Centre for Economic Performance

Discussion Paper
ISSN 2042-2695

No.1775
June 2021

Service offshoring and export experience

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THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE
30 YEARS CEP
Economic and Social Research Council

Abstract
Service inputs are a key component of the costs of exporting, and contribute to explain the process of internationalization of firms. A new dataset on the participation of French firms in global value chains reveals that firms with longer export experience in a market are more likely to source service inputs from there. We rationalize this fact in a model where firms are initially uncertain about how successful they are as exporters, but learn their export profitability as they keep selling abroad. Because offshoring requires larger sunk costs than domestic sourcing, some firms decide to offshore only when they become sufficiently confident about their export prospects, i.e., once they acquire enough export experience. More export experience in a foreign destination also induces firms to offshore within the boundaries of the firm rather than at arm's length. The model further implies that firms are more likely to offshore when frictions in the provision of services between the domestic and the foreign market are greater. In turn, offshoring firms sell greater volumes, display less volatility, and are less likely to exit foreign markets. Exploiting our novel dataset, we provide strong empirical support for each of these predictions.

Key words: export dynamics, commercial presence, global sourcing, services, firm boundaries
JEL codes: F12; F14; F23; L22; L23; L84

This paper was produced as part of the Centre's Trade Programme. The Centre for Economic Performance is financed by the Economic and Social Research Council.

We thank Sébastien Miroudot, Yuhei Miyauchi, and Maurizio Zanardi for valuable comments and suggestions; as well as seminar and conference participants at ESSEC Business School, the 2021 CESifo Area Conference on Global Economy, and the 2020 Empirical Investigations in International Trade conference. Access to French confidential data was made possible thanks to the secure environment provided by the Centre d'accès sécurise´ aux données (CASD). Berlingieri acknowledges support by the ESSEC Research Centre.

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Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London WC2A 2AE

1 Introduction

How do service inputs enter global value chains? Despite accounting for more than four fifths of GDP in most advanced countries, services still represent only one fifth of cross-border trade (WTO, 2019). This share increases when computed in terms of value added rather than gross trade flows, as services enter the production of manufacturing goods as upstream inputs (Johnson and Noguera, 2017; Miroudot and Cadestin, 2017). In many ways, however, this figure still falls short of accounting for services' real contribution, since service inputs can also be provided in the destination market with local commercial presence or through workers' movement, rather than via a cross-border flow (Andrenelli et al., 2018). For example, the survey reveals that 37% of French exporters offshored services in 2011, and 29% did so through commercial presence abroad.

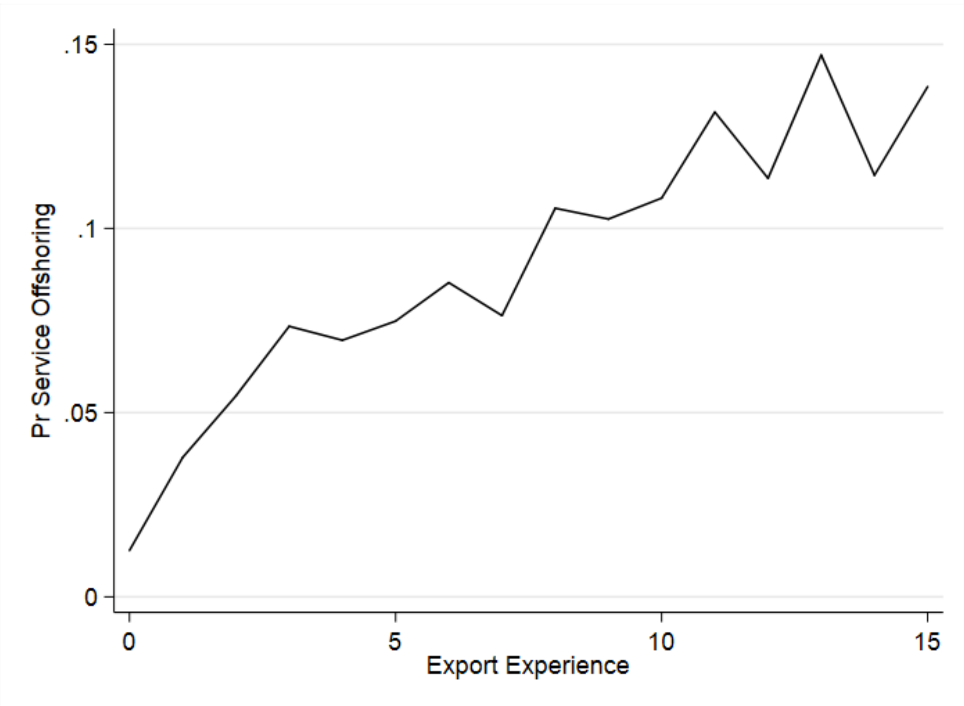
Our paper contributes to the understanding of this phenomenon by investigating how firms decide to source service inputs across borders, and how this activity is related to the firms' exporting strategies. It does so by exploiting a unique, detailed firm-level dataset from France, which includes a new survey of firm participation in global value chain activities (Enquête sur les Chaînes d'Activité Mondiales - CAM). We can thus observe the different modes of service sourcing, including through a commercial presence abroad either inside or outside the boundaries of the firm.

Our analysis identifies one clear channel through which goods exporting enters a firm's decision to source service inputs abroad: the firm's experience in the export market. When firms enter a new export destination, they face substantial uncertainty about their probability to succeed there, while having to incur large costs to set up distribution channels, learn the institutional and regulatory environment, translate their products' labels in the foreign language, advertise their products, and monitor regulatory standards (Das et al., 2007). All of these are service activities. In this paper, we argue that firms with longer export experience have better knowledge of their profitability in a foreign market, and are therefore more likely to offshore to that country the service inputs that are complementary to exporting. Service offshoring helps firms to avoid adjustment frictions related to the use of domestically provided services to serve the export market.

Figure 1 motivates our hypothesis. It plots the average probability with which a French firm in our sample sources service inputs from a foreign market, as a function of the firm's years of export experience in that destination. The probability of offshoring is clearly increasing in the firm's experience in exporting to the foreign destination. The unconditional probability that a firm offshores some of its inputs to a given destination market in the first year of exporting to that market is as low as 1 percent, but it increases sharply to 7 percent in the following two years of exporting to the same destination. It keeps growing for longer export experience, but at a slower pace, exceeding 10 percent by the eighth year of export experience.

To investigate the relationship between export experience and offshoring, we develop a theoretical framework where firms tentatively enter new markets and commit greater resources only once uncertainty about the profitability of the destination market is resolved, in the spirit of Albornoz et al. (2012) and Conconi et al. (2016). When entering a foreign market, a firm has an expectation about its profits as an exporter to that market. Over time, the firm accumulates experience in the market and eventually learns its actual profitability there. With that information, the firm may alter its mode of sourcing export-related services. If the market proves to be highly profitable, a firm that initially sourced services domestically (which requires adjustment costs to be adapted to the foreign destination) switches to offshoring directly in the destination country (which requires a higher sunk cost but has lower marginal cost, as the strategy does not entail adjustment frictions). Otherwise, the firm keeps sourcing services domestically or, if the market proves to be unprofitable, exits. A key implication of the model is that firms with longer experience exporting to a foreign market are more likely to have discovered a high enough profitability of selling there, and are therefore more likely to source export-related services directly from the destination market.

Figure 1: Probability of Offshoring Services to a Destination and Export Experience



Note: The figure plots the average probability of offshoring service inputs to a destination market against the years of export experience to that destination. Offshoring takes value 1 if the firm offshores any service input to a destination. Export experience measures the number of years during which a firm has exported to a destination. Plotted values are averages across all destinations and firms in the sample. The sample includes all exporting and non-exporting French firms surveyed in the Enquête sur les Chaînes d'Activité Mondiales (CAM).

Our empirical analysis exploits firm-destination-specific information both on the trading side and the sourcing side, which we obtain by matching customs data with the information contained in the CAM survey. We find strong empirical support for the main prediction of the model. Measuring export experience in several different ways, we confirm that it leads to an increase in the probability of sourcing service inputs from abroad, even after controlling for a large set of other determinants of offshoring and a demanding set of fixed effects. At the firm-destination level, one standard deviation increase in a firm's export experience (around 5 years) leads to an increase of 2.7 percentage points in the probability of offshoring services. At the finer firm-service-destination level, the corresponding increase in the probability of offshoring a specific service in the same destination market is of 0.9 percentage points. This increase corresponds to more than half of the average probability of offshoring in the sample at this higher level of data disaggregation. Importantly, these estimates include destination, activity, and firm fixed effects, as well as controls for exporter size at the destination level. Thus, they reflect the effect of differential levels of export experience for a given firm across destinations, excluding the influence of factors related to exporter size at the destination level.

We develop the logical implications of our proposed mechanism to generate additional testable predictions. If the main assumptions of our model hold, we should observe a greater likelihood of offshoring from the destination market when the market is expected to be more profitable and when the adjustment friction from obtaining export-related services domestically is higher (i.e., the relative cost of foreign sourcing is lower). More subtly, these effects increase with export experience. We confirm those predictions using different proxies for these foreign market characteristics. For example, we show that a firm's propensity to offshore service inputs to a foreign market is higher and respond more to experience if the market is larger, has better enforcement of the rule of law, and shares a common currency or a regional trade agreement with France. Extending the same rationale to the choice of offshoring inside or outside the firm, it follows that greater export experience should also increase the probability that firms source service inputs from abroad through affiliates or other firms of their business group, rather than at arm's length. We confirm this prediction in our data as well.

The model further allows us to explore the consequences of the firm's propensity to offshore services in the destination market for future exporting outcomes. First, offshoring firms export larger volumes. This follows from selection into offshoring, as well as from the fact that marginal costs of exporting are lower under offshoring. Second, export volumes are less volatile over time for offshoring firms. Intuitively, if a firm has decided to incur the sunk cost to start offshoring, it is likely to have already learned enough about its export potential, and hence it is no longer affected by that source of volatility. A similar rationale applies to exiting, implying that offshoring firms are less likely to exit, as they have already established themselves as profitable exporters. We find empirical support for each of those predictions, using a variety of specifications, including firm and destination fixed effects, and controlling for other potential channels and for different measures of exporter size at the destination level. These effects are sizeable in magnitude, too: all else held constant, sourcing at least one service activity from the destination market increases future exported volumes by more than 90 percent and decreases the volatility of exported volumes by 12 percent, or one fifth of the volatility of the average exporter in the sample.

Our work contributes to the existing literature studying the connections between services and goods in international trade. Trade in services is shaped by trade costs and distance according to a gravity model as much if not more than trade in goods (Head et al., 2009; Anderson et al., 2018; Gervais and Jensen, 2019). While industry-level analyses stress the importance of services in global value chains across countries (Timmer et al., 2014; Miroudot and Cadestin, 2017; Heuser and Mattoo, 2017; Liu et al., 2020), they cannot pinpoint whether this happens through an expansion of the output product range of manufacturing companies or through a change in the nature of inputs to production. A series of firm-level studies estimate the impact of service input liberalization on domestic performance in downstream manufacturing sectors (Arnold et al., 2011, 2016; Fernandes and Paunov, 2012; Bourlés et al., 2013). Other contributions focus on firm-level exporting of services, and find a number of similarities with exports of goods (e.g., Breinlich and Criscuolo, 2011), but also a certain degree of complementarity between the two. Exporting both services and goods rather than goods only increases the quantity and price of the exported goods (Ariu et al., 2020), while importing both increases the firm's productivity, but exposes both flows to changes in the regulatory barriers to importing goods (Ariu et al., 2019a).

In our firm-level analysis, we expand on this literature by highlighting the key role of export experience in the decision to offshore service inputs. Importantly, this is not a study of cross-border trade in services; instead, we identify firms that source service inputs directly in the export market, at arm's length or via a local subsidiary of the same business group. We can precisely observe offshoring (i.e., the purchase of goods or services from abroad that were previously produced domestically; see U.S. GAO, 2004), and therefore do not need to approximate it as a firm's import of services, which may or may not have been previously produced domestically.[1] In this sense, our analysis offers the first firm-level evidence of service sourcing through commercial presence (mode 3 of GATS), which is notoriously difficult to measure (Maurer et al., 2008) but accounts for more than 50% of total trade in services (WTO, 2019) and involves the most important regulatory provisions in GATS (Staiger and Sykes, 2021). Moreover, our data allow us to identify transactions that remain outside the scope of service trade statistics, as they happen at arm's length, i.e., a commercial presence abroad through unaffiliated parties (foreign outsourcing). Although largely unexplored by previous research, this is likely to be an important margin; for example, about half of the imports of U.S. multinationals comes from arm's length transactions (Bernard et al., 2009). We investigate the role of export experience to explain the propensity of firms to engage in these modes of service supply.[2]

While exporting to foreign markets can help a firm discover its own ability to export, each destination country imposes different challenges. This justifies differences in entry and exit behavior of exporters across countries (e.g., as shown by Eaton et al., 2011), a fact that has prompted a large literature on the dynamics of firms' exporting strategies. Our study is related to this line of research, which analyzes the role of past exporting

[1] Previous work, mainly analyzing labor market outcomes, has focused on service offshoring at the industry level, measured as the import of services (e.g., Amiti and Wei, 2005, 2009; Crinò, 2010; Liu and Trefler, 2019). Ariu et al. (2019b) and Eppinger (2019) further refine this approach by employing firm-level service imports as their measure of offshoring. Our paper is closer to Monarch et al. (2017), who precisely identify offshoring events associated with a shift from domestic to foreign production for firms filing a Trade Adjustment Assistance petition, including cases that do not give rise to cross-border flows (e.g., when the entire production process is offshored). Their focus, however, is on manufacturing firms and the effects on domestic employment. Fort (2017) also investigates how U.S. manufacturing plants subcontract customized production, assembly, or other manufacturing services to foreign or domestic firms. While she analyzes the role of technology and skill complementarities in the firm's decision to fragment production domestically or abroad, we focus on the relationship between export experience and the sourcing of service inputs, consider only the offshoring of tasks that were previously performed domestically, and exploit variation in the destination where the activity is offshored.

[2] To the best of our knowledge, only Bernard et al. (2020) use a similar survey on value chain operations, but for the very different purpose of showing that Danish firms often produce the same goods both domestically and abroad, albeit in varieties of different quality. Our work also differs from theirs by focusing on the offshoring of services rather than manufacturing inputs, by linking it to firms' exporting rather than importing activity, and by exploring variation in the mode of integration while offshoring (vertical vs. arm's length integration).

experience for the entry decision and survival in export markets.[3] However, while many of these studies assume or explain the nature of export costs in light of service-intensive tasks (see, for example, Arkolakis, 2010; Berlingieri and Pisch, 2021), none of them tests the role of experience in shaping the firm's sourcing strategy of service inputs. We are the first to show that learning through exporting affects the firm's decision to source (service) inputs domestically or from abroad.

We also contribute to that literature by studying whether export experience in a given destination is related to the firm's choice of its international boundaries in that country. A few recent papers expand the choice set of firms to include FDI and its dynamics. They show how experienced, fast-growing exporters and exporters to low-volatility destinations start serving the market through foreign affiliates rather than exports only (Ramondo et al., 2013; Garetto et al., 2019; Gumpert et al., 2020). In this sense, our paper is most closely related to Conconi et al. (2016), who consider both the export and FDI activity of a firm in the destination market. In their study, a firm switches from exporting to horizontal FDI after a period of experimentation, in which uncertainty about the firm's success in the foreign market is resolved through exporting. We complement this evidence by establishing that experience affects the sourcing of service inputs as well. Moreover, we show that export experience increases the probability of offshoring service inputs through a foreign affiliated rather than an unaffiliated party, further refining the findings of Conconi et al. (2016).

The remainder of the paper is organized as follows. Section 2 develops the theoretical model and draws testable empirical predictions from it. Section 3 describes the datasets of French companies we use to carry out the empirical analysis. Section 4 presents the results of estimating the baseline prediction and tests its robustness to different definitions of experience and possible alternative mechanisms. We also exploit detailed information at the destination level to investigate how offshoring is affected by features of the destination market. Section 5 presents the results from testing the predictions on the relationship between the relative propensity to offshore service inputs to a destination market and the firm's future exported volume and volatility there, as well as the firm's probability to stop serving the market. Finally, Section 6 provides evidence that export experience to a foreign market affects the firm's propensity to offshore through vertical integration rather than arm's length in the same market. Section 7 concludes.

2 A simple model of export experience and offshoring

We develop a model motivated by the empirical regularity highlighted in Figure 1. The model rationalizes the relationship between the provision of service inputs offshored and export experience. In addition, it generates further testable predictions, which we assess in sections 4 and 5.

