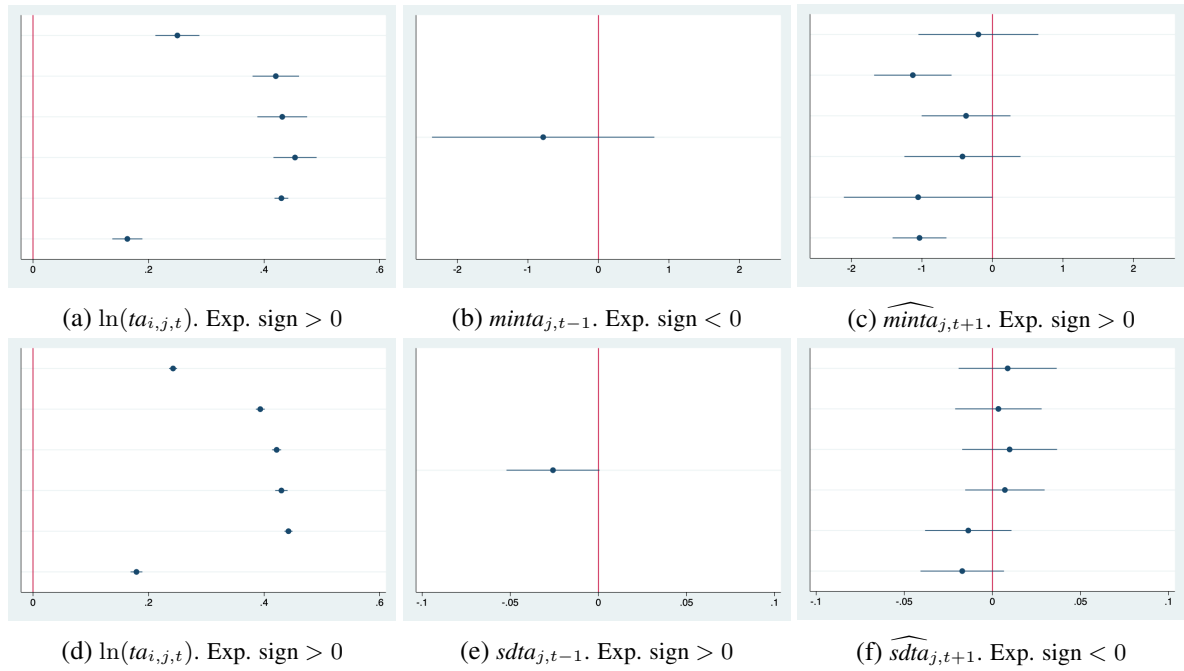


Figure A5: Structural Model for Small Open Economy (SMOPEC). Sectors with at least 200 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

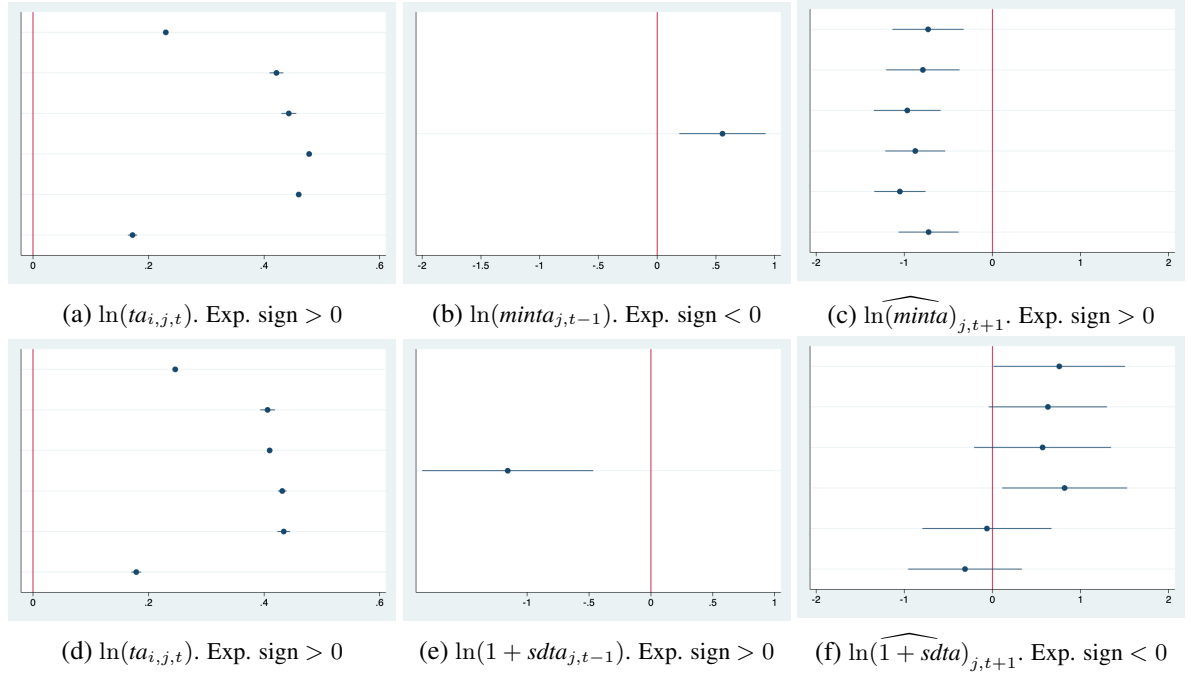


Figure A6: Structural Model for Small Open Economy (SMOPEC). Sectors with at least 200 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

**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:

$$\Pr \left( d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \Gamma_{1,j} \ln(ta_{i,j,t}) - \Gamma_j - \Gamma_t + \Gamma_2 is_{j,t} - \Gamma_{3,j} \widehat{is}_{j,t+1} \right) \right]. \quad (\text{A66})$$

Figure A7 reports the results for the direct and alternative information spillover measures for the sample with sectors with at least 100 firms, whereas Figure A8 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 A7–A10. However, concerning the coefficients associated with the effects of the expected fixed-cost differential and the expected new information, we observe heterogeneous evidence. Whereas some specifications show theory-consistent effects<sup>118</sup>, other specifications show ambiguous and theory-inconsistent results.

<sup>118</sup>For example, Figure A7e, A7b, A9b, A9c.

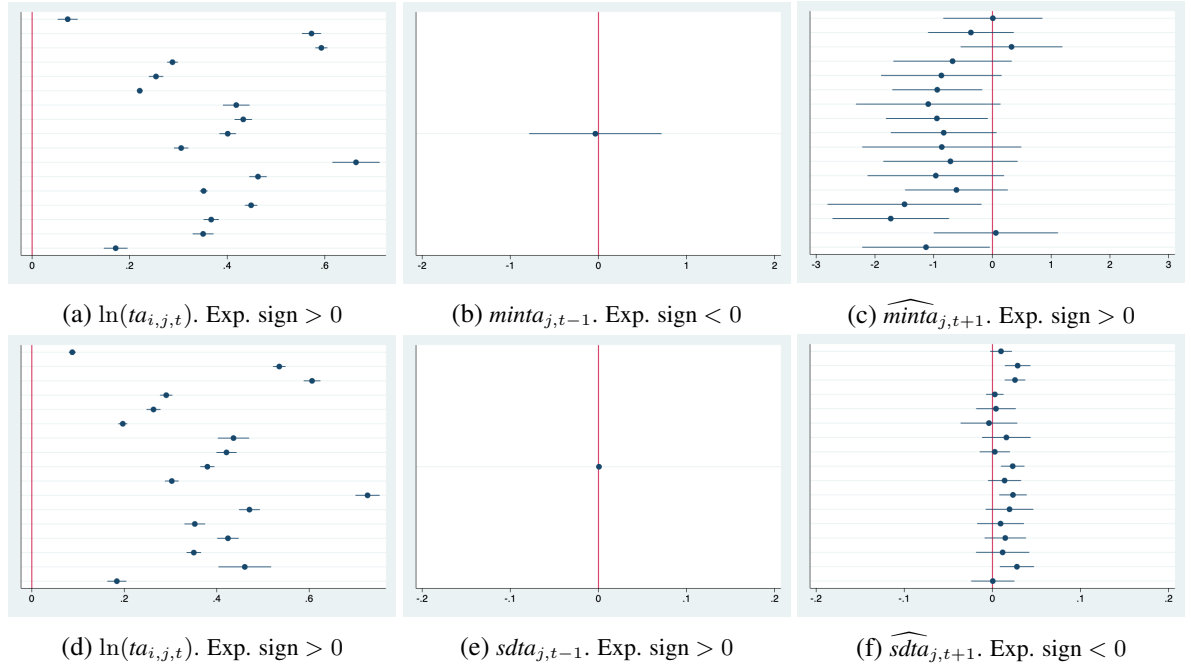


Figure A7: Structural Model for Small Open Economy (SMOPEC) with time-varying wages. Sectors with at least 100 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

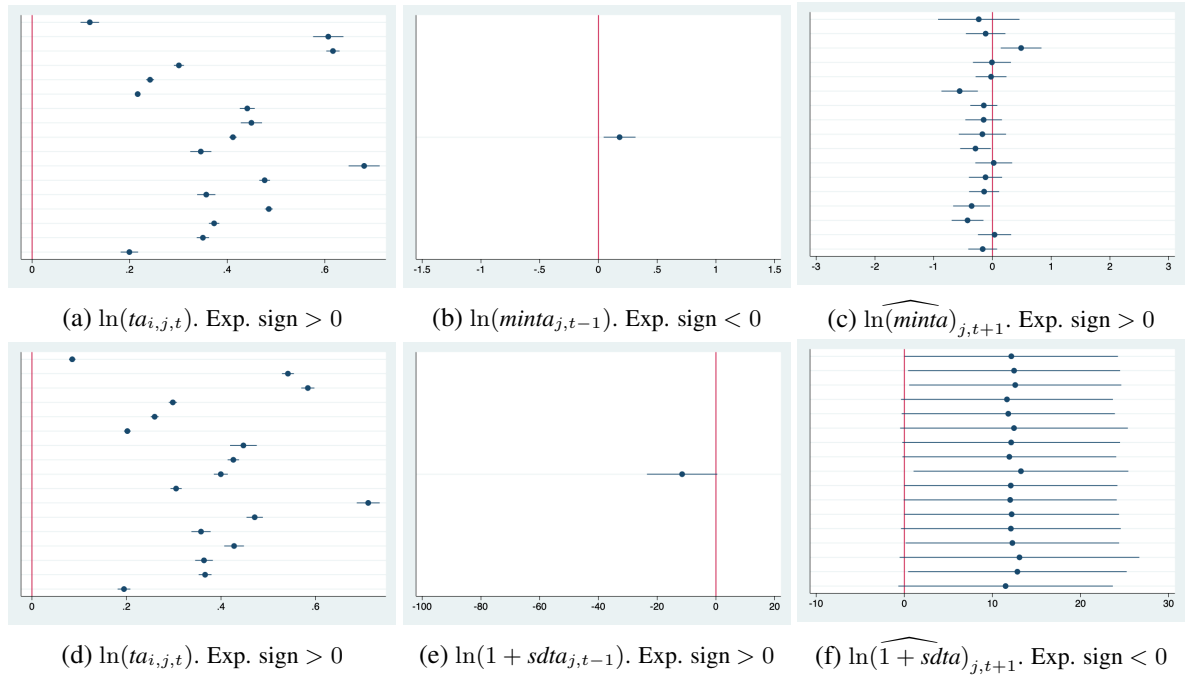


Figure A8: Structural Model for Small Open Economy (SMOPEC) with time-varying wages. Sectors with at least 100 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

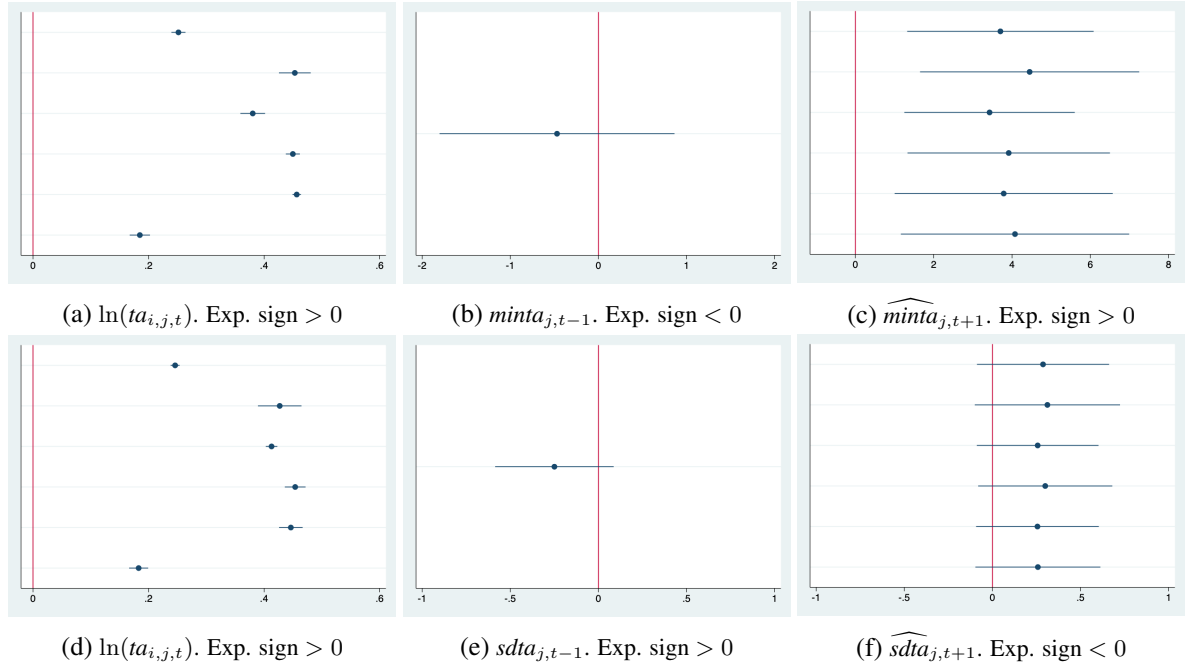


Figure A9: Structural Model for Small Open Economy (SMOPEC) with time-varying wages. Sectors with at least 200 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

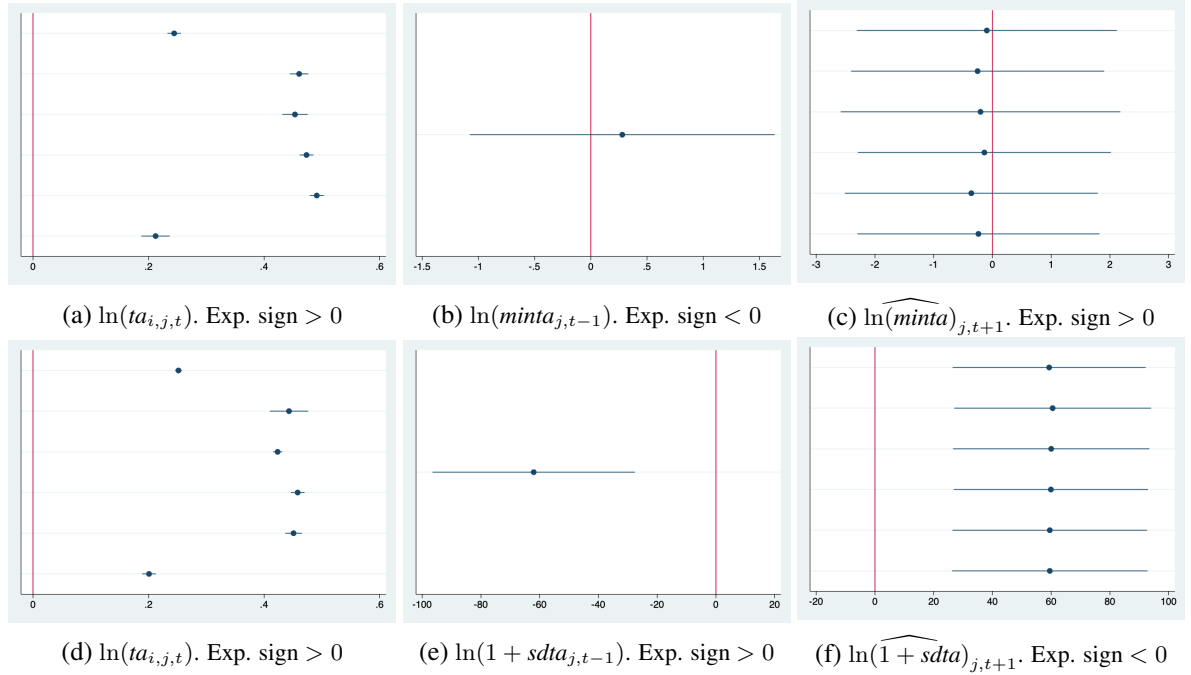


Figure A10: Structural Model for Small Open Economy (SMOPEC) with time-varying wages. Sectors with at least 200 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.



### D.3.6 Full Structural Model: Results

We relax the SMOPEC assumption and specify a full model defined in equation (17):

$$\Pr\left(d_{i,j,t}^s = 1 \mid d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t}\right) = \Phi\left[\Sigma^{-1}\left(\Gamma_{1,j,t} \ln(ta_{i,j,t}) - \Gamma_j + \Gamma_2 is_{j,t} - \Gamma_{3,j} \widehat{is}_{j,t+1}\right)\right]. \quad (\text{A67})$$

We estimate the model for sectors with at least 200 firms.<sup>119</sup> Figure A11 reports the results for the models with the direct and alternative information spillover measures in levels, whereas Figure A12 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.

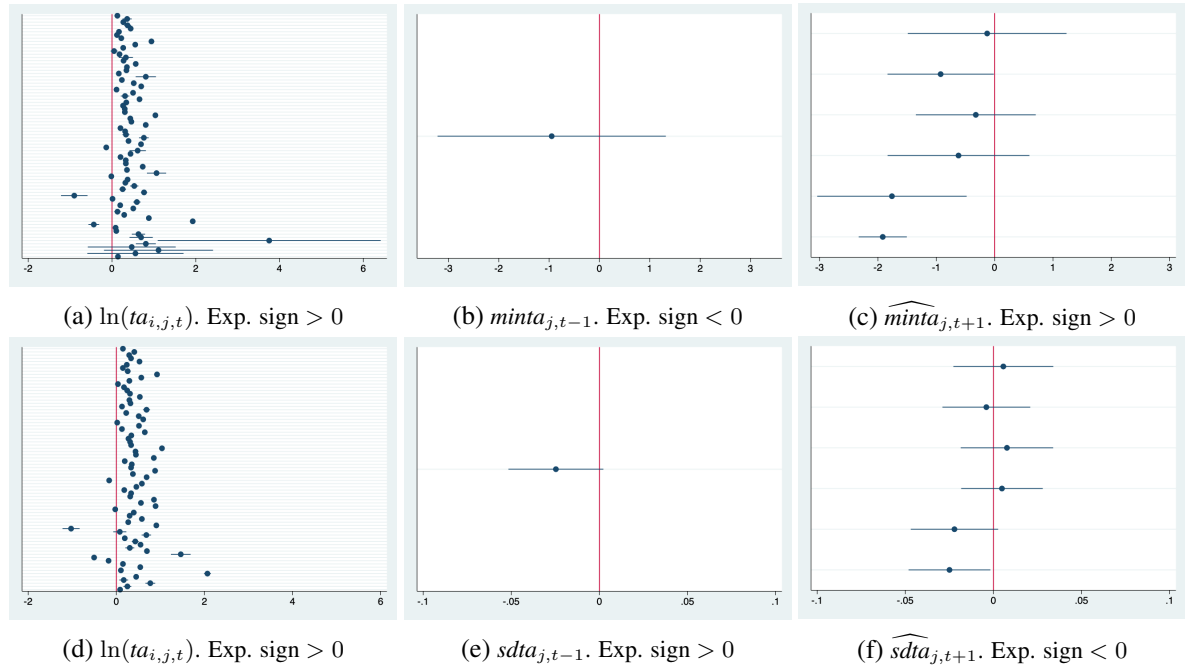


Figure A11: Full structural model. Sectors with at least 200 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

<sup>119</sup>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  $\ln(ta_{i,j,t})$ .

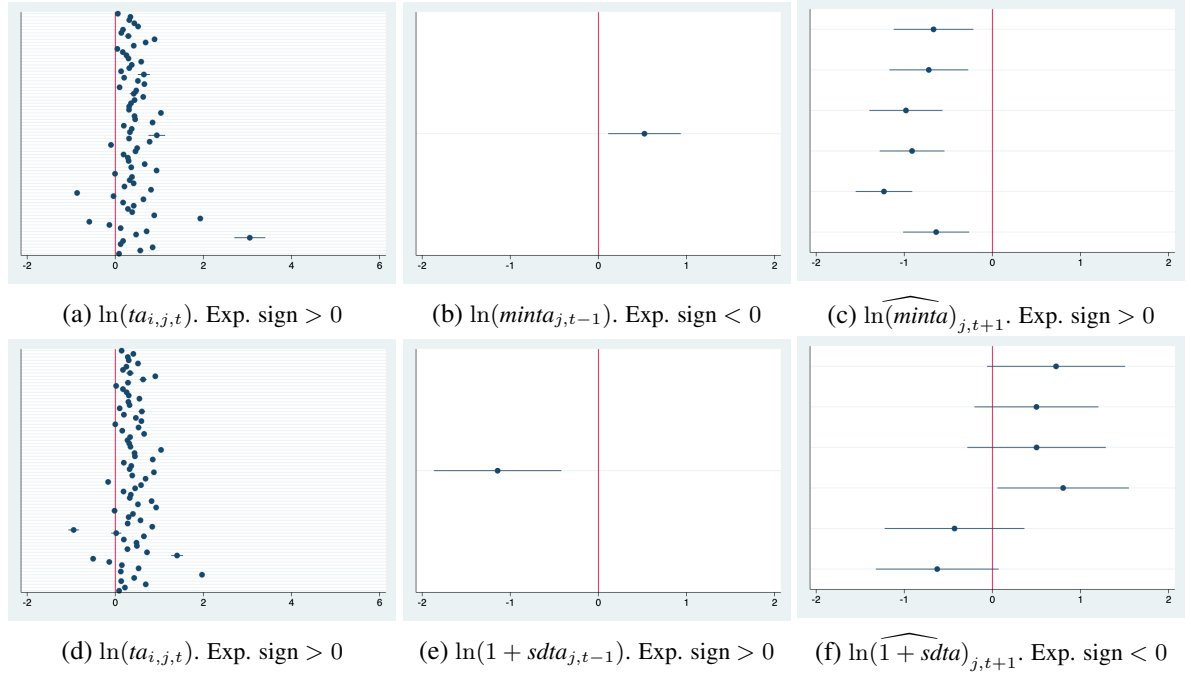


Figure A12: Full structural model. Sectors with at least 200 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

**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.,  $E_t$ ):<sup>120</sup>

$$\Pr(d_{i,j,t}^s = 1 | d_{i,j,t-1}^s = 0, \mathcal{I}_{i,j,t}) = \Phi \left[ \Sigma^{-1} \left( \Gamma_{1,j,t} \ln(ta_{i,j,t}) - \Gamma_j - \Gamma_t + \Gamma_2 is_{j,t} - \Gamma_{3,j} \widehat{is}_{j,t+1} \right) \right]. \quad (\text{A68})$$

As before, we estimate the model for sectors with at least 200 firms. We report in Figure A13 reports the results for the models with the direct and alternative information spillover measures in levels, whereas Figure A14 reports the respective results for the model with information spillovers in natural logarithm.

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 A13, show strong support for the role of the information spillovers—other empirical models report non-significant or theory-inconsistent results.

<sup>120</sup>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  $j$ .