A key assumption of the model is that some services are essential for exporting. We can think of foreign distribution, marketing and many other activities, as discussed in the introduction. Firms may acquire those services domestically or in the destination

[3] See, for example, Albornoz et al. (2012, 2021); Nguyen (2012); Alvarez et al. (2013); Cadot et al. (2013); Fernandes and Tang (2014, 2015); Berthou and Vicard (2015); Timoshenko (2015a,b); Araujo et al. (2016); Fernandes et al. (2016); Ruhl and Willis (2017); Berman et al. (2019); Morales et al. (2019). For an insightful review of this literature, see Alessandria et al. (forthcoming).

country to which they export. We consider that sourcing service inputs domestically increases the cost of serving a foreign market, relative to a situation where the services are sourced directly in the destination country. The reason is that local providers have a lower (quality-adjusted) cost thanks to their knowledge of their own markets and/or the proximity to final consumers. Put differently, we consider that obtaining service inputs domestically creates costly frictions, relative to obtaining them in the destination market.[4]

Specifically, we let the marginal cost of firm i selling to market j depend on where it obtains the services related to exporting:

$$\begin{cases} c_i > 0 & \text{if offshoring,} \\ c_i + \tau_j > c_i & \text{if sourcing domestically.} \end{cases}$$

We can split c_i into two components: $c_i = c_i^g + c_i^s$, where c_i^g represents the marginal cost of producing goods and c_i^s denotes the marginal costs associated with the provision of export-related services in the destination the firm is exporting to. If the firm obtains those services domestically, it incurs an additional cost, τ_j, which we call the "adjustment friction." It reflects all the extra costs related to sourcing export-related service inputs domestically, rather than directly in the destination country.[5]

On the other hand, a firm that chooses to offshore services to market j also incurs a sunk cost, $F_j^o > 0$. This represents the cost of finding a service provider and establishing a trustworthy relationship in the foreign destination, among other potential costs.[6] Hence, when deciding its sourcing mode, a firm effectively chooses whether to incur F_j^o to save τ_j on each unit sold. Naturally, the choice will depend on the level of its engagement in the foreign market. The key is that one mode is cheaper in the absence of previous "investment," but more costly otherwise. Typically, if the firm expects large, long-term exports to market j, it will decide to "invest" F_j^o to save τ_j per unit sold today and in the future; otherwise, it will not "invest." Regardless of the service sourcing mode, there is a sunk, destination-specific, cost to start exporting to destination j for any firm, $F_j^e > 0$.

We consider that markets are segmented. Hence, the mechanics in each market are the same, but independent across markets. For that reason, henceforth we drop destination subscripts in the description of the model, but it should be understood that we are describing the activities of a firm toward a specific foreign market, and that the same analysis should be extended to each market to which the firm exports.[7] For simplicity, we assume that residual demand takes a simple linear form in each market the firm serves:

$$q_i(\rho_i) = a_i - \rho_i,$$

where q_i denotes the quantity sold by firm i, ρ_i is its price, and a_i is an idiosyncratic demand parameter.

[4]Given the nature of the service inputs considered, we assume that the knowledge required in their production is mostly destination- rather than firm-specific.

[5]In reality, there are several services related to exporting; indeed, our data distinguishes seven categories of service activities. We keep the model simple by assuming that there is only one service activity, but one could readily extend it to accommodate other services, with the same tradeoff applying to each one of them.

[6]More precisely, F_j^o should be interpreted as the *additional* sunk cost to sourcing export-related inputs abroad, relative to doing so domestically.

[7]In the empirical analysis, we relax this assumption by allowing export experience in one market to be useful in different markets. Extending the model to allow for that possibility is relatively straightforward.

Now, a key assumption is that, at entry, the "long-run export profitability" of firm i is unknown, where export profitability is defined as $\mu_i \equiv a_i - c_i^s$ and distributed according to $H(\mu)$ in the interval $(\underline{\mu}, \bar{\mu})$, where $\underline{\mu} \leq 0 < \bar{\mu}$, with associated density $h(\mu)$. The rationale is that, before exporting, a firm does not know its own residual demand in the foreign market, and/or the level of the export-specific marginal costs it will have to incur, both of which are encapsulated in μ_i. As a result, before the firm learns its own parameter μ_i, it chooses quantities and mode of servicing its exports based on its expectation. We assume that $E\mu$ is common across firms, so ex ante firms differ only in terms of observed productivity in the production of goods (i.e., heterogeneity in c_i^g). Thus, if the firm chooses to offshore, its expected per-period variable profit is $E\pi_i^o = E\left[q_i(a_i - c_i) - q_i^2\right] = q_i\left(E\mu - c_i^g - q_i\right)$, where superscript o denotes offshoring. Analogously, if the firm decides to source service inputs domestically, its expected period variable profit is $E\pi_i^d = E\left[q_i(a_i - c_i) - q_i^2 - \tau q_i\right] = q_i\left(E\mu - c_i^g - \tau - q_i\right)$, where superscript d denotes domestic sourcing.

We consider an infinite-horizon problem, where firms discount future profits at a factor $\delta < 1$. Firm i learns its own μ_i only if it exports $q_i > 0$. However, this happens probabilistically. If in period t the firm has not yet learned μ_i and exports $q_i > 0$, at the end of that period it learns μ_i with probability $p \in [0, 1]$;[8] if $q_i = 0$, it does not learn μ_i. Conversely, if in period t the firm has already learned μ_i, then it will know it in every future period $t' \geq t$.

This simple framework captures the idea that firms need to experiment in foreign markets to learn how profitable they are as exporters, in line with the literature discussed in the introduction. Unlike other scholars (e.g., Albornoz et al., 2012; Conconi et al., 2016), we do not impose that learning happens right after the firm starts to export. Instead, we allow for the more empirically plausible process where learning can happen at any point during firms' export tenure. This allows us to have a continuous definition for firms' "export experience," rather than a binary one. However (and as in Albornoz et al., 2012; Conconi et al., 2016), we keep the learning process simple and link it solely to the duration of the experience the firm has in foreign markets, rather than to the intensity of the firm's foreign presence (i.e., the level of q_i), although one could extend the model to allow for both components to play a role.

In this setup, if a firm has exported $q_i > 0$ for T periods, the probability that it has learned μ_i by then, p_μ^T, is

$$p_\mu^T = 1 - (1 - p)^T . \tag{1}$$

Clearly, a firm with greater export experience (as indicated by T) is more likely to have uncovered its fundamental export profitability. Moreover, if the firm experiments enough, it will eventually learn its μ_i; that is, $\lim_{T \to \infty} p_\mu^T = 1$.

The first period in which the firm exports (t_1) is unique, both because it has to decide whether to pay the sunk cost to export, F^e, and because it is the only period in which we know for sure that the firm has not yet learned its μ_i. Now, if at the beginning of period $t' > t_1$ firm i has not yet learned μ_i, it solves a problem identical to the one it had solved in all previous periods, $t = \{t_2, ..., t' - 1\}$, where t_2 is the second period in which it exported. Conversely, if at the beginning of period t'' firm i has learned μ_i for more than

[8] We can interpret the event of "not learning μ_i after an export experience" as a situation where the firm observes a profit realization that is too noisy to be informative about its true, long-run export profitability.

one period, then in that period it solves a problem identical to the one it will solve in all future periods $t > t''$.[9] Now, let $\hat{t}$ denote the first period after which firm i has learned its μ_i. Then, in period $\hat{t}$ it faces a distinct problem, when it may reassess its export service provision mode in light of the new information.

We start the analysis backwards, first looking at a period after $\hat{t}$, when the choices of the firm remain unchanged. We then look at the earlier periods, moving back until t_1, when the firm decides whether to enter and, if so, how. For notational ease, henceforth we drop firm subscripts. When needed, we use subscripts to identify the period of analysis.

2.1 Period $t > \hat{t}$

At period $\hat{t}$, the firm will have just learned its μ. Based on that, it will decide between exit, export while sourcing services domestically, and export while offshoring services. If it was not offshoring before, that option will also require spending F^o. Now, if the firm reaches $t > \hat{t}$, it is because it has decided to keep exporting. Moreover, if it had chosen to offshore, it has already paid F^o. Since no additional information is obtained after $\hat{t}$, the firm's problem becomes very simple, as it must choose quantities to maximize variable profits in each period. That, of course, depends on the firm's sourcing mode, as decided at $\hat{t}$.

2.1.1 Firm sourced domestically at $\hat{t}$

If the firm sourced export services domestically at $\hat{t}$, in each future period it chooses q to maximize the period variable profit under domestic sourcing:

$$Max_q q\left(\mu - c^g - \tau - q\right) \Rightarrow q^d = \frac{\mu - c^g - \tau}{2}. \tag{2}$$

Clearly, if the firm chose to source domestically at $\hat{t}$, it knows that $\mu > c^g + \tau$. By choosing q^d, it obtains a period profit of $\pi^d = \frac{(\mu - c^g - \tau)^2}{4}$. Afterwards, since it will face an identical problem in every period, it earns exactly the same profit in every future period.

2.1.2 Firm offshored at $\hat{t}$

If the firm offshored export services at $\hat{t}$, in each future period it chooses q to maximize the period variable profit under offshoring:

$$Max_q q\left(\mu - c^g - q\right) \Rightarrow q^o = \frac{\mu - c^g}{2}. \tag{3}$$

Clearly, if the firm chose to offshore at $\hat{t}$, it knows that $\mu > c^g$. By choosing q^d, it obtains a period profit of $\pi^o = \frac{(\mu - c^g)^2}{4}$. Since it faces an identical problem in every future period, it will earn exactly the same profit in every future period.

[9] This statement implicitly assumes that the firm can re-start exporting and/or offshoring after exiting, or equivalently, that the sunk costs F^e and F^o do not "depreciate" if the firm exits. Whether realistic or not, this implicit assumption is immaterial for our theoretical analysis, because in the absence of other shocks, if the firm chooses to exit, it will never want to start exporting again. In the empirical part, we operationalize this assumption by not depreciating export experience when a firm exits (and possibly re-enters) a certain destination. But we also show that the relationship between export experience and offshoring is robust to multiple definitions of experience, including when experience depreciates linearly in the number of years the firm does not export to the destination.

2.2 Period $\hat{t}$

We now consider the problem of the firm at $\hat{t}$, right after learning its μ. The firm's choices in that period depend on its export mode at $\hat{t}-1$. We consider each case in turn.

2.2.1 Firm sourced domestically at $\hat{t}-1$

Consider first a firm that sourced export services domestically at $\hat{t}-1$. Clearly, this must have been its sourcing mode in every period since t_2, since at $\hat{t}-1$ the firm faces the same problem it did in every period between t_2 and $\hat{t}-1$.

Now, at $t=\hat{t}$, the problem is different, because the firm has just learned μ. Period-$\hat{t}$ variable profit depends on the sourcing mode, as follows:

- If the firm exits, it earns $\pi^{d\varnothing}=0$ in that period, where the first superscript indicates the sourcing mode at $\hat{t}-1$ and the second superscript the sourcing mode at $\hat{t}$, with $\varnothing$ denoting exit.
- If the firm keeps sourcing domestically, it chooses q to maximize the period variable profit under domestic sourcing: $q^d=\frac{\mu-c^g-\tau}{2}$ if $\mu>c^g+\tau$. In that case, the firm obtains a profit of $\pi^{dd}=\frac{(\mu-c^g-\tau)^2}{4}$ at $\hat{t}$. If $\mu\leq c^g+\tau$, $q^d=0$, which is equivalent to exit and yields $\pi^{d\varnothing}=0$.
- If the firms switches to offshoring, it chooses q to maximize the period variable profit under offshoring: $q^o=\frac{\mu-c^g}{2}$ if $\mu>c^g$. In that case, the firm obtains a variable profit of $\frac{(\mu-c^g)^2}{4}$ at $\hat{t}$, which corresponds to a total period profit of $\pi^{do}=\frac{(\mu-c^g)^2}{4}-F^o$. If $\mu\leq c^g$, $q^o=0$, which is equivalent to exit and yields $\pi^{d\varnothing}=0$.

Now, before considering the conditions under which each sourcing strategy is best, we need to impose restrictions on the relative sizes of $\{F^o,\tau\}$ so that there are circumstances when offshoring is the optimal sourcing mode and there are circumstances when domestic sourcing is the optimal sourcing mode. First, notice that π^{do} increases in μ at a higher rate than π^{dd} does. Thus, if d can ever be chosen over o, it must yield a higher present value profit ($PV\Pi$) at the lowest μ under which d is viable, which is when $\mu>c^g+\tau$ but arbitrarily close to $c^g+\tau$. In that case, $\lim_{\mu\to(c^g+\tau)^+}PV\Pi^d=0$, whereas $\lim_{\mu\to(c^g+\tau)^+}PV\Pi^o=\frac{\tau^2}{4(1-\delta)}-F^o$. Thus, we require that

$$A1: F^o>\frac{\tau^2}{4(1-\delta)}.$$

This ensures that there are circumstances when domestic sourcing is the optimal sourcing mode at $\hat{t}$. Similarly, if o can ever be chosen over d, it must yield a higher present value profit at the highest possible μ. In that case, $PV\Pi^d=\frac{(\bar{\mu}-c^g-\tau)^2}{4(1-\delta)}$ and $PV\Pi^o=\frac{(\bar{\mu}-c^g)^2}{4(1-\delta)}-F^o$. Thus, we require that

$$A2: F^o<\frac{\tau([2\left(\bar{\mu}-c^g\right)-\tau]}{4(1-\delta)}.$$

This ensures that there are circumstances when offshoring is the optimal sourcing mode at $\hat{t}$.

We can now study when the firm will want to switch to offshoring in period $\hat{t}$. It will do so if

$$-F^o + \sum_{j=0}^{\infty} \delta^j \pi_{\hat{t}}^{do} > \sum_{j=0}^{\infty} \delta^j \pi_{\hat{t}}^{dd},$$

or equivalently, if

$$\frac{(\mu - c^g)^2}{4} - \frac{(\mu - c^g - \tau)^2}{4} > (1-\delta)F^o$$
$$\Leftrightarrow \mu > c^g + \frac{\tau^2 + 4(1-\delta)F^o}{2\tau}.$$

Hence, a firm will switch to offshoring in period $\hat{t}$ if $\mu > \tilde{\mu}$, where $\tilde{\mu}$ is defined as

$$\tilde{\mu} \equiv c^g + \frac{\tau}{2} + \frac{2(1-\delta)F^o}{\tau} \ . \tag{4}$$

Note that the cutoff $\tilde{\mu}$ is firm-specific, as it depends on the firm's (inverse) productivity, c^g. In particular, $\tilde{\mu}$ is increasing in c^g, because less productive firms gain less from a switch to offshoring than more productive firms do.

Using $A1$, we have that $\tilde{\mu} > c^g + \tau$. Furthermore, $\tilde{\mu}$ is decreasing in τ:

$$\frac{d\tilde{\mu}}{d\tau} = \frac{1}{2} - \frac{2(1-\delta)F^o}{\tau^2} < 0$$
$$\Leftrightarrow \tau^2 < 4(1-\delta)F^o,$$

which is true under $A1$. Thus, a higher adjustment friction τ lowers the threshold of μ above which the firm switches from domestic sourcing to offshoring, since it makes offshoring more advantageous. Naturally, an increase in F^o has the opposite effect on $\tilde{\mu}$, raising the threshold under which the switch takes place.

In turn, if $\mu < c^g + \tau$, domestic sourcing is no longer viable, and the firm chooses to exit.

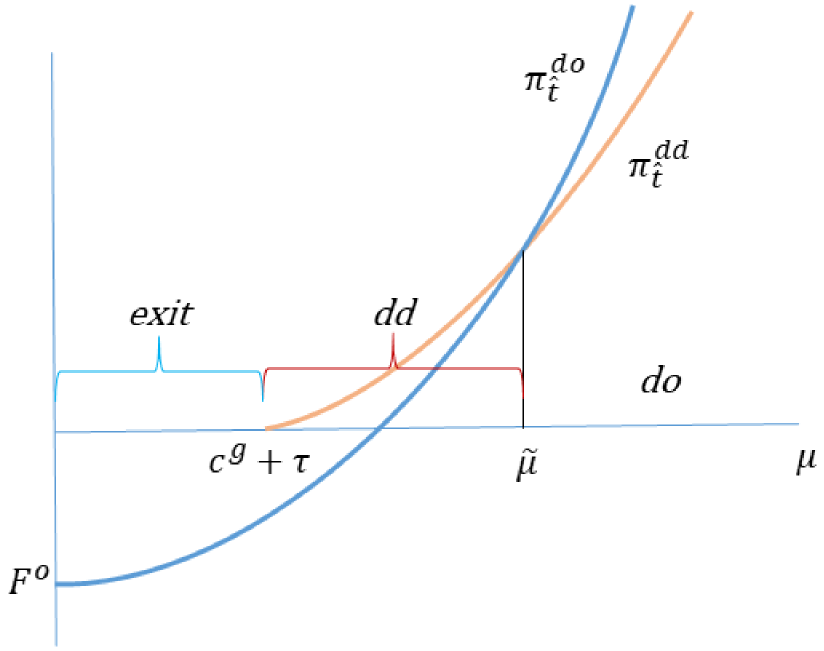
Hence, at $\hat{t}$ the firm chooses its sourcing mode according to the following rule:

$$\begin{cases} \text{if } \mu \leq c^g + \tau\text{:} & \text{exit} \\ \text{if } \mu \in (c^g + \tau, \tilde{\mu})\text{:} & \text{keep domestic sourcing} \\ \text{if } \mu \geq \tilde{\mu}\text{:} & \text{switch to offshoring} \end{cases} \tag{5}$$

That is, the firm chooses to engage in long-term commitment (and invest F^o accordingly) if it finds out that its μ is sufficiently high. If, instead, it finds out that its μ is too low, it gives up exporting. For intermediate cases, it keeps exporting while sourcing services domestically. Figure 2 illustrates the points above, indicating how a firm that starts exporting under domestic sourcing adjusts its exporting-sourcing strategy depending on the realization of μ.[10]

[10] The curves have those relative shapes because $\frac{\partial \pi_{\hat{t}}^{do}}{\partial \mu} = \frac{\mu - c^p}{2} > \frac{\mu - c^p - \tau}{2} = \frac{\partial \pi_{\hat{t}}^{dd}}{\partial \mu}$ and $\frac{\partial^2 \pi_{\hat{t}}^{do}}{\partial \mu^2} = \frac{\partial^2 \pi_{\hat{t}}^{dd}}{\partial \mu^2} = \frac{1}{2}$.

Figure 2: Offshoring and exit thresholds at $\hat{t}$ when a firm enters with domestic sourcing



2.2.2 Firm offshored at $\hat{t} - 1$

At $t = \hat{t}$, the firm has learned μ and has already paid F^o. Period-$\hat{t}$ profit depends on whether it keeps exporting. If the firms exits, it earns $\pi^{o\varnothing} = 0$ at $\hat{t}$. If instead it keeps offshoring, it chooses $q^o = \frac{\mu - c^g}{2}$, earning a period profit of $\pi^{oo} = \frac{(\mu - c^g)^2}{4}$. As we have seen, this is also the profit the firm would earn in every future period under offshoring. Thus, it keeps exporting under offshoring if $\mu > c^g$; otherwise, it exits.

Observe that the firm will never switch from offshoring to domestic sourcing, because $\pi^{od} < \pi^{oo}$ for any μ, since F^o has already been incurred and $\tau > 0$. Hence, if a firm was offshoring before uncertainty was revealed, it either exits (if $\mu \leq c^g$) or keeps exporting under offshoring (if $\mu > c^g$).

2.3 Period $t \in \left[t_2, \hat{t} - 1\right]$

After the firm has entered the foreign market, but before it learns its export profitability, it faces an identical problem in every period. This is the same problem it faced at entry, except that the sunk cost F^e has already been paid. The quantities are therefore identical to those at t_1. Accordingly, we now turn to the entry period.[11]

2.4 Period $t = t_1$

We consider the total payoff of a firm entering with each sourcing mode. We then compare them to determine when it will choose each sourcing strategy at entry.

[11]Note that, if uncertainty is revealed right after $t_1, \hat{t} = t_2$ and there is not any period between t_2 and $\hat{t} - 1$.

2.4.1 Firm enters with domestic sourcing at $t = t_1$

The firm chooses q_1 based on its expected profitability:

$$\begin{aligned} Max_q E\pi_1^d &\Rightarrow E\mu - c^g - \tau - 2q_1 = 0 \\ &\Leftrightarrow q_1^d = \frac{E\mu - c^g - \tau}{2}. \end{aligned} \tag{6}$$

Naturally, this presumes that $E\mu > c^g + \tau$. In that case, the expected variable export profit at t_1 when sourcing domestically is:

$$E\pi^d = q_1^d(E\mu - c^g - \tau - q_1^d) = \left(\frac{E\mu - c^g - \tau}{2}\right)^2.$$

If instead $E\mu \leq c^g + \tau$, then any strictly positive quantity yields negative expected profits at $t = 1$. However, a small quantity $\epsilon \to 0$ makes that loss arbitrarily small in absolute value, while also uncovering the firm's export profitability with probability p.

To compute the present value profit from starting to export with domestic sourcing of services (Ψ^d), we first need to define its ex-ante expected profit at $\hat{t}$ under that sourcing mode, right after uncertainty is revealed, as well as subsequently. From decision rule (5), we know that, at $\hat{t}$, the firm's period profit will be π^{dd} if it keeps sourcing domestically, π^{do} if it switches to offshoring, and zero if it exits. Hence, when the firm starts exporting sourcing services domestically, its expected profit at $\hat{t}$ is

$$\begin{aligned} \tilde{\pi}_{\hat{t}}^d &= \int_{\tau+c^g}^{\tilde{\mu}} \frac{(\mu - c^g - \tau)^2}{4} dH(\mu) + \int_{\tilde{\mu}}^{\bar{\mu}} \left[\frac{(\mu - c^g)^2}{4} - F^o\right] dH(\mu) \\ &= \int_{\tau+c^g}^{\tilde{\mu}} \frac{(\mu - c^g - \tau)^2}{4} dH(\mu) + \int_{\tilde{\mu}}^{\bar{\mu}} \frac{(\mu - c^g)^2}{4} dH(\mu) - F^o\left[1 - H(\tilde{\mu})\right]. \end{aligned} \tag{7}$$

Subsequently, at any $t > \hat{t}$, the firm's period profit will be π^d if it had chosen to keep sourcing domestically, π^o if it had chosen to switch to offshoring, and zero if it had chosen to exit. Hence, when the firm starts exporting sourcing services domestically, its expected profit at $t > \hat{t}$ is

$$\tilde{\pi}_{>\hat{t}}^d = \int_{\tau+c^g}^{\tilde{\mu}} \frac{(\mu - c^g - \tau)^2}{4} dH(\mu) + \int_{\tilde{\mu}}^{\bar{\mu}} \frac{(\mu - c^g)^2}{4} dH(\mu). \tag{8}$$

Now notice that, at t_2, with probability p uncertainty will already have been revealed, in which case the firm's expected profit in that period is $\tilde{\pi}_{\hat{t}}^d$, and $\tilde{\pi}_{>\hat{t}}^d$ thereafter. In contrast, with probability $1 - p$, at t_2 the firm faces exactly the same problem it faced at t_1, in which case its period profit is $E\pi^d$.

Summing over all relevant terms, we have that the firm's present value payoff when entering with domestic sourcing is:[12]

$$\Psi^d = \frac{1}{1 - \delta(1-p)}\left[E\pi^d + \delta p\left(\frac{\pi_{>\hat{t}}^d}{1-\delta} - \left[1 - H(\tilde{\mu})\right] F^o\right)\right] - F^e. \tag{9}$$

[12]See Appendix B for the derivation of this expression.

2.4.2 Firm enters with offshoring at $t = t_1$

Again, the firm chooses q_1 based on its expected profitability:

$$\begin{aligned} Max_q E\pi_1^o \;&\Rightarrow\; E\mu - c^g - 2q_1 = 0 \\ &\Leftrightarrow\; q_1^o = \frac{E\mu - c^g}{2}. \end{aligned} \tag{10}$$

Naturally, this presumes $E\mu > c^g$. In that case, the expected variable export profit at t_1 when offshoring is:

$$E\pi^o = q_1^o(E\mu - c^g - q_1^o) = \left(\frac{E\mu - c^g}{2}\right)^2.$$

If $E\mu \leq c^g$ instead, then any strictly positive quantity yields negative expected profits at $t = 1$. However, a small quantity $\epsilon \to 0$ makes that loss arbitrarily small in absolute value, while also uncovering the firm's export profitability with probability p.

To compute the present value profit of starting to export while offshoring services (Ψ^o), we first need to define that ex-ante expected profit at $\hat{t}$ under that sourcing mode, right after uncertainty is revealed, as well as subsequently. We know that, at $\hat{t}$, the firm's period profit will be π^{oo} if it keeps offshoring and zero if it exits.[13] Hence, when the firm offshores services as it starts exporting, its expected profit at $\hat{t}$ is simply

$$\tilde{\pi}_{\hat{t}}^o = \int_{c^g}^{\bar{\mu}} \frac{(\mu - c^g)^2}{4} dH(\mu). \tag{11}$$

Subsequently, at any $t > \hat{t}$, the firm's period profit will be π^o, which is identical to π^{oo}, if it had chosen to keep exporting, and zero if it had chosen to exit. Hence, when the firm starts exporting while offshoring services, its expected profit at $t > \hat{t}$ is

$$\tilde{\pi}_{>\hat{t}}^o = \int_{c^g}^{\bar{\mu}} \frac{(\mu - c^g)^2}{4} dH(\mu) = \tilde{\pi}_{\hat{t}}^o.$$

At t_2, uncertainty will have been already revealed with probability p, in which case the firm's expected profit in that period is $\tilde{\pi}_{\hat{t}}^o$, and $\tilde{\pi}_{>\hat{t}}^o$ thereafter. With probability $1-p$, at t_2 the firm faces exactly the same problem it faced in t_1, in which case its period profit is $E\pi^o$.

Proceeding analogously to the derivation of the firm's present value payoff under domestic sourcing, while recalling that $\tilde{\pi}_{\hat{t}}^o = \tilde{\pi}_{>\hat{t}}^o$, we have that the firm's present value payoff when entering with offshoring is:

$$\Psi^o = \frac{1}{1 - \delta(1-p)} \left[E\pi^o + \delta p \frac{\tilde{\pi}_{>\hat{t}}^o}{1-\delta} \right] - F^o - F^e. \tag{12}$$

2.4.3 Firm does not enter in $t = t_1$

In this case, the firm makes no profit:

$$\Psi^{\varnothing} = 0.$$

[13]Recall that the firm will never want to switch from offshoring to domestic sourcing.

2.5 When is domestic sourcing better than offshoring at entry?

At entry, a firm compares the present value payoff under the two sourcing strategies (and from not entering) to decide its sourcing mode (if it decides to export). It will prefer to start with domestic sourcing over offshoring when $\Psi^d > \Psi^o$. Using (9) and (12), that happens when:

$$\frac{1}{1-\delta(1-p)}\left[E\pi^d + \delta p\left(\frac{\tilde{\pi}^d_{>\hat{t}}}{1-\delta} - [1-H(\tilde{\mu})]\,F^o\right)\right] \geq \frac{1}{1-\delta(1-p)}\left[E\pi^o + \delta p \frac{\tilde{\pi}^o_{>\hat{t}}}{1-\delta}\right] - F^o$$

$$\Leftrightarrow \{1-\delta\,[1-pH(\tilde{\mu})]\}\,F^o \geq \left[E\pi^o - E\pi^d\right] + \frac{\delta p}{1-\delta}\left(\tilde{\pi}^o_{>\hat{t}} - \tilde{\pi}^d_{>\hat{t}}\right). \qquad (13)$$

Each of the three elements in the inequality are positive. The left-hand side represents the expected savings of the sunk cost of offshoring that entering with domestic sourcing entails. Naturally, it increases in the size of the sunk cost, F^o. Hence, as F^o increases, the left-hand side of criterion (13) rises while its right-hand side remains unchanged, so a higher F^o makes entering with d more desirable as an export entry strategy in foreign markets.

On the right-hand side, the term in square brackets represents the additional period-t_1 variable profit under offshoring, relative to domestic sourcing. Specifically:

$$E\pi^o - E\pi^d = I_{\{E\mu > c^g\}}\frac{(E\mu - c^g)^2}{4} - I_{\{E\mu > c^g+\tau\}}\frac{(E\mu - c^g - \tau)^2}{4}. \qquad (14)$$

This expression is always positive, since $I_{\{E\mu>c^p+\tau\}} = 1 \Rightarrow I_{\{E\mu>c^p\}} = 1$, and in that case the first term is greater than the second. Moreover, $I_{\{E\mu>c^p\}} = 1$ in some circumstances when $I_{\{E\mu>c^p+\tau\}} = 0$, and in that case the first term is strictly positive, while the second is nil.

In turn, the term $\left(\tilde{\pi}^o_{>\hat{t}} - \tilde{\pi}^d_{>\hat{t}}\right)$ reflects the additional expected variable profit when the firm enters with offshoring instead of domestic sourcing, after uncertainty has been revealed. It is positive because entering with o saves τ whenever $\mu \in (c^g+\tau, \tilde{\mu})$ and because it yields strictly positive export variable profits when $\mu \in (c^g, c^g+\tau)$. More precisely:

$$\begin{aligned}\tilde{\pi}^o_{>\hat{t}} - \tilde{\pi}^d_{>\hat{t}} &= \int_{c^g}^{\bar{\mu}} \frac{(\mu - c^g)^2}{4}dH(\mu) - \left[\int_{c^g+\tau}^{\tilde{\mu}} \frac{(\mu - c^g - \tau)^2}{4}dH(\mu) + \int_{\tilde{\mu}}^{\bar{\mu}} \frac{(\mu - c^g)^2}{4}dH(\mu)\right] \\ &= \int_{c^g}^{c^g+\tau} \frac{(\mu - c^g)^2}{4}dH(\mu) + \tau\int_{c^g+\tau}^{\tilde{\mu}} \frac{2(\mu - c^g) - \tau}{4}dH(\mu) > 0. \qquad (15)\end{aligned}$$

While intuitive, it is not immediately possible to deduce from inequality (13) that a larger adjustment friction τ makes offshoring more appealing at entry. The following lemma confirms that intuition:

Lemma 1 *As the adjustment friction τ rises, inequality (13) is satisfied under a smaller set of parameters, and in that sense offshoring becomes more appealing at entry.*

Proof of Lemma 1. See Appendix B. ■

2.6 Measure of firms in each sourcing mode

Ex ante, firms are different only because of their heterogeneity in productivity (i.e., in their production cost of goods, c_i^g). Let c_i^g be distributed according to $M(c^g)$, where $M(.)$ is the distribution function of the firms that choose to enter and $m(.)$ is the associated density.[14] We want to define a cutoff that determines how firms that are sufficiently productive behave relative to less productive ones. To do so, we first need to show that the criterion for entering with domestic sourcing, inequality (13), varies monotonically with c^g.

Lemma 2 *If inequality (13) is satisfied when $c^g = c_1^g$, then it is also satisfied when $c^g = c_2^g$, for any $c_2^g > c_1^g$.*

Proof of Lemma 2. See Appendix B. ■

Let us then define $\widetilde{c^g}$ as the value of c^g that solves equation (13) with equality. From the proof of Lemma 2, we know that $\widetilde{c^g}$ is unique. It follows that, among the entering firms, those with $c^g < \widetilde{c^g}$ will enter offshoring, whereas those with $c^g \geq \widetilde{c^g}$ will enter sourcing services domestically. Hence, the measure of firms entering with o is $M(\widetilde{c^g})$; the remainder enter with d. In turn, the measure of firms that switch to o when uncertainty is revealed is given by

$$\int_{\tilde{\mu}}^{\bar{\mu}} \left[1 - M(\widetilde{c^g})\right] dH(\mu) = \left[1 - M(\widetilde{c^g})\right] \left[1 - H(\tilde{\mu})\right].$$

2.7 Testable predictions

Having established the basic workings of the model, we now proceed to identify testable predictions from it. In doing so, we take into account the data available for estimation and some key stylized facts from the data.

As we have seen, if a firm starts exporting under offshoring, it will never switch to domestic sourcing. Now, among the firms that enter with domestic sourcing, some will switch to offshoring once they uncover their long-run export profitability. The probability that uncertainty is resolved, in turn, increases with export tenure. This follows directly from equation (1), which implies that the greater a firm's export experience (T), the more likely it is that it will have uncovered its fundamental export profitability by then. It follows that, as T rises, the probability that a firm will export under offshoring increases. This gives our first, and central, prediction:

Prediction 1 *All else equal, firms with more export experience in a foreign destination are more likely to serve it through offshoring.*

Proof of Prediction 1. See Appendix B. ■

Our model is silent about whether this happens at the firm level (in line with the results of Albornoz et al., 2012) or at the firm-destination level (in the spirit of most other analyses

[14]Since our goal is to study how exporting firms source services, we focus on that choice among the firms that choose to export. Naturally, the distribution of those firms, $M(c^g)$, is affected by the magnitude of the sunk cost to export, F^e.

of firm export dynamics, including the one by Conconi et al., 2016). It is plausible that part of the knowledge a firm obtains comes from its experience as an exporter in general, whereas another part is specific to experience selling in specific destinations. Accordingly, while in our baseline empirical specification we test Prediction 1 considering exporting and sourcing at the firm-destination level, in other specifications we allow the overall firm-level exporting activities to affect sourcing decisions.

The model delivers predictions about the relative incidence of offshoring depending on the characteristics of the destination, too. Because the cost of offshoring is sunk in nature, firms are more likely to offshore when they expect larger variable profits. The same is true if the adjustment friction is higher, because offshoring helps to save on them. Moreover, if the mass of firms around the cutoff $\widetilde{c^g}$ is small, those effects increase with export experience. Intuitively, this happens because, when τ (or $E\mu$) is higher, the cutoff $\tilde{\mu}$ to switch to offshoring is lower, so export experience makes it especially likely that firms will switch to offshoring.