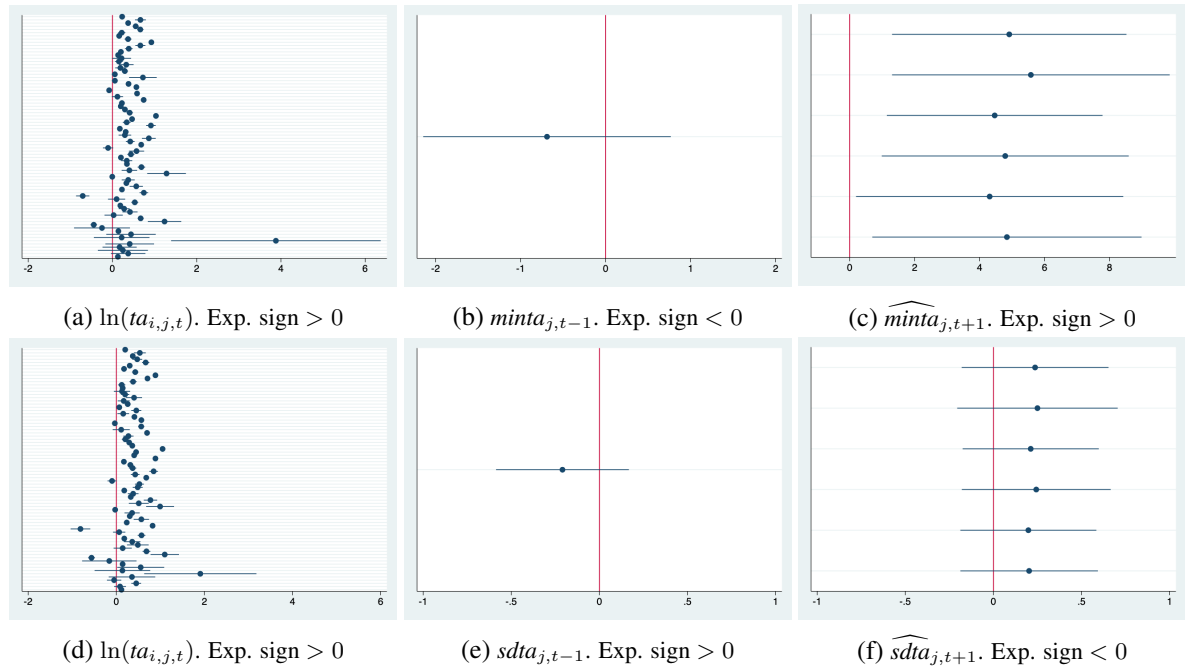


Figure A13: Full structural model with time-varying wages. Sectors with at least 200 firms and information spillovers in levels. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

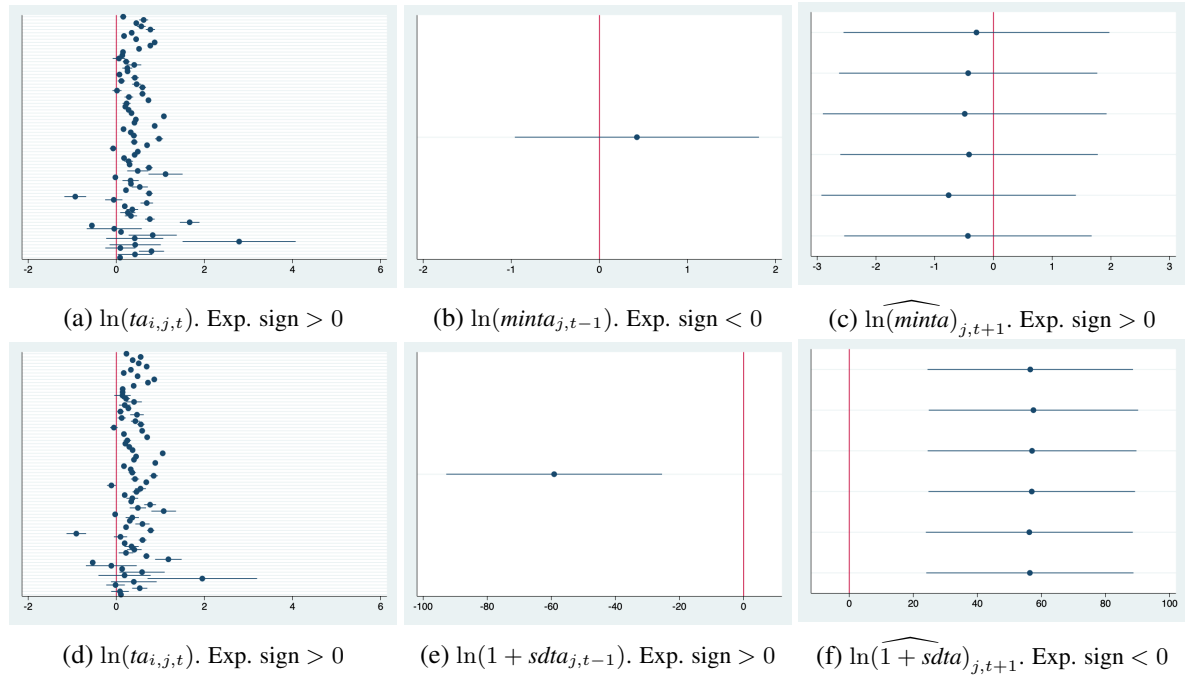


Figure A14: Full structural model with time-varying wages. Sectors with at least 200 firms and information spillovers in logs. Estimated coefficients are represented by dots. Lines give the 95%-confidence intervals.

## D.4 Multi-country model

### D.4.1 Relative information spillover measures: alternative measures

The variable  $\ln(ris_{i,l,j,t}^W)$  refers to the information revealed about country  $l$  relative to the information revealed about the other potential locations. In addition to the measures introduced above, we develop two additional alternative indices. The two alternative relative spillover indices used are:

$$\ln(ris\_minta_{i,l,j,t}^{W^{max}}) \equiv \ln\left(\frac{minta_{l,j,t-1}}{\min\{minta_{i,s,j,t-1} | s \in S_{i,j,t-1}\}}\right), \quad (A69)$$

$$\ln(ris\_minta_{i,l,j,t}^{W^{mean}}) \equiv \ln\left(\frac{minta_{l,j,t-1}}{S_{i,j,t-1}^{-1} \sum_{s=1}^{S_{i,j,t-1}} minta_{s,j,t-1}}\right). \quad (A70)$$

The first measure given in equation (A69) compares the information revealed in country  $l$  relative to the country  $s$  with the highest information revealed. The second measure given in equation (A70) compares it relative to the mean information revealed in all non-explored locations.

Regarding the alternative theory-consistent measure, the equivalent indices are given by:

$$\ln(ris\_sdta_{i,l,j,t}^{W^{max}}) \equiv \ln\left(1 + \frac{sdta_{l,j,t-1}}{\max\{sdta_{s,j,t-1} | s \in S_{i,j,t-1}\}}\right), \quad (A71)$$

$$\ln(ris\_sdta_{i,l,j,t}^{W^{mean}}) \equiv \ln\left(1 + \frac{sdta_{l,j,t-1}}{S_{i,j,t-1}^{-1} \sum_{s=1}^{S_{i,j,t-1}} sdta_{s,j,t-1}}\right). \quad (A72)$$

Tables A10 and A11 show the estimation results of the reduced-form models with the alternative information spillover measures for those firms that are domestically sourcing, i.e., for first-time explorers. Tables A12 and A13 show the equivalent results for the firms already offshoring from different locations. Our results are robust to the alternative information spillover measures, both for domestic-sourcing firms and for firms already offshoring firms.

Table A10: Alternative information spillover measures:  $W^{max}$ . Non-offshoring firms

Model:	Conditional Probit Model					Transition (survival) Analysis			
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*** (0.0198)	0.236*** (0.0193)	0.225*** (0.0223)	0.222*** (0.0214)	0.674*** (0.0536)	0.680*** (0.0542)	0.628*** (0.0542)	0.632*** (0.0537)
$\ln(ris\_minta_{i,l,j,t}^{W^{max}})$	-	-0.0467*** (0.0143)		-0.0430*** (0.0142)		-0.120*** (0.0390)		-0.105*** (0.0363)	
$\ln(ris\_sdta_{i,l,j,t}^{W^{max}})$	+		0.225*** (0.0830)		0.106 (0.0819)		0.613** (0.247)		0.255 (0.257)
$\ln(t)$						-1.054*** (0.0980)	-0.992*** (0.105)	-1.003*** (0.0990)	-0.951*** (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 A11: Alternative information spillover measures:  $W^{mean}$ . Non-offshoring firms

Model:	Conditional Probit Model					Transition (survival) Analysis			
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*** (0.0200)	0.236*** (0.0193)	0.225*** (0.0224)	0.222*** (0.0214)	0.673*** (0.0544)	0.679*** (0.0542)	0.627*** (0.0545)	0.632*** (0.0538)
$\ln(ris\_minta_{i,l,j,t}^{W^{mean}})$	-	-0.0573*** (0.0143)		-0.0461*** (0.0119)		-0.171*** (0.0390)		-0.137*** (0.0350)	
$\ln(ris\_sdta_{i,l,j,t}^{W^{mean}})$	+		0.0712*** (0.0199)		0.0472*** (0.0180)		0.204*** (0.0578)		0.135** (0.0555)
$\ln(t)$						-1.072*** (0.101)	-0.977*** (0.106)	-1.015*** (0.101)	-0.938*** (0.109)
FES		$\dot{j}, t, l$	$\dot{j}, t, l$	$\dot{j}, t, l$	$\dot{j}, t, l$	$\dot{j}, l$	$\dot{j}, l$	$\dot{j}, l$	$\dot{j}, l$

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 A12: Alternative information spillover measures:  $W^{max}$ . Offshoring firms

Model:	Conditional Probit Model					Transition (survival) Analysis			
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*** (0.00687)	0.251*** (0.00646)	0.249*** (0.00874)	0.248*** (0.00848)	0.575*** (0.0185)	0.604*** (0.0179)	0.571*** (0.0239)	0.595*** (0.0236)
$\ln(ris\_minta_{i,l,j,t}^{W^{max}})$	-	-0.0624*** (0.00510)		-0.0652*** (0.00639)		-0.138*** (0.0122)		-0.149*** (0.0138)	
$\ln(ris\_sdta_{i,l,j,t}^{W^{max}})$	+		0.334*** (0.0508)		0.301*** (0.0728)		0.714*** (0.110)		0.649*** (0.159)
$\ln(t)$						-0.601*** (0.0352)	-0.477*** (0.0338)	-0.602*** (0.0465)	-0.475*** (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 A13: Alternative information spillover measures:  $W^{mean}$ . Offshoring firms

Model:	Conditional Probit Model					Transition (survival) Analysis			
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*** (0.00690)	0.245*** (0.00608)	0.252*** (0.00874)	0.242*** (0.00779)	0.583*** (0.0190)	0.589*** (0.0164)	0.577*** (0.0245)	0.579*** (0.0211)
$\ln(ris\_minta_{i,l,j,t}^{W^{mean}})$	-	-0.0586*** (0.00529)		-0.0616*** (0.00684)		-0.133*** (0.0120)		-0.142*** (0.0156)	
$\ln(ris\_sdta_{i,l,j,t}^{W^{mean}})$	+		0.115*** (0.0135)		0.124*** (0.0215)		0.262*** (0.0295)		0.295*** (0.0490)
$\ln(t)$						-0.586*** (0.0397)	-0.476*** (0.0329)	-0.574*** (0.0528)	-0.467*** (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.4.2 Reduced-form models: marginal effects

Table A14: Non-offshoring firms. Average marginal effects for models in Table 3.

Model: Sample:	Exp. sign	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) $os_{i,l,j,t}$	(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) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.00191*** (0.000155)	0.00117*** (0.0000935)	0.00173*** (0.000167)	0.00120*** (0.000113)	0.00202*** (0.000156)	0.00125*** (0.0000952)	0.00178*** (0.000149)	0.00126*** (0.000103)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-	-0.000445*** (0.000112)		-0.000337*** (0.0000889)		-0.000503*** (0.000115)		-0.000380*** (0.0000983)	
$\ln(ris\_sdta_{i,l,j,t}^{W^{dist}})$	+		0.000355*** (0.000102)		0.000268*** (0.000103)		0.000373*** (0.000106)		0.000282** (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 3. 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. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A15: Non-offshoring firms. Marginal effects at mean for models in Table 3

Model: Sample:	Exp. sign	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) $os_{i,l,j,t}$	(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) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.00149*** (0.0000978)	0.000936*** (0.0000718)	0.00138*** (0.000105)	0.00103*** (0.0000895)	0.00147*** (0.0000952)	0.000964*** (0.0000779)	0.00133*** (0.0000945)	0.00105*** (0.0000832)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-	-0.000345*** (0.0000750)		-0.000270*** (0.0000624)		-0.000365*** (0.0000673)		-0.000284*** (0.0000586)	
$\ln(ris\_sdta_{i,l,j,t}^{W^{dist}})$	+		0.000283*** (0.0000720)		0.000230*** (0.0000842)		0.000287*** (0.0000705)		0.000235*** (0.0000896)
FEs		$j, t, l$	$j, t, l$	$j, t, l$	$j, t, l$	$j, l$	$j, l$	$j, l$	$j, l$

Marginal effects at the mean for the models reported in Table 3. 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. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A16: Offshoring firms. Average marginal effects for models in Table 4.

Model: Sample:	Exp. sign	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) $os_{i,l,j,t}$	(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*** (0.000232)	0.00274*** (0.0000646)	0.00830*** (0.000275)	0.00277*** (0.0000845)	0.00911*** (0.000282)	0.00280*** (0.0000738)	0.00832*** (0.000337)	0.00281*** (0.0000968)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-	-0.00204*** (0.000187)		-0.00200*** (0.000227)		-0.00208*** (0.000191)		-0.00205*** (0.000229)	
$\ln(ris\_sdta_{i,l,j,t}^{W^{dist}})$	+		0.00121*** (0.000143)		0.00137*** (0.000235)		0.00116*** (0.000127)		0.00137*** (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 4. 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. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A17: Offshoring firms. Marginal effects at mean for models in Table 4

Model: Sample:	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	
	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) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.00740*** (0.000142)	0.00204*** (0.0000613)	0.00670*** (0.000160)	0.00206*** (0.0000860)	0.00700*** (0.000164)	0.00199*** (0.0000625)	0.00626*** (0.000188)	0.00198*** (0.0000851)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-	-0.00167*** (0.000137)		-0.00162*** (0.000159)		-0.00159*** (0.000126)		-0.00154*** (0.000144)	
$\ln(ris\_sdata_{i,l,j,t}^{W^{dist}})$	+		0.000906*** (0.0000806)		0.00101*** (0.000130)		0.000827*** (0.0000671)		0.000962*** (0.000110)
FEs		$j, t, l$	$j, t, l$	$j, t, l$	$j, t, l$	$j, l$	$j, l$	$j, l$	$j, l$

Marginal effects at the mean for the models reported in Table 4. 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. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Institutional measures and learning mechanism.** We report here the average marginal effects and the marginal effects at the mean for the models in section 4.5. Tables A18 and A19 report the average marginal effect and marginal effects at the mean for domestic-sourcing firms, respectively.

Table A18: Prior beliefs and information spillovers. Non-offshoring firms. Average Marginal Effects

Institutional Index:	GEest	RQest	RLest	GEest	RQest	RLest
	(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*** (0.000167)	0.00173*** (0.000167)	0.00173*** (0.000167)	0.00120*** (0.000113)	0.00120*** (0.000113)	0.00120*** (0.000113)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-0.000334*** (0.0000882)	-0.000337*** (0.0000888)	-0.000332*** (0.0000885)			
$\ln(ris\_sdata_{i,l,j,t}^{W^{dist}})$				0.000268*** (0.000103)	0.000266*** (0.000102)	0.000268*** (0.000102)
$\ln(rel\_inst_{i,l,j,t}^{W^{dist}})$	-0.00133 (0.000865)	0.000593 (0.00111)	-0.00193 (0.00180)	-0.000108 (0.000859)	0.00163** (0.000766)	0.000553 (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 A19: Prior beliefs and information spillovers. Non-offshoring firms. Marginal Effects at the Mean

Institutional Index:	GEest	RQest	RLest	GEest	RQest	RLest
	(1)	(2)	(3)	(4)	(5)	(6)
	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$	$os_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.00137*** (0.000113)	0.00140*** (0.000119)	0.00139*** (0.000106)	0.222*** (0.0214)	0.222*** (0.0214)	0.222*** (0.0214)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-0.000266*** (0.0000602)	-0.000273*** (0.0000640)	-0.000268*** (0.0000624)			
$\ln(ris\_sdata_{i,l,j,t}^{W^{dist}})$				0.0495*** (0.0188)	0.0490*** (0.0188)	0.0494*** (0.0188)
$\ln(rel\_inst_{i,l,j,t}^{W^{dist}})$	-0.00106 (0.000691)	0.000481 (0.000910)	-0.00156 (0.00152)	-0.0198 (0.158)	0.300** (0.141)	0.102 (0.271)
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 marginal effects at the mean. Standard errors are clustered at the sector level and reported in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Tables A20 and A21 report the the average marginal effect and marginal effects at the mean for offshoring firms, respectively.

Table A20: Prior beliefs and information spillovers. Offshoring firms. Average Marginal Effects

<b>Institutional Index:</b>	<b>GEest</b>	<b>RQest</b>	<b>RLest</b>	<b>GEest</b>	<b>RQest</b>	<b>RLest</b>
	(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*** (0.000278)	0.00823*** (0.000279)	0.00818*** (0.000284)	0.00273*** (0.0000831)	0.00275*** (0.0000841)	0.00273*** (0.0000842)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-0.00200*** (0.000235)	-0.00201*** (0.000231)	-0.00200*** (0.000231)			
$\ln(ris\_sdta_{i,l,j,t}^{W^{dist}})$				0.00136*** (0.000236)	0.00136*** (0.000234)	0.00136*** (0.000234)
$\ln(rel\_inst_{i,l,j,t}^{W^{dist}})$	0.0117*** (0.00235)	0.00853*** (0.00177)	0.0110*** (0.00288)	0.00593*** (0.000729)	0.00315*** (0.000487)	0.00666*** (0.000915)
FES	$\hat{j}, t, l$	$\hat{j}, t, l$	$\hat{j}, t, l$	$\hat{j}, t, l$	$\hat{j}, t, l$	$\hat{j}, t, l$

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 A21: Prior beliefs and information spillovers. Offshoring firms. Marginal Effects at the Mean

<b>Institutional Index:</b>	<b>GEest</b>	<b>RQest</b>	<b>RLest</b>	<b>GEest</b>	<b>RQest</b>	<b>RLest</b>
	(1)	(2)	(3)	(4)	(5)	(6)
	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$	$OS_{i,l,j,t}$
$\ln(ta_{i,j,t})$	0.00657*** (0.000140)	0.00657*** (0.000144)	0.00661*** (0.000139)	0.239*** (0.00770)	0.241*** (0.00779)	0.239*** (0.00777)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-0.00161*** (0.000174)	-0.00161*** (0.000168)	-0.00162*** (0.000167)			
$\ln(ris\_sdta_{i,l,j,t}^{W^{dist}})$				0.119*** (0.0206)	0.119*** (0.0204)	0.119*** (0.0205)
$\ln(rel\_inst_{i,l,j,t}^{W^{dist}})$	0.00936*** (0.00199)	0.00682*** (0.00147)	0.00886*** (0.00248)	0.519*** (0.0635)	0.275*** (0.0425)	0.583*** (0.0803)
FES	$\hat{j}, t, l$	$\hat{j}, t, l$	$\hat{j}, t, l$	$\hat{j}, t, l$	$\hat{j}, t, l$	$\hat{j}, t, l$

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



### D.4.3 Reduced-form models: robustness checks

Table A22 reports the coefficients of the models for domestic-sourcing firms reported in Table 3 but without country fixed effects. Instead, it controls for the country-level variables: market thickness, mean income per capita, common language, and distance. On the one hand, note that controlling for market thickness is consistent with Grossman and Helpman (2005)'s prediction that firms tend to search for suppliers in more dense markets. We proxy market thickness by the country's mean GDP. On the other hand, the variable mean income per capita proxies for the country's marginal cost (i.e.,  $w^S$  in the theoretical model).

Table A22: Non-offshoring firms

Model: Sample:		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	
	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) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.235*** (0.0196)	0.227*** (0.0185)	0.220*** (0.0219)	0.214*** (0.0205)	0.672*** (0.0544)	0.679*** (0.0535)	0.625*** (0.0544)	0.632*** (0.0534)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-	-0.0964*** (0.0128)		-0.0919*** (0.0126)		-0.284*** (0.0331)		-0.270*** (0.0321)	
$\ln(ris\_scta_{i,l,j,t}^{W^{dist}})$	+		0.163*** (0.0191)		0.158*** (0.0213)		0.537*** (0.0559)		0.552*** (0.0720)
$\ln(t)$						-1.109*** (0.105)	-0.976*** (0.107)	-1.061*** (0.111)	-0.913*** (0.106)
$\ln(\overline{mkt\_thick}_l)$	+	0.242*** (0.0139)	0.299*** (0.0140)	0.248*** (0.0160)	0.301*** (0.0169)	0.677*** (0.0383)	0.879*** (0.0389)	0.709*** (0.0396)	0.896*** (0.0456)
$\ln(\overline{inc\_pc}_l)$	-	-0.0846*** (0.0156)	-0.0833*** (0.0177)	-0.0805*** (0.0204)	-0.0795*** (0.0236)	-0.266*** (0.0458)	-0.282*** (0.0546)	-0.265*** (0.0607)	-0.279*** (0.0739)
$common\_lang_l$	+	0.129*** (0.0320)	0.178*** (0.0340)	0.127*** (0.0399)	0.194*** (0.0438)	0.240*** (0.0928)	0.330*** (0.105)	0.235*** (0.118)	0.392*** (0.135)
$\ln(dist_l)$	-	-0.115*** (0.0289)	-0.142*** (0.0282)	-0.128*** (0.0347)	-0.142*** (0.0361)	-0.353*** (0.0904)	-0.462*** (0.0914)	-0.395*** (0.112)	-0.461*** (0.119)
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. *Exp. sign* column reports the expected sign of the coefficients from our theoretical model. Other controls: market thickness, mean income per capita, common language, and distance. Transition analysis models include the year of entry of the firm into the sample as a control. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table A23 reports the coefficients of the models for offshoring firms reported in Table 4 but without country fixed effects. Instead, it controls for the country-level variables: market thickness, mean income per capita, common language, and distance.

Table A23: Offshoring firms

Model:	Conditional Probit Model					Transition (survival) Analysis			
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) $\Lambda_{i,l,j,t}$
$\ln(ta_{i,j,t})$	+	0.243*** (0.00659)	0.222*** (0.00564)	0.239*** (0.00832)	0.220*** (0.00702)	0.560*** (0.0179)	0.552*** (0.0144)	0.555*** (0.0233)	0.543*** (0.0179)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-	-0.0966*** (0.00662)		-0.103*** (0.00791)		-0.221*** (0.0150)		-0.241*** (0.0168)	
$\ln(ris\_sdta_{i,l,j,t}^{W^{dist}})$	+		0.204*** (0.0143)		0.224*** (0.0217)		0.481*** (0.0329)		0.560*** (0.0484)
$\ln(t)$						-0.644*** (0.0364)	-0.548*** (0.0312)	-0.629*** (0.0482)	-0.537*** (0.0421)
$\ln(\overline{mkt\_thick}_l)$	+	0.226*** (0.00932)	0.271*** (0.00834)	0.224*** (0.0117)	0.270*** (0.0111)	0.519*** (0.0180)	0.687*** (0.0176)	0.521*** (0.0224)	0.685*** (0.0233)
$\ln(\overline{inc\_pc}_l)$	-	-0.0234* (0.0138)	-0.00155 (0.0130)	-0.0233 (0.0181)	-0.00795 (0.0177)	-0.0572* (0.0294)	-0.0120 (0.0323)	-0.0603 (0.0397)	-0.0297 (0.0441)
$common\_lang_l$	+	0.148*** (0.0218)	0.235*** (0.0210)	0.146*** (0.0274)	0.249*** (0.0263)	0.274*** (0.0499)	0.487*** (0.0491)	0.271*** (0.0632)	0.525*** (0.0616)
$\ln(dist_l)$	-	-0.0451*** (0.0144)	-0.0752*** (0.0151)	-0.0455*** (0.0171)	-0.0652*** (0.0177)	-0.125*** (0.0333)	-0.221*** (0.0370)	-0.128*** (0.0397)	-0.199*** (0.0439)
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. *Exp. sign* column reports the expected sign of the coefficients from our theoretical model. Other controls: market thickness, mean income per capita, common language, and distance. Transition analysis models include the year of entry of the firm into the sample as a control. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Institutional measures and learning mechanism.** Table A24 reports the result of the empirical model in equation (28), 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 domestic-sourcing firms' offshoring decisions. However, the results become theory-consistent after controlling for unobservable country characteristics.

Table A25 reports the result of the empirical model in equation (29) and, as before, the country fixed effects are replaced by country-level control variables. For offshoring firms, the results remain completely robust and consistent with the specifications with country fixed effects.

## D.5 Multi-country model: structural model

In this appendix, we develop the structural model of the exploration decisions under multiple countries and one intermediate input for domestic sourcing and offshoring firms as characterised by the theoretical model described in section 4.