Prediction 2 *If the expected profitability of a market (in the sense of first-order stochastic dominance) is higher and/or the adjustment friction (τ) is larger, firms are more likely to offshore. Moreover, their impacts on the probability of offshoring increase with export experience if the mass of firms around the cutoff $\widetilde{c^g}$ is sufficiently small.*

Proof of Prediction 2. See Appendix B. ■

We test this prediction by using proxies for the expected profitability of the market and for the adjustment friction. For the former, the natural proxy is the real GDP of the destination market, which tends to be associated with demand size and firm profits. For the adjustment friction, any destination characteristic that makes it easier for a domestic firm to conduct business in the destination could be associated with a lower relative cost of foreign sourcing (i.e., a higher τ), and therefore a greater benefit from offshoring. Several "gravity-like" variables fit that description: a common currency (which makes foreign transactions free of exchange rate risk and other currency transaction costs); a regional trade agreement (which often lowers the regulatory costs of contracting services in the partner countries); a common legal system (which tends to facilitate the resolution of disputes in the foreign destination); a stronger rule of law (which lowers the regulatory costs of contracting services in the destination country); and higher human capital stock (which tends to increase the quality of services offshored). In contrast, greater distance from the *Home* country should have the opposite effect.[15]

As Prediction 2 indicates, the model implies that those effects are magnified by export experience. Indeed a higher adjustment cost τ lowers the cutoff rule firms follow to decide whether to switch from domestic sourcing to offshoring, thus making the switch to offshoring more likely as firms acquire export experience. This line of reasoning requires, however, that an increase in τ does not affect too much the mass of firms that choose domestic sourcing at entry. This seems to be the case in our setting, where very few firms offshore at entry, as already highlighted in Figure 1. Moreover, in typical distributions

[15] The impact of sharing a common language is less clear-cut. On the one hand, it makes contracting services in the foreign destination easier. On the other hand, it also increases the value abroad of domestic services for exports (e.g., marketing services can be "transported" from the *Home* country to the destination country with little friction if the two countries speak the same language).

of firm productivity, which are highly skewed, the mass of firms at the very top of the distribution tends to be indeed very low. A similar rationale applies to the expected profitability of the market.

Predictions 1 and 2 associate firm export experience and market characteristics with the likelihood of offshoring services. Now, given the location where the firm sources services, the model also sheds light on the subsequent export behavior of the firm.

First, the model associates the sourcing mode of a firm with its trade volume. Before the resolution of uncertainty, quantities are higher if a firm offshores than if it sources domestically. This simply reflects the lower marginal cost under offshoring, as equations (6) and (10) show. This effect is reinforced by selection at entry: only high-productivity firms, which export more for any sourcing mode, choose to offshore at entry. The same is true after uncertainty is resolved, as equations (2) and (3) indicate. Once again, this is because marginal costs are lower under offshoring. There is also further selection at $\hat{t}$: only the firms that uncover a high enough μ switch to offshoring. Since a higher μ is associated with higher volumes, selection further reinforces the relationship.

As a consequence, we have that a firm's export volume to a destination is higher under o than under d, because (i) the former entails lower marginal cost than the latter (an assumption of the model); (ii) firms that choose o at entry have lower marginal cost in producing goods than those that choose d (a result of the model); and (iii) firms that switch from d to o after entry are those that find out to have higher export profitability. Hence:

Prediction 3 *All else equal, if a firm exports to a destination while offshoring services there, it will export more than it would do if it sourced services domestically.*

In testing this prediction empirically, we use firm and destination fixed effects and effectively compare the behavior of the same firm across markets when its sourcing choices vary across markets. Those fixed effects absorb changes in export volumes due to different marginal costs of production across firms and due to destination specificities. Furthermore, since our model is silent about which activities are key for that result, we test Prediction 3 in different ways, looking both at the effect of the number of activities offshored and at the effect of offshoring any service activity.

Our model also delivers clear results regarding the volatility of firms' trade flows. In the model, firms' trade volumes move up or down only when uncertainty about μ is resolved, both for firms that had entered with d and for firms that had entered with o. Now, as illustrated by Figure 1, very few firms in our dataset enter with o, implying that $\widetilde{c^g}$ is very low. Thus, a firm using o in period t signals that uncertainty has most likely been resolved; in that case, there is no longer a reason for q_i to change in that market. If instead the firm uses d, either the uncertainty has been resolved and μ is relatively low $(\mu < \widetilde{\mu})$, in which case there is no longer a reason for q_i to change in that market, or the uncertainty is still unresolved, in which case q_i may fall or rise in the future. Thus, there are more reasons for future changes in q_i under d than under o.

Putting it slightly more formally, the measure of firms offshoring in a given year for the cohort of age T is $M(\widetilde{c^g})\left\{(1-p_T^{\mu}) + p_T^{\mu}\left[1-H(\widetilde{\mu})\right]\right\} + \left[1-M(\widetilde{c^g})\right] p_T^{\mu}\left[1-H(\widetilde{\mu})\right]$. The firms represented in the first term chose o at entry, and the portion of them that has not yet learned their own μ (i.e., $1-p_T^{\mu}$) will adjust quantities when they do. In turn, the firms represented in the second term chose d at entry. They switched to o because they have already learned their μ and their export volumes will no longer change. Clearly, then, if $\widetilde{c^g}$ is arbitrarily low, $M(\widetilde{c^g}) \to 0$ and there is no future volatility in trade volumes for firms that offshore. The same rationale does not extend to firms that are sourcing domestically, however, since the model allows for changes in sourcing modes from d to o, but not from o to d. This gives us another testable prediction:

Prediction 4 *If the cutoff $\widetilde{c^g}$ is sufficiently low, then, all else equal, there is more volatility in future trade volumes for firms sourcing service inputs domestically than for firms offshoring.*

Our model yields this prediction too bluntly, because it abstracts from other shocks that could induce firms to change their sales in a foreign market. But it does so because those shocks would not affect the main messages of the model. For example, if we allowed for i.i.d. shocks on μ – so that firms only learn about its permanent component – then they would generate trade flows volatility both before and after period $\hat{t}$. However, those shocks would affect trade flows volatility similarly regardless of where the firm sources services. As a result, they would not affect Prediction 4.

In our empirical analysis, we test Prediction 4 in different ways, depending on how we define the volatility of exports to a destination and on whether we define offshoring as the number of offshored activities or as a dummy for offshoring some activity. Notice that, strictly within the model, the prediction is about the export volatility of different firms. However, with i.i.d. shocks on firm-destination export profitability, μ_{id}, the prediction also applies to the behavior of a given firm across markets. This allows us to use firm fixed effects in our empirical specification.

Finally, the model also has implications for firms' future exit patterns from foreign destinations. Upon entry, exit happens only at $\hat{t}$. If a firm entered with domestic sourcing, it exits at $\hat{t}$ if it learns that $\mu \leq c^g + \tau$. If instead the firm entered with offshoring, it exits at $\hat{t}$ if it learns that $\mu \leq c^g$ – an event that has a lower probability for a given firm.

As we have seen, the firms entering with offshoring have higher productivity (i.e., lower c^g) than those entering with domestic sourcing. That further reinforces the relationship between offshoring and lower exit rates, because the event $\mu \leq c_i^g$ is less likely than the event $\mu \leq c_j^g$ if $c_i^g \leq c_j^g$. Thus, the probability of exit for a firm that chooses o at entry is lower than the probability of exit for a firm that chooses d at entry: $H(c_i^g) < H(c_j^g) < H(c_j^g + \tau)$. Hence, we have the following:

Prediction 5 *All else equal, exit rates are lower if the firm offshores service inputs.*

Once again, it is important to point out that the model abstracts from other shocks that could induce firms to exit a foreign market. But again, adding those shocks would not affect Prediction 5. If we allowed for i.i.d. shocks that could hit firms of all types, firms would exit in periods other than $\hat{t}$ (and possibly re-enter later), but the ways different sourcing modes relate to exit would either remain unchanged or be reinforced. To see that, notice that, if those shocks were simply random "death shocks" (i.e., if firms exited immediately after being hit), then they would obviously make no difference to the relative exit frequency of offshoring/domestic sourcing exporters. If the i.i.d. shocks were instead on μ, then they would have a greater impact on exit rates for firms sourcing domestically, which operate under a tighter margin (they sell strictly positive quantities only if $\mu_i >$

$c_i^g + \tau$), than on firms offshoring (which sell strictly positive quantities if $\mu_i > c_i^g$). Since strictly positive sales are what define exit empirically, that type of shock would reinforce our previous claim.

In our empirical analysis, we test Prediction 5 in different ways, depending on how we define "exit" from a destination, and on whether we define offshoring as the number of offshored activities or as a dummy for offshoring some activity. The remarks above about the role of firm fixed effects in Prediction 4 apply here as well.

3 Data

Our analysis focuses on the relationship between firms' exporting behavior (experience, volumes, survival in the destination market) and their sourcing choice of service inputs between home and foreign markets. While deciding to export, a firm may want to offshore the production of services that are key for exports to the destination market, i.e., to establish closer linkages with the market at various stages of the delivery (e.g., distribution, marketing, sale and delivery, after-sales services). To do so, the firm can establish a commercial presence in the destination market by transacting through a subsidiary or controlled company, or by purchasing service inputs from independent suppliers in the destination market. Only the former transactions fall within the scope of service trade statistics according to the GATS (Article I:2), and are labeled Mode 3 of supply for trade in services.

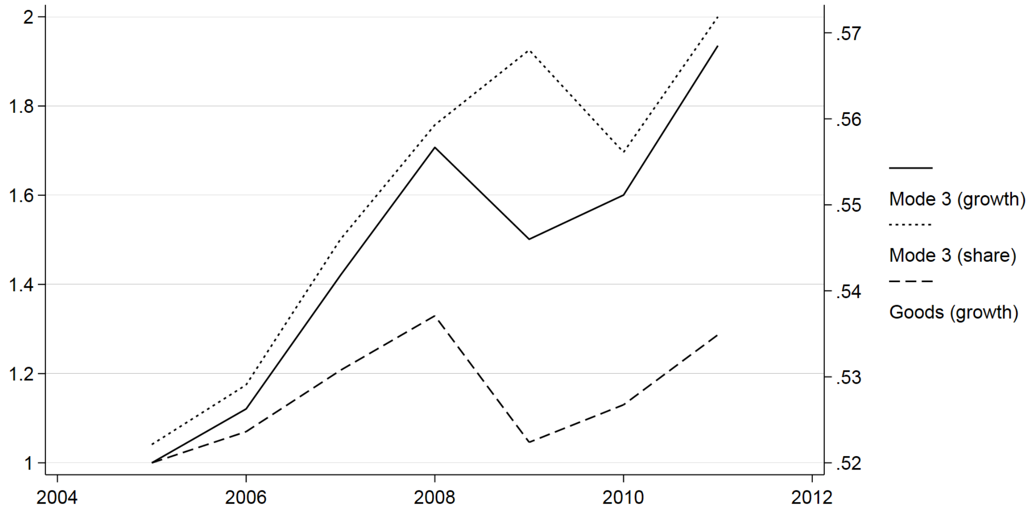
Figure 3 reports the growth of trade in professional and business services through Mode 3 for France from 2005 to 2011. The value of services exported via commercial presence abroad doubled in the reference period, significantly surpassing the growth in merchandise exports. Moreover, Mode 3 increased its importance relative to other modes of cross-border supply of professional and business services, representing approximately 57 percent of the total transacted value in 2011. Our analysis provides micro-level evidence for this mode of service trade, together with commercial presence abroad through unaffiliated parties (foreign outsourcing). By explaining a fundamental mechanism at the root of the decision to offshore services to the destination market, our study helps to explain a dimension of service trade that is of primary importance.

3.1 Data sources

Our empirical analysis relies on data from the Enquête sur les Chaînes d'Activité Mondiales (CAM), a survey on global value chains administered by INSEE in 2012, which asks firms about their outsourcing and offshoring decisions in 2011. The survey covers the population of firms with more than 250 employees and a sample of firms between 50 and 249 employees (with employment levels observed at the end of 2008), for a total of 6,024 firms, excluding non-responses. Firms belong to sections B to N of the NACE Rev.2 classification (i.e., mining, manufacturing, and all market services) except for financial and insurance services.

The survey is unique in that it characterizes the value chain activities of the firm, differentiating between the core of the firm's production and six other non-core service activities, as well as between activities that are sourced locally and those that are sourced

Figure 3: Professional and Business Services Supplied via Commercial Presence Abroad (Mode 3 of GATS)



Note: The figure plots, for France, the growth of the export value of professional and business services supplied through Mode 3 of GATS, or commercial presence abroad (left axis), as well as its share of the total service trade (right axis). For comparison, the figure also plots the growth in the value of merchandise (goods) exports (left axis). The professional and business services considered are: transport, telecommunications, computer, information and audiovisual services, charges for the use of intellectual property, and other business services.
Source: WTO Trade in Services by Mode of Supply (TiSMoS).

in a foreign market (offshoring).[16] In Section 6, we also use the distinction between offshored activities that take place outside and within the boundaries of the business group (either a direct affiliate of the firm or another firm of the same group), which we identify henceforth as "Offshoring Out" and "Offshoring In," respectively.

The survey applies a narrow definition of offshoring, i.e., sourcing of goods or services from abroad that were previously produced domestically (U.S. GAO, 2004). The survey questionnaire stresses that, in the case of offshoring, the focus is on activities transferred abroad that resulted in a reduction or total closure of the production in France, indicating that the activity was produced before in the domestic market (by the firm or its suppliers).

To the best of our knowledge, only Bernard et al. (2020) have used a similar type of data, for Denmark, but to approach a different question. Furthermore, they focus on the core activities of manufacturing firms, while we use the full information set covering both manufacturing and non-manufacturing companies, and study the sourcing of the whole range of service inputs used by the firms in the sample. We also explore an additional novel dimension of service offshoring at the firm level, namely whether it takes place at arm's length or through vertical integration (Section 6).

The definition of the core activity is left to the firm and is identified in the survey with the broad sector of the firm's operations (e.g., manufacturing, construction, services). Non-core activities refer instead to the following six broad service categories: transport and logistics; marketing, commercial and after-sales services; ICT services; administra-

[16]Within the same activity, firms may engage in offshoring but also in other modes of production (in-house production, domestic outsourcing within or outside the boundaries of the business group).

tive and management services; design, R&D, engineering and technical services; and other support activities. For example, for a manufacturing firm, service activities occur both downstream (marketing, logistics) and upstream (R&D, ICT, management consulting) phases of production. With the possible exception of R&D, the same can apply to wholesalers, too.[17] Several of these activities can be thought of as representing variable costs (e.g., after-sale services), while others represent fixed costs (e.g., R&D). The analysis focuses on these non-core service inputs.

Information on the destination of offshoring is reported at a geographical level sometimes referring to a country, sometimes to a group of countries: Africa, Brazil, China, EU15, the "new" 12 EU countries, Other European countries, India, Russia, the USA and Canada, Other Latin American countries, Other Asia and Oceania. Information about the destination of offshoring for service inputs allows us to analyze firms' sourcing decisions at the firm-activity-destination level, and to test whether destination-specific experience, together with other characteristics of the destination, affects the offshoring decision. The inclusion of destination fixed effects in the econometric specification ensures that differences in size and composition among destination markets do not affect the identification of the main relationship of interest.

While our main empirical specification exploits cross-sectional variation from the CAM, panel information is needed to compute the firms' exporting experience. For firms engaged in international trade, we use French Customs data on imports and exports by product and country of destination for the period 1996–2017. These data have been widely used by other authors.

Finally, we obtain balance sheet data for firms in France from the Fichier Approché des Résultats d'Esane (FARE), which contains accounting information for the population of French firms, as well as their primary industry of activity.

3.2 Descriptive statistics

In our sample, 37 percent of exporters in 2011 offshore at least one service activity to at least one destination, but only 9 percent of non-exporters do so (Table 1).[18] Furthermore, exporters are almost six times more likely than non-exporters to offshore one such activity within the boundaries of the business group, and nearly four times more likely to do so outside of those boundaries. Differences between exporters and non-exporters are even starker for manufacturing firms, with the average exporter being seven times more likely to offshore one service activity (44 percent) than the average non-exporter (Table A.1). Manufacturing firms represent 29 percent of the total number of firms in the sample, but 44 percent of exporters and 10 percent of non-exporters.

A natural measure of a firm's experience in an export market, which follows directly from the model, is the number of years the firm has been exporting to the market since 1996, the first year of available French custom data at the firm level.[19] Now, the fact

[17]This is especially true if some firms are categorized as wholesalers but also perform production phases that are typical of manufacturing firms, such as goods design and coordination of production activities (Bernard and Fort, 2015).

[18]For the purpose of this table, information on the mode of input sourcing is aggregated to the firm level from the original firm-activity-destination level: offshoring takes a value of one for a firm if it sources any of the service categories from abroad.