Table A24: Conditional Probit Model: Prior beliefs and information spillovers. Non-offshoring firms

Institutional Index:	GEest	RQest	RLest	GEest	RQest	RLest
	(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*** (0.0219)	0.221*** (0.0219)	0.221*** (0.0218)	0.214*** (0.0205)	0.214*** (0.0204)	0.214*** (0.0204)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-0.0909*** (0.0121)	-0.0917*** (0.0123)	-0.0901*** (0.0118)			
$\ln(ris\_sdta_{i,l,j,t}^{W^{dist}})$				0.161*** (0.0221)	0.160*** (0.0221)	0.160*** (0.0224)
$\ln(rel\_inst_{i,l,j,t}^{W^{dist}})$	-0.203*** (0.0557)	-0.140** (0.0555)	-0.230*** (0.0536)	-0.124** (0.0563)	-0.0488 (0.0499)	-0.169*** (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 A25: Conditional Probit Model: Prior beliefs and information spillovers. Offshoring firms

Institutional Index:	GEest	RQest	RLest	GEest	RQest	RLest
	(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*** (0.00844)	0.239*** (0.00839)	0.239*** (0.00842)	0.220*** (0.00698)	0.220*** (0.00697)	0.220*** (0.00700)
$\ln(ris\_minta_{i,l,j,t}^{W^{dist}})$	-0.102*** (0.00821)	-0.102*** (0.00817)	-0.103*** (0.00802)			
$\ln(ris\_sdta_{i,l,j,t}^{W^{dist}})$				0.211*** (0.0220)	0.210*** (0.0211)	0.219*** (0.0220)
$\ln(rel\_inst_{i,l,j,t}^{W^{dist}})$	0.120*** (0.0367)	0.142*** (0.0350)	0.0337 (0.0243)	0.200*** (0.0373)	0.219*** (0.0328)	0.0869*** (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.5.1 Identification of the bilateral trade-off function: general identification

**Offshoring revenue premium.** The revenue of firm  $i$  with productivity  $\theta$  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:

$$r_{i,j,t}^l \equiv r_{j,t}^l(\theta) = \left( \frac{w^{l'}}{w^l} \right)^{(1-\eta_j)(\sigma_j-1)} r_{j,t}^{l'}(\theta), \quad (\text{A73})$$

If  $l' = N$  the firm sources domestically.

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

$$r_{i,j,t}^l \equiv r_{j,t}^l(\theta) = \left( \frac{w^N}{w^l} \right)^{(1-\eta_j)(\sigma_j-1)} r_{j,t}^N(\theta). \quad (\text{A74})$$

From this expression, the offshoring revenue premium of country  $l$  relative to domestic sourcing is:

$$r_{i,j,t}^{l/N,\text{prem}} \equiv r_{j,t}^{l/N,\text{prem}}(\theta) = \left[ \left( \frac{w^N}{w^l} \right)^{(1-\eta_j)(\sigma_j-1)} - 1 \right] r_{j,t}^N(\theta).$$

Replacing  $r_{j,t}^N(\theta)$  with the expression of the domestic-sourcing revenues given in equation (A50), we end up with:

$$\begin{aligned} r_{i,j,t}^{l/N,\text{prem}} &\equiv r_{j,t}^{l/N,\text{prem}}(\theta) = \left[ \left( \frac{w^N}{w^l} \right)^{(1-\eta_j)(\sigma_j-1)} - 1 \right] \left[ \frac{\sigma_j - 1}{\sigma_j} \right]^{\sigma_j-1} \theta^{\sigma_j-1} (\gamma_j E)^{\sigma_j} Q_{j,t}^{1-\sigma_j} (w^N)^{1-\sigma_j}, \\ r_{i,j,t}^{l/N,\text{prem}} &\equiv r_{j,t}^{l/N,\text{prem}}(\theta) = z_{j,t}^{l/N} \theta^{\sigma_j-1}, \end{aligned}$$

with

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

*Offshoring firms.* For a firm currently offshoring from country  $l'$ , the offshoring revenue premium from relocating offshoring from  $l'$  to  $l$  is:

$$r_{i,j,t}^{l/l',\text{prem}} \equiv r_{j,t}^{l/l',\text{prem}}(\theta) = \left[ \left( \frac{w^{l'}}{w^l} \right)^{(1-\eta_j)(\sigma_j-1)} - 1 \right] r_{j,t}^{l'}(\theta).$$

Replacing  $r_{j,t}^{l'}(\theta)$  by an expression where  $r_{j,t}^{l'}(\theta)$  is a function of  $r_{j,t}^N(\theta)$  using equation (A74), we have:

$$r_{i,j,t}^{l/l',\text{prem}} \equiv r_{j,t}^{l/l',\text{prem}}(\theta) = \left[ \left( \frac{w^{l'}}{w^l} \right)^{(1-\eta_j)(\sigma_j-1)} - 1 \right] \left( \frac{w^N}{w^{l'}} \right)^{(1-\eta_j)(\sigma_j-1)} r_{j,t}^N(\theta).$$

Finally, replacing  $r_{j,t}^N(\theta)$  with the expression for the revenues under domestic sourcing given in equation (A50), we have:

$$r_{i,j,t}^{l/l',\text{prem}} \equiv r_{j,t}^{l/l',\text{prem}}(\theta) = z_{j,t}^{l/l'} \theta^{\sigma_j-1},$$

with

$$z_{j,t}^{l/l'} \equiv \left[ \left( \frac{w^{l'}}{w^l} \right)^{(1-\eta_j)(\sigma_j-1)} - 1 \right] \left( \frac{w^N}{w^{l'}} \right)^{(1-\eta_j)(\sigma_j-1)} \left[ \frac{\sigma_j - 1}{\sigma_j} \right]^{\sigma_j-1} (\gamma_j E)^{\sigma_j} Q_{j,t}^{1-\sigma_j} (w^N)^{1-\sigma_j}.$$

**Information set and expected offshoring profits.**  $\mathcal{I}_{i,j,t}$  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:

$$\begin{aligned}\mathbb{E} \left[ \pi_{i,j,t}^{l/l', \text{prem}} | \mathcal{I}_{i,j,t} \right] &= \sigma_j^{-1} \mathbb{E} \left[ r_{i,j,t}^{l/l', \text{prem}} | \mathcal{I}_{i,j,t} \right] - w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] \\ &= \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^{l/l'} \theta^{\sigma_j - 1} | \mathcal{I}_{i,j,t} \right] - w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right],\end{aligned}\tag{A75}$$

where  $l' = N$  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:

$$\Pr \left[ d_{i,j,t}^l = 1 \mid d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t} \right],$$

with

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

Replacing  $\mathbb{E} \left[ \pi_{i,j,t}^{l/l', \text{prem}} | \mathcal{I}_{i,j,t} \right]$  with the expression given in equation (A75), we have:

$$\begin{aligned}d_{i,j,t}^l \Big|_{d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t}} &= \mathbb{1} \left\{ \max \left\{ 0; \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^{l/l'} \theta^{\sigma_j - 1} | \mathcal{I}_{i,j,t} \right] - w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] \right\} \right. \\ &\quad \left. - w^N s_j^r \left[ 1 - \lambda_j Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t}) \right] \geq 0 \right\}.\end{aligned}\tag{A76}$$

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

From our theory, we have:

$$w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] = w^N \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - w^N f_j^{l'}.\tag{A77}$$

**Domestic-sourcing firms.** We begin by identifying the terms on the right-hand side of equation (A77) separately. We characterise the expected fixed cost of offshoring in country  $l$  in period  $t$  as:

$$w^N \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) = \gamma_{11} \ln(\text{dist}_l) - \gamma_{12} \text{lang}_l - \gamma_{13} \ln(\overline{\text{mkt.thick}}_l) + \gamma_{14} \ln(\overline{\text{inc-pc}}_l) - \gamma_{21} \text{inst}_{l,j,t}^{\text{posterior}} + \gamma_j.$$

From the expression above, we define the expected fixed cost of offshoring from country  $l$  to be increasing in distance ( $\text{dist}_l$ ), income per capita ( $\text{inc-pc}_l$  as proxy for country  $l$ 's wages) and decreasing in common language

( $lang_l$ ) and market thickness ( $mkt\_thick_l$ ). The term  $\gamma_j$  captures a sector-specific fixed effect. Finally, the term  $inst_{l,j,t}^{posterior}$  identifies the changes in the expected value due to changes in beliefs about institutional conditions in country  $l$ . As we discuss later, this is a function of the prior beliefs and the learning mechanism characterised by the model (i.e., the information spillovers).

Alternatively, the specifications of the model with country fixed effects absorb all time-invariant country  $l$ -specific variables leading to:

$$w^N \mathbb{E} (f_j^l | \mathcal{I}_{i,j,t}) = \gamma_l - \gamma_2 inst_{l,j,t}^{posterior} + \gamma_j.$$

The second term in equation (A77) is given by  $w^N f_j^N = \gamma_j$ . Therefore, the expected fixed-cost differential in period  $t$  is given by:

$$w^N \left[ \mathbb{E} (f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] = \mathbf{controls}_l' \gamma_1 - \gamma_2 inst_{l,j,t}^{posterior} + \gamma_j + v_{i,l,j,t}, \quad (33a \text{ revisited})$$

$$= \gamma_l - \gamma_2 inst_{l,j,t}^{posterior} + \gamma_j + v_{i,l,j,t}, \quad (33b \text{ revisited})$$

where  $\mathbf{controls}_l'$  indicates a vector of the time-invariant country  $l$ -specific variables mentioned above. Moreover, the specification with year fixed effects allows for and captures movements in domestic wages and domestic-sourcing fixed costs.

**Offshoring firms.** In the case of offshoring firms, the first term on the right-hand side of equation (A77) is defined as before, but the identification of the second term differs. It is given by:

$$w^N f_j^{l'} = \mathbf{source\_struct}_{i,l',j,t-1}' \gamma_3 + \gamma_j, \quad (A79)$$

where  $l'$  represents the current sourcing structure of firm  $i$  in period  $t-1$ . We approximate it by  $\mathbf{source\_struct}_{i,l',j,t-1}$ , which is a vector of control variables that corresponds to the same variables as the control vector above ( $\mathbf{controls}_l$ ) but relative to current sourcing location  $l'$ . Hence, the values in the vector  $\mathbf{source\_struct}_{i,l',j,t-1}$  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.6.5 we report the results using the controls for the current sourcing structure and compare the results with the main specification. The robustness of the results in the latter are not affected by the omission in controlling for  $\mathbf{source\_struct}_{i,l',j,t-1}'$ . In the following paragraphs we continue deriving the model for the case where we control for  $\mathbf{source\_struct}_{i,l',j,t-1}'$  to obtain a complete identification of the model.

Hence, using equation (A77), we identify the expected fixed-cost differential in period  $t$  for a firm currently offshoring from  $l'$ , where  $l'$  denotes the sourcing structure of the firm in the period  $t-1$ , as follows:

$$w^N \left[ \mathbb{E} (f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] = \mathbf{controls}_l' \gamma_1 - \gamma_2 inst_{l,j,t}^{posterior} + \mathbf{source\_struct}_{i,l',j,t-1}' \gamma_3 + \gamma_j + v_{i,l,j,t}, \quad (33a \text{ revisited})$$

$$= \gamma_l - \gamma_2 inst_{l,j,t}^{posterior} + \mathbf{source\_struct}_{i,l',j,t-1}' \gamma_3 + \gamma_j + v_{i,l,j,t}, \quad (33b \text{ revisited})$$

**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:

$$inst_{l,j,t}^{posterior} = \rho_1 is_{l,j,t} + \rho_2 inst_{l,t} + \rho_3 FTA_{l,t} + \rho_4 FTA_{l,t}^{inst}, \quad (34 \text{ revisited})$$

where the information spillovers,  $is_{l,j,t}$ , are modelled by the two measures defined earlier: i)  $minta_{l,j,t-1}$ , and ii)  $sdt_{l,j,t-1}$ . We use the institutional index of country  $l$  in year  $t$ —e.g., *Government Efficiency*, *Regulatory Quality* or *Rule of Law*—as a proxy measure for the prior beliefs. The underlying assumption is that the priors are homogenous across sectors, i.e. the variable  $inst_{l,t}$  does not vary in the  $j$  dimension.

The variables  $FTA_{l,t}$  and  $FTA_{l,t}^{inst}$  identify exogenous institutional shocks on prior beliefs coming from FTAs.<sup>121</sup> The first variable is a dummy variable that identifies whether country  $l$  has an FTA with Colombia in year  $t$ . The second variable aims to identify institutional information about country  $l$  that may be revealed at the moment the country signs or becomes part of the agreement, and thus the information has been possessed by Colombian firms since that moment. We discuss this further below.

**Identification of institutional information shock of FTAs.** Assume that a country  $l$  signs an FTA with Colombia in year  $t'$ . We identify the institutional information revealed about country  $l$  after it signs the FTA by the variable  $FTA_{l,t}^{inst}$ . For every period  $t > t'$ , the variable captures the institutional differential between Colombia and the prior beliefs of country  $l$  at  $t'$  when the FTA is signed. Instead, when prior beliefs about institutions in country  $l$  at  $t'$  were better than Colombia, the variable  $FTA_{l,t}^{inst}$  takes a value of zero as the agreement provides no additional information about the institutional conditions in  $l$ . Therefore, the variable  $FTA_{l,t}^{inst}$  is given by:<sup>122</sup>

$$FTA_{l,t}^{inst} = \begin{cases} \max \{ inst_{COL,t'} - inst_{l,t'}, 0 \} & \text{if } l \text{ access the FTA in } t' \leq t, \\ 0 & \text{otherwise .} \end{cases} \quad (A81)$$

The intuition behind equation (A81) is the following. FTAs usually incorporate a set of rules and regulations that define the institutional framework of the agreements, such as intellectual property and property rights protection, foreign investments, dispute resolution mechanisms, environmental regulations, labour market regulations and mobility.<sup>123</sup> The ratification of an FTA reveals an explicit commitment of the signing governments to provide an institutional environment that meets the set of rules specified in the agreement. Moreover, when an FTA is under negotiation, countries with good institutional fundamentals may not want to expose themselves to trade with partners having poor institutional conditions, whereas countries with a bad institutional fundamentals may want to avoid strict rules that they cannot enforce. Thus, the institutional framework of the FTA emerges as the result of a

<sup>121</sup> When the dataset allows, it would be possible to additionally identify information shocks from multilateral agreements such as WTO membership by including a dummy variable  $WTO_{l,t}$  that takes the value one beginning in the year country  $l$  becomes a member of the WTO.

<sup>122</sup> Only FTAs signed during the sample period are considered.

<sup>123</sup> See Maggi (1999), Dür et al. (2014), and Limão (2016). Examples of FTAs with regulatory rules are NAFTA ([www.naftanow.org](http://www.naftanow.org)), the EU ([europa.eu](http://europa.eu)), the Pacific Alliance ([alianzapacifico.net/en](http://alianzapacifico.net/en)), MERCOSUR ([www.mercosur.int](http://www.mercosur.int)), and China-Australia (ChAFTA, [www.dfat.gov.au/trade/agreements/in-force/chafta/Pages/australia-china-fta](http://www.dfat.gov.au/trade/agreements/in-force/chafta/Pages/australia-china-fta)).

bargaining process on a set of rules that regulate the relationships among the members. If those rules are observable by the Colombian firms, a new FTA is more likely to affect the institutional beliefs about a partner country with bad institutional reputation, leading to an improvement of the previously pessimistic priors.

**Empirical identification of expected fixed-cost differential.** Using equation (34), the expected fixed-cost differential from equation (33) for offshoring firms becomes:

$$w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] = \mathbf{controls}'_l \gamma_1 - \gamma_{21} is_{l,j,t} - \gamma_{22} inst_{l,t} - \gamma_{23} FTA_{l,t} - \gamma_{24} FTA_{l,t}^{inst} + \mathbf{source\_struct}'_{i,l',j,t-1} \gamma_3 + \gamma_j + v_{i,l,j,t}, \quad (35a \text{ revisited})$$

$$w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] = \gamma_l - \gamma_{21} is_{l,j,t} - \gamma_{22} inst_{l,t} - \gamma_{23} FTA_{l,t} - \gamma_{24} FTA_{l,t}^{inst} + \mathbf{source\_struct}'_{i,l',j,t-1} \gamma_3 + \gamma_j + v_{i,l,j,t}, \quad (35b \text{ revisited})$$

For domestic-sourcing firms, the model is given by:

$$w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] = \mathbf{controls}'_l \gamma_1 - \gamma_{21} is_{l,j,t} - \gamma_{22} inst_{l,t} - \gamma_{23} FTA_{l,t} - \gamma_{24} FTA_{l,t}^{inst} + \gamma_j + v_{i,l,j,t}, \quad (35a \text{ revisited})$$

$$w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] = \gamma_l - \gamma_{21} is_{l,j,t} - \gamma_{22} inst_{l,t} - \gamma_{23} FTA_{l,t} - \gamma_{24} FTA_{l,t}^{inst} + \gamma_j + v_{i,l,j,t}, \quad (35b \text{ revisited})$$

As mentioned above, the models with year fixed effects capture changes in Colombian wages, total expenditure changes and other general shocks.

### 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:

$$w^N s_j^r [1 - \lambda_j Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t})] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j} \mathbb{E} [inst_{l,j,t+1}^{posterior} | \mathcal{I}_{i,j,t}] + e_{l,j,t}, \quad (36 \text{ revisited})$$

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

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  $\mathbb{E} [inst_{l,j,t+1}^{posterior} | \mathcal{I}_{i,j,t}]$  and  $\tilde{\gamma}_{1,j}$ .  $\mathbb{E} [inst_{l,j,t+1}^{posterior} | \mathcal{I}_{i,j,t}]$  represents the expression  $Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t})$ , which refers to 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. 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 about country  $l$  in  $t + 1$  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., institutional information shocks) from the information set they possess in period  $t$ . Based on this setup, we identify the expected gains from waiting as follows. As in section 3.3, 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  $t$ . We define the underlying AR(1) process for the formation of expectations about future information revealed as:

$$Y(f_{j,t+1}^l) = \rho_{1,j}Y(f_{j,t}^l) + \epsilon_{l,j,t},$$

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:

$$Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t}) \equiv \mathbb{E}[Y(f_{j,t+1}^l)] = \rho_{1,j}Y(f_{j,t}^l).$$

Replacing with the information spillover measures, we estimate the AR(1) model given by:

$$\ln(is_{l,j,t+1}) = \rho_{1,j}is_{l,j,t} + \epsilon_{l,j,t} \Rightarrow \mathbb{E}[\ln(is_{l,j,t+1})] = \rho_{1,j}is_{l,j,t}. \quad (37 \text{ revisited})$$

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

$$w^N s_j^r [1 - \lambda_j Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t})] = \tilde{\gamma}_j + \tilde{\gamma}_{1,j} \widehat{is}_{l,j,t+1} + e_{l,j,t}, \quad (38 \text{ revisited})$$

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 posteriors, increases the gains from waiting.

#### D.5.4 Bilateral trade-off function: Probit model

Back to the expression in equation (A76), the conditional probability model is given by:

$$\begin{aligned} \Pr \left[ d_{i,j,t}^l = 1 \mid d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t} \right] &= \int_v \mathbb{1} \left\{ \mathcal{D}_{i,j,t}^{l/l'}(\theta; \mathcal{I}_{i,j,t}) \geq 0 \right\} \frac{1}{\Sigma} \phi \left( \frac{v}{\Sigma} \right) dv, \\ \Pr \left( d_{i,j,t}^l = 1 \mid d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t} \right) &= \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^{l/l'} \theta^{\sigma_j-1} \mid \mathcal{I}_{i,j,t} \right] - w^N \left[ \mathbb{E}(f_j^l | \mathcal{I}_{i,j,t}) - f_j^{l'} \right] \right. \right. \\ &\quad \left. \left. - w^N s_j^r [1 - \lambda_j Y(f_{j,t+1}^l | \mathcal{I}_{i,j,t})] \right) \right], \end{aligned}$$

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:

$$\begin{aligned} \Pr \left( d_{i,j,t}^l = 1 \mid d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t} \right) &= \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^{l/l'} \theta^{\sigma_j-1} \mid \mathcal{I}_{i,j,t} \right] - \Gamma_l - \Gamma_j \right. \right. \\ &\quad \left. \left. + \Gamma_1 inst_{l,t} + \Gamma_2 FTA_{l,t} + \Gamma_3 FTA_{l,t}^{inst} \right. \right. \\ &\quad \left. \left. + \Gamma_4 is_{l,j,t} + \Gamma_{5,j} \widehat{is}_{l,j,t+1} \right. \right. \\ &\quad \left. \left. + \mathbf{source\_struct}_{i,l',j,t-1}' \Gamma_6 \right) \right]. \end{aligned} \quad (39 \text{ revisited})$$

For domestic-sourcing firms, the probit model is given by:

$$\Pr \left( d_{i,j,t}^l = 1 \mid d_{i,j,t-1}^l = 0, \mathcal{I}_{i,j,t} \right) = \Phi \left[ \Sigma^{-1} \left( \sigma_j^{-1} \mathbb{E} \left[ z_{j,t}^{l/N} \theta^{\sigma_j-1} \mid \mathcal{I}_{i,j,t} \right] - \Gamma_l - \Gamma_j \right. \right. \\ \left. \left. + \Gamma_1 inst_{l,t} + \Gamma_2 FTA_{l,t} + \Gamma_3 FTA_{l,t}^{inst} \right. \right. \\ \left. \left. + \Gamma_4 is_{l,j,t} + \Gamma_{5,j} \widehat{is}_{l,j,t+1} \right) \right].$$

### 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.

$$\mathcal{D}_{i,j,t}^{l/N}(\theta; \mathcal{I}_{i,j,t}) = \psi \mathbf{W}_{i,j} \mathcal{D}_{i,j,t}^{l/N}(\theta; \mathcal{I}_{i,j,t}) + \left[ \Gamma_{1,j} \frac{\ln(ta_{i,j,t})}{w^l} - \Gamma_l - \Gamma_j \right. \\ \left. + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 FTA_{l,t}^{inst} \right. \\ \left. + \Gamma_5 is_{l,j,t} + \Gamma_{6,j} \widehat{is}_{l,j,t+1} \right]. \quad (\text{A84})$$

#### Offshoring firms.

$$\mathcal{D}_{i,j,t}^{l'/l'}(\theta; \mathcal{I}_{i,j,t}) = \psi \mathbf{W}_{i,j,t} \mathcal{D}_{i,j,t}^{l'/l'}(\theta; \mathcal{I}_{i,j,t}) + \left[ \Gamma_{1,j} \left( \frac{w_{i,j,t-1}^{l'}}{w^l} \right) \ln(ta_{i,j,t}) - \Gamma_l - \Gamma_j \right. \\ \left. + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 FTA_{l,t}^{inst} \right. \\ \left. + \Gamma_5 is_{l,j,t} + \Gamma_{6,j} \widehat{is}_{l,j,t+1} + \text{source\_struct}'_{i,l',j,t-1} \Gamma_7 \right]. \quad (\text{A85})$$

where  $w_{i,j,t-1}^{l'}$  denotes the offshoring structure—i.e., mean marginal cost of offshoring—of firm  $i$  in sector  $j$  in period  $t - 1$ . This is proxy by the weighted mean income per capital 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.<sup>124</sup>

### 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.

<sup>124</sup>The missing value in  $w_{i,j,t-1}^{l'}$  represents the case of a firm that does not offshore in  $t - 1$  but offshored in previous periods.