[19]This implies that our measure of firm experience in a market is censored at 16 years. Section 4.1.1

Table 1: Summary Statistics by Trade Status - 2011

	All firms				Non-exporters				Exporters			
	mean	median	sd	count	mean	median	sd	count	mean	median	sd	count
Offshoring	0.24	0	0.43	6,428	0.092	0	0.29	2,881	0.37	0	0.48	3,547
Offshoring In	0.18	0	0.39	6,428	0.053	0	0.22	2,881	0.29	0	0.45	3,547
Offshoring Out	0.13	0	0.33	6,428	0.053	0	0.22	2,881	0.19	0	0.39	3,547
Num. offshored activities	0.6	0	1.32	6,428	0.19	0	0.72	2,881	0.93	0	1.57	3,547
Export experience (avg across destinations)	4.59	3	4.61	6,428	0.88	0	1.47	2,881	7.6	7.18	4.06	3,547
Total num. countries exported to	11.6	1	20.8	6,428	0	0	0	2,881	21	12	24.2	3,547
Total num. exported products	40.9	1	143.6	6,428	0	0	0	2,881	74.1	20	186.8	3,547
Total exports (volume)	29,580.2	7.5	270,254	6,428	0	0	0	2,881	53,606.3	2,820.6	362,062	3,547
Total num. imported products	61.8	7	154	6,428	8.69	0	45.6	2,881	104.9	50	192.7	3,547
Total imports (volume)	35,416.2	196.8	414,893	6,428	1,327.7	0	30,624	2,881	63,104	6,028.2	556,344	3,547
Employment	789.6	294	5,410.5	6,347	594.3	243	4,956.4	2,830	946.7	342	5,745.9	3,517
Capital/Labour Ratio	178.3	41.2	797.3	6,333	211	17.2	798.3	2,820	152	64.1	795.7	3,513

Note: *Offshoring In* stands for offshoring within the boundaries of the business group (i.e., offshoring to an affiliate). *Offshoring Out* stands for offshoring outside said boundaries, or at arm's length. *Export experience (avg across destinations)* is the firm's export experience in each destination, averaged over all destinations served by the firm. *Total num. countries exported to* and *Total num. exported products* aggregate over all countries served by the firm across all destinations. Total exports and imports are measured in thousands of €.

that the CAM survey only reports relatively aggregate destinations for offshoring commands a more flexible approach. Throughout the analysis, our main measure of exporting experience is the number of years in which the firm has been exporting to a particular destination, no matter the country within the destination (henceforth "export experience"), but we assess the robustness of our results using several alternative definitions for export experience. In addition, when calculating the experience indicators, we stay consistent with the theoretical model and assume that experience does not depreciate over time, even if the firm exits the export market. Nevertheless, we evaluate the sensitivity of the results to the possibility of depreciating experience, computed in different ways. As we will see, these variations in the measurement of export experience make little difference for the sign and magnitude of the main relationships of interest.

The resulting experience at the firm-destination level is averaged across destinations for the purposes of Table 1. The average firm thus serves a destination for 4.6 years, whereas the average exporter does so for 7.6 years. This number increases to 9.2 for exporters in the manufacturing sector (Table A.1). As experience never depreciates in the baseline definition, non-exporters that have exported in the past can have positive export experience, although this is small relative to current exporters. On average, exporters in the sample sold 74 different 8-digit products to 21 countries in 2011.[20] Again, those figures are higher if we consider only manufacturing firms.

Table 2a reports the frequency of service offshoring by exporting status, at the firm-activity-destination level in 2011. This is the level at which the baseline empirical specification is defined, as we are primarily interested in investigating the effects of destination-specific learning. The average probability of a firm offshoring a service in a specific destination is 1.6 percent, which increases to 2.6 percent for exporting firms.[21]

Table 2b displays the frequency with which offshoring firms choose to do so outside vs. within the boundaries of the business group (from a direct affiliate or other firm in the group). Consistently with panel (a) and with the baseline regressions, frequencies are calculated at the firm-activity-destination level, but conditional on firms doing offshoring to at least one destination and for at least one activity. Firms are more likely to offshore the provision of service inputs within the boundary of the group than outside it. This outcome may be partially explained by the fact that we consider the boundary of the business group, while the literature often considers only the direct affiliates. Mixed choices, when firms offshore both at arm's length and through an affiliate, are the least frequent case, albeit slightly more so among exporters than in the full sample of offshoring companies. These mixed choices may be a consequence of the relatively high level of aggregation at which service categories are defined: since the service categories are relatively broad, it is possible that firms are making different choices for more detailed services, but this cannot be investigated with the data at hand.

shows that our baseline results are robust to the potential expansion bias of this top coding.

[20]Recall the distinction between "country" and "destination," which can denote a group of countries. Here the figure refers to actual countries, not destinations.

[21]These probabilities, which may seem low, correspond exactly to the firm-level probability of offshoring reported at the beginning of this section, i.e., 24 percent (for the full sample) and 37 percent (for the sample of exporters). The lower figures reported here are a mechanical consequence of the large number of zeros introduced when the service activity and destination dimensions are considered as well, since most firms do not offshore all services to all destinations.

Table 2: Frequency of Sourcing Decision at the Firm-Activity-Destination Level (2011)

(a) Offshoring by Exporting Status

	All firms	Exporters only
Offshoring: Yes	6,934	6,161
Offshoring: No	417,314	227,941

(b) Offshoring In vs Offshoring Out

	All firms		Exporters only	
	Offshoring Out: No	Offshoring Out: Yes	Offshoring Out: No	Offshoring Out: Yes
Offshoring In: No		1,604		1,327
Offshoring In: Yes	4,549	781	4,117	717

Note: *Offshoring In* stands for offshoring within the boundaries of the firm (i.e., offshoring to an affiliate). *Offshoring Out* stands for offshoring outside the boundaries of the firm, or at arm's length. Only the offshoring of service activities is considered. Firms with mixed domestic and foreign sourcing strategies are included.

4 Export experience and the propensity to offshore

In this section, we test the first two predictions of our model using the cross-section of firms from the CAM survey and the 1996-2011 customs data for the same set of firms, which consists of French firms operating in sections NACE Rev.2 B to N (mining, manufacturing and market services except for finance and insurance).

In the first subsection, we test Prediction 1, i.e., whether there is a positive relationship between firms' export experience and their propensity to source service inputs from abroad (offshoring). We first estimate the relationship at the firm-activity-destination level. If exporting provides information that can enhance a firm's willingness to offshore, this information is naturally more relevant for the offshoring of inputs in the same destination, rather than elsewhere. This is also the most disaggregated level available in our data and the one that allows controlling for the most detailed set of fixed effects. We then establish that the sign and strength of the empirical relationship between offshoring and export experience do not depend on how we aggregate the data, and in particular on aggregating away the activity or destination dimensions.

In Subsection 4.2, we test Prediction 2, which relates to how characteristics of the destination market enter the firm's choice to offshore services there. Market characteristics can affect that decision directly but also indirectly, depending on the firm's export experience.

4.1 Offshoring and export experience

Prediction 1 posits a positive relationship between a firm's experience in serving a destination through exports and its propensity to source inputs from that foreign market. The longer the firm's experience in the export market, the more likely it is that the firm will have discovered its fundamental export profitability, and that it will offshore services rather than source them domestically if its profitability is sufficiently high. Intuitively, this should be especially true for outsourced service inputs that are at least partially destination-specific. In Arkolakis (2010), for instance, the fixed cost of exporting is associated to market-specific services such as advertising and distribution. Berlingieri and Pisch (2021) provide evidence about the specific service inputs that French firms need to acquire when entering new destination markets.

We test this prediction on the CAM data, exploiting the full extent of its variation (firm-activity-destination), i.e., the level at which the probability of offshoring is reported in the dataset:

$$OFF_{iaj} = \alpha + \beta_1 Experience_{ij} + \boldsymbol{X'_{ij}}\boldsymbol{\vartheta} + \chi_a + \varphi_i + \gamma_j + \xi_{iaj}, \tag{16}$$

where OFF_{iaj} is a dummy variable with value 1 if firm i is offshoring a given service activity a from destination j in 2011, and activity a refers to one of the service categories contained in the CAM.[22]

The main regressor of interest is the firm's experience as an exporter in the destination market ($Experience_{ij}$). It is defined as the number of years since the firm started exporting to any country belonging to that destination group. We add a number of controls for the size of the firm's trading activity with the destination, as summarized by $\boldsymbol{X_{ij}}$: the number of countries reached within the destination group, the total exported volume, and the number of products exported by the firm. All trade-related explanatory variables are constructed at the firm-destination level. The estimating sample is designed so that all firm-activity-destinations are defined, even if they imply a zero value. As we control for firm, activity, and destination fixed effects (φ_i, χ_a, γ_j), we account for possible alternative mechanisms that affect the general propensity of firms to offshore, such as ICT intensity or productivity, the intrinsic offshorability of a service activity, or destination-specific conditions that facilitate offshoring, such as strong contract enforcement. Critically, all firm-specific factors that are not destination-specific are absorbed by the firm fixed effect.

The main coefficient of interest is β_1, which is expected to be positive: better knowledge of a firm's own export profitability, which comes with a longer experience in the export destination, provides greater incentives for the firm to switch away from domestic sourcing of service inputs in favor of foreign supply. The propensity to offshore inputs from the destination market is also expected to increase with the volume of goods exported to the destination which, under the theoretical model, is a proxy for the expected profitability of the export market. Empirically, as productivity and size are positively correlated, the term for exported volumes potentially controls for unobserved firm-destination specific productivity differences, which may simultaneously affect the firm's export and offshoring behavior. The very same intensive margin can further be interpreted as a proxy for experience, something that we explore in one of our robustness specifications. Measures of the extensive margin of exports (number of products and countries) are expected to correlate positively to offshoring, too: conditional on being an exporter into the destination, both dimensions represent an extra source of learning for the firm and therefore may increase its willingness to offshore.

In Table 3 we present the results from estimating a linear specification of equation (16), with clustered standard errors at the firm level. All explanatory variables are stan-

[22]In our theoretical model, firms are either sourcing inputs only from the destination of exports or domestically. Of course, reality is more complex, and a zero value in the offshoring dummy could also imply that the firm is sourcing from a different destination, or not using the input at all. Empirically, this matters if export experience is correlated across destinations. In the next subsections, we separately account for experience in other destinations and for the fact that some firms never use the service input altogether. We find that neither affects the strength of our baseline result.

dardized, which simplifies the comparison of coefficients. Our main prediction holds: an increase of one standard deviation of export experience in a given destination increases the probability with which the firm sources service inputs from that destination by 0.8 to 0.9 percentage points, depending on the set of extra controls included (Columns I and II). These figures should be compared to the average probability of offshoring a certain activity to a given destination in the sample, of 1.6 percent.[23] A five-year increase in experience in a destination market (approximately one standard deviation of experience) thus raises the probability to offshore service inputs there by 46 to 52 percent of the average probability of offshoring, conditional on different measures of exporter size. The sign and significance of the coefficients for all other regressors are in line with expectations.

Table 3: Offshoring and Export Experience

	(I)	(II)	(III)	(IV)	(V)	(VI)
	Firm-Activity-Dest		Firm-Dest		Firm-Activity	
Export Experience	0.009***	0.008***	0.027***	0.024***	0.042***	0.033***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)	(0.004)
Export Volume	0.004**	0.004**	0.005*	0.005*	0.022***	0.016***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.006)	(0.005)
Num. Exp. Products	0.005***	0.004***	0.010***	0.009***	0.020***	0.005
	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)	(0.005)
Num. Countries		0.003***		0.008***		0.037***
		(0.001)		(0.002)		(0.006)
Observations	424,248	424,248	70,708	70,708	38,088	38,088
Number of firms	6,428	6,428	6,428	6,428	6,348	6,348
R-Square	0.192	0.193	0.401	0.402	0.09	0.096
Firm FE	Yes	Yes	Yes	Yes		
Activity FE	Yes	Yes			Yes	Yes
Destination FE	Yes	Yes	Yes	Yes		
Industry FE					Yes	Yes

Note: Cross-sectional data for 2011 at the firm-activity-destination (Columns I-II), firm-destination (Columns III-IV), and firm-activity level (Columns V-VI). *Activity* refers to the type of service which is offshored, and *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is a dummy with value 1 if the firm is offshoring the production of a given service input to a given destination group (Columns I-II), to any destination group (Columns V-VI), or any activity to a given destination group (Columns III-IV), and 0 otherwise. *Experience* is defined as the number of years since the firm started exporting to any country belonging to a destination group (Columns I-IV), or as the number of years since the firm started exporting to one of the 12 destination groups, then averaged across all destination groups served by the firm (Columns V-VI). Exported volumes, number of exported products and number of export countries are defined at the firm-destination level (Columns I-IV) or firm level (Columns V-VI). All variables are standardized. The results are obtained estimating a fixed effect linear model, with clustered errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

As mentioned earlier, our theoretical model does not posit an explicit correspondence between exporting and offshoring destinations. Indeed, the process of self-discovery could have both a firm and a firm-destination dimension, if firms learn their export profitability because of their overall export activity, or because of learning spillovers across destinations

[23]Recall that the relatively low probability of offshoring relative to Table 1 is explained by the shape of the dataset for the regression analysis, which exploits firm-activity-destination variation and where the dataset has been rectangularized to account for all zeros. The probability corresponds to what is reported in Table 2a.

(with complementarties as in Antràs et al., 2017). Accordingly, Columns III-VI of Table 3 re-estimate equation (16), aggregating the activity and destination dimensions away (Columns III-IV and V-VI respectively) and adjusting the set of fixed effects accordingly. The relationship between offshoring and experience remains positive and well identified, but magnitudes cannot be immediately compared across specifications, as the distribution of export experience and of the offshoring probability differ between the firm-destination and firm-activity aggregation level. Accounting for these differences, we find that an additional five-year export experience increases the probability of offshoring by 46 to 50 percent of its average in the sample, as in the baseline specification of Columns I-II.

Taken together, these results suggest that firms do indeed leverage the knowledge acquired across the destinations they serve to explore their potential profitability in the marginal destination, and to decide how to structure operations across the domestic and foreign markets. Moreover, no matter the specification, the effects we document are economically important, implying an approximate 50 percent increase in offshoring for a five-year increase in export experience.

4.1.1 Robustness checks

To test the robustness of our results, we propose a battery of exercises, where we change the definition of experience, the depreciation schedule of the knowledge gathered by firms in the export market, the set of additional controls, the estimation sample, and the estimation technique.

We first investigate whether the results are robust to alternative definitions of export experience, which are reported in Table A.2 in the Appendix. We alter the rate with which knowledge gained in the export market depreciates over time. In the benchmark specification of Table 3, *Experience* accumulates linearly over time, and the knowledge gathered by the exporter does not depreciate after exiting the destination market. Therefore, a firm keeps the same export experience over time, even years after exiting the export market. If the firm has also stopped offshoring there, the baseline measure of *Experience* introduces a downward bias in the estimated relationship between offshoring and experience.[24]

Since our theoretical model does not speak about the mechanism of depreciation of experience, this is just one possible measurement approach. An alternative approach assumes that a firm forgets the lessons learned in an export market as time passes after the moment in which it exited that market. In Table A.2, we first propose that experience depreciates linearly over time, so that one year is subtracted from experience for every year in which the firm is not exporting to a given export market (Column II). Another specification takes a mixed approach, where there is no depreciation of experience, but experience drops to zero in years in which the firm does not export to the destination (Column III). Under this approach, non-exporters always have zero experience, but they regain their previous level of experience if they resume exporting to the same destination. Table A.2 shows that the alternative specifications of depreciation do not affect the size of the estimated relationship. This shows that the contribution to our estimation by firms that exit and later re-enter a destination is rather small.

[24]Naturally, it is possible that the firm stops serving the market through exports and starts doing so by establishing a production unit in the destination market, as in Conconi et al. (2016). In such a case, where horizontal foreign direct investment substitutes for exporting, the offshoring of service inputs is expected to persist.

In the same table, a second set of robustness specifications relies on different definitions of experience. The baseline definition does not distinguish between experience gained by exporting consistently to a single country within the destination or by exporting occasionally to multiple countries in the destination. In this sense, it equates experience to the time spent serving a destination market, and allows us to identify a separate term for the number of countries in the destination served through exporting. As a consequence, under the baseline definition, experience does not increase mechanically with the number of countries encompassed by the destination group – a desirable property when destination fixed effects are omitted, which absorb the impact of the destination group's size on offshoring.

A different approach can bring together both the geographical and time dimensions of exporting. After all, an exporter's experience can increase both with the duration of its activities in a market and with the complexity of serving multiple countries in that destination market. In Table A.2, Column IV, "cumulative export experience" counts the number of years in which the firm has served a given country, then sums these country-specific experiences over all countries in the destination.[25] Both definitions measure the capacity of firms to learn from the exporting activity, but "cumulative" experience captures possible knowledge spillovers from serving multiple countries in the destination, while the baseline experience identifies learning from a given destination market more directly.

A second alternative definition of experience (Column V) better accounts for the geographical dimension and averages the country-specific experiences within a destination group. A last indicator (Column VI) evaluates experience based on how much the firm exports in each year to a given country, or the "intensity" of its experience. Smaller exported volumes can be used by the firm to experiment in the market, and can signal a higher degree of uncertainty about the market's export profitability. Under this definition, we sum over the total volume sold by the firm in the destination market in the previous years; we use its logarithm to minimize the importance of outliers. This measure conveniently attributes different weights to small and large countries within one destination.