**Domestic-sourcing firms.**

$$\begin{aligned}
\mathcal{D}_{i,j,t}^{l/N}(\theta; \mathcal{I}_{i,j,t}) = & \psi \mathbf{W}_{i,j} \mathcal{D}_{i,j,t}^{l/N}(\theta; \mathcal{I}_{i,j,t}) + \left[ \Gamma_{1,j,t} \frac{\ln(ta_{i,j,t})}{w^l} - \Gamma_l - \Gamma_j \right. \\
& + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 FTA_{l,t}^{inst} \\
& \left. + \Gamma_5 is_{l,j,t} + \Gamma_{6,j} \widehat{is}_{l,j,t+1} \right].
\end{aligned} \tag{A86}$$

**Offshoring firms.**

$$\begin{aligned}
\mathcal{D}_{i,j,t}^{l/l'}(\theta; \mathcal{I}_{i,j,t}) = & \psi \mathbf{W}_{i,j,t} \mathcal{D}_{i,j,t}^{l/l'}(\theta; \mathcal{I}_{i,j,t}) + \left[ \Gamma_{1,j,t} \left( \frac{w^{l'}}{w^l} \right) \ln(ta_{i,j,t}) - \Gamma_l - \Gamma_j \right. \\
& + \Gamma_2 inst_{l,t} + \Gamma_3 FTA_{l,t} + \Gamma_4 FTA_{l,t}^{inst} \\
& \left. + \Gamma_5 is_{l,j,t} + \Gamma_{6,j} \widehat{is}_{l,j,t+1} + \mathbf{source\_struct}'_{i,l',j,t-1} \Gamma_7 \right].
\end{aligned} \tag{A87}$$

## 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 summarise them in the following tables:

Table A26: Summary of results: Models with sector, year and country fixed effects

Model	Info Sp.	Firm type	Theory-consistent results (GE   RQ   RL)					
			Current Info.	Expected Info.	Inst. Index	FTA dummy	FTA Inst Index	Spatial Coef.
Model with: • Sector FE • Year FE • Country FE	minta	Domestic	✓   ✓   ✓	✓   ✓   ✓	X   ✓   X*	✓   ✓*   ✓	X*   X   X	✓   ✓   ✓
		Offshr	✓   ✓   ✓	✓   ✓   ✓	X   X   X	X   X   X	X   X   X	✓   ✓   ✓
	sdta	Domestic	X   X   X	X   X   X	X   ✓   X*	✓   ✓*   ✓	X*   X   X	✓   ✓   ✓
		Offshr	X   X   X	X   X   X	X   .   X	X*   X   X	X   X   X	✓   ✓   ✓
	ln(minta)	Domestic	✓   ✓   ✓	✓   ✓   ✓	.   ✓   X*	✓   ✓*   ✓	X   X   X	✓   ✓   ✓
		Offshr	✓   ✓   ✓	✓   ✓   ✓	X   X   X	X   X   X	X   X   X*	✓   ✓   ✓
	ln(sdta)	Domestic	✓   X   ✓	X   X   X	.   ✓   X*	✓   ✓   ✓	X   X   X	✓   ✓   ✓
		Offshr	X*   X   X*	X   X   X	X   ✓   X	X   X   X	X   X   X	✓   ✓   ✓

Table A27: Summary of results: Models with sector and year fixed effects

Model	Info Sp.	Firm type	Theory-consistent results (GE, RQ, RL)					
			Current Info.	Expected Info.	Inst. Index	FTA dummy	FTA Inst Index	Spatial Coef.
Model with: • Sector FE • Year FE	minta	Domestic	✓-   ✓-   ✓-	✓   ✓   ✓	✓   ✓   X	X   X   X	✓   ✓   ✓	O   x   O
		Offshr	✓   ✓   ✓	✓   ✓   ✓	✓   ✓   ✓	X   X   X	✓   ✓   ✓	✓   ✓   ✓
	sdta	Domestic	✓-   X   ✓	.   X   ✓-	✓   ✓   ✓*	X   X   X	✓   ✓   ✓*	O   x   O
		Offshr	✓   ✓   ✓	X   X   X	✓   ✓   ✓	X   X   ✓	✓   ✓   ✓	✓   ✓   ✓
	ln(minta)	Domestic	✓*   ✓-   ✓	✓*   ✓*   ✓	✓*   ✓   X	X   X   X	.   X   .	✓*   x   ✓
		Offshr	✓   ✓   ✓	✓   ✓   ✓	✓   ✓   ✓	✓   ✓   ✓	✓   X   ✓	✓   ✓   ✓
	ln(sdta)	Domestic	✓   ✓*-   ✓-	✓*   ✓   ✓*	✓   ✓   X*	X   X   X	✓   ✓   ✓	O   x   O
		Offshr	X   X   .	X   X   X	✓   ✓   ✓	X   X   ✓	✓   ✓   ✓	✓   ✓   ✓

References of symbols in Tables A26 and A27:

- ✓: Expected sign in all specifications and significant.
- ✓\*: Expected sign in all specifications. One specification not significant.
- ✓-: Significant and theory-consistent signs. Inconsistent indirect effect in one case.
- ✓: Expected sign. Not significant.
- O: Mixed results. Only theory-consistent result is significant.
- .: Mixed results. Not significant.
- X: Mixed results. Significant.
- X: Wrong sign but not significant
- X\*: Wrong sign and significant.

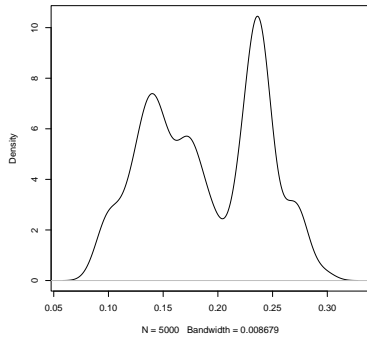
Significance of the results refers to the usual levels considered above (i.e., 1%, 5%, and 10%). the respective p-values are reported in the tables below.

## D.6.1 Main specification: Models with $W^{dist}$

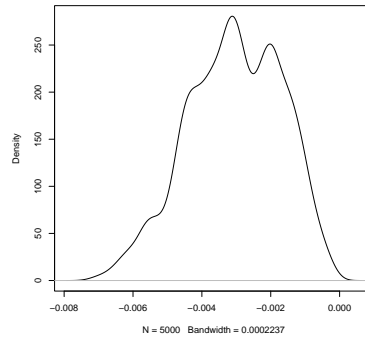
Table A28: Domestic-Sourcing Firms - Information Spillover Measure:  $minta$ .

	inst: RQ					Inst: RL				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000472	-0.000220	0.000252	0.189445	0.000000	0.000448	-0.000210	0.000238	0.180196	0.000000
$minta_{l,j,t-1}$	-0.000009	0.000004	-0.000005	-0.003041	0.000000	-0.000008	0.000004	-0.000004	-0.003153	0.035000
$\widehat{minta}_{l,j,t+1}$	0.000008	-0.000004	0.000005	0.003023	0.000000	0.000008	-0.000004	0.000004	0.003137	0.035400
$inst_{l,t}$	0.000236	-0.000110	0.000126	0.091048	0.207800	-0.000307	0.000143	-0.000164	-0.114799	0.142800
$FTA_{l,t}$	0.000888	-0.000427	0.000460	0.395413	0.099800	0.000501	-0.000246	0.000255	0.221586	0.149200
$FTA_{l,t}^{inst}$	-0.000443	0.000210	-0.000233	-0.188270	0.026000	-0.000305	0.000145	-0.000160	-0.123352	0.046600
$\psi$				-0.870491	0.000000				-0.888547	0.000000

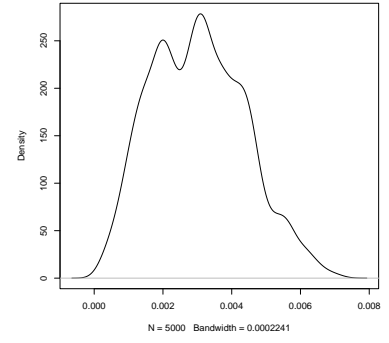
Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ . Weighting matrix:  $W_{i,j,t}^{dist}$ .



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

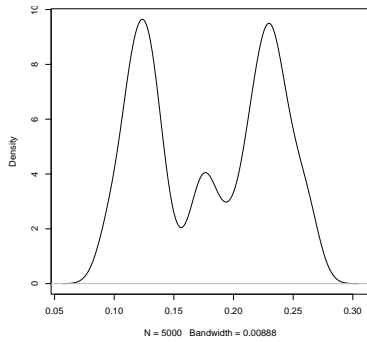


(b)  $minta_{l,j,t-1}$ . Exp. sign  $< 0$

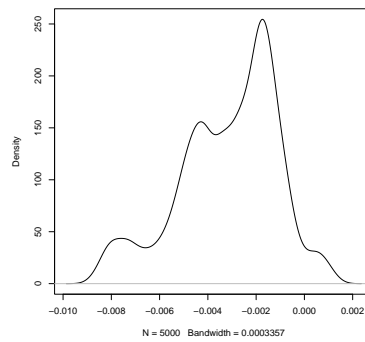


(c)  $\widehat{minta}_{l,j,t+1}$ . Exp. sign  $> 0$

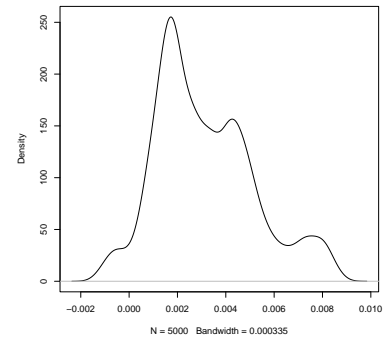
Figure A15: Coefficients: Domestic-Sourcing Firms - Model w/ Regulatory Quality and  $W_{i,j,t}^{dist}$ .



(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 A16: Coefficients: Domestic-Sourcing Firms - Model w/ Rule of Law and  $W_{i,j,t}^{dist}$ .

Table A29: Offshoring Firms - Information Spillover Measure: *minta*.

	inst: RQ					inst: RL				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003547	-0.001686	0.001861	0.368734	0.000000	0.003580	-0.001697	0.001883	0.376943	0.000000
$minta_{l,j,t-1}$	-0.000012	0.000005	-0.000006	-0.001194	0.004400	-0.000011	0.000005	-0.000006	-0.001198	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000011	-0.000005	0.000006	0.001156	0.004400	0.000011	-0.000005	0.000006	0.001160	0.000000
$inst_{l,t}$	-0.000012	0.000005	-0.000007	-0.001229	0.499800	-0.001563	0.000739	-0.000824	-0.163625	0.000000
$FTA_{l,t}$	-0.000244	0.000115	-0.000129	-0.024925	0.326800	-0.000669	0.000317	-0.000352	-0.070474	0.046800
$FTA_{l,t}^{inst}$	-0.000346	0.000164	-0.000182	-0.035891	0.032200	-0.000178	0.000084	-0.000094	-0.018438	0.128000
$\psi$				-0.891502	0.000000				-0.889043	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ . Weighting matrix:  $W_{i,j,t}^{dist}$ .

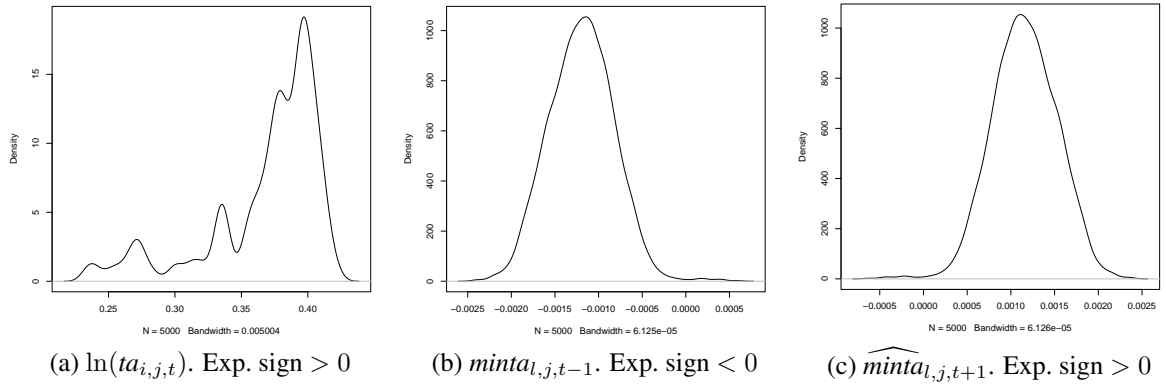


Figure A17: Coefficients: Offshoring Firms - Model w/ Regulatory Quality and  $W_{i,j,t}^{dist}$ .

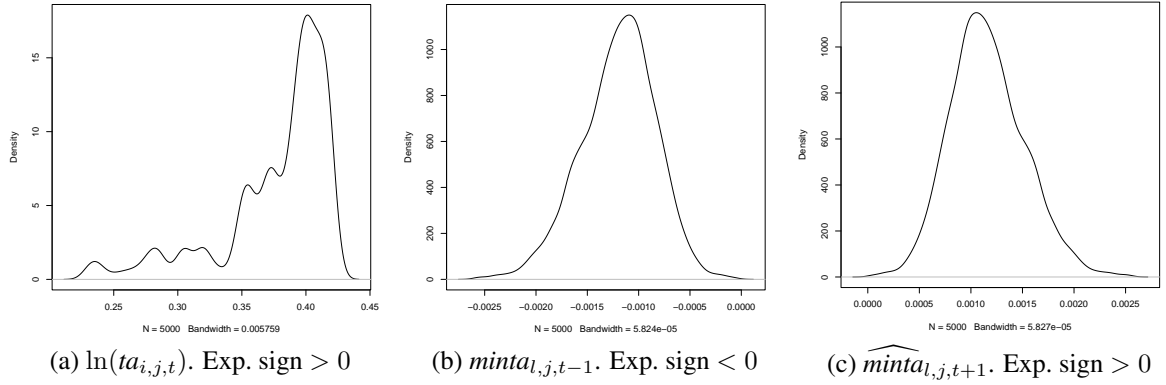


Figure A18: Coefficients: Offshoring Firms - Model w/ Rule of Law and  $W_{i,j,t}^{dist}$ .

## D.6.2 Main specification: Models with Government Efficiency

Table A30: Domestic-Sourcing Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000465	-0.000224	0.000241	0.187843	0.000000	0.000461	-0.000215	0.000246	0.183215	0.000000
$minta_{l,j,t-1}$	-0.000008	0.000004	-0.000004	-0.003215	0.036000	-0.000007	0.000003	-0.000004	-0.002985	0.029800
$\widehat{minta}_{l,j,t+1}$	0.000007	-0.000004	0.000004	0.003197	0.035800	0.000007	-0.000003	0.000004	0.002969	0.029800
$GE_{l,t}$	-0.000055	0.000024	-0.000030	-0.018360	0.401400	0.000065	-0.000034	0.000031	0.029835	0.417600
$FTA_{l,t}$	0.000456	-0.000215	0.000240	0.198968	0.217400	0.000715	-0.000333	0.000382	0.316749	0.165000
$FTA\_GE_{l,t}$	-0.000310	0.000147	-0.000163	-0.126422	0.101800	-0.000378	0.000174	-0.000203	-0.157720	0.091000
$\psi$				-0.922817	0.000000				-0.871207	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ . Inst: Government Efficiency.

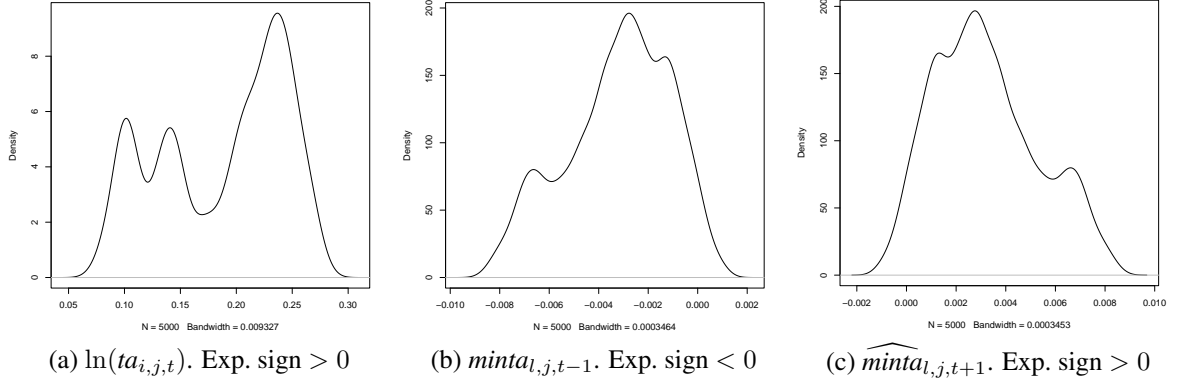


Figure A19: Coefficients: Domestic-Sourcing Firms - Model with GE and  $W^{mean}$ .

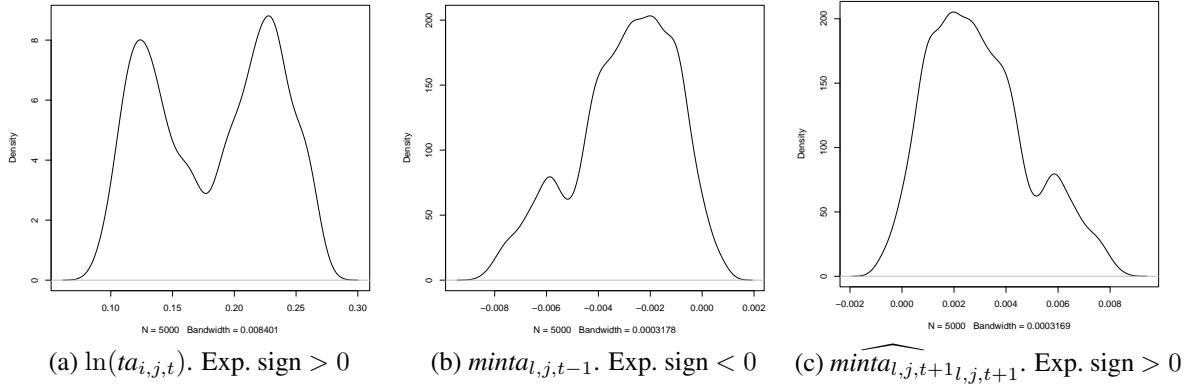


Figure A20: Coefficients: Domestic-Sourcing Firms - Model with GE and  $W^{mean}$ .

Table A31: Offshoring Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003685	-0.001822	0.001863	0.383802	0.000000	0.003583	-0.001700	0.001883	0.377110	0.000000
$minta_{l,j,t-1}$	-0.000012	0.000006	-0.000006	-0.001234	0.000000	-0.000012	0.000005	-0.000006	-0.001211	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000012	-0.000006	0.000006	0.001197	0.000000	0.000011	-0.000005	0.000006	0.001174	0.000000
$GE_{l,t}$	-0.000082	0.000040	-0.000042	-0.008475	0.390600	-0.000015	0.000007	-0.000008	-0.001711	0.476000
$FTA_{l,t}$	-0.000727	0.000360	-0.000368	-0.075962	0.066200	-0.000613	0.000291	-0.000322	-0.064714	0.097200
$FTA\_GE_{l,t}$	-0.000141	0.000069	-0.000072	-0.014369	0.224400	-0.000175	0.000083	-0.000092	-0.018087	0.173200
$\psi$				-0.968601	0.000000				-0.890810	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ . Inst: Government Efficiency.

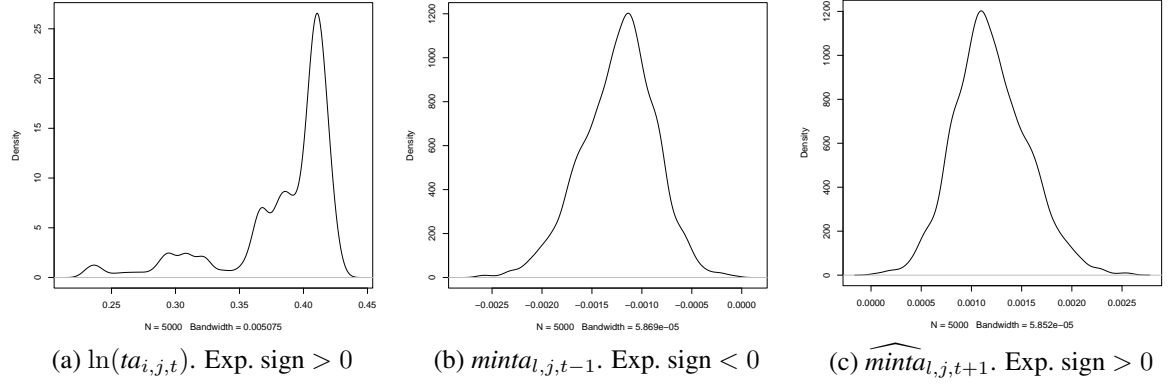


Figure A21: Coefficients: Offshoring Firms - Model with GE and  $W^{mean}$ .

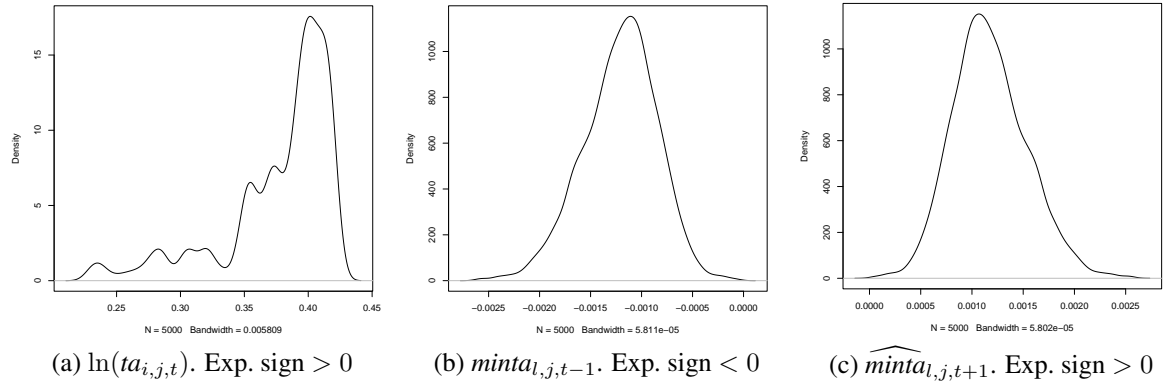


Figure A22: Coefficients: Offshoring Firms - Model with GE and  $W^{mean}$ .



### D.6.3 Alternative specifications: Models with country fixed effects

**Information spillover: *sdt*<sub>a</sub>.** Tables A32 and A33 report the coefficients and marginal effects for the models with government efficiency (GE) as institutional index and the alternative (theory-based) information spillover measure for domestic-sourcing and offshoring firms, respectively.

Table A32: Domestic-Sourcing Firms - Information Spillover Measure: *sdt*<sub>a</sub>.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000465	-0.000224	0.000240	0.188939	0.000000	0.000461	-0.000215	0.000246	0.184169	0.000000
<i>sdt</i> <sub><i>l,j,t-1</i></sub>	-0.000003	0.000001	-0.000002	-0.001240	0.322800	-0.000002	0.000001	-0.000001	-0.000979	0.356000
$\widehat{sdt}_{l,j,t+1}$	0.000002	-0.000001	0.000001	0.000783	0.420800	0.000001	-0.000001	0.000001	0.000515	0.460600
<i>GE</i> <sub><i>l,t</i></sub>	-0.000047	0.000021	-0.000026	-0.015912	0.403600	0.000071	-0.000036	0.000034	0.032107	0.402600
<i>FTA</i> <sub><i>l,t</i></sub>	0.000465	-0.000220	0.000245	0.201526	0.212400	0.000725	-0.000338	0.000387	0.319628	0.160000
<i>FTA_GE</i> <sub><i>l,t</i></sub>	-0.000306	0.000145	-0.000161	-0.124454	0.102400	-0.000374	0.000173	-0.000201	-0.156106	0.091600
$\psi$				-0.924076	0.000000				-0.874027	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: *j, t, l*.

Table A33: Offshoring Firms - Information Spillover Measure: *sdt*<sub>a</sub>.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003635	-0.001795	0.001840	0.373540	0.000000	0.003528	-0.001671	0.001857	0.365231	0.000000
<i>sdt</i> <sub><i>l,j,t-1</i></sub>	-0.000003	0.000001	-0.000001	-0.000279	0.353800	-0.000004	0.000002	-0.000002	-0.000370	0.316800
$\widehat{sdt}_{l,j,t+1}$	0.000004	-0.000002	0.000002	0.000410	0.340800	0.000005	-0.000002	0.000003	0.000515	0.309800
<i>GE</i> <sub><i>l,t</i></sub>	-0.000112	0.000056	-0.000056	-0.011619	0.373600	-0.000057	0.000027	-0.000030	-0.006070	0.431400
<i>FTA</i> <sub><i>l,t</i></sub>	-0.000685	0.000338	-0.000347	-0.069914	0.099400	-0.000582	0.000274	-0.000308	-0.059707	0.139000
<i>FTA_GE</i> <sub><i>l,t</i></sub>	-0.000192	0.000095	-0.000098	-0.019657	0.169800	-0.000220	0.000104	-0.000116	-0.022723	0.130600
$\psi$				-0.962870	0.000000				-0.885434	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: *j, t, l*.

Tables A34 and A35 report the coefficients and marginal effects for the models with regulatory quality (RQ) as institutional index and the alternative (theory-based) information spillover measure for domestic-sourcing and offshoring firms, respectively.

Table A34: Domestic-Sourcing Firms - Information Spillover Measure: *sdt*<sub>*a*</sub>.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(it_{i,j,t})$	0.000476	-0.000232	0.000245	0.194936	0.000000	0.000472	-0.000220	0.000252	0.189566	0.000000
$sdt_{l,j,t-1}$	-0.000006	0.000003	-0.000003	-0.002634	0.152400	-0.000006	0.000003	-0.000003	-0.002378	0.175200
$\widehat{sdt}_{l,j,t+1}$	0.000006	-0.000003	0.000003	0.002559	0.203600	0.000005	-0.000003	0.000003	0.002309	0.231600
$RQ_{l,t}$	0.000211	-0.000102	0.000109	0.084672	0.223600	0.000236	-0.000110	0.000126	0.091429	0.209200
$FTA_{l,t}$	0.000504	-0.000246	0.000258	0.221837	0.171200	0.000889	-0.000428	0.000461	0.397078	0.099000
$FTA\_RQ_{l,t}$	-0.000334	0.000162	-0.000172	-0.138234	0.039600	-0.000438	0.000208	-0.000230	-0.186919	0.027600
$\psi$				-0.935312	0.000000				-0.871557	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: *j*, *t*, *l*.

Table A35: Offshoring Firms - Information Spillover Measure: *sdt*<sub>*a*</sub>.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(it_{i,j,t})$	0.003661	-0.001811	0.001850	0.380641	0.000000	0.003568	-0.001697	0.001871	0.374570	0.000000
$sdt_{l,j,t-1}$	-0.000002	0.000001	-0.000001	-0.000211	0.388000	-0.000003	0.000002	-0.000002	-0.000350	0.319600
$\widehat{sdt}_{l,j,t+1}$	0.000003	-0.000002	0.000002	0.000362	0.358400	0.000005	-0.000002	0.000003	0.000526	0.309000
$RQ_{l,t}$	-0.000040	0.000019	-0.000021	-0.003291	0.460000	0.000022	-0.000012	0.000009	0.003070	0.469400
$FTA_{l,t}$	-0.000255	0.000126	-0.000129	-0.026678	0.307200	-0.000172	0.000081	-0.000091	-0.017975	0.372000
$FTA\_RQ_{l,t}$	-0.000360	0.000178	-0.000182	-0.037144	0.035400	-0.000379	0.000180	-0.000199	-0.039519	0.024800
$\psi$				-0.966972	0.000000				-0.893048	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: *j*, *t*, *l*.

Tables A36 and A37 report the coefficients and marginal effects for the models with rule of law (RL) as institutional index and the alternative (theory-based) information spillover measure for domestic-sourcing and offshoring firms, respectively.

Table A36: Domestic-Sourcing Firms - Information Spillover Measure: *sdt*<sub>*a*</sub>.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(it_{i,j,t})$	0.000464	-0.000224	0.000240	0.188874	0.000000	0.000461	-0.000215	0.000246	0.184259	0.000000
$sdt_{l,j,t-1}$	-0.000003	0.000002	-0.000002	-0.001259	0.319800	-0.000002	0.000001	-0.000001	-0.001008	0.354800
$\widehat{sdt}_{l,j,t+1}$	0.000002	-0.000001	0.000001	0.000838	0.419600	0.000001	-0.000001	0.000001	0.000577	0.454800
$RL_{l,t}$	-0.000489	0.000238	-0.000252	-0.202789	0.066600	-0.000346	0.000163	-0.000183	-0.143699	0.135000
$FTA_{l,t}$	0.000224	-0.000104	0.000120	0.103368	0.320000	0.000444	-0.000207	0.000237	0.205797	0.256800
$FTA\_RL_{l,t}$	-0.000223	0.000105	-0.000118	-0.091585	0.143200	-0.000281	0.000129	-0.000151	-0.119212	0.136000
$\psi$				-0.923861	0.000000				-0.874205	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: *j*, *t*, *l*.

Table A37: Offshoring Firms - Information Spillover Measure:  $sdt_a$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ia_{i,j,t})$	0.003655	-0.001805	0.001850	0.378049	0.000000	0.003560	-0.001688	0.001873	0.371640	0.000000
$sdt_{l,j,t-1}$	-0.000006	0.000003	-0.000003	-0.000623	0.198400	-0.000007	0.000003	-0.000004	-0.000697	0.179200
$\widehat{sdt_{l,j,t+1}}$	0.000008	-0.000004	0.000004	0.000883	0.179800	0.000009	-0.000004	0.000005	0.000961	0.163200
$RL_{l,t}$	-0.001476	0.000728	-0.000748	-0.152037	0.003400	-0.001403	0.000662	-0.000740	-0.145683	0.006000
$FTA_{l,t}$	-0.000762	0.000376	-0.000387	-0.078328	0.053800	-0.000675	0.000318	-0.000357	-0.069876	0.081000
$FTA\_RL_{l,t}$	-0.000181	0.000089	-0.000092	-0.018534	0.159400	-0.000204	0.000096	-0.000108	-0.021168	0.130800
$\psi$				-0.965254	0.000000				-0.887599	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

**Information spillover:  $\ln(minta)$ .** Tables A38 and A39 report the coefficients and marginal effects for the models with government efficiency (GE) as institutional index and the direct information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A38: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(minta)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ia_{i,j,t})$	0.000467	-0.000225	0.000242	0.188470	0.000000	0.000463	-0.000216	0.000247	0.183752	0.000000
$\ln(minta_{l,j,t-1})$	-0.000330	0.000159	-0.000171	-0.128464	0.007600	-0.000334	0.000155	-0.000179	-0.129617	0.006600
$\ln(\widehat{minta_{l,j,t+1}})$	0.000279	-0.000134	0.000145	0.106714	0.019000	0.000285	-0.000131	0.000153	0.109371	0.018800
$GE_{i,t}$	-0.000048	0.000021	-0.000027	-0.015486	0.409400	0.000069	-0.000036	0.000033	0.031565	0.409800
$FTA_{l,t}$	0.000480	-0.000227	0.000253	0.209693	0.212000	0.000746	-0.000348	0.000398	0.330129	0.159400
$FTA\_GE_{l,t}$	-0.000319	0.000151	-0.000168	-0.130384	0.099200	-0.000388	0.000179	-0.000209	-0.162282	0.089000
$\psi$				-0.922753	0.000000				-0.870471	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Table A39: Offshoring Firms - Information Spillover Measure:  $\ln(minta)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ia_{i,j,t})$	0.003689	-0.001822	0.001867	0.384727	0.000000	0.003584	-0.001699	0.001885	0.376702	0.000000
$\ln(minta_{l,j,t-1})$	-0.001054	0.000519	-0.000535	-0.108534	0.000000	-0.001043	0.000491	-0.000552	-0.108450	0.000000
$\ln(\widehat{minta_{l,j,t+1}})$	0.000642	-0.000316	0.000327	0.065728	0.000000	0.000631	-0.000296	0.000335	0.065279	0.000000
$GE_{i,t}$	-0.000071	0.000035	-0.000036	-0.007698	0.410600	-0.000005	0.000003	-0.000002	-0.000937	0.495600
$FTA_{l,t}$	-0.000689	0.000340	-0.000349	-0.071955	0.139600	-0.000564	0.000266	-0.000298	-0.059293	0.181000
$FTA\_GE_{l,t}$	-0.000148	0.000073	-0.000075	-0.015099	0.266600	-0.000185	0.000088	-0.000098	-0.019182	0.210800
$\psi$				-0.964790	0.000000				-0.887958	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Tables A40 and A41 report the coefficients and marginal effects for the models with regulatory quality (RQ) as institutional index and the direct information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A40: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(minta)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ia_{i,j,t})$	0.000478	-0.000233	0.000245	0.195628	0.000000	0.000473	-0.000221	0.000252	0.190212	0.000000
$\ln(minta_{i,j,t-1})$	-0.000324	0.000155	-0.000169	-0.117751	0.001400	-0.000336	0.000150	-0.000186	-0.123766	0.000600
$\ln(\widehat{minta}_{i,j,t+1})$	0.000267	-0.000127	0.000140	0.093365	0.027400	0.000283	-0.000124	0.000158	0.101412	0.012000
$RQ_{i,t}$	0.000170	-0.000082	0.000088	0.067128	0.269400	0.000200	-0.000093	0.000107	0.075973	0.251800
$FTA_{i,t}$	0.000495	-0.000242	0.000253	0.218124	0.175400	0.000882	-0.000425	0.000458	0.393692	0.099400
$FTA\_RQ_{i,t}$	-0.000336	0.000163	-0.000172	-0.139142	0.039800	-0.000439	0.000208	-0.000231	-0.187298	0.027600
$\psi$				-0.935726	0.000000				-0.871512	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Table A41: Offshoring Firms - Information Spillover Measure:  $\ln(minta)$ .

	$W^{mean}$					$W^{inst}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ia_{i,j,t})$	0.003701	-0.001828	0.001874	0.384454	0.000000	0.003599	-0.001699	0.001900	0.377834	0.000000
$\ln(minta_{i,j,t-1})$	-0.001039	0.000511	-0.000528	-0.106622	0.000000	-0.001018	0.000478	-0.000540	-0.105813	0.000000
$\ln(\widehat{minta}_{i,j,t+1})$	0.000632	-0.000310	0.000321	0.064449	0.000800	0.000610	-0.000286	0.000325	0.063154	0.001400
$RQ_{i,t}$	-0.000066	0.000033	-0.000033	-0.006728	0.409600	-0.000009	0.000004	-0.000004	-0.000895	0.478200
$FTA_{i,t}$	-0.000346	0.000170	-0.000176	-0.035995	0.272800	-0.000258	0.000121	-0.000137	-0.026906	0.329200
$FTA\_RQ_{i,t}$	-0.000270	0.000133	-0.000137	-0.027821	0.085400	-0.000290	0.000136	-0.000153	-0.030275	0.063800
$\psi$				-0.964731	0.000000				-0.881798	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Tables A42 and A43 report the coefficients and marginal effects for the models with rule of law (RL) as institutional index and the direct information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A42: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(minta)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ia_{i,j,t})$	0.000466	-0.000225	0.000241	0.188353	0.000000	0.000462	-0.000215	0.000247	0.183694	0.000000
$\ln(minta_{i,j,t-1})$	-0.000329	0.000158	-0.000171	-0.128133	0.008000	-0.000332	0.000154	-0.000178	-0.129057	0.006800
$\ln(\widehat{minta}_{i,j,t+1})$	0.000278	-0.000134	0.000145	0.106527	0.019200	0.000283	-0.000131	0.000153	0.108928	0.019000
$RL_{i,t}$	-0.000498	0.000242	-0.000256	-0.203720	0.064000	-0.000353	0.000165	-0.000188	-0.144962	0.128800
$FTA_{i,t}$	0.000226	-0.000105	0.000121	0.106290	0.318400	0.000451	-0.000210	0.000241	0.210911	0.255800
$FTA\_RL_{i,t}$	-0.000232	0.000110	-0.000123	-0.095556	0.137000	-0.000290	0.000134	-0.000156	-0.123394	0.132600
$\psi$				-0.922231	0.000000				-0.869628	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Table A43: Offshoring Firms - Information Spillover Measure:  $\ln(\widehat{minta})$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\widehat{ita}_{i,j,t})$	0.003657	-0.001802	0.001855	0.378623	0.000000	0.003550	-0.001667	0.001883	0.371231	0.000000
$\ln(\widehat{minta}_{i,j,t-1})$	-0.001057	0.000519	-0.000538	-0.108147	0.000000	-0.001031	0.000481	-0.000550	-0.106665	0.000000
$\ln(\widehat{minta}_{i,j,t+1})$	0.000651	-0.000319	0.000332	0.066302	0.001800	0.000625	-0.000291	0.000334	0.064372	0.003800
$RL_{i,t}$	-0.001502	0.000738	-0.000764	-0.153755	0.000800	-0.001447	0.000675	-0.000772	-0.149704	0.002800
$FTA_{i,t}$	-0.000655	0.000322	-0.000333	-0.067144	0.058000	-0.000572	0.000267	-0.000305	-0.059278	0.072200
$FTA\_RL_{i,t}$	-0.000178	0.000088	-0.000091	-0.018305	0.133600	-0.000201	0.000094	-0.000107	-0.020875	0.100400
$\psi$				-0.959856	0.000000				-0.871839	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

**Information spillover:**  $\ln(1 + \widehat{sdt})$ . Tables A44 and A45 report the coefficients and marginal effects for the models with government efficiency (GE) as institutional index and the alternative (theory-based) information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A44: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(1 + \widehat{sdt})$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\widehat{ita}_{i,j,t})$	0.000466	-0.000225	0.000241	0.189675	0.000000	0.000462	-0.000216	0.000246	0.184941	0.000000
$\ln(1 + \widehat{sdt}_{i,j,t-1})$	0.000031	-0.000017	0.000013	0.016259	0.463800	0.000071	-0.000035	0.000036	0.022458	0.431000
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	0.000062	-0.000026	0.000035	0.019807	0.447800	0.000018	-0.000006	0.000013	0.012735	0.471600
$GE_{i,t}$	-0.000051	0.000023	-0.000028	-0.017570	0.396200	0.000071	-0.000036	0.000035	0.032178	0.403600
$FTA_{i,t}$	0.000453	-0.000214	0.000239	0.197835	0.218400	0.000712	-0.000332	0.000380	0.315987	0.165600
$FTA\_GE_{i,t}$	-0.000314	0.000149	-0.000165	-0.128354	0.099600	-0.000382	0.000177	-0.000206	-0.159890	0.088000
$\psi$				-0.923251	0.000000				-0.873193	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Table A45: Offshoring Firms - Information Spillover Measure:  $\ln(1 + \widehat{sdt})$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\widehat{ita}_{i,j,t})$	0.003669	-0.001811	0.001858	0.379779	0.000000	0.003565	-0.001687	0.001878	0.372123	0.000000
$\ln(1 + \widehat{sdt}_{i,j,t-1})$	-0.000707	0.000347	-0.000360	-0.072253	0.112200	-0.000809	0.000380	-0.000429	-0.083544	0.088000
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	0.001356	-0.000667	0.000689	0.139008	0.037800	0.001465	-0.000689	0.000776	0.151702	0.023400
$GE_{i,t}$	-0.000072	0.000035	-0.000037	-0.006248	0.396600	-0.000012	0.000004	-0.000009	-0.000325	0.466200
$FTA_{i,t}$	-0.000671	0.000331	-0.000340	-0.069270	0.105000	-0.000547	0.000258	-0.000289	-0.056900	0.151600
$FTA\_GE_{i,t}$	-0.000180	0.000088	-0.000092	-0.018290	0.186800	-0.000214	0.000100	-0.000113	-0.022055	0.139200
$\psi$				-0.964535	0.000000				-0.885681	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Tables A46 and A47 report the coefficients and marginal effects for the models with regulatory quality (RQ) as institutional index and the alternative (theory-based) information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A46: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(1 + sdt_a)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000477	-0.000232	0.000245	0.195515	0.000000	0.000473	-0.000221	0.000252	0.189867	0.000000
$\ln(1 + sdt_{i,j,t-1})$	-0.000061	0.000029	-0.000031	-0.026882	0.416000	-0.000050	0.000026	-0.000025	-0.025069	0.407400
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	0.000163	-0.000079	0.000084	0.068713	0.309200	0.000156	-0.000075	0.000081	0.067331	0.305600
$RQ_{l,t}$	0.000217	-0.000105	0.000112	0.088388	0.212600	0.000246	-0.000115	0.000132	0.096637	0.193800
$FTA_{l,t}$	0.000530	-0.000260	0.000271	0.234615	0.167200	0.000913	-0.000440	0.000473	0.408382	0.101200
$FTA\_RQ_{l,t}$	-0.000355	0.000173	-0.000182	-0.147382	0.033800	-0.000458	0.000217	-0.000241	-0.195300	0.024400
$\psi$				-0.935533	0.000000				-0.870823	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Table A47: Offshoring Firms - Information Spillover Measure:  $\ln(1 + sdt_a)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003691	-0.001823	0.001868	0.384489	0.000000	0.003583	-0.001691	0.001892	0.377366	0.000000
$\ln(1 + sdt_{i,j,t-1})$	-0.000667	0.000329	-0.000338	-0.069152	0.095400	-0.000847	0.000399	-0.000448	-0.089236	0.042600
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	0.001312	-0.000647	0.000665	0.136069	0.005800	0.001513	-0.000713	0.000800	0.159236	0.003600
$RQ_{l,t}$	0.000039	-0.000019	0.000019	0.003785	0.438800	0.000115	-0.000054	0.000061	0.011829	0.367400
$FTA_{l,t}$	-0.000221	0.000110	-0.000112	-0.023536	0.311400	-0.000136	0.000065	-0.000071	-0.014833	0.383800
$FTA\_RQ_{l,t}$	-0.000361	0.000178	-0.000183	-0.037066	0.029000	-0.000382	0.000179	-0.000202	-0.039700	0.022400
$\psi$				-0.965756	0.000000				-0.881879	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Tables A48 and A49 report the coefficients and marginal effects for the models with rule of law (RL) as institutional index and the alternative (theory-based) information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A48: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(1 + sdt_a)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000466	-0.000225	0.000241	0.189524	0.000000	0.000462	-0.000215	0.000246	0.184897	0.000000
$\ln(1 + sdt_{i,j,t-1})$	0.000030	-0.000017	0.000013	0.015576	0.463800	0.000069	-0.000034	0.000035	0.021318	0.434200
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	0.000064	-0.000028	0.000037	0.021412	0.445800	0.000022	-0.000007	0.000015	0.014609	0.466800
$RL_{l,t}$	-0.000534	0.000259	-0.000274	-0.221729	0.052800	-0.000384	0.000181	-0.000203	-0.159601	0.106000
$FTA_{l,t}$	0.000213	-0.000099	0.000114	0.100506	0.328200	0.000432	-0.000201	0.000231	0.202247	0.263200
$FTA\_RL_{l,t}$	-0.000234	0.000110	-0.000124	-0.096112	0.134400	-0.000290	0.000134	-0.000156	-0.123333	0.128800
$\psi$				-0.922758	0.000000				-0.872304	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Table A49: Offshoring Firms - Information Spillover Measure:  $\ln(1 + sdt)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003650	-0.001801	0.001849	0.375885	0.000000	0.003539	-0.001671	0.001868	0.367313	0.000000
$\ln(1 + sdt_{i,j,t-1})$	-0.000627	0.000309	-0.000318	-0.064356	0.114800	-0.000705	0.000333	-0.000372	-0.073222	0.091000
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	0.001252	-0.000617	0.000635	0.128419	0.013800	0.001335	-0.000629	0.000706	0.138370	0.010000
$RL_{l,t}$	-0.001907	0.000939	-0.000967	-0.195396	0.000000	-0.001860	0.000875	-0.000985	-0.192133	0.000000
$FTA_{l,t}$	-0.000789	0.000388	-0.000400	-0.080605	0.031400	-0.000710	0.000334	-0.000377	-0.073136	0.048000
$FTA\_RL_{l,t}$	-0.000180	0.000089	-0.000091	-0.018422	0.131200	-0.000199	0.000094	-0.000105	-0.020551	0.101800
$\psi$				-0.961211	0.000000				-0.880260	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

## D.6.4 Models without country fixed effects

In this section, we report the results of the models where we control for the time-invariant country-level variables.

**Information spillover: *mint*.** Tables A50 and A51 report the coefficients and marginal effects for the models with government efficiency (GE) as institutional index and the direct information spillover measure for domestic-sourcing and offshoring firms, respectively.

Table A50: Domestic-Sourcing Firms - Information Spillover Measure: *mint*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000446	-0.000192	0.000254	0.164733	0.000000	0.000311	0.000012	0.000323	0.176790	0.000000
$mint_{l,j,t-1}$	-0.000028	0.000011	-0.000016	-0.009967	0.000000	-0.000041	-0.000005	-0.000045	-0.024200	0.000000
$\widehat{mint}_{l,j,t+1}$	0.000028	-0.000011	0.000016	0.009935	0.000000	0.000040	0.000005	0.000045	0.024101	0.000000
$GE_{l,t}$	0.000139	-0.000061	0.000079	0.052502	0.022000	0.000299	0.000068	0.000367	0.187778	0.014600
$FTA_{l,t}$	-0.000387	0.000157	-0.000230	-0.133730	0.112200	-0.000648	-0.000034	-0.000682	-0.394750	0.144000
$FTA\_GE_{l,t}$	0.000048	-0.000021	0.000027	0.014737	0.392000	0.000168	0.000021	0.000189	0.104544	0.240400
$\psi$				-0.750828	0.000000				0.021444	0.367400

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A51: Offshoring Firms - Information Spillover Measure: *mint*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003325	-0.001437	0.001888	0.342544	0.000000	0.003225	-0.001322	0.001903	0.333789	0.000000
$mint_{l,j,t-1}$	-0.000038	0.000016	-0.000022	-0.003868	0.000000	-0.000037	0.000015	-0.000022	-0.003818	0.000000
$\widehat{mint}_{l,j,t+1}$	0.000037	-0.000016	0.000021	0.003796	0.000000	0.000037	-0.000015	0.000022	0.003746	0.000000
$GE_{l,t}$	0.002299	-0.000992	0.001306	0.237266	0.000000	0.002226	-0.000912	0.001313	0.230709	0.000000
$FTA_{l,t}$	-0.000349	0.000151	-0.000198	-0.034882	0.172000	-0.000411	0.000168	-0.000242	-0.041509	0.135000
$FTA\_GE_{l,t}$	0.000430	-0.000186	0.000244	0.043870	0.002600	0.000430	-0.000176	0.000254	0.044137	0.002600
$\psi$				-0.754300	0.000000				-0.688100	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Tables A52 and A53 report the coefficients and marginal effects for the models with regulatory quality (RQ) as institutional index and the direct information spillover measure for domestic-sourcing and offshoring firms, respectively.

Table A52: Domestic-Sourcing Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000479	-0.000210	0.000269	0.176123	0.000000	0.000266	0.000071	0.000337	0.158658	0.000000
$minta_{l,j,t-1}$	-0.000028	0.000012	-0.000016	-0.010206	0.000000	-0.000042	-0.000012	-0.000054	-0.025094	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000028	-0.000012	0.000016	0.010171	0.000000	0.000042	0.000012	0.000054	0.025024	0.000000
$RQ_{l,t}$	0.000037	-0.000020	0.000017	0.017783	0.326600	0.000120	0.000042	0.000162	0.073800	0.139600
$FTA_{l,t}$	-0.000470	0.000205	-0.000265	-0.176872	0.139400	-0.000424	-0.000123	-0.000547	-0.267956	0.189200
$FTA\_RQ_{l,t}$	0.000067	-0.000028	0.000039	0.024559	0.378800	0.000064	0.000016	0.000080	0.040379	0.374200
$\psi$				-0.776966	0.000000				0.211726	0.052200

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A53: Offshoring Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003346	-0.001470	0.001876	0.344551	0.000000	0.003238	-0.001347	0.001891	0.335204	0.000000
$minta_{l,j,t-1}$	-0.000041	0.000018	-0.000023	-0.004210	0.000000	-0.000040	0.000017	-0.000024	-0.004139	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000041	-0.000018	0.000023	0.004137	0.000000	0.000040	-0.000017	0.000023	0.004065	0.000000
$RQ_{l,t}$	0.002321	-0.001018	0.001303	0.240051	0.000000	0.002263	-0.000941	0.001322	0.235004	0.000000
$FTA_{l,t}$	-0.000688	0.000303	-0.000385	-0.069424	0.063800	-0.000697	0.000290	-0.000407	-0.070879	0.058200
$FTA\_RQ_{l,t}$	0.000205	-0.000091	0.000114	0.020382	0.117200	0.000194	-0.000081	0.000113	0.019458	0.122600
$\psi$				-0.775883	0.000000				-0.705073	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Tables A54 and A55 report the coefficients and marginal effects for the models with rule of law (RL) as institutional index and the direct information spillover measure for domestic-sourcing and offshoring firms, respectively.

Table A54: Domestic-Sourcing Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000488	-0.000210	0.000278	0.183770	0.000000	0.000312	0.000037	0.000349	0.181697	0.000000
$minta_{l,j,t-1}$	-0.000028	0.000012	-0.000016	-0.010500	0.000000	-0.000038	-0.000007	-0.000046	-0.022983	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000028	-0.000012	0.000016	0.010460	0.000000	0.000038	0.000007	0.000045	0.022887	0.000000
$RL_{l,t}$	-0.000150	0.000066	-0.000084	-0.059228	0.121200	-0.000016	0.000006	-0.000010	-0.005045	0.542400
$FTA_{l,t}$	-0.000208	0.000082	-0.000126	-0.073146	0.244200	-0.000096	0.000021	-0.000075	-0.048954	0.442000
$FTA\_RL_{l,t}$	0.000001	-0.000000	0.000001	-0.000065	0.508400	0.000016	-0.000004	0.000012	0.009273	0.423200
$\psi$				-0.751509	0.000000				0.094930	0.278600

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .



Table A55: Offshoring Firms - Information Spillover Measure: *minta*.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003380	-0.001505	0.001875	0.348158	0.000000	0.003263	-0.001376	0.001887	0.337768	0.000000
$minta_{l,j,t-1}$	-0.000042	0.000019	-0.000023	-0.004316	0.000000	-0.000041	0.000017	-0.000024	-0.004230	0.000000
$\widehat{minta}_{l,j,t+1}$	0.000042	-0.000019	0.000023	0.004242	0.000000	0.000041	-0.000017	0.000023	0.004156	0.000000
$RL_{l,t}$	0.002316	-0.001030	0.001285	0.238610	0.000000	0.002291	-0.000966	0.001325	0.237126	0.000000
$FTA_{l,t}$	-0.000129	0.000057	-0.000071	-0.012359	0.374200	-0.000153	0.000064	-0.000089	-0.015193	0.338200
$FTA\_RL_{l,t}$	0.000431	-0.000192	0.000239	0.044103	0.000200	0.000413	-0.000174	0.000239	0.042466	0.000400
$\psi$				-0.793535	0.000000				-0.720816	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

**Information spillover: *sdt*.** Tables A56 and A57 report the coefficients and marginal effects for the models with government efficiency (GE) as institutional index and the alternative (theory-based) information spillover measure for domestic-sourcing and offshoring firms, respectively.