Table A.2 shows that all approaches confirm the positive link between the probability of sourcing service inputs from the export destination and export experience. We find that one extra standard deviation in experience increases the probability of offshoring between 31 and 75 percent of the average offshoring probability in the sample, with the wide range of estimates mainly reflecting the differences in the standard deviation of experience across definitions. Where standard deviations are more comparable (Columns II and III), we obtain the same magnitude as in the baseline specification (Column 1), with a quantification for a five-year increase in experience that is virtually unchanged.

Next, we run additional regressions to check whether the results are driven by some omitted variable that is correlated with experience or offshoring. Columns I-II in Table A.3 in the Appendix add extra controls, namely a dummy with value 1 if the firm exports anything to that destination in the year (column I), and controls for the volume of goods

[25] Consider two firms, both exporting to two different countries in the same destination, but one serving both countries for both years, the other serving only one country in each year. According to the baseline definition of experience, the two firms have the same export experience (2 years), while under the cumulative definition the first firm has double the experience (4 years) of the second firm.

imported by the firm and the number of imported products (column II). The exporter dummy tests whether exporters to the specific destination source service inputs more or less intensively than non-exporters, and allows us to identify the effect of experience on offshoring conditional on the exporting status. The model suggests that service inputs are needed for exporting; therefore, the dummy's coefficient should have a positive sign.[26] The imported volume and the number of imported products simply control for the frequent co-occurrence of importing and exporting, and the possibility that exporting is correlated to offshoring because offshoring firms also import more goods from the same destination.

Column III excludes from the sample the firms that do not use the service input altogether, a possibility that is disregarded in the theoretical model, where exporting firms always need the service inputs and source them either domestically or from the foreign market. In reality, about 30 percent of firm-activity-destination observations in the sample do not report any offshoring, domestic sourcing or employment of workers in the in-house production of that service input.[27] If these firms display non-zero export experience (and of course zero propensity to offshore), they introduce a downward bias in the coefficient of export experience in the baseline estimations.

Column IV restricts the sample to firms with positive export experience in at least one destination. Under a strict interpretation of the model, service inputs are necessary only for exports; hence, firms that never export should not make use of them, whether the inputs are sourced domestically or abroad.This is clearly a simplification, but firms that never export may offshore for reasons entirely unrelated to the mechanism under study, so we exclude them in this robustness specification. Reassuringly, service offshoring is a rare event for firms with zero export experience, occurring with a probability of 0.2% compared to 1.6% for the full sample.[28]

Column V excludes the firm-destination pairs with a level of experience equal to 16 years. Since Customs data are available to us from 1996, our measure of experience is censored at 16 years (in 2011). This may lead to a classical expansion bias due to top coding (e.g., Rigobon and Stoker, 2009). Firms with an export experience of 16 years indeed display a significantly higher probability of offshoring services in the respective destinations. However, the results show that the potential bias is limited. When excluding the top-coded observations, export experience remains highly significant. Although the

[26]A coefficient on the export dummy can be empirically estimated because a small number of firms offshore services even without engaging in any export activity (Table 1), and because our baseline measure of experience remains positive even if the firm stops exporting.

[27]Domestic sourcing can take place at arm's length (outsourcing), from a domestic affiliate, or from another firm of the same business group. Note that this exercise excludes service platform offshoring, whereby the firm sources service inputs from nearby destinations, a possibility that is not considered in our baseline model, but which would be relatively easy to incorporate. Once the investment in a nearby destination is sunk, the firm may find it optimal to source the service input from there, rather than in the destination (where it would have to pay the fixed cost of offshoring) or from home (where the marginal adjustment cost is likely to be higher). This possibility could introduce a downward bias in our baseline estimation, since export experience is likely to be correlated across nearby destinations. Nevertheless, platform offshoring remains quite rare: only 261 firms are potentially involved, accounting for 0.08% of our sample at the firm-activity-destination level; the activities with the highest incidence are Design and R&D.

[28]Note, however, that firms may export indirectly via other affiliates belonging to the same business group, via intermediaries, or through carry-along trade (Bernard et al., 2019). In these cases, and especially the first one, our mechanism can still be at play. Note also that every sector covered by the CAM survey includes at least some exporters.

coefficient drops somewhat in magnitude, this is primarily due to the reduction in the standard deviation of export experience (now equal to 3.9 years as opposed to 5.4 in the full sample). As a result, the increase in the offshoring probability due to a five-year increase in export experience is equivalent to 49 percent of the average probability of offshoring in the original sample, in line with baseline results.[29]

Lastly, in Columns VI and VII, we change the econometric specification by estimating, respectively, a linear model using the sampling weights provided in the CAM survey, and a non-linear specification (logit), which accounts for the binary nature of the outcome variable. All specifications of Table A.3 confirm the baseline results. The sign and significance of the coefficients on export experience are robust, and magnitudes, when directly comparable, closely mirror those of the baseline table.[30]

Overall, we find strong empirical validation for Prediction 1. Regardless of how it is measured, of how its depreciation is computed, of the set of controls included, and of the sub-samples used, export experience is a key determinant of the firm's propensity to offshore services in the export destination, conditional on export volume, number of exported products, and other unobservable firm-specific characteristics.

4.1.2 Alternative mechanisms

The empirical association of export experience and service input offshoring, however, need not rely on the mechanisms described in our theoretical model. Here we test some alternative mechanisms, but do not find any evidence that they invalidate (or alter in any significant way) the empirical support for Prediction 1.

One possibility is that firms learn important lessons about their profitability when exporting to markets that are not necessarily the ones from which they source service inputs. The previous subsection explored the link between exporting to a destination and sourcing inputs *from the same market*, which seems to be the most natural approach and allows for a cleaner identification of the relationship of interest, as it absorbs firm- and destination-specific confounding factors. However, while certain "lessons" from exporting are certainly market-specific, others may be useful across markets; i.e., the firm can learn something about itself and its own profitability as an exporter in a market after selling to a different market.[31]

We document the firm dimension to this process of self-discovery in the firm-activity specification of Table 3. In Table 4, Columns I-II, we focus instead on cross-destination learning spillovers, and augment equation (16) with a term for the experience the firm accumulates by exporting to third markets, i.e., any of the 11 destination markets other than j. A first measure simply averages the firm's experience across all destinations $k \neq j$; a second measure considers all destinations $k \neq j$ as if they were countries within one large

[29]Figure 1 implies that our effect is larger for smaller values of experience. Indeed, we find larger effects when experience is below five years.

[30]The magnitudes cannot be compared between linear and non-linear specifications, as the table reports coefficients for the logit specification, not the marginal effects. The two specifications also differ in the number of observations, due to the mechanics of the conditional logit estimation: whenever the firm has the same offshoring behavior across all destinations, the outcome is perfectly predicted and the firm is automatically dropped from the sample. Further differences in the magnitude may be attributed to genuine differences in the way the linear vs non-linear models capture the underlying relationship of interest.

[31]In fact, this is the central message of Albornoz et al. (2012).

worldwide destination market, and therefore assigns value one to each year in which a firm is exporting anywhere in the world that is not destination j. The results in Columns I-II attest that the additional controls for third-market experience hardly affect the coefficient on the destination-specific *Experience*. Moreover, we find that longer experience in third markets is also positively associated with the probability of offshoring to j, albeit with a lower magnitude (42-47 percent of the average probability of offshoring for a 5-year increase in experience) and with slightly lower precision than the baseline experience.

Table 4: Alternative Mechanisms

	(I) 3rd Market	(II) 3rd Market	(III) Rauch Sample	(IV) Rauch Inter	(V) Manuf Only	(VI) No Cred Cons
Export Experience	0.010***	0.010***	0.006***	0.006***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Exp Exp - 3rd market	0.007**					
	(0.003)					
Exp Exp - 3rd market (tenure)		0.009**				
		(0.004)				
Export Experience × Rauch				0.000		
				(0.001)		
Observations	424,248	424,248	221,958	221,958	122,496	73,392
Number of firms	6,428	6,428	3,363	3,363	1,856	1,112
R-Square	0.192	0.192	0.206	0.206	0.223	0.241
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Cross-sectional data at the firm-activity levels, for 2011, where *Activity* refers to the type of service which is offshored, and *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is a dummy with value 1 if the firm is offshoring service inputs and 0 otherwise, in a given activity and destination in 2011. *Experience* is defined as the number of years since the firms started exporting to any country belonging to a certain destination group *Experience 3rd market* takes an average of the baseline experience gained in each of the 11 destination markets different from j. *Experience 3rd market (tenure)* gives value equal to one for any year of export to a given destination different from j, then sums those over the years and destinations. *Export Experience × Rauch* stands for the cross-product of export experience and a continuous variable capturing the weight of differentiated products in the firm's exports, where goods are classified as homogeneous or differentiated according to Rauch (1999). Similarly, *Rauch Sample* estimates the baseline only on the sample of exporting firms for which export product data are available. In *Manuf Only*, the sample is restricted to manufacturing firms only, and in *No Cred Cons* to manufacturing firms operating in sectors which are relatively less credit constrained, based on Manova (2013)'s classification of industries by asset tangibility. *Controls* stand for the exported volume and the number of exported products. All variables are standardized. Fixed effect linear model regressions with clustered standard errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

Table 4 further explores other potential economic mechanisms that would be inconsistent with our theoretical model, but that would also yield a positive correlation between experience and offshoring. For instance, sourcing service inputs at destination may be more important for an exporter of differentiated products, which relies on local services to adjust to the specific export market and gain a competitive edge. If this were the case, export experience should affect offshoring of service inputs more for the foreign sales of differentiated than of homogeneous goods. We therefore classify exported products as homogeneous or differentiated following Rauch (1999). We then compute the share of non-homogeneous products a firm exports using each product's weight in the total export volume of the firm, and interact this with our indicator of export experience. We estimate this specification on the sub-sample of exporters only, as computing the new indicator requires (firm-)product-level export data.[32] We find no differential impact of

[32]The sample does not include all exporters because firms trading less than EUR 460,000 in a year file

export experience on the propensity to offshore depending on the firm's export intensity in differentiated goods (Column IV).[33] Furthermore, a comparison between Column III (where the sample is equally restricted but there is no extra control) and Column IV reveals that the introduction of the intensity term does not affect the magnitude of the relationship of main interest.

Finally, it is plausible that, even if all exporting firms want to offshore service inputs from the export destination, only few may have the financial resources to cover the sunk cost of offshoring at entry. The others can only offshore once they have gained some export experience and have retained sufficient earnings to cover the sunk cost. If this were the case, we should find that credit-constrained firms rely more on export experience to offshore the production of service inputs. While we do not observe the credit worthiness of firms directly, we can identify the industries that are more or less credit constrained based on the proportion of collateralizable assets, as in Manova (2013). If the value of asset tangibility for the industry is below the median of the whole manufacturing sector, we define the industry as credit constrained. We then test Prediction 1 on the sub-samples of all manufacturing firms (Column V) and of firms in manufacturing industries that are less credit constrained (Column VI). Again, results are virtually the same across the specifications, rejecting the hypothesis that the link between service input offshoring and export experience is driven by credit constraints.

4.2 Offshoring and market characteristics

The baseline specification in equation (16) captures how export experience across the different destination markets affects a firm's offshoring behavior. Our model also predicts a role in this relationship for specific features of the export market, in particular the expected profitability of the market and the adjustment friction. According to Prediction 2, the offshoring probability is increasing in both: more profitable markets help sustain the fixed cost of offshoring, while large adjustment frictions provide a disincentive for firms to do domestic sourcing relative to offshoring. Moreover, the impact of export experience on the likelihood to offshore services in the destination increases in more profitable markets and in markets that entail larger adjustment frictions when sourcing domestically. While both statements in Prediction 2 have equal standing in the model, the estimation of the level effects (the first statement) requires the omission of the destination fixed effect. This introduces a misalignment with the baseline specification (16) that tends to weaken the identification of the coefficient on export experience.

We therefore focus on testing the validity of the second statement of Prediction 2, on the interaction effects, by estimating:

$$\begin{aligned} OFF_{iaj} = \alpha + \beta_1 Experience_{ij} + \beta_2 Experience_{ij} \times E\mu_j + \beta_3 Experience_{ij} \times \tau_j \\ + \boldsymbol{X'_{ij}} \boldsymbol{\vartheta} + \chi_a + \varphi_i + \gamma_j + \xi_{iaj}, \quad (17) \end{aligned}$$

where β_2 and β_3 capture the marginal effect of an increase in export experience for different levels of expected market profitability ($E\mu_j$) and the adjustment friction (τ_j). In a second

a simplified declaration that does not include product-level information for intra-European exports. As a result, the sample misses around 5% of firms exporting in 2011.

[33]We employ the liberal classification of differentiated product, as in Nunn (2007) and Corcos et al. (2013), and find that a large share of firms in our sample export fully differentiated product. The value of the product differentiation for our median firm is very close to 1.

exercise, we omit the destination fixed effects γ_j and test the effect of $E\mu_j$ and τ_j on the probability of sourcing service inputs from the destination market, as predicted by the first part of Prediction 2.

In our context, markets where expected profits are higher tend to induce offshoring of services. We approximate the profitability of the destination market by its real GDP. On the other hand, choosing a measure for τ_j is less straightforward. Parameter τ_j stands for any factor that eases doing business with foreign suppliers relative to domestic ones, thus reducing the firm's relative cost to source inputs from abroad rather than domestically. We therefore need measures of (dis)similarity between the origin and export country that affect the firm's ability to source service inputs abroad and its cost. Several gravity-like variables, which we source from the CEPII Gravity database (Head and Mayer, 2014), are *a priori* good candidates: being part of the same regional trade agreement (RTA) or sharing the same currency or legal system are likely to increase τ, i.e., to reduce the relative marginal cost of sourcing inputs from abroad. Strong rule of law provisions and enforcement, as measured by the World Bank Governance Indicators database (Kaufmann et al., 2011), should also reduce the marginal cost of offshoring services by creating a more business-friendly institutional environment in the destination. Similarly, the quality of services tends to be higher and transaction costs (be them communication costs or costs associated to failures in production) tend to be lower when the workforce in the destination is more skilled, which we approximate with its human capital level (Human Capital Index, from the Penn World Tables v9). We have the opposite expectation for the physical distance between France and the foreign market: if the distance between them increases, offshoring of service inputs becomes less convenient. Note that (the inverse of) distance could also in part capture the effect of $E\mu_j$, because higher distance implies higher marginal costs of exporting goods, and hence a lower profitability of the destination market.

The results from estimating equation (17) are reported in Table 5. The first column only controls for the interaction with our measure for $E\mu$, while all other columns simultaneously estimate an effect for the interactions with $E\mu$ and τ.

As predicted by the model, the effects of the size of the destination market and of the adjustment friction on the firm's probability to offshore there are stronger, the longer the firm's experience in exporting there, and thus its knowledge of the destination market. The probability of offshoring in a destination increases with experience, and it does so by more in locations with a stronger-than-average rule of law and human capital endowment, and that share a common currency or a regional trade agreement with France – once cross-destination differences in GDP are also accounted for. In contrast, the effect of experience on the probability of offshoring decreases for destinations that are further away from France than the average destination of export, and that have lower-than-average GDP, as these destinations are likely to be less profitable to offshore in. Sharing the same language or colonial ties, which are highly correlated, has a more subtle effect instead. While it should make offshoring easier, it also increases the effectiveness of domestically sourced services in the destination. The estimates indicate that the net effect of export experience on offshoring in the destination is lower for French-speaking countries and those with colonial ties with France. Overall, introducing an interaction between experience and τ does not affect the significance and ballpark magnitude of the interaction between experience and $E\mu$, which confirms the relevance of both profitability and adjustment cost

Table 5: Offshoring by Destination and Destination Characteristics - Interactions

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
Export Experience	0.008***	0.003***	0.008***	0.004***	0.008***	0.008***	0.005***	0.007***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Exp Exp × Real GDP	0.005***	0.007***	0.005***	0.003***	0.005***	0.006***	0.003***	0.004***	0.008***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Exp Exp × RTA		0.008***							
		(0.001)							
Exp Exp × Comm Legal			0.000						
			(0.000)						
Exp Exp × Comm Currency				0.007***					
				(0.001)					
Exp Exp × Comm Language					-0.001***				
					(0.000)				
Exp Exp × Colony						-0.002***			
						(0.000)			
Exp Exp × RoL							0.008***		
							(0.001)		
Exp Exp × HC								0.005***	
								(0.000)	
Exp Exp × Distance									-0.008***
									(0.001)
Observations	424,248	424,248	424,248	424,248	424,248	424,248	424,248	424,248	424,248
Number of firms	6,428	6,428	6,428	6,428	6,428	6,428	6,428	6,428	6,428
R-Square	0.194	0.198	0.194	0.198	0.194	0.194	0.197	0.195	0.197
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Cross-sectional data at the firm-activity-destination level, for 2011, where *Activity* refers to the type of service which is offshored, and *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is a dummy with value 1 if the firm is only offshoring to a given destination group, 0 otherwise, in a given activity in 2011. All trade-related variables are defined at the firm-destination level (over all countries in the destination group), including *Exp Exp*, which is the export experience defined as the number of years since the firms started exporting to any country belonging to a certain destination group. *Real GDP* measures the cumulative USD value of the underlying indicator over the countries in the destination group, taken in logarithm. *RTA*, *Comm Legal*, *Comm Currency*, *Comm Language*, and *Colony* are dummy variables with value 1 if France and one of the countries in the offshoring destination group share, respectively, a regional trade agreement, common legal origin, common currency, common official language, and a colonial link, from the CEPII Gravity database. *RoL* is the average index of the effectiveness of the rule of law in the destination countries, as measured by the World Bank Governance Indicators database. *HC* is the Human Capital Index from the Penn World Tables (v9), averaged across countries in the destination. *Distance* measures the distance between France and the country of export destination. *Controls* stand for the exported volume and the number of exported products. All variables are standardized. The results are obtained estimating a fixed effect linear model, with clustered errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

channels in our framework.[34] These results validate the second statement of Prediction 2: higher market expected profitability and higher domestic adjustment costs reduce the profitability threshold beyond which the firm switches to offshoring, thus also lowering the export experience required to induce firms to start offshoring.

The results of estimating equation (17) while omitting the destination fixed effects and without interaction terms are reported in Table A.4 in the Appendix. The predictions of the model are once again confirmed empirically: larger economies command a higher probability of offshoring there, everything else held constant, while various proxies for the adjustment frictions affect the probability of offshoring at destination according to intuition and the evidence in Table 5.

5 The trade consequences of offshoring

In this section, we test Predictions 3-5 of our model using the cross-section of firms from the CAM survey and extending the customs data until 2017, to study the relationship between offshoring and subsequent trade volumes (Subsection 5.1), the volatility of export volumes (Subsection 5.2), and the probability of exit from the destination market (Subsection 5.3).

5.1 Offshoring and trade volumes

Prediction 3 indicates that offshoring induces firms to export greater volumes. As discussed in the model, this is both a consequence of model assumptions (the lower marginal cost of offshoring relative to domestic sourcing) and one of the model's outcomes (the selection of firms to offshore both at entry and when they discover their export profitability).

We test this prediction by estimating the following equation:

$$ExpVolume_{ij,t+} = \alpha + \sigma OFF_{ij} + \boldsymbol{Z'_{ij}}\boldsymbol{\vartheta} + \varphi_i + \gamma_j + \xi_{ij}, \tag{18}$$

where $ExpVolume$ is the (log of the) future volume exported towards a destination after 2011, OFF is a measure of the firm's offshoring activities of service inputs in the destination, φ_i captures firm fixed effects, and γ_j captures destination-specific effects. The relationship is estimated on the sub-sample of firms that are active exporters in 2011.[35] Prediction 3 indicates that coefficient σ should be positive. Given the firm and destination fixed effects, we are comparing the behavior of the same firm across destinations, while also controlling for destination characteristics. This set of dummies captures a host of possible confounding determinants of future export volumes. Importantly, the extra controls for the volume and number of products exported *in 2011* ensure that σ is not affected by the size of the transactions to the destination. Note also that there is no

[34] Jointly controlling for all proxies of τ in the same specification would suffer from the strong collinearity among them. We therefore perform a principal components analysis of these variables, and found that the three most important components rotate around RTA and common currency, common language and colonial linkages, and common legal system. Introducing all these components simultaneously in equation (17) instead of the gravity-like variables leaves the magnitude of the coefficients on experience and $E\mu$ virtually unaffected (see Table A.5).

[35] In unreported specifications, we relax this condition and obtain similar results.

Experience term in equation (18), since the link between destination-specific offshoring and exporting holds true independently of the length of the exporting spell.

Table 6 reports the outcomes of estimating equation (18) with a linear regression in which all regressors are aggregated at the firm-destination level. While Columns I-IV use export volumes for 2012 only, Columns V-VIII use the yearly average exports over the full 2012-2017 period, calculated by dividing the firm's cumulative exports to the destination by the number of years of actual export activity in that period. The measure of offshoring has value 1 if the firm offshores at least one service activity to the destination in 2011, and 0 otherwise (Columns I-II and V-VI). The number of offshored activities (Columns III-IV and VII-VIII) sums over the number of service inputs the firm offshores in the destination in 2011.

Table 6: Offshoring and Trade Volumes

	(I) 2012	(II) 2012	(III) 2012	(IV) 2012	(V) 2012-17	(VI) 2012-17	(VII) 2012-17	(VIII) 2012-17
Offshoring	0.709***	0.644***			0.728***	0.664***		
	(0.065)	(0.064)			(0.062)	(0.061)		
Num. Offsh. Activities			0.229***	0.194***			0.210***	0.177***
			(0.025)	(0.025)			(0.024)	(0.023)
Observations	15,426	15,426	15,426	15,426	16,762	16,762	16,762	16,762
Number of firms	2,558	2,558	2,558	2,558	2,720	2,720	2,720	2,720
R-Square	0.615	0.633	0.614	0.632	0.663	0.677	0.661	0.676
Controls		Yes		Yes		Yes		Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Cross-sectional data at the firm-destination level for 2011, where *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is the log of the total exported volumes towards all countries included in the offshoring destination group in 2012 (Columns I-IV), and the average exported volumes between 2012 and 2017 (Columns V-VIII). These are not defined for firms which are not exporting in 2011. *Offshoring* is a dummy with value 1 if the firm offshores at least one service activity to that destination in 2011, and 0 otherwise. *Num. Offshored Activities* is the number of service activities that are offshored by the firm to that destination. *Controls* stand for the exported volume in 2011 and the number of exported products (in 2011). The results are obtained estimating a fixed-effect linear model, with clustered errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

In line with Prediction 3, firms offshoring to a destination export greater volumes of goods there in the future. Based on the most demanding specifications (controlling for current export volume and number of products exported), future exported volumes are 90 to 94 percent higher for firms that offshore at least one service activity to the same destinations than for firms that do not, everything else held constant.[36] Under the alternative measure of offshoring, we find that one additional offshored activity increases the exported volume by 19 to 21 percent. Evaluated at the mean, adding one offshored service activities leads to approximately an extra 2.2 million euros in exports. In sum, controlling for destination characteristics, firms sell substantially more in the markets where they offshore more services, corroborating the basic mechanism of the model.

[36] Exp(0.644)-1 = 0.90.

5.2 Offshoring and export volatility

Prediction 4 states that an offshoring firm is more likely to keep exported volumes stable than a firm choosing to source inputs domestically, since offshoring firms are more likely to have already discovered their export profitability. That is also true for a given firm choosing different sourcing modes in different markets. In other words, Prediction 4 stipulates that offshoring inputs to a destination decreases the volatility of firms' export volumes to that destination.

We test this prediction by estimating the following equation:

$$ExportVolatility_{ij,t+} = \alpha + \kappa OFF_{ij} + \boldsymbol{Z'_{ij}}\boldsymbol{\vartheta} + \varphi_i + \gamma_j + \xi_{ij}, \tag{19}$$

where $ExportVolatility$ is a measure of the volatility of the firm's future exports to a destination. φ_i and γ_j capture firm and destination-specific effects, respectively. The model predicts that coefficient κ is negative: offshoring firms should exhibit lower volatility in exports relative to exporting firms that source service inputs domestically.

Table 7: Offshoring and Export Volatility

	(I) CV	(II) CV	(III) CV	(IV) CV	(V) Num Exits	(VI) Num Exits	(VII) Num Exits	(VIII) Num Exits
Offshoring	-0.127***	-0.115***			-0.073***	-0.068***		
	(0.021)	(0.020)			(0.014)	(0.014)		
Num. Offsh. Activities			-0.034***	-0.028***			-0.018***	-0.016***
			(0.008)	(0.008)			(0.005)	(0.005)
Observations	16,762	16,762	16,762	16,762	17,534	17,534	17,534	17,534
Number of firms	2,720	2,720	2,720	2,720	2,853	2,853	2,853	2,853
R-Square	0.583	0.589	0.582	0.588	0.443	0.446	0.443	0.445
Controls		Yes		Yes		Yes		Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Cross-sectional data at the firm-destination level for 2011, where *Destination* includes one of 12 aggregates reported in the CAM survey and only exporters are considered. The dependent variable is the logarithm of the coefficient of variation in the volumes exported to all countries in a given destination group between 2011 and 2017 (Columns I-IV: *CV*), or the number of times between 2012 and 2017 in which the firm has stopped serving the destination market (all the countries in the destination group) after serving it in the previous year (Columns V-VIII: *Num Exits*). *Offshoring* is a dummy with value 1 if the firm offshores at least one activity to that destination in 2011, and 0 otherwise. *Num. Offsh. Activities* is the number of offshored activities in the destination in 2011, and ranges from zero (no offshoring for the firm) to 6. *Controls* stand for the exported volume and the number of exported products (in 2011). The results are obtained estimating a fixed effect linear model, with clustered errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

Table 7 reports the results from estimating equation (19). The specifications in Columns I to IV measure the volatility of exports as the logarithm of the coefficient of variation in the volumes exported to all countries in a given destination group between 2012 and 2017, while Columns V to VIII measure it as the number of years in which a firm has stopped serving the destination market between 2012 and 2017.[37] The results from both specifications confirm that offshoring service inputs to a destination leads to lower export volatility for the firm. Sourcing at least one service input from the destination market decreases the firm's volatility of export volumes by 12 percent (Column II), or 20

[37]Some firms export in 2011, then exit until the end of the sample. The coefficient of variation in export volume is not defined for those firms, which do not contribute to estimating the results of Columns I-IV. As a consequence, the reported number of observations is slightly lower in Columns I-IV than in Columns V-VIII.

percent of the volatility of the average exporter in the sample. Furthermore, one extra offshored activity decreases the volatility of export volumes by approximately 3 percent.

5.3 Offshoring and exit

In a similar vein, Prediction 5 states that, everything else equal, exit rates from export markets should be lower for firms that offshore services there, relative to those that do not. This happens both because firms, by offshoring, avoid the adjustment frictions of providing the services domestically, and because better firms select themselves into offshoring at entry. For both reasons, offshoring firms are less likely to exit foreign markets. If one allows for the existence of i.i.d. shocks on firm profitability in a market, the prediction also applies to a firm exporting to different markets. That is, in destinations where the firm decided to offshore, the firm's propensity to exit is lower than in destinations where it chose not to offshore services.

We test this prediction by estimating the following equation:

$$Exit_{ij,t+} = \alpha + \eta OFF_{ij} + \boldsymbol{Z'_{ij}}\boldsymbol{\vartheta} + \varphi_i + \gamma_j + \xi_{ij}, \tag{20}$$

where OFF is, as before, a measure of the firm's offshoring activities in a given destination, and φ_i and γ_j capture, respectively, firm and destination fixed effects. $Exit$ is a measure of the propensity of the firm to stop serving the destination market through exports in the future. The model predicts that η is negative: exporting firms that also offshore services to that destination should exhibit a lower probability of exit from that destination.

Table 8: Offshoring and Exit from Export

	(I) One exit	(II) One exit	(III) One exit	(IV) One exit	(V) Length	(VI) Length	(VII) Length	(VIII) Length
Offshoring	-0.049***	-0.046***			-0.027***	-0.026***		
	(0.010)	(0.010)			(0.006)	(0.006)		
Num. Offsh. Activities			-0.013***	-0.012***			-0.006***	-0.005**
			(0.004)	(0.004)			(0.002)	(0.002)
Observations	17,534	17,534	17,534	17,534	17,534	17,534	17,534	17,534
Number of firms	2,853	2,853	2,853	2,853	2,853	2,853	2,853	2,853
R-Square	0.513	0.516	0.513	0.515	0.543	0.545	0.543	0.545
Controls		Yes		Yes		Yes		Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Cross-sectional data at the firm-destination level for 2011, where *Destination* includes one of 12 aggregates reported in the CAM survey and only exporters are considered. The dependent variable is a dummy with value 1 if the firm stops exporting to one of the countries in the destination group at least once from 2012 to 2017 (Columns I-IV: *One Exit*), or the number of years between 2012 and 2017 in which the firm does not export to any country in the destination group, divided by six (Columns V-VIII: *Length*). *Offshoring* is a dummy with value 1 if the firm offshores at least one activity to that destination in 2011, and 0 otherwise. *Num. Offsh. Activities* is the number of offshored activities in the destination in 2011, and ranges from zero (no offshoring for the firm) to 6. *Controls* stand for the exported volume and the number of exported products (in 2011). The results are obtained estimating a fixed effect linear model, with clustered errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

The results from estimating equation (20) are reported in Table 8. We use two measures of exit from the export market. The first identifies firms that export to a destination in 2011, but stop exporting there at least once in the period 2012-2017 (Columns I to IV). The second counts the number of years between 2012 and 2017 in which the firm does not serve any of the countries in the destination market divided by six (Columns V to VIII), that is, the variable takes value one if the firm permanently exits the destination in 2011.

The estimates support our hypothesis: firms that are both exporting to and offshoring in a destination in 2011 stop exporting to that market less frequently than firms that do not offshore in that destination. In particular, sourcing at least one service input from one of the countries in a destination decreases the probability of exiting that export market at least once between 2012 and 2017 by 4.6 percentage points. For comparison, the average probability of exit is 33 percent. In a similar way, offshoring one extra service activity to a country in the destination market decreases the probability of exit by 1.2 percentage points.

6 Extension: vertical integration abroad

Our model relies on a couple of key premises: (1) offshoring export-related services in the foreign destination where the firm is selling entails a higher sunk cost and a lower marginal cost; and (2) firms are initially unsure about their long-run profitability in the foreign destination, but eventually learn it as they keep exporting. Other than that, the model imposes little structure. One advantage of that approach is that it makes the model easily suitable for extensions. We discuss one such an extension here.

A firm developing a global sourcing strategy decides not only where to source different parts of its production, but also its degree of control over those activities. In this section, we therefore study the firm's choice between vertical integration and arm's length subcontracting of service inputs.

Consider that vertical integration abroad (v) requires a higher fixed cost, $F^v > F^o$, but yields a lower marginal cost of production θc^p, $\theta \in (0, 1)$, than offshoring at arm's length – where, with some abuse of notation, superscript o now refers to offshoring at arm's length. This is the usual assumption in studies of cross-border vertical integration (e.g., Antràs and Helpman, 2004). Under this premise, an analysis similar to the one we developed earlier can be performed adding a third option, i.e., a possibility that the firm chooses only if μ is observed to be sufficiently high. Exactly the same trade-off that exists between o vs. d will then extend to, respectively, v vs. o. As a result, predictions similar to those developed in Section 2.7 could be generated for offshoring inside vs. outside the firm. In particular, we would have that:

Prediction 6 *All else equal, firms that offshore services and have greater export experience in a foreign destination are more likely to offshore inside the boundaries of the firm than at arm's length.*

This approach is consistent with the literature that explores the link between the firm's choice of its international boundaries and the degree of relationship specificity of investment by final good producers and their suppliers, or the ability to specify these investments in enforceable contracts (Antràs, 2003; Antràs and Helpman, 2004, 2008; Ornelas and Turner, 2012). Although we do not test the theoretical predictions of that literature, we follow it by assuming a ranking of sunk costs for different forms of firm internationalization, where cross-country vertical integration has higher sunk costs than arm's length offshoring. Conditional on offshoring of service activities, therefore, an uncertain exporting firm reaching a new market may first resort to outsourcing at arm's length;

in a second moment, when the firm has gathered sufficient knowledge of the destination market, it may decide to move to vertical integration. As a consequence, we expect export experience to increase the probability of vertical integration relative to arm's length contracting.

We test that prediction by estimating the following equation:

$$OFF\_VI_{iaj} = \alpha + \beta_1 Experience_{ij} + \boldsymbol{X'_{ij}}\boldsymbol{\vartheta} + \chi_a + \varphi_i + \gamma_j + \xi_{iaj}, \tag{21}$$

where OFF_VI identifies the probability that a firm, conditional on offshoring an activity to a given destination in 2011, does so by integrating vertically rather than at arm's length.[38] Export experience is defined as before, i.e., as the number of years since the firm started exporting to any country belonging to a certain destination group defined in the CAM survey. All other trade variables are defined as the sum of flows over all countries within a broader destination group. The same fixed effects as before apply here. We expect β_1 to be positive: offshoring firms that have greater export experience should exhibit a higher probability of integrating vertically.