Table A56: Domestic-Sourcing Firms - Information Spillover Measure: *sdt*.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.000448	-0.000195	0.000253	0.165027	0.000000	0.000299	0.000026	0.000325	0.173876	0.000000
$sdt_{l,j,t-1}$	0.000001	-0.000000	0.000000	0.000243	0.428000	0.000003	0.000001	0.000004	0.002109	0.187000
$\widehat{sdt}_{l,j,t+1}$	0.000002	-0.000001	0.000001	0.000531	0.437200	-0.000001	-0.000001	-0.000002	-0.000772	0.383200
$GE_{l,t}$	0.000310	-0.000135	0.000175	0.115365	0.000000	0.000570	0.000156	0.000727	0.357955	0.000000
$FTA_{l,t}$	-0.000439	0.000182	-0.000257	-0.151244	0.083400	-0.000827	-0.000127	-0.000954	-0.533034	0.089800
$FTA\_GE_{l,t}$	0.000093	-0.000040	0.000053	0.031594	0.296000	0.000256	0.000054	0.000310	0.165737	0.135200
$\psi$				-0.768364	0.000000				0.061359	0.362400

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A57: Offshoring Firms - Information Spillover Measure: *sdt*.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ta_{i,j,t})$	0.003134	-0.001202	0.001932	0.321283	0.000000	0.003057	-0.001119	0.001939	0.314264	0.000000
$sdt_{l,j,t-1}$	0.000003	-0.000001	0.000002	0.000315	0.312000	0.000002	-0.000001	0.000001	0.000224	0.358000
$\widehat{sdt}_{l,j,t+1}$	0.000013	-0.000005	0.000008	0.001383	0.057400	0.000015	-0.000005	0.000009	0.001523	0.044000
$GE_{l,t}$	0.003434	-0.001316	0.002118	0.352298	0.000000	0.003370	-0.001232	0.002138	0.346562	0.000000
$FTA_{l,t}$	-0.000092	0.000036	-0.000057	-0.008803	0.409400	-0.000139	0.000051	-0.000088	-0.013622	0.365800
$FTA\_GE_{l,t}$	0.000447	-0.000172	0.000275	0.045517	0.002200	0.000449	-0.000164	0.000284	0.045763	0.002200
$\psi$				-0.617579	0.000000				-0.572366	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Tables A58 and A59 report the coefficients and marginal effects for the models with regulatory quality (RQ) as institutional index and the alternative (theory-based) information spillover measure for domestic-sourcing and offshoring firms, respectively.

Table A58: Domestic-Sourcing Firms - Information Spillover Measure: *sdt*<sub>*a*</sub>.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(it_{i,j,t})$	0.000480	-0.000209	0.000271	0.173907	0.000000	0.000256	0.000077	0.000333	0.150782	0.000000
$sdt_{l,j,t-1}$	-0.000003	0.000001	-0.000002	-0.000887	0.347000	-0.000001	-0.000000	-0.000001	-0.000549	0.453600
$\widehat{sdt}_{l,j,t+1}$	0.000006	-0.000003	0.000004	0.002100	0.215400	0.000004	0.000001	0.000005	0.002503	0.264600
$RQ_{l,t}$	0.000175	-0.000079	0.000096	0.066583	0.035600	0.000240	0.000080	0.000320	0.140317	0.005200
$FTA_{l,t}$	-0.000579	0.000250	-0.000329	-0.212964	0.093600	-0.000538	-0.000176	-0.000714	-0.328914	0.125000
$FTA\_RQ_{l,t}$	0.000103	-0.000043	0.000060	0.037116	0.304400	0.000087	0.000028	0.000115	0.052869	0.327200
$\psi$				-0.771221	0.000000				0.233805	0.002400

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: *j*, *t*.

Table A59: Offshoring Firms - Information Spillover Measure: *sdt*<sub>*a*</sub>.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(it_{i,j,t})$	0.003143	-0.001222	0.001922	0.322056	0.000000	0.003062	-0.001135	0.001928	0.314769	0.000000
$sdt_{l,j,t-1}$	0.000002	-0.000001	0.000001	0.000238	0.352200	0.000001	-0.000001	0.000001	0.000136	0.408800
$\widehat{sdt}_{l,j,t+1}$	0.000016	-0.000006	0.000010	0.001643	0.029000	0.000017	-0.000006	0.000011	0.001794	0.021800
$RQ_{l,t}$	0.003303	-0.001283	0.002021	0.338977	0.000000	0.003260	-0.001207	0.002053	0.335470	0.000000
$FTA_{l,t}$	-0.000423	0.000165	-0.000258	-0.042425	0.144800	-0.000424	0.000158	-0.000266	-0.042595	0.146000
$FTA\_RQ_{l,t}$	0.000056	-0.000022	0.000033	0.005142	0.397400	0.000048	-0.000018	0.000030	0.004410	0.413000
$\psi$				-0.631066	0.000000				-0.583894	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: *j*, *t*.

Tables A60 and A61 report the coefficients and marginal effects for the models with rule of law (RL) as institutional index and the alternative (theory-based) information spillover measure for domestic-sourcing and offshoring firms, respectively.

Table A60: Domestic-Sourcing Firms - Information Spillover Measure: *sdt*<sub>*a*</sub>.

	<i>W<sup>mean</sup></i>					<i>W<sup>dist</sup></i>				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(it_{i,j,t})$	0.000448	-0.000193	0.000255	0.165176	0.000000	0.000309	0.000017	0.000327	0.177731	0.000000
$sdt_{l,j,t-1}$	0.000001	-0.000000	0.000000	0.000289	0.417600	0.000003	0.000001	0.000004	0.001792	0.213000
$\widehat{sdt}_{l,j,t+1}$	0.000002	-0.000001	0.000001	0.000674	0.415200	-0.000000	-0.000001	-0.000001	-0.000228	0.453000
$RL_{l,t}$	0.000095	-0.000040	0.000055	0.035725	0.127800	0.000321	0.000085	0.000407	0.200257	0.014200
$FTA_{l,t}$	-0.000408	0.000166	-0.000241	-0.141652	0.068600	-0.000767	-0.000083	-0.000850	-0.479045	0.051200
$FTA\_RL_{l,t}$	0.000086	-0.000037	0.000049	0.028887	0.293200	0.000242	0.000040	0.000282	0.152479	0.087800
$\psi$				-0.753612	0.000000				0.033950	0.369800

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects: *j*, *t*.

Table A61: Offshoring Firms - Information Spillover Measure:  $sdt_a$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ia_{i,j,t})$	0.003159	-0.001246	0.001913	0.322056	0.000000	0.003087	-0.001167	0.001920	0.315892	0.000000
$sdt_{i,j,t-1}$	0.000001	-0.000000	0.000001	0.000080	0.433400	-0.000000	0.000000	-0.000000	-0.000013	0.507800
$\widehat{sdt_{i,j,t+1}}$	0.000017	-0.000007	0.000010	0.001765	0.017800	0.000018	-0.000007	0.000011	0.001897	0.013400
$RL_{i,t}$	0.003720	-0.001466	0.002254	0.379507	0.000000	0.003705	-0.001400	0.002306	0.379378	0.000000
$FTA_{i,t}$	0.000021	-0.000008	0.000012	0.002623	0.473400	0.000007	-0.000003	0.000004	0.001299	0.489800
$FTA\_RL_{i,t}$	0.000509	-0.000201	0.000308	0.051644	0.000000	0.000493	-0.000186	0.000307	0.050129	0.000000
$\psi$				-0.645872	0.000000				-0.602041	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

**Information spillover:  $\ln(minta)$ .** Tables A62 and A63 report the coefficients and marginal effects for the models with government efficiency (GE) as institutional index and the direct information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A62: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(minta)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ia_{i,j,t})$	0.000448	-0.000194	0.000254	0.166962	0.000000	0.000343	-0.000027	0.000316	0.191844	0.000000
$\ln(minta_{i,j,t-1})$	-0.001033	0.000432	-0.000601	-0.378417	0.000000	-0.000574	0.000134	-0.000440	-0.275963	0.198400
$\widehat{\ln(minta_{i,j,t+1})}$	0.000931	-0.000389	0.000542	0.340366	0.000000	0.000407	-0.000146	0.000261	0.173478	0.259800
$GE_{i,t}$	0.000083	-0.000036	0.000047	0.031947	0.130200	0.000203	0.000034	0.000237	0.130617	0.049000
$FTA_{i,t}$	-0.000180	0.000072	-0.000108	-0.057153	0.314800	-0.000482	0.000038	-0.000445	-0.286634	0.128400
$FTA\_GE_{i,t}$	-0.000039	0.000016	-0.000023	-0.017593	0.398600	0.000098	0.000004	0.000102	0.063426	0.264800
$\psi$				-0.763033	0.000000				-0.102903	0.359400

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A63: Offshoring Firms - Information Spillover Measure:  $\ln(minta)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ia_{i,j,t})$	0.003460	-0.001550	0.001910	0.360123	0.000000	0.003336	-0.001414	0.001922	0.348590	0.000000
$\ln(minta_{i,j,t-1})$	-0.002028	0.000911	-0.001117	-0.206653	0.000000	-0.002005	0.000848	-0.001156	-0.206087	0.000000
$\widehat{\ln(minta_{i,j,t+1})}$	0.001277	-0.000575	0.000702	0.128759	0.000000	0.001256	-0.000531	0.000725	0.128036	0.000000
$GE_{i,t}$	0.001896	-0.000849	0.001047	0.197798	0.000000	0.001829	-0.000775	0.001054	0.191433	0.000000
$FTA_{i,t}$	0.000391	-0.000176	0.000215	0.040817	0.180600	0.000337	-0.000143	0.000194	0.035268	0.207200
$FTA\_GE_{i,t}$	0.000107	-0.000048	0.000059	0.011154	0.231200	0.000107	-0.000045	0.000062	0.011211	0.233400
$\psi$				-0.802658	0.000000				-0.726924	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Tables A64 and A65 report the coefficients and marginal effects for the models with regulatory quality (RQ) as institutional index and the direct information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A64: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(\widehat{minta})$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\widehat{ita}_{i,j,t})$	0.000481	-0.000210	0.000271	0.177554	0.000000	0.000249	0.000088	0.000337	0.153456	0.000000
$\ln(\widehat{minta}_{i,j,t-1})$	-0.001059	0.000444	-0.000614	-0.377241	0.000000	-0.000441	-0.000152	-0.000593	-0.284073	0.006000
$\ln(\widehat{minta}_{i,j,t+1})$	0.000950	-0.000398	0.000551	0.337946	0.000000	0.000305	0.000100	0.000405	0.199972	0.125600
$RQ_{i,t}$	0.000012	-0.000009	0.000003	0.008816	0.417000	0.000136	0.000057	0.000193	0.083431	0.149600
$FTA_{i,t}$	-0.000221	0.000100	-0.000121	-0.089457	0.364200	-0.000250	-0.000118	-0.000367	-0.175747	0.347400
$FTA\_RQ_{i,t}$	-0.000027	0.000011	-0.000016	-0.009002	0.420800	-0.000011	0.000000	-0.000011	-0.002927	0.387400
$\psi$				-0.773451	0.000000				0.263161	0.003000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A65: Offshoring Firms - Information Spillover Measure:  $\ln(\widehat{minta})$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\widehat{ita}_{i,j,t})$	0.003487	-0.001570	0.001918	0.362735	0.000000	0.003330	-0.001420	0.001911	0.347425	0.000000
$\ln(\widehat{minta}_{i,j,t-1})$	-0.002079	0.000936	-0.001143	-0.212624	0.000000	-0.002036	0.000868	-0.001168	-0.208736	0.000000
$\ln(\widehat{minta}_{i,j,t+1})$	0.001308	-0.000590	0.000719	0.132668	0.000000	0.001276	-0.000544	0.000732	0.129673	0.000000
$RQ_{i,t}$	0.001993	-0.000896	0.001096	0.208027	0.000000	0.001942	-0.000828	0.001114	0.203375	0.000000
$FTA_{i,t}$	0.000022	-0.000009	0.000013	0.002553	0.498600	0.000033	-0.000015	0.000019	0.003908	0.478000
$FTA\_RQ_{i,t}$	-0.000077	0.000034	-0.000043	-0.008265	0.308600	-0.000086	0.000037	-0.000049	-0.009251	0.286600
$\psi$				-0.808805	0.000000				-0.734779	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Tables A66 and A67 report the coefficients and marginal effects for the models with rule of law (RL) as institutional index and the direct information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A66: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(\widehat{minta})$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\widehat{ita}_{i,j,t})$	0.000448	-0.000194	0.000254	0.167102	0.000000	0.000380	-0.000081	0.000299	0.200491	0.000000
$\ln(\widehat{minta}_{i,j,t-1})$	-0.001016	0.000425	-0.000591	-0.372302	0.000000	-0.000716	0.000168	-0.000548	-0.344627	0.000000
$\ln(\widehat{minta}_{i,j,t+1})$	0.000905	-0.000377	0.000527	0.330777	0.000000	0.000583	-0.000143	0.000440	0.270610	0.000000
$RL_{i,t}$	-0.000161	0.000071	-0.000090	-0.059153	0.028600	-0.000161	0.000038	-0.000123	-0.083299	0.037000
$FTA_{i,t}$	-0.000207	0.000083	-0.000124	-0.067956	0.230800	-0.000334	0.000080	-0.000254	-0.165487	0.117400
$FTA\_RL_{i,t}$	-0.000030	0.000012	-0.000018	-0.014039	0.414200	0.000055	-0.000011	0.000044	0.028965	0.342400
$\psi$				-0.762901	0.000000				-0.271974	0.074200

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A67: Offshoring Firms - Information Spillover Measure:  $\ln(\widehat{minta})$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\widehat{ta}_{i,j,t})$	0.003456	-0.001558	0.001897	0.357762	0.000000	0.003336	-0.001426	0.001910	0.347130	0.000000
$\ln(\widehat{minta}_{i,j,t-1})$	-0.002122	0.000955	-0.001166	-0.215748	0.000000	-0.002092	0.000893	-0.001199	-0.214126	0.000000
$\ln(\widehat{minta}_{i,j,t+1})$	0.001355	-0.000610	0.000745	0.136563	0.000000	0.001329	-0.000567	0.000762	0.134862	0.000000
$RL_{i,t}$	0.001992	-0.000898	0.001094	0.206202	0.000000	0.001950	-0.000833	0.001117	0.203307	0.000000
$FTA_{i,t}$	0.000376	-0.000170	0.000206	0.039485	0.130400	0.000284	-0.000122	0.000162	0.029847	0.199800
$FTA\_RL_{i,t}$	0.000152	-0.000069	0.000083	0.015646	0.124000	0.000146	-0.000062	0.000084	0.015131	0.141800
$\psi$				-0.811496	0.000000				-0.737867	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

**Information spillover:**  $\ln(1 + \widehat{sdt})$ . Tables A68 and A69 report the coefficients and marginal effects for the models with government efficiency (GE) as institutional index and the alternative (theory-based) information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A68: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(1 + \widehat{sdt})$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\widehat{ta}_{i,j,t})$	0.000445	-0.000187	0.000258	0.166019	0.000000	0.000298	0.000031	0.000329	0.173487	0.000000
$\ln(1 + \widehat{sdt}_{i,j,t-1})$	0.000534	-0.000227	0.000307	0.204322	0.049200	0.000993	0.000284	0.001276	0.631564	0.014400
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	-0.000349	0.000153	-0.000196	-0.136517	0.214400	-0.000790	-0.000259	-0.001048	-0.510216	0.084200
$GE_{i,t}$	0.000127	-0.000054	0.000072	0.047823	0.033800	0.000366	0.000129	0.000495	0.236940	0.020200
$FTA_{i,t}$	-0.000416	0.000164	-0.000252	-0.148000	0.104600	-0.000725	-0.000112	-0.000837	-0.460037	0.104800
$FTA\_GE_{i,t}$	0.000049	-0.000021	0.000028	0.015411	0.395400	0.000189	0.000045	0.000234	0.122538	0.199000
$\psi$				-0.720052	0.000000				0.072480	0.360400

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A69: Offshoring Firms - Information Spillover Measure:  $\ln(1 + \widehat{sdt})$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\widehat{ta}_{i,j,t})$	0.003347	-0.001414	0.001933	0.345277	0.000000	0.003246	-0.001303	0.001943	0.335809	0.000000
$\ln(1 + \widehat{sdt}_{i,j,t-1})$	-0.000303	0.000124	-0.000178	-0.033164	0.336800	-0.000423	0.000169	-0.000254	-0.045223	0.264400
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	0.001603	-0.000673	0.000930	0.166992	0.006800	0.001741	-0.000697	0.001044	0.181231	0.002200
$GE_{i,t}$	0.002425	-0.001023	0.001401	0.250573	0.000000	0.002357	-0.000946	0.001411	0.244112	0.000000
$FTA_{i,t}$	-0.000199	0.000085	-0.000115	-0.019801	0.322200	-0.000267	0.000107	-0.000161	-0.027075	0.256800
$FTA\_GE_{i,t}$	0.000321	-0.000136	0.000185	0.032949	0.020800	0.000325	-0.000130	0.000194	0.033436	0.019400
$\psi$				-0.725149	0.000000				-0.663933	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Tables A70 and A71 report the coefficients and marginal effects for the models with regulatory quality (RQ) as institutional index and the alternative (theory-based) information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A70: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(1 + sdt_a)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(it_{i,j,t})$	0.000478	-0.000204	0.000275	0.174471	0.000000	0.000246	0.000088	0.000334	0.148445	0.000000
$\ln(1 + sdt_{i,j,t-1})$	0.000366	-0.000159	0.000208	0.138866	0.127600	0.000647	0.000261	0.000907	0.388234	0.074200
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	-0.000149	0.000071	-0.000078	-0.062169	0.355600	-0.000483	-0.000204	-0.000687	-0.287885	0.185400
$RQ_{l,t}$	0.000018	-0.000012	0.000005	0.010162	0.367000	0.000116	0.000049	0.000165	0.068621	0.170800
$FTA_{l,t}$	-0.000504	0.000214	-0.000290	-0.187535	0.125600	-0.000452	-0.000174	-0.000626	-0.280091	0.132600
$FTA\_RQ_{l,t}$	0.000066	-0.000027	0.000039	0.024104	0.380600	0.000062	0.000023	0.000085	0.037104	0.395000
$\psi$				-0.738745	0.000000				0.265764	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A71: Offshoring Firms - Information Spillover Measure:  $\ln(1 + sdt_a)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(it_{i,j,t})$	0.003356	-0.001446	0.001910	0.346661	0.000000	0.003254	-0.001332	0.001922	0.337612	0.000000
$\ln(1 + sdt_{i,j,t-1})$	-0.000231	0.000098	-0.000133	-0.026188	0.321800	-0.000364	0.000148	-0.000215	-0.040056	0.255400
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	0.001569	-0.000675	0.000895	0.164013	0.018000	0.001719	-0.000703	0.001016	0.180380	0.013800
$RQ_{l,t}$	0.002448	-0.001053	0.001395	0.253910	0.000000	0.002396	-0.000980	0.001416	0.249411	0.000000
$FTA_{l,t}$	-0.000463	0.000200	-0.000263	-0.046539	0.124200	-0.000471	0.000193	-0.000278	-0.047656	0.124200
$FTA\_RQ_{l,t}$	0.000052	-0.000023	0.000029	0.004820	0.392600	0.000044	-0.000018	0.000026	0.004035	0.409800
$\psi$				-0.749901	0.000000				-0.685835	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Tables A72 and A73 report the coefficients and marginal effects for the models with rule of law (RL) as institutional index and the alternative (theory-based) information spillover measure in natural logarithm for domestic-sourcing and offshoring firms, respectively.

Table A72: Domestic-Sourcing Firms - Information Spillover Measure:  $\ln(1 + sdt_a)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(it_{i,j,t})$	0.000445	-0.000186	0.000259	0.166526	0.000000	0.000310	0.000020	0.000330	0.178834	0.000000
$\ln(1 + sdt_{i,j,t-1})$	0.000541	-0.000229	0.000312	0.207394	0.044800	0.000991	0.000244	0.001235	0.624280	0.013600
$\ln(1 + \widehat{sdt}_{i,j,t+1})$	-0.000332	0.000145	-0.000187	-0.129895	0.228800	-0.000759	-0.000223	-0.000981	-0.486412	0.087200
$RL_{l,t}$	-0.000196	0.000081	-0.000114	-0.072698	0.013200	-0.000052	0.000032	-0.000020	-0.025155	0.341600
$FTA_{l,t}$	-0.000411	0.000161	-0.000250	-0.147588	0.072000	-0.000671	-0.000060	-0.000731	-0.414355	0.062600
$FTA\_RL_{l,t}$	0.000045	-0.000019	0.000026	0.013832	0.410200	0.000175	0.000031	0.000206	0.111347	0.178000
$\psi$				-0.714651	0.000000				0.037942	0.368200

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A73: Offshoring Firms - Information Spillover Measure:  $\ln(1 + sdta)$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ita_{i,j,t})$	0.003382	-0.001474	0.001908	0.348697	0.000000	0.003270	-0.001353	0.001917	0.338517	0.000000
$\ln(1 + sdta_{i,j,t-1})$	0.000123	-0.000055	0.000067	0.009969	0.441800	-0.000050	0.000020	-0.000029	-0.007285	0.479000
$\ln(1 + \widehat{sdta}_{i,j,t+1})$	0.001165	-0.000506	0.000659	0.122446	0.066800	0.001355	-0.000560	0.000795	0.142154	0.035000
$RL_{l,t}$	0.002404	-0.001047	0.001358	0.248274	0.000000	0.002387	-0.000987	0.001399	0.247321	0.000000
$FTA_{l,t}$	0.000031	-0.000013	0.000018	0.004100	0.449400	0.000010	-0.000005	0.000006	0.001762	0.473200
$FTA_{RL_{l,t}}$	0.000319	-0.000139	0.000180	0.032779	0.007600	0.000304	-0.000126	0.000178	0.031284	0.010600
$\psi$				-0.764141	0.000000				-0.698057	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

## D.6.5 Offshoring firms: Approximation of control by current sourcing structure

**Models with country fixed effects.** Tables A74 to A76 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.<sup>125</sup> This variable is denoted as  $\ln(\overline{inc-pc}_{i,j,l',t-1})$  and it is given by:

$$\ln(\overline{inc-pc}_{i,j,l',t-1}) = \sum_{l=1}^S shr_{i,j,l,t-1} \overline{inc-pc}_l$$

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  $t - 1$ .<sup>126</sup>

We estimate the models only for the direct 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.

Table A74: Offshoring Firms - Information Spillover Measure:  $minta$ .

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(ita_{i,j,t})$	0.003624	-0.001790	0.001834	0.375092	0.000000	0.003517	-0.001648	0.001870	0.368613	0.000000
$minta_{i,j,t-1}$	-0.000012	0.000006	-0.000006	-0.001243	0.000000	-0.000012	0.000006	-0.000006	-0.001237	0.000000
$\widehat{minta}_{i,j,t+1}$	0.000012	-0.000006	0.000006	0.001206	0.000000	0.000012	-0.000005	0.000006	0.001200	0.000000
$GE_{l,t}$	-0.000013	0.000006	-0.000006	-0.001205	0.496000	0.000038	-0.000018	0.000020	0.004010	0.436800
$FTA_{l,t}$	-0.000776	0.000383	-0.000393	-0.080326	0.091000	-0.000661	0.000309	-0.000351	-0.069047	0.125800
$FTA_{l,t}^{GE}$	-0.000141	0.000069	-0.000072	-0.014273	0.258800	-0.000173	0.000080	-0.000092	-0.017833	0.208600
$\ln(\overline{inc-pc}_{i,j,l',t-1})$	0.000609	-0.000301	0.000309	0.062864	0.000000	0.000614	-0.000287	0.000327	0.064108	0.000000
$\psi$				-0.961164	0.000000				-0.866230	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

<sup>125</sup>Missing values, which are related to firms that offshored in previous years but not in  $t - 1$ , we assume that they have sourced domestically in that year and thus replace the missing value by the mean income per capita of Colombia.

<sup>126</sup>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.

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.<sup>127</sup> 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). We discuss this further below in the models without country fixed effects.

Table A75: Offshoring Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\overline{ta}_{i,j,t})$	0.003641	-0.001792	0.001849	0.377456	0.000000	0.003518	-0.001649	0.001869	0.368650	0.000000
$\widehat{minta}_{i,j,t-1}$	-0.000013	0.000006	-0.000007	-0.001332	0.000000	-0.000012	0.000006	-0.000006	-0.001232	0.000000
$\widehat{minta}_{i,j,t+1}$	0.000013	-0.000006	0.000006	0.001295	0.000000	0.000011	-0.000005	0.000006	0.001195	0.000000
$RQ_{l,t}$	0.000002	-0.000002	0.000001	0.000811	0.503200	0.000087	-0.000042	0.000045	0.009670	0.436600
$FTA_{l,t}$	-0.000390	0.000191	-0.000198	-0.038910	0.257600	-0.000247	0.000116	-0.000131	-0.025848	0.325600
$FTA_{l,t}^{RQ}$	-0.000290	0.000143	-0.000148	-0.030191	0.086600	-0.000343	0.000160	-0.000183	-0.035653	0.038000
$\ln(\overline{inc-pc}_{i,j,l',t-1})$	0.000628	-0.000309	0.000319	0.065181	0.000000	0.000614	-0.000287	0.000327	0.064079	0.000000
$\psi$				-0.956083	0.000000				-0.866780	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

Table A76: Offshoring Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\overline{ta}_{i,j,t})$	0.003611	-0.001781	0.001830	0.374961	0.000000	0.003515	-0.001645	0.001870	0.368407	0.000000
$\widehat{minta}_{i,j,t-1}$	-0.000012	0.000006	-0.000006	-0.001214	0.000000	-0.000012	0.000005	-0.000006	-0.001225	0.000000
$\widehat{minta}_{i,j,t+1}$	0.000011	-0.000006	0.000006	0.001177	0.000400	0.000011	-0.000005	0.000006	0.001187	0.000200
$RL_{l,t}$	-0.001460	0.000720	-0.000740	-0.151510	0.001600	-0.001432	0.000671	-0.000762	-0.150708	0.014200
$FTA_{l,t}$	-0.000763	0.000376	-0.000387	-0.078994	0.043000	-0.000707	0.000331	-0.000376	-0.073971	0.067600
$FTA_{l,t}^{RL}$	-0.000168	0.000082	-0.000085	-0.017092	0.174400	-0.000182	0.000085	-0.000098	-0.018822	0.147600
$\ln(\overline{inc-pc}_{i,j,l',t-1})$	0.000626	-0.000309	0.000317	0.064936	0.000000	0.000612	-0.000286	0.000326	0.063940	0.000000
$\psi$				-0.963340	0.000000				-0.864786	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t, l$ .

**Models without country fixed effects.** Tables A77 to A79 report the respective results for models without country fixed effects. Instead, we include the country-level variables defined in the model. The results remain robust relative to the main specifications where we omit controlling for the current sourcing structure.

In relation to the effect of  $\ln(\overline{inc-pc}_{i,j,l',t-1})$ , the results are theory-consistent as above. Moreover, the tables also show that a reduction in the marginal cost of a non-explored country  $l$ —identified by  $\ln(\overline{inc-pc}_l)$ —increases the probability of exploring offshoring in that location in  $t$  (direct effect). That is, both effects together are consistent with the prediction that firms have a stronger incentive to relocate intermediate-input suppliers to new locations

<sup>127</sup>One difference is a stronger (theory-consistent) effect of productivity in some specifications.



when there are higher expected marginal cost gains from relocation.

Table A77: Offshoring Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\overline{ta}_{i,j,t})$	0.003316	-0.001421	0.001896	0.343765	0.000000	0.003207	-0.001300	0.001907	0.334056	0.000000
$\widehat{minta}_{i,j,t-1}$	-0.000038	0.000016	-0.000021	-0.003859	0.000000	-0.000037	0.000015	-0.000022	-0.003802	0.000000
$\widehat{minta}_{i,j,t+1}$	0.000037	-0.000016	0.000021	0.003787	0.000000	0.000036	-0.000015	0.000021	0.003730	0.000000
$GE_{i,t}$	0.002309	-0.000988	0.001321	0.239745	0.000000	0.002240	-0.000908	0.001332	0.233551	0.000000
$FTA_{i,t}$	-0.000375	0.000162	-0.000213	-0.037674	0.178000	-0.000426	0.000173	-0.000253	-0.043408	0.145800
$FTA_{i,t}^{GE}$	0.000443	-0.000190	0.000253	0.045591	0.007200	0.000438	-0.000178	0.000261	0.045461	0.009200
$\ln(\overline{inc.pc}_{i,j,t-1})$	0.000661	-0.000283	0.000378	0.068755	0.000000	0.000657	-0.000266	0.000390	0.068533	0.000000
$\ln(\overline{inc.pc}_l)$	-0.001389	0.000593	-0.000796	-0.144835	0.000000	-0.001432	0.000580	-0.000852	-0.149896	0.000000
$\psi$				-0.743956	0.000000				-0.675900	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A78: Offshoring Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\overline{ta}_{i,j,t})$	0.003337	-0.001452	0.001884	0.345723	0.000000	0.003220	-0.001324	0.001896	0.335527	0.000000
$\widehat{minta}_{i,j,t-1}$	-0.000041	0.000018	-0.000023	-0.004206	0.000000	-0.000040	0.000016	-0.000024	-0.004127	0.000000
$\widehat{minta}_{i,j,t+1}$	0.000040	-0.000018	0.000023	0.004132	0.000000	0.000039	-0.000016	0.000023	0.004053	0.000000
$RQ_{i,t}$	0.002333	-0.001014	0.001319	0.242499	0.000000	0.002279	-0.000937	0.001343	0.238016	0.000000
$FTA_{i,t}$	-0.000710	0.000310	-0.000399	-0.071931	0.079000	-0.000707	0.000291	-0.000416	-0.072390	0.077000
$FTA_{i,t}^{RQ}$	0.000213	-0.000093	0.000120	0.021493	0.123600	0.000196	-0.000081	0.000116	0.020065	0.134000
$\ln(\overline{inc.pc}_{i,j,t-1})$	0.000663	-0.000288	0.000375	0.068897	0.000000	0.000658	-0.000271	0.000388	0.068751	0.000000
$\ln(\overline{inc.pc}_l)$	-0.001254	0.000544	-0.000710	-0.130959	0.000000	-0.001299	0.000534	-0.000766	-0.136199	0.000000
$\psi$				-0.764807	0.000000				-0.692076	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

Table A79: Offshoring Firms - Information Spillover Measure: *minta*.

	$W^{mean}$					$W^{dist}$				
	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value	Direct Eff.	Indirect Eff.	Total Eff.	Coef.	p-value
$\ln(\overline{ta}_{i,j,t})$	0.003338	-0.001458	0.001881	0.344633	0.000000	0.003229	-0.001337	0.001892	0.335281	0.000000
$\widehat{minta}_{i,j,t-1}$	-0.000041	0.000018	-0.000023	-0.004171	0.000000	-0.000040	0.000016	-0.000023	-0.004088	0.000000
$\widehat{minta}_{i,j,t+1}$	0.000040	-0.000018	0.000023	0.004096	0.000000	0.000039	-0.000016	0.000023	0.004013	0.000000
$RL_{i,t}$	0.002315	-0.001010	0.001305	0.239024	0.000000	0.002289	-0.000947	0.001342	0.237661	0.000000
$FTA_{i,t}$	-0.000218	0.000096	-0.000122	-0.021475	0.266600	-0.000240	0.000099	-0.000141	-0.024132	0.242200
$FTA_{i,t}^{RL}$	0.000452	-0.000198	0.000255	0.046491	0.002200	0.000431	-0.000178	0.000253	0.044620	0.004400
$\ln(\overline{inc.pc}_{i,j,t-1})$	0.000665	-0.000290	0.000375	0.068812	0.000000	0.000661	-0.000274	0.000387	0.068812	0.000000
$\ln(\overline{inc.pc}_l)$	-0.000850	0.000370	-0.000480	-0.088309	0.000000	-0.000914	0.000378	-0.000536	-0.095385	0.000000
$\psi$				-0.768440	0.000000				-0.699394	0.000000

Marginal Effects and Coefficient are reported. Sample: Sectors with at least 100 firms. Fixed Effects:  $j, t$ .

## 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  $\theta$ , it is given by:

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

Under uncertainty, this expression for a firm with productivity  $\theta$  currently sourcing in the East in period  $t$  is given by:

$$\begin{aligned} \mathbb{E}_t[\pi^{S,prem}(\theta) | f^S \leq f_t^S] - \pi_t^{E,prem}(\theta) &= \frac{r^N(\theta, Q_t)}{\sigma} (w^N)^{(1-\eta)(\sigma-1)} \\ &\times \left[ \frac{(w^E)^{(1-\eta)(\sigma-1)} - (w^S)^{(1-\eta)(\sigma-1)}}{(w^E w^S)^{(1-\eta)(\sigma-1)}} \right] \\ &- w^N [\mathbb{E}_t(f^S | f^S \leq f_t^S) - f^E]. \end{aligned}$$

### E.2 Case A: Equilibria with symmetric initial beliefs

We assume that both countries are fully symmetric in terms of beliefs.<sup>128</sup> 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. In particular, 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 that takes place 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 the sector to a steady state where the welfare gains from offshoring are fully achieved, 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 following condition:

$$\underline{f} + (1 - \lambda)s^r \geq f^E \geq \underline{f}.$$

<sup>128</sup>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  $Y(\cdot)$ .

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 receive offshoring flows. 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:

$$\theta_t^S \searrow \theta_\infty^S = \theta^{S,*} \text{ and } \theta_t^E \searrow \theta_\infty^E < \infty \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*.$$

### 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 that take place when prior beliefs about eastern institutions are ‘optimistic’. First, we define the condition for ‘optimistic beliefs’ and then we show that the sector converges in the long run to an efficient allocation of suppliers across foreign countries. However, the sector achieves that steady state through different paths depending on the priors and differences in institutional fundamentals.

**Optimistic beliefs.** We consider now the situation where the prior beliefs are relatively *optimistic* such that the institutional fundamentals in the East are revealed in a finite time. This represents the situation characterised by Case II of Proposition 2. 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, and thus different steady states. 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  $\theta_{\hat{t}}^E$  as the productivity level of the marginal firms that remain offshoring in East in  $\hat{t}$ . For  $t > \hat{t}$ , the new offshoring exploration flow concentrates 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:

$$\theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*.$$

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. Nevertheless, as mentioned, different types of relocation processes may take place as the share of offshoring firms in the South increases. We analyse and define the conditions under which these relocation dynamics take place.

**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 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.

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Considering the relocation decision of the least productive firms offshoring from the East, the steady state is (temporarily)<sup>130</sup> characterised by the following expression:

$$\theta_{t>\hat{t}}^E \nearrow \theta_\infty^E < \infty \text{ and } \theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*,$$

where some firms remain offshoring in the East (i.e.  $\theta_\infty^E < \infty$ ). However, as we show below, this is not the only relocation that can potentially take place.

Offshoring productivity cutoff in the East for any  $t > \hat{t}$ . For any period  $t > \hat{t}$ , the model shows that  $P_t < P_{\hat{t}}$  and  $Q_t > Q_{\hat{t}}$ , and therefore the offshoring productivity cutoff from the East in any period  $t > \hat{t}$  is given by:

$$\theta_t^E = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q_t \left[ \frac{w^N [f^E - f^N]}{\psi^E - \psi^N} \right]^{\frac{1}{\sigma-1}} > \theta_{\hat{t}}^E.$$

As new firms keep exploring their offshoring potential in 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 the offshoring productivity cutoff in the South  $\theta_\infty^S$ . The latter determines  $P_\infty$  and  $Q_\infty$ , and thus defines the steady-state level of  $\theta_\infty^E$ .<sup>131</sup> Therefore, the offshoring productivity cutoff in the East in the steady state of the industry is given by:<sup>132</sup>

$$\theta_\infty^E = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q_\infty \left[ \frac{w^N [f^E - f^N]}{\psi^E - \psi^N} \right]^{\frac{1}{\sigma-1}}.$$

**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 may take place (from the East to the South). The firms offshoring from the East with productivity  $\theta > \theta_\infty^E$  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 suppliers. However, they may consider relocating to the South when the following condition holds:

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

<sup>129</sup>We derive the offshoring productivity cutoff in the East for any  $t > \hat{t}$  below.

<sup>130</sup>This characterisation considers only the relocation of the least productive firms in the East. Therefore, it may not represent the true steady state of the industry. Below we incorporate another type of relocation that may arise in the industry, as well as the long-run effect of the death shock.

<sup>131</sup>In this regard, the sector's offshoring productivity cutoff  $\theta_\infty^S$  is defined as in section 2.2.3 with the corresponding price index and aggregate consumption steady-state levels  $P_\infty \equiv P(\theta_\infty^S)$  and  $Q_\infty \equiv Q(\theta_\infty^S)$ .

<sup>132</sup>This characterisation considers only the relocation of the least productive firms in the East. Therefore, it may not represent the true steady state of the industry. Below we incorporate another type of relocation that may arise in the industry, as well as the long-run effect of the death shock.

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 in the South, considering that the relocation of the supply chain involves the payment of the market research sunk cost  $s^r$  to discover the offshoring potential in the new location. Solving this equation leads to the following condition:

$$f^E - \mathbb{E}_t [f^S | f^S \leq f_t^S] \geq (1 - \lambda)s^r. \quad (\text{A88})$$

Hence, whenever the expected institutional quality in the South is good enough compared to eastern institutional fundamentals, the remaining firms sourcing from the East will change their suppliers' location to the South.<sup>133</sup>

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  $\theta > \theta_\infty^E$  do not relocate to the South in any period  $t$ . The steady state, without considering the exogenous death shock effect, is given by:

$$\theta_t^E \rightarrow \theta_\infty^E < \infty \text{ and } \theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*.$$

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 in the long run. Therefore, the perfect information steady state is achieved in the long run:

$$\theta_t^E \rightarrow \infty \text{ and } \theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*.$$

**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  $\theta > \theta_\infty^E$  relocate to the South. The relocation period  $t < \infty$  is defined by the following condition:  $f^E - \mathbb{E}_t [f^S | f^S \leq f_t^S] = (1 - \lambda)s^r$ .

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 realised. The main difference to the *Case A-II* is that here the optimal specialisation is achieved in a finite time, whereas in the other case it is realised in the long run (death-shock effect):

$$\theta_t^E \rightarrow \infty \text{ and } \theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*.$$

### 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

<sup>133</sup>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.

initial coordinated movement in favour of offshoring exploration in one of the countries.

To analyse the strength of the path dependence process, 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 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:

$$f^S = \underline{f}^E = \underline{f} \text{ and } \bar{f}^S = \bar{f}^E - \delta; \text{ with } \delta > 0 \Rightarrow E_{t=0}(f^S | f^S \leq \bar{f}^S) < E_{t=0}(f^E | f^E \leq \bar{f}^E).$$

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.<sup>134</sup>

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. This leads the sector 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. To conclude, the welfare gains from offshoring are fully realised in the long run:<sup>135</sup>

$$\theta_t^E \rightarrow \infty \forall t \text{ and } \theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*,$$

with  $\theta_t^E \rightarrow \infty \forall t$  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 emerge concerning the southern country, while no new information about eastern institutions is revealed. Therefore, the

<sup>134</sup>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.

<sup>135</sup>There is a special case when  $\delta$  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  $\mathcal{D}_t^E(\theta_{t=1}^S; \bar{\theta}^E, \bar{\theta}^E) > 0$ . 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 steady state of the sector is defined by the perfect information steady state.

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  $\theta$  is given by:

$$\mathcal{V}_t(\theta; \cdot) = \max \left\{ V_t^{o,S}(\theta; \cdot); V_t^{w,1,S}(\theta; \cdot) \right\},$$

and the respective trade-off function is:

$$\mathcal{D}_t^S(\theta; \theta_t^S, \tilde{\theta}_{t+1}^S) = \max \left\{ 0; \mathbb{E}_t \left[ \pi_t^{S,prem}(\theta) \middle| f^S \leq f_t^S \right] \right\} - w^N s^r \left[ 1 - \lambda \frac{Y(f_{t+1}^S)}{Y(f_t^S)} \right]. \quad (\text{A89})$$

### 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.,  $\delta < 0$ ):

$$\underline{f}^S = \underline{f}^E = \underline{f} \text{ and } \bar{f}^S = \bar{f}^E - \delta; \text{ with } \delta < 0 \Rightarrow E_{t=0}(f^S | f^S \leq \bar{f}^S) > E_{t=0}(f^E | f^E \leq \bar{f}^E).$$

The coordination to the non-efficient equilibrium may be stable or unstable depending on the institutional fundamentals in the East, the size of  $\delta$  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.** The differences in the distance between the priors and fundamentals of eastern institutions push the sector to different transition paths and steady states. Using the definitions of ‘*pessimistic*’ and ‘*optimistic*’ beliefs from above, we show below the two possible paths.

Pessimistic beliefs. As mentioned above, this represents the situation in which the institutional fundamentals are not revealed in a 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,  $\theta_\infty^E > \theta^{S,*}$ , leads the sector to a steady state with a higher price index  $P_\infty$  and lower aggregate consumption index  $Q_\infty$ :

$$\theta_t^S \rightarrow \infty \forall t \text{ and } \theta_t^E \searrow \theta_\infty^E > \theta^{S,*} \Rightarrow P_t \searrow P_\infty > P^* \Rightarrow Q_t \nearrow Q_\infty < Q^*.$$

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,<sup>136</sup> and the potential welfare gains from offshoring are not fully achieved 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.<sup>137</sup> At any period  $t \leq \hat{t}$ , the strategy of exploring the offshoring

<sup>136</sup>That is, the South remains producing only the homogeneous good while all offshored production of intermediate inputs has been located in the East.

<sup>137</sup>When  $f^E - \underline{f}^E \leq (1 - \lambda)s^r$ , then  $\hat{t} \rightarrow \infty$ .

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:

$$\begin{aligned} f^S &\sim Y(f^S) \text{ with } f^S \in [\underline{f}^S, \bar{f}^S], \\ f^E &= f^E(\theta_t^E), \end{aligned}$$

with  $\theta_t^E$  denoting the least productive firms offshoring in East in period  $\hat{t}$ .

Consider that  $|\delta|$  is large enough such that the following condition holds:  $\mathcal{D}_t^S(\theta_t^E; \bar{\theta}^S, \bar{\theta}^S) < 0$ .<sup>138</sup> 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.<sup>139</sup> Therefore, no exploration of the South takes place. The sector ends up in a steady state where the specialisation of countries is suboptimal and the welfare gains from offshoring are not fully realised.

$$\theta_t^S \rightarrow \infty \forall t \text{ and } \theta_t^E \searrow \theta_\infty^E > \theta^{S,*} \Rightarrow P_t \searrow P_\infty > P^* \Rightarrow Q_t \nearrow Q_\infty < Q^*,$$

with  $\theta_t^S \rightarrow \infty \forall t$  referring to the fact that no firm offshores in the South in any period  $t$ .

*Additional considerations to Case C-I: Stable non-efficient equilibrium path.* We consider first the case of 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:

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

The decision at any period  $t < \hat{t}$  of a non-offshoring firm  $\theta$  is given by:

$$\mathcal{V}_t(\theta; \cdot) = \max \left\{ V_t^{o,E}(\theta; \cdot); V_t^{w,1,E}(\theta; \cdot) \right\},$$

and the respective trade-off function is represented by:

$$\mathcal{D}_t^E(\theta; \theta_t^E, \tilde{\theta}_{t+1}^E) = \max \left\{ 0; \mathbb{E}_t \left[ \pi_t^{E,prem}(\theta) | f^E \leq f_t^E \right] \right\} - w^N s^r \left[ 1 - \lambda \frac{Y(f_{t+1}^E)}{Y(f_t^E)} \right]. \quad (\text{A90})$$

For 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  $\delta$  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

<sup>138</sup>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.

<sup>139</sup>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.



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  $f^E > f^E(\tilde{\theta}_{t=1}^E) \equiv \tilde{f}_{t=1}^E$ , where  $\tilde{\theta}_{t=1}^E$  indicates the least productive firms that have explored the offshoring potential in the East in period  $t = 0$ , and  $\theta_{t=1}^E$  refers to the least productive firms that remained sourcing from the East.

Those firms with productivity  $\theta \in [\tilde{\theta}_{t=1}^E, \theta_{t=1}^E)$ , who have explored their offshoring potential in the East in period  $t = 0$  discovered that it is not profitable for them to source from this country. In consequence, if  $|\delta|$  is small enough such that firms  $\theta \in [\tilde{\theta}_{t=1}^E, \theta_{t=1}^E)$  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:  $\mathcal{D}_{t=1}(\theta_{t=1}^E; \bar{\theta}^S, \bar{\theta}^S) > 0$ . Intuitively, 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*.

*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  $\theta > \theta_{t=1}^E$  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:

$$\theta_\infty^E = \theta_{t=1}^E < \infty \text{ and } \theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*.$$

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:

$$\theta_t^E \nearrow \infty \text{ and } \theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*.$$

*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  $\theta > \theta_{t=1}^E$  will relocate to the South in period  $t < \infty$  defined by the following condition:

$$f^E - \mathbb{E}_t[f^S | f^S \leq f_t^S] = (1 - \lambda)s^r.$$

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:

$$\theta_t^E \nearrow \infty \text{ and } \theta_t^S \searrow \theta^{S,*} \Rightarrow P_t \searrow P^* \Rightarrow Q_t \nearrow Q^*.$$

*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:

$$f^E = f_{t=1}^E,$$

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

and firm's decision at any period  $t \geq 1$  is characterised by the trade-off function in equation (A89) in Appendix E.3.1.

## F Initial conditions: Alternative specifications

### F.1 North-South Model

We assume that before the institutional reform in the South has been implemented, the offshoring productivity cutoff  $\theta_{t<0}^S < \bar{\theta}$ . 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:

$$P(\theta_{t<0}^S) > P^* \quad ; \quad Q(\theta_{t<0}^S) < Q^* \quad ; \quad \underline{\theta}(\theta_{t<0}^S) < \underline{\theta}^*, \quad (8 \text{ redefined})$$

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  $\theta_{t<0}^S$ . Comparing these conditions with the *n.t.i.* scenario:

$$P(\theta_{t<0}^S) < P^{n.t.i.} \quad ; \quad Q(\theta_{t<0}^S) > Q^{n.t.i.} \quad ; \quad \underline{\theta}(\theta_{t<0}^S) > \underline{\theta}^{n.t.i.}. \quad (A91)$$

At  $t = 0$ , the institutional reform in the South takes place and new priors emerge similar to the case defined in section 2.2.3. The main difference from the case in section 2.2.3 is that if the institutional reform implies an improvement in the fundamentals—that is,  $f_{t<0}^S > f^S$ , where  $f_{t<0}^S$  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  $\theta_{t<0}^S$ . Formally,

$$f^S \sim Y(f^S) \quad \text{with} \quad f^S \in [\underline{f}^S, \bar{f}^S] \quad \text{and} \quad \bar{f}^S \leq f^S(\theta_{t<0}^S) \quad (9 \text{ redefined})$$

#### F.1.1 Considerations on sequential institutional reforms

In the previous case, we assumed for simplicity that the initial conditions represent a steady-state situation. However,  $\theta_{t<0}^S$  can alternatively represent the offshoring productivity of a sequential offshoring path from a previous reform, which was in a converging trajectory to  $f_{t<0}^S$ .

In this case, the new institutional reform announced in  $t = 0$  represents a new exogenous information shock that leads to a change in the beliefs about the South in  $t = 0$ . Therefore, the previous offshoring sequence is redefined according to the new priors, with prior beliefs after the new reform given by equation (9 redefined), and the sector converges to the new institutional fundamentals  $f^S$  according to the conditions defined in Proposition 2.

## F.2 Multi-Country Model

In this section, we define the general conditions and features of a set of alternative initial conditions and the resulting equilibrium paths and equilibria. However, we do not aim to do a complete taxonomy of cases. We consider first the case of simultaneous institutional reforms with different initial—i.e., pre-reform—offshoring conditions in the East and South. We follow with the analysis of an institutional reform in the South (East) with initial conditions given by firms offshoring from the East (South). We conclude with the analysis of a sequence of institutional reforms, where in  $t = 0$  the South (East) implements a reform and in a later period  $\hat{t} > 0$  the East (South) responds with another institutional reform.

### F.2.1 Simultaneous institutional reform in the South and East

**Initial conditions: offshoring in South.** In the first case, the initial conditions are defined by offshoring productivity cutoffs  $\theta_{t<0}^S < \bar{\theta}$  and  $\theta_{t<0}^E \rightarrow \infty$ . That is, previous to the simultaneous reform in the East and South, firms with productivity  $\theta \geq \theta_{t<0}^S$  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 F.1,  $f^S(\theta_{t<0}^S)$  denotes the upper bound of the new prior distribution related to the South.<sup>140</sup> Therefore, when  $\bar{f}^E > f^S(\theta_{t<0}^S)$  the sector follows an equilibrium path of asymmetric beliefs with coordination to the efficient equilibrium, when  $\bar{f}^E < f^S(\theta_{t<0}^S)$  the sector is placed in the asymmetric beliefs situation with coordination to the inefficient equilibrium, whereas when  $\bar{f}^E = f^S(\theta_{t<0}^S)$  the equilibrium path of the sector is characterised by the symmetric beliefs situation.