Table 9: Offshoring: Vertical Integration vs Arm's Length

	(I)	(II)	(III)	(IV)	(V)	(VI)
	Firm & Activity FEs			Firm, Activity & Dest FEs		
Export Experience	0.038***	0.035***	0.039***	0.032**	0.030**	0.030**
	(0.012)	(0.013)	(0.013)	(0.014)	(0.014)	(0.013)
Num. Countries			-0.009			-0.007
			(0.007)			(0.009)
Observations	6,499	6,499	6,499	6,499	6,499	6,499
Number of firms	1,129	1,129	1,129	1,129	1,129	1,129
R-Square	0.683	0.683	0.683	0.686	0.687	0.687
Controls		Yes	Yes		Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE				Yes	Yes	Yes

Note: Cross-sectional data at the firm-activity-destination level for 2011, where *Activity* refers to the type of service which is offshored, and *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is a dummy with value 1 if the firm, while offshoring a given service activity in 2011 to a given destination, does so integrating vertically, and 0 if it does so at arm's length only. All trade-related variables are defined at the firm-destination level (over all countries in the destination group), including *Experience*, which is defined as the number of years since the firm started exporting to any country belonging to a certain destination group. *Controls* stand for the exported volume and the number of exported products. Columns IV to VI also control for destination-specific fixed effects. Singleton observations are excluded. All variables are standardized. The results are obtained estimating a fixed effect linear model, with clustered errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

In Table 9, we investigate the role of export experience in determining the probability of offshoring in-house rather than at arm's length with a linear specification. The results in Columns I to III show that greater export experience increases the relative probability of vertically integrating the service suppliers. Columns IV to VI further control

[38] The exclusion of mixed cases, i.e., destinations where the firm offshores the same activity both at arm's length and through vertical integration, does not qualitatively alter the results. Note that these occurrences, rare in the sample, are coherent with the model as long as firms choose different offshoring strategies for different services witihn the same relatively broad service category, as coded in the CAM.

for destination fixed effects and identify coefficients through within-firm variation across activities and destinations.[39] Even in these demanding specifications, the association of "offshoring-in" with experience remains positive and statistically significant, and of similar magnitude: one extra standard deviation in export experience to a destination increases the probability of offshoring within the boundaries of the group, in the same destination, by 3 to 3.2 percentage points. In Table A.6 in the Appendix, we re-estimate the same relationship with a non-linear specification and obtain compatible results.

7 Conclusions

A recent but already extensive literature analyzes exporter dynamics across countries using firm- and transaction-level data. Firms undergo important changes in order to export, and display very heterogeneous patterns. For example, there are large differences in survival rates, in export volumes, and in growth across firms operating in different foreign markets. These differences can be explained, at least partially, by firms' uncertainty about their own profitability in the export market, and by the existence of sunk costs required to reach foreign destinations. These sunk costs have been loosely linked to export-related services, such as advertising or establishing and maintaining a network of distributors in the foreign country. However, no attempt has yet been made to systematically analyze the relationship between a firm's sourcing strategy for service inputs and its export dynamics. This is what we do in this paper.

Using balance sheet and trade information for French firms, together with a new survey of firms' participation in global value chain activities that provides a precise measure of service offshoring at the firm-activity-destination level, we document for the first time that a firm's export experience and its propensity to source service inputs abroad are positively related. We then develop a theoretical model linking a firm's propensity to offshore service inputs and its experience in the export market. When service inputs are functional to the exporting process to a specific destination, firms may choose to source them from the destination market rather than from domestic suppliers. The advantage is that foreign sourcing better fits the necessities and constraints of that market, and, as a result, generates lower marginal costs for the firms. However, offshoring firms also incur a higher sunk cost, for example due to search costs to find a suitable supplier. By providing a firm with better knowledge of its own profitability in a destination – which may reveal a high return from increasing sales there – export experience tilts that trade-off toward offshoring.

We confirm empirically that greater export experience increases the likelihood of offshoring, other determinants of offshoring held constant, and that this phenomenon is economically meaningful. We show that the result is robust to a number of specifications and alternative explanations, and that the relationship is stronger for ex-ante more profitable markets and markets exhibiting larger adjustment frictions, as predicted by the model.

[39] As we exploit within-firm, between-destination variation, our results cannot be explained by firm-specific changes in productivity (important in Antràs and Helpman, 2004), unless the firm displays different productivity across destinations, which we cannot observe, but which we can at least partially account for controlling for the volume of exports.

We find empirical support for other predictions of the model, too. Once a firm has decided to source service inputs from the destination market, its future export volume increases and becomes less volatile, while its probability of exiting that market falls. Furthermore, when it comes to the sourcing of service inputs, greater export experience increases the probability of vertical integration across borders relative to arm's length offshoring. This finding reinforces the general idea developed in the paper that firms are more likely to incur the sunk costs related to a long-run commitment to an export market after a sufficiently long (and successful) experience selling in that market.

Broadly speaking, this paper contributes to the literature that seeks to understand the organization of global value chains at the firm level (Antràs and Chor, 2021), but with a particular focus on services. Exploring a unique dataset that reports the offshoring of service activities previously performed domestically, we offer new insights on the complex ways in which service inputs enter value chains, their interaction with goods trade, and the ways in which firms organize these activities. Admittedly, ours is only an initial step toward understanding these complex relationships. Further research is needed to provide a fuller understanding of how the integration of services and manufacturing interacts with other dimensions of export dynamics (e.g., Morales et al., 2019), a firm's choice of its boundaries (e.g., Ding et al., 2020; Berlingieri and Pisch, 2021), as well as trade policy and the design of international trade agreements (e.g., Staiger and Sykes, 2021).

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Appendix

A Additional results

Table A.1: Sample Composition by Trade Status, Manufacturing Only - 2011

	Non-exporters				Exporters			
	mean	median	sd	count	mean	median	sd	count
Offshoring	0.065	0	0.25	278	0.44	0	0.5	1,578
Offshoring In	0.014	0	0.12	278	0.36	0	0.48	1,578
Offshoring Out	0.054	0	0.23	278	0.22	0	0.41	1,578
Num. offshored activities	0.13	0	0.65	278	1.18	0	1.74	1,578
Export experience (avg across destinations)	1.29	1	1.78	278	9.17	9.33	4.06	1,578
Total num. countries exported to	0	0	0	278	29.2	21	26.5	1,578
Total num. exported products	0	0	0	278	76.2	33	149.9	1,578
Total exports (volume)	0	0	0	278	84,355.2	14,379	373,493.3	1,578
Total num. imported products	7.12	0	17.9	278	102.3	66.5	134.5	1,578
Total imports (volume)	1,342.9	0	6,930.4	278	78,176.6	10,796.5	709,396.1	1,578

Table A.2: Offshoring by Destination - Different Definitions of Experience

	(I)	(II)	(III)	(IV)	(V)	(VI)
Export Experience (No depr)	0.009***					
	(0.001)					
Export Experience (Depr)		0.009***				
		(0.001)				
Export Experience (mixed)			0.009***			
			(0.001)			
Exp Exp (No depr) - Cumulative				0.005***		
				(0.001)		
Exp Exp (No depr) - Avg country					0.012***	
					(0.001)	
Exp Exp (No depr) - Cumul Export Volume (ln)						0.014***
						(0.001)
Observations	424,248	424,248	424,248	424,248	424,248	169,368
Number of firms	6,428	6,428	6,428	6,428	6,428	4,700
R-Square	0.192	0.193	0.193	0.192	0.194	0.224
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Cross sectional data at the firm-activity-destination level for 2011. *Activity* refers to the type of service which is offshored, and *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is a dummy with value 1 if the firm is only offshoring to a given destination group, 0 otherwise, in a given activity in 2011. All trade-related variables are defined at the firm-destination level (over all countries in the destination group). Columns I reports the baseline coefficients as in Table 3 and assumes no depreciation of experience over time. Columns II assumes a linear depreciation of experience. Column III assumes complete depreciation of experience when the firm is not exporting, and no depreciation in the years when the firm exports. Experience in Columns I-III is defined as the number of years since the firm started exporting to any country belonging to a certain destination group, while *Experience* (*cumulative*) is the number of years since the firm started exporting to a given country, summed over all countries served in the same destination group; *Experience* (*Avg country*) takes the same number of years of export in the country, but averages across all countries in the destination group; *Cumul Export Volume* sums the volume of goods exported in all countries within the destination group in the year, and takes it in logarithm. *Controls* stand for the exported volume and the number of exported products. All variables are standardized. The results are obtained estimating a fixed effect linear model, with clustered errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

Table A.3: Offshoring by Destination - Robustness on the Specifications

	(I) Exp dummy	(II) Imp Ctrl	(III) Used Act	(IV) Exp Firms	(V) No Censor	(VI) WLS	(VII) Logit
Export Experience	0.008***	0.008***	0.010***	0.007***	0.006***	0.009***	0.671***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.035)
Observations	424,248	424,248	298,582	310,200	387,480	424,248	103,158
Number of firms	6,428	6,428	6,331	4,700	6,401	6,428	1,563
R-Square	0.192	0.198	0.220	0.197	0.177	0.161	
Pseudo R-Square							0.215
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Cross sectional data at the firm-activity-destination level, for 2011, where *Activity* refers to the type of service which is offshored, and *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is a dummy with value 1 if the firm is only offshoring to a given destination group, 0 otherwise, in a given activity in 2011. All trade-related variables are defined at the firm-destination level (over all countries in the destination group), including *Experience*, which is defined as the number of years since the firms started exporting to any country belonging to a certain destination group, as in Table 3. *Controls* stand for the exported volume and the number of exported products. Column I introduces an extra control for the status of the firm as an exporter in the destination in 2011 (dummy variable with value 1 if the firm export to the specific destination, 0 otherwise); Column II controls for the imported volume and the number of imported products. Column III is estimated excluding firms that do not use the service input (i.e., that do not offshore it, source it domestically, or employ any worker to produce that activity). Column IV restricts the sample to firms that export at least once in at least one destination, across all considered years (1996-2017). Column V omits the firm-destination pairs with a level of experience equal to 16 years, to avoid censoring of at the top, due to firms that already export in the first year of the sample (1996) and thereafter. Column VI estimates the baseline in Weighted Least Squares, using the sampling weights available in the CAM survey. Column VII estimates a logit specification, where coefficients are reported instead of marginal effects. The number of observations varies between the logit and OLS specifications due to treatment of singleton observations: whenever the firm has the same offshoring behavior across all destinations, the outcome is perfectly predicted and the firm gets automatically dropped from the sample. Export experience is standardized. Clustered errors at the firm level for Columns I to VI, and robust standard errors for Columns VII. *** p<0.01, ** p<0.05, * p<0.1.

Table A.4: Offshoring and Destination Characteristics

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
Export Experience	0.014***	0.008***	0.014***	0.008***	0.015***	0.014***	0.011***	0.013***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Real GDP	0.005***	0.008***	0.005***	0.002***	0.006***	0.006***	0.002***	0.005***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
RTA		0.012***							
		(0.000)							
Comm Legal			0.002***						
			(0.000)						
Comm Currency				0.015***					
				(0.001)					
Comm Language					-0.003***				
					(0.000)				
Colony						-0.004***			
						(0.000)			
RoL							0.009***		
							(0.000)		
HC								0.005***	
								(0.000)	
Distance									-0.012***
									(0.000)
Observations	424,248	424,248	424,248	424,248	424,248	424,248	424,248	424,248	424,248
Number of firms	6,428	6,428	6,428	6,428	6,428	6,428	6,428	6,428	6,428
R-Square	0.179	0.187	0.179	0.190	0.179	0.180	0.184	0.180	0.186
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Cross-sectional data at the firm-activity-destination level for 2011, where *Activity* refers to the type of service which is offshored, and *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is a dummy with value 1 if the firm is offshoring to a given destination group, and 0 otherwise, in a given activity in 2011. All trade-related variables are defined at the firm-destination level (over all countries in the destination group), including *Experience*, which is defined as the number of years since the firms started exporting to any country belonging to a certain destination group. *Real GDP* measures the cumulative USD value of the underlying indicator over the countries in the destination group, taken in logarithm. *RTA*, *Comm Legal*, *Comm Currency*, *Comm Language*, and *Colony* are dummy variables with value 1 if France and one of the countries in the offshoring destination group share, respectively, a free trade agreement, common legal origin, common currency, common official language, and a colonial link, from the CEPII Gravity database. *RoL* is the average index of the effectiveness of the rule of law in the destination countries, as measured by the World Bank Governance Indicators database. *HC* is the Human Capital Index from the Penn World Tables (v9), averaged across countries in the destination. *Distance* measures the distance between France and the country of export destination. *Controls* stand for the exported volume and the number of exported products. All variables are standardized. The results are obtained estimating a fixed effect linear model, with clustered errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

Table A.5: Offshoring and Destination Characteristics - Principal Component Analysis

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Exp Exp	0.014***	0.008***	0.008***	0.007***	0.008***	0.004***	0.004***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Real GDP	0.005***	0.006***	0.007***	0.007***				
	(0.000)	(0.000)	(0.000)	(0.000)				
Principal Comp 1		0.013***	0.013***	0.013***				
		(0.000)	(0.000)	(0.000)				
Principal Comp 2			-0.003***	-0.003***				
			(0.000)	(0.000)				
Principal Comp 3				0.005***				
				(0.000)				
Exp Exp × Real GDP					0.005***	0.005***	0.005***	0.005***
					(0.000)	(0.000)	(0.000)	(0.000)
Exp Exp × Principal Comp 1						0.008***	0.008***	0.008***
						(0.001)	(0.001)	(0.001)
Exp Exp × Principal Comp 2							0.000	0.001
							(0.000)	(0.000)
Exp Exp × Principal Comp 3								0.002***
								(0.000)
Observations	424,248	424,248	424,248	424,248	424,248	424,248	424,248	424,248
Number of firms	6,428	6,428	6,428	6,428	6,428	6,428	6,428	6,428
R-Square	0.179	0.188	0.188	0.190	0.194	0.198	0.198	0.198
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE					Yes	Yes	Yes	Yes

Note: Cross-sectional data at the firm-activity-destination level for 2011, where *Activity* refers to the type of service which is offshored, and *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is a dummy with value 1 if the firm is offshoring to a given destination group, and 0 otherwise, in a given activity in 2011. All trade-related variables are defined at the firm-destination level (over all countries in the destination group), including *Exp Exp*, which is the export experience defined as the number of years since the firms started exporting to any country belonging to a certain destination group. *Real GDP* measures the cumulative USD value of the underlying indicator over the countries in the destination group, taken in logarithm. The other variables are the first three principal components of an analysis that includes *Comm Language*, *Comm Legal*, *Comm Currency*, *Colony*, *Distance*, *HC*, *RTA*, and *RoL*. See Table A.4 for the definitions. *Controls* stand for the exported volume and the number of exported products. All variables are standardized. The results are obtained estimating a fixed effect linear model, with clustered errors at the firm level (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

Table A.6: Offshoring: Vertical Integration vs Arm's Length - Robustness

	(I)	(II)	(III)	(IV)	(V)	(VI)
	Firm & Activity FEs			Firm, Activity & Dest FEs		
Export Experience	0.490***	0.459***	0.506***	0.422***	0.404***	0.408***
	(0.116)	(0.117)	(0.121)	(0.136)	(0.137)	(0.137)
Num. Countries			-0.119			-0.106
			(0.073)			(0.095)
Observations	2,178	2,178	2,178	2,178	2,178	2,178
Number of firms	289	289	289	289	289	289
R-Square						
Pseudo R-Square	0.131	0.134	0.135	0.169	0.170	0.171
Controls		Yes	Yes		Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE				Yes	Yes	Yes

Note: Cross sectional data at the firm-activity-destination level, for 2011, where *Activity* refers to the type of service which is offshored, and *Destination* includes one of 12 aggregates reported in the CAM survey. The dependent variable is a dummy with value 1 if the firm is only offshoring to a given destination group, 0 otherwise, in a given activity in 2011. All trade-related variables are defined at the firm-destination level (over all countries in the destination group), including *Experience*, which is defined as the number of years since the firms started exporting to any country belonging to a certain destination group. Further controls for *Exports* stand for the exported volume and the number of exported products. The results are obtained estimating a non-linear specification of the empirical model (conditional maximum likelihood specification for the logistic function). The table reports coefficients, as opposed to marginal effects. Errors are "robust", as specified in the body of the text. *** p<0.01, ** p<0.05, * p<0.1.

B Proofs

Derivation of equation (9). When entering with d, the firm's present value payoff can be written as

$$\begin{aligned}
\Psi^d &= E\pi^d\left[1+(1-p)\delta+(1-p)^2\delta^2+...\right]+\left[p\left(\delta\tilde{\pi}^d_{\hat{t}}+\delta^2\tilde{\pi}^d_{>\hat{t}}+\delta^3\tilde{\pi}^d_{>\hat{t}}+...\right)\right.\\
&\quad\left.+p(1-p)\left(\delta^2\tilde{\pi}^d_{\hat{t}}+\delta^3\tilde{\pi}^d_{>\hat{t}}+\delta^4\tilde{\pi}^d_{>\hat{t}}+...\right)+p(1-p)^2\left(\delta^3\tilde{\pi}^d_{\hat{t}}+\delta^4\tilde{\pi}^d_{>\hat{t}}+\delta^5\tilde{\pi}^d_{>\hat{t}}+...\right)+...\right]-F^e\\
&= \frac{E\pi^d}{1-\delta(1-p)}+\tilde{\pi}^d_{\hat{t}}\left[p\delta+p(1-p)\delta^2+p(1-p)^2\delta^3+...\right]\\
&\quad+\tilde{\pi}^d_{>\hat{t}}\sum_{j=0}^{\infty}\delta^j\left[p\delta^2+p(1-p)\delta^3+p(1-p)^2\delta^4+...\right]-F^e\\
&= \frac{E\pi^d}{1-\delta(1-p)}+p\delta\tilde{\pi}^d_{\hat{t}}\sum_{j=0}^{\infty}\delta^j(1-p)^j+\frac{p\delta^2\tilde{\pi}^d_{>\hat