**Initial conditions: offshoring in East.** The second case corresponds to initial conditions with offshoring productivity cutoffs  $\theta_{t<0}^S \rightarrow \infty$  and  $\theta_{t<0}^E < \bar{\theta}$ . That is, previous to the simultaneous reform in the East and South, firms with productivity  $\theta \geq \theta_{t<0}^E$  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

<sup>140</sup>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.

or asymmetric situation.  $f^E(\theta_{t<0}^E)$  denotes the upper bound of the new prior distribution related to the East.<sup>141</sup> Therefore, the cases  $\bar{f}^S > f^E(\theta_{t<0}^E)$ ,  $\bar{f}^S < f^E(\theta_{t<0}^E)$  or  $\bar{f}^S = f^E(\theta_{t<0}^E)$  define—in a similar way as in the previous case—the equilibrium paths and equilibria follow by the sector in the long run.

We can easily 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 (i.e., first South second East or vice versa). 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.

## G Extension: multiple countries with heterogeneous wages and institutional fundamentals

We assume that the East and the South not only differ in institutional fundamentals but also in their respective wages.

**Assumption A. 7.** *Institutions are better in the South but the wages are higher than in the East, i.e.:*

$$w^E < w^S < w^N \text{ and } f^N < f^S + (1 - \lambda)s^r < f^E + (1 - \lambda)s^r.$$

Therefore, as before, profits are given by:

$$\pi^l(\theta, \cdot) = \theta^{\sigma-1}(\gamma E)^\sigma Q^{1-\sigma} \psi^l - w^N f^l, \quad (\text{A92})$$

with  $l = \{N, S, E\}$ , and  $\psi^l$  is defined as:

$$\psi^l \equiv \frac{\alpha^{\sigma-1}}{\sigma [(w^N)^\eta (w^l)^{1-\eta}]^{\sigma-1}}.$$

Considering Assumption A.7,  $\psi^N < \psi^S < \psi^E$ , the perfect information equilibrium is represented by Figure A23.

In equilibrium, the most productive firms supply the intermediate input from the country with the worst institutional fundamentals (higher fixed costs) exploiting the advantages that come from the lower marginal costs. However, the firms with intermediate productivity cannot overcome the higher fixed costs with the marginal costs advantages of the East, choosing instead to source from the South. Still, the least productive firms in the market source domestically.

**Productivity cutoffs.** The market productivity cutoff is still defined as above. The productivity cutoff for firms offshoring from the South,  $\theta^{S,*}$ , is defined by the following condition:

$$\begin{aligned} \pi^N(\theta^{S,*}) &= \pi^S(\theta^{S,*}) - w^N(1 - \lambda)s^r, \\ \theta^{S,*} &= (\gamma E)^{\frac{\sigma}{1-\sigma}} Q \left[ \frac{w^N[f^S + (1 - \lambda)s^r - f^N]}{\psi^S - \psi^N} \right]^{\frac{1}{\sigma-1}}. \end{aligned} \quad (\text{A93})$$

<sup>141</sup>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.

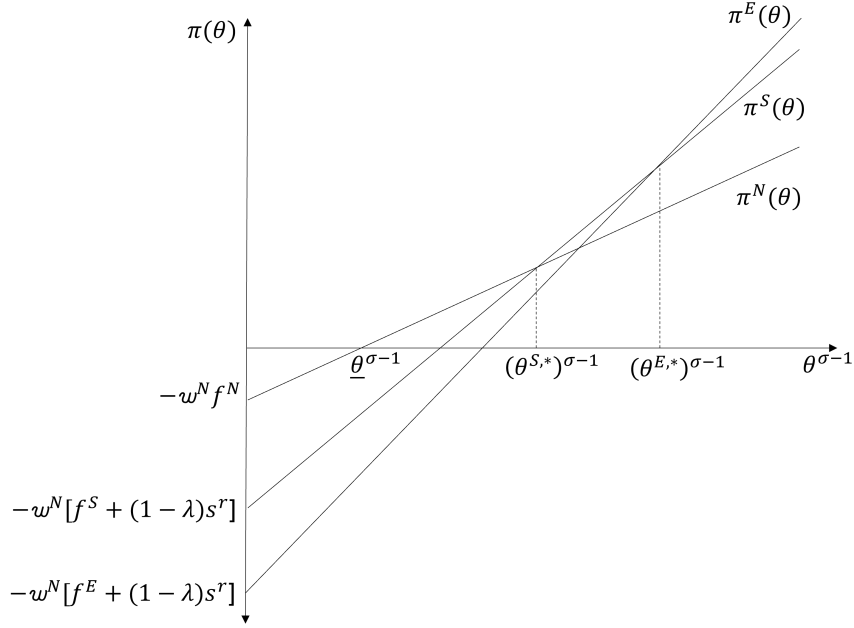


Figure A23: Perfect-information equilibrium

However, when the marginal cost advantages are too large relative to the institutional disadvantages, no firm will offshore from the South. Formally, define  $\hat{\theta}^E$  as:

$$\pi^N(\hat{\theta}^E) = \pi^S(\hat{\theta}^E) - w^N(1-\lambda)s^r,$$

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

Therefore, firm offshore from the South, i.e.  $\theta^{S,*} < \infty$ , iff:

$$\theta^{S,*} < \hat{\theta}^E \Rightarrow \frac{\theta^{S,*}}{\hat{\theta}^E} < 1 \Rightarrow \left[ \frac{\psi^E - \psi^N}{\psi^S - \psi^N} \right]^{\frac{1}{\sigma-1}} \left[ \frac{f^S + (1-\lambda)s^r - f^N}{f^E + (1-\lambda)s^r - f^N} \right]^{\frac{1}{\sigma-1}} < 1,$$

where given Assumption A.7 and A.5:

$$\left[ \frac{\psi^E - \psi^N}{\psi^S - \psi^N} \right]^{\frac{1}{\sigma-1}} > 1 \quad \text{and} \quad \left[ \frac{f^S + (1-\lambda)s^r - f^N}{f^E + (1-\lambda)s^r - f^N} \right]^{\frac{1}{\sigma-1}} < 1.$$

Finally, assuming that  $\theta^{S,*} < \hat{\theta}^E$ , the offshoring productivity cutoff for firms offshoring from the East is defined by:

$$\pi^S(\theta^{E,*}) = \pi^E(\theta^{E,*}),$$

$$\theta^{E,*} = (\gamma E)^{\frac{\sigma}{1-\sigma}} Q \left[ \frac{w^N(f^E - f^S)}{\psi^E - \psi^S} \right]^{\frac{1}{\sigma-1}}. \quad (\text{A94})$$

**Model with uncertainty and learning.** The model dynamic model with uncertainty in the per-period fixed costs leads to a new taxonomy of cases with multiple dynamic paths and equilibria. In some cases, it is possible to show that the information spillovers lead the sector to the perfect information steady state, whereas in some other cases the sector ends up in a suboptimal steady state, with the respective implications in terms of specialisation of countries and welfare. We leave to the reader the characterisation of the taxonomy of cases with the respective equilibrium paths and equilibria.

## H Social Planner Analysis

We assume that the Social Planner (SP) characterised in this appendix has perfect knowledge of the prior beliefs of the northern firms and about the offshoring conditions 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 North-South model in section H.1, and we extend it to the multi-country setup in section H.2.

### H.1 Social Planner: North-South model

We analyse an SP's policy that leads to the perfect information steady state in  $t = 0$ . 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  $t = 0$ .

#### H.1.1 SP's Policy A

We analyse a simple SP's policy where 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 tax on per-period offshoring fixed costs. 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.<sup>142</sup> Therefore, the SP's optimal tax-subsidy policy  $T(f^S)$ , illustrated in Figure A24, is given by:

$$T(f^S) = f^{S,SP} - f^S \begin{cases} > 0 & \text{if } f^S < f^{S,SP}, \\ = 0 & \text{if } f^S = f^{S,SP}, \\ < 0 & \text{if } f^S > f^{S,SP}. \end{cases} \quad (\text{A95})$$

This SP regime 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  $f^{S,SP} = f^S$ , the prior uncertainty collapses around the true  $f^S$  and the sector converges immediately to the perfect information steady state.<sup>143</sup> Moreover, it is easy to see that, ex-post, the SP does neither pay subsidies nor collect taxes at any period  $t$ .<sup>144</sup> Lemma 2 summarises the results of SP's policy A.

<sup>142</sup>It is straightforward to see that the maximum tax that 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  $T^{\min} = f^{S,SP} - \bar{f}^S$ .

<sup>143</sup>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  $T^{\max} = 0$ .

<sup>144</sup>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

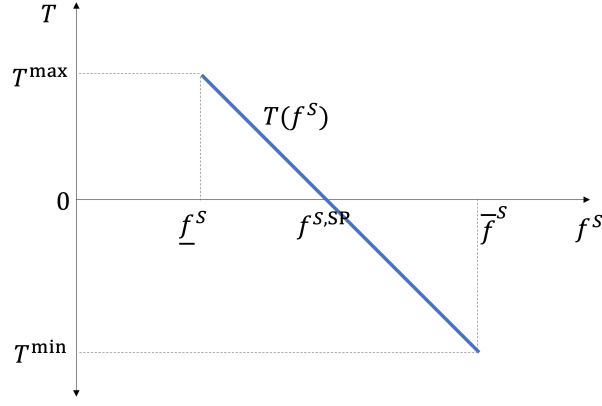


Figure A24: SP's Tax-Subsidy Policy

**Lemma 2 (Convergence under SP's Policy A).** *The SP's tax-subsidy regime  $T(f^S)$  defined in equation (A95) places the sector at the perfect information steady state from period  $t = 0$  onwards.*

**Proof.** Follows from the text above. □

### H.1.2 SP's Policy B

We characterise an alternative SP's policy regime, which 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—denoted as  $T$ —on per-period offshoring fixed costs.

In this regime, the SP announces a per-period tax regime defined as tax  $T(f^S)$  given by:

$$T(f^S) = \begin{cases} \underline{f}^{S,SP} - f^S > 0 & \text{if } f^S < \underline{f}^{S,SP}, \\ 0 & \text{if } f^S \geq \underline{f}^{S,SP}, \end{cases} \quad (\text{A96})$$

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.<sup>145</sup> The new prior distribution of offshoring fixed costs beliefs under the SP regime is denoted as  $Y^{SP}(f^S)$ , with  $f^S \in [\underline{f}^{S,SP}, \bar{f}^S]$ . Figure A25 illustrates SP's tax policy.

Under the tax regime described above, 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, the contingent subsidy policy consists of an SP's commitment to compensate the potential losses that these firms may face after exploring

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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  $f^S$ .

<sup>145</sup>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  $t = 0$ .

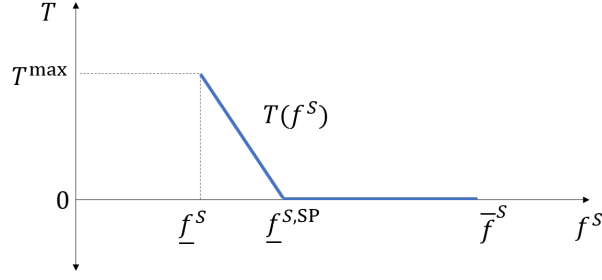


Figure A25: SP's contingent tax policy.

their offshoring potential in  $t = 0$ .

The trade-off function at  $t = 0$  under SP regime is given by:

$$\mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{\text{SP}}) = \max \left\{ 0; \mathbb{E}_{t=0} \left[ \pi_t^{S, \text{prem}}(\theta) \mid f^S \leq \bar{f}^S, T \right] \right\} - w^N s^r \left[ 1 - \lambda \frac{Y^{\text{SP}}(f_{t=1}^S)}{Y^{\text{SP}}(\bar{f}^S)} \right], \quad (\text{A97})$$

with  $\mathcal{I}_{i,j,t=0}^{\text{SP}} \equiv \{\bar{\theta}, \bar{\theta}_{t=1}^{\text{SP}}\}$ , and  $\bar{\theta}_{t=1}^{\text{SP}}$  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  $\bar{\theta}_{t=1}^{\text{SP}} = \theta^{S,*}$ .<sup>146</sup>

The SP must shift upwards the trade-off function for all firms with productivity  $\theta \geq \theta^{S,*}$  such that  $\mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{\text{SP}}) \geq 0$  for all firms with productivity  $\theta \geq \theta^{S,*}$ . From equation (A97), we observe that the first term on the right-hand side has a minimum at zero.<sup>147</sup> Therefore, the SP's policy must only compensate the expected losses from the second term on the right-hand side (that is, from the exploration sunk costs). The optimal firm-specific SP's contingentsubsidy policy at  $t = 0$ —denoted as  $X(\theta)$ —for all firms with productivity  $\theta \geq \theta^{S,*}$  is given by:<sup>148</sup>

$$X(\theta) \begin{cases} = 0 & \text{if } A, \text{ for } \theta \geq \theta_A, \\ = X^{\max} \equiv w^N s^r \left[ 1 - \lambda \frac{Y^{\text{SP}}(f_{t=1}^{S, \text{SP}})}{Y^{\text{SP}}(\bar{f}^S)} \right] & \text{if } \neg A \wedge B, \text{ for } \theta \in [\theta^{S,*}, \theta_B], \\ 0 < X(\theta) < X^{\max} & \text{if } \neg A \wedge C, \text{ for } \theta \in (\theta_B, \theta_A), \end{cases} \quad (\text{A98})$$

where  $\theta^{S,*} < \theta_B < \theta_A < \bar{\theta}$ , and  $f_{t=1}^{S, \text{SP}} \equiv f^S(\theta^{S,*})$ ,

$$A \equiv \mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{\text{SP}}) \geq 0, \quad \text{with } \theta_A : \mathcal{D}_{t=0}(\theta_A; \mathcal{I}_{i,j,t=0}^{\text{SP}}) = 0, \quad (\text{A99a})$$

$$B \equiv \mathbb{E}_{t=0} \left[ \pi_t^{S, \text{prem}}(\theta) \mid f^S \leq \bar{f}^S, T \right] \leq 0, \quad \text{with } \theta_B : \mathbb{E}_{t=0} \left[ \pi_t^{S, \text{prem}}(\theta_B) \mid f^S \leq \bar{f}^S, T \right] = 0, \quad (\text{A99b})$$

$$C \equiv \mathbb{E}_{t=0} \left[ \pi_t^{S, \text{prem}}(\theta) \mid f^S \leq \bar{f}^S, T \right] > 0. \quad (\text{A99c})$$

For proofs on contingent subsidy policy, see Appendix H.3.1.

<sup>146</sup>Starting from the trade-off function (13) and Lemma 1, we know that without SP intervention, the offshoring exploration productivity cutoff in  $t = 0$  is given by  $\mathcal{D}_t(\bar{\theta}_{t+1}; \theta_t, \bar{\theta}_{t+1}) = 0$ . *Ceteris paribus*, the SP contingent subsidy increases the expected gains from waiting, as  $\bar{\theta}_{t=1}^{\text{SP}} < \bar{\theta}_{t=1}$ , where the latter reflects the expected state without SP intervention.

<sup>147</sup>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.

<sup>148</sup>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 H.3.2.



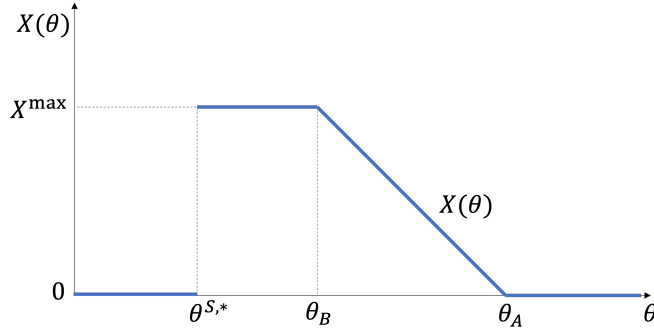


Figure A26: SP's contingent subsidy policy by productivity.

Intuitively, equation (A98) together with the conditions defined in equation (A99) characterise the optimal contingent subsidy policy illustrated in Figure A26. 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.<sup>149</sup> 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  $\theta$ .<sup>150</sup>

Summing up, the trade-off function under the SP regime at  $t = 0$  for firms with  $\theta \geq \theta^{S,*}$  is:

$$\mathcal{D}_{t=0}(\theta; \mathcal{T}_{i,j,t=0}^{\text{SP}}) \geq 0 \quad \text{for } \theta \geq \theta_A, \quad (\text{A100a})$$

$$\mathcal{D}_{t=0}(\theta; \mathcal{T}_{i,j,t=0}^{\text{SP}}) + X(\theta) = 0 \quad \text{for } \theta \in [\theta^{S,*}, \theta_A), \quad (\text{A100b})$$

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  $t > 0$ , that is, we focus on the exploration decisions of firms with productivity  $\theta < \theta^{S,*}$  that remained under domestic sourcing at  $t = 0$ . 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 firm exploring offshoring in  $t = 0$ , denoted as  $\theta_{t=1}^S = \theta^{S,*}$ —provides information to the domestic-sourcing firms about the maximum affordable fixed cost for that firm ( $f_{t=1}^S = f(\theta^{S,*})$ ), as defined by equation (10). Thus, from

<sup>149</sup>Recall that when the expected offshoring profit premium is negative, the first term of the right-hand side of the trade-off function (A97) 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.

<sup>150</sup>As shown in Figure A26, 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.

the learning mechanism characterised in section 2.2.3, we know that it defines the upper bound of the posterior distribution in  $t = 1$ . However, from equations (6), (7) and (10), it is easy to see that:<sup>151</sup>

$$f^S(\theta^{S,*}) = f_{t=1}^S = (1 - \lambda)s^r + f^S > f^S. \quad (\text{A101})$$

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  $t > 0$ .<sup>152</sup> 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 North-South model.<sup>153</sup>

**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 (A96) and (A98), 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.<sup>154</sup> On the other hand, after exploration, all offshoring firms discover that the true fixed cost  $f^S = \underline{f}^{S,SP}$ . Therefore, the SP charges a zero per-period tax (i.e.,  $T = 0$ ) to the offshoring firms.

## H.2 Social Planner: Multi-Country model

We analyse the SP's policies described in section H.1 in the context of the multi-country model. In particular, we define the main features of the SP policies that lead to the perfect information steady state in  $t = 0$ . 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. For simplicity, we define SP's policy regimes that hold under any of these cases of initial prior beliefs as defined in section 4.1.2, i.e. with symmetric and asymmetric initial prior beliefs.

<sup>151</sup> Equation (10) 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.

<sup>152</sup> 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  $f^S \geq \underline{f}^{S,SP}$ .

<sup>153</sup> In Appendix H.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  $t = 1$ .

<sup>154</sup> 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.

### H.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  $f^{S,SP}$ , which is implemented by a tax-subsidy policy—denoted here by  $T^S(f^S)$ —similar to the underlying policy in Lemma 2 given in equation A95. 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.,  $f^{S,SP} = f^S$ —, collapsing the prior uncertainty related to the South around the true value  $f^S$ .

In addition, the SP defines a minimum per-period fixed cost of offshoring in the East—denoted as  $\underline{f}^{E,SP}$ —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  $\underline{f}^{E,SP} = f^E$ . The SP's tax policy to the East is given by:<sup>155</sup>

$$T^E(f^E) = \begin{cases} \underline{f}^{E,SP} - f^E > 0 & \text{if } f^E < \underline{f}^{E,SP}, \\ 0 & \text{if } f^E \geq \underline{f}^{E,SP}. \end{cases} \quad (\text{A102})$$

With these policies, 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  $t$ , we have that  $\theta^E \rightarrow \infty$ . Hence, the East remains specialised in the production of the homogenous good, whereas all offshored production of intermediate inputs is located in the South.

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 (A95) and (A102), respectively—achieve the perfect information steady-state in the sector from period  $t = 0$  onwards.*

**Proof.** Follows from the text above. □

### H.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 H.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 (A96), whereas the SP's contingent subsidy policy—here defined as  $X^S(\theta)$ —is given by equation (A98).

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<sup>155</sup>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.

Lemma 5 summarises the results of SP's policy B under the multi-country model.

**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. □

### H.3 Additional Considerations on SP's analysis

#### H.3.1 Derivation of SP's contingent subsidy policy in the North-South model.

We start from the trade-off function under the SP regime given by equation (A97). The offshoring exploration productivity cutoff at  $t = 0$ , as before, is characterised by the fixed point of the trade-off function defined by firm  $\theta_A$ , 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 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  $\theta \in [\theta^{S,*}, \theta_A)$ ,  $\mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{\text{SP}}) < 0$ . 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,  $\mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{\text{SP}}) = 0$ . We divide the characterisation of the subsidy policy in two groups, starting with firms with productivity  $\theta \in [\theta^{S,*}, \theta_B]$  for which  $\mathbb{E}_{t=0} \left[ \pi_t^{S, \text{prem}}(\theta) \mid f^S \leq \bar{f}^S, T \right] \leq 0$ . The productivity  $\theta_B$  is defined by firms with  $\mathbb{E}_{t=0} \left[ \pi_t^{S, \text{prem}}(\theta_B) \mid f^S \leq \bar{f}^S, T \right] = 0$ .

We define the condition  $B$  as  $B \equiv \mathbb{E}_{t=0} \left[ \pi_t^{S, \text{prem}}(\theta) \mid f^S \leq \bar{f}^S, T \right] \leq 0$ . This implies that the first term on the right-hand side of equation (A97) equals zero. Thus, for these firms, we have:

$$\mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{\text{SP}}) = -w^N s^r \left[ 1 - \lambda \frac{Y^{\text{SP}}(f_{t=1}^S)}{Y^{\text{SP}}(\bar{f}^S)} \right] < 0.$$

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:

$$\begin{aligned} X(\theta) + \mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{\text{SP}}) &= 0, \\ X(\theta) - w^N s^r \left[ 1 - \lambda \frac{Y^{\text{SP}}(f_{t=1}^S)}{Y^{\text{SP}}(\bar{f}^S)} \right] &= 0, \\ X^{\max} \equiv X(\theta) &= w^N s^r \left[ 1 - \lambda \frac{Y^{\text{SP}}(f_{t=1}^S)}{Y^{\text{SP}}(\bar{f}^S)} \right], \end{aligned}$$

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.,  $\mathbb{E}_{t=0} [\pi_t^{S, prem}(\theta) | f^S \leq \bar{f}^S, T] > 0$ —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  $\mathbb{E}_{t=0} [\pi_t^{S, prem}(\theta) | f^S \leq \bar{f}^S, T] > 0$ , but the trade-off function at  $t = 0$  is  $\mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{SP}) < 0$ . Thus, the optimal policy subsidy  $X(\theta)$  is:

$$\begin{aligned} X(\theta) + \mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{SP}) &= 0, \\ X(\theta) &= -\mathcal{D}_{t=0}(\theta; \mathcal{I}_{i,j,t=0}^{SP}), \\ X(\theta) &= w^N s^r \left[ 1 - \lambda \frac{Y^{SP}(f_{t=1}^S)}{Y^{SP}(\bar{f}^S)} \right] - \mathbb{E}_{t=0} [\pi_t^{S, prem}(\theta) | f^S \leq \bar{f}^S, T]. \end{aligned}$$

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  $\theta$  as well. Therefore, the subsidy policy is a function of firms' productivities.

### H.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. As we discuss below, 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 H.1.2. Thus, the lower bound of the prior distribution under the SP regime is given by  $\underline{f}^{S, SP} = f^S$ . 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:

$$\begin{aligned} X + \mathcal{D}_{t=0}(\theta^{S,*}; \mathcal{I}_{i,j,t=0}^{SP}) &= 0, \\ X &= -\mathcal{D}_{t=0}(\theta^{S,*}; \mathcal{I}_{i,j,t=0}^{SP}), \\ X &= w^N s^r \left[ 1 - \lambda \frac{Y^{SP}(f_{t=1}^S)}{Y^{SP}(\bar{f}^S)} \right] - \mathbb{E}_{t=0} [\pi_t^{S, prem}(\theta^{S,*}) | f^S \leq \bar{f}^S, T]. \end{aligned}$$

If  $\mathbb{E}_{t=0} [\pi_t^{S, prem}(\theta^{S,*}) | f^S \leq \bar{f}^S, T] < 0$ , 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  $\theta_A$  is given by  $\mathcal{D}_{t=0}(\theta_A; \mathcal{I}_{i,j,t=0}^{SP}) = 0$ . 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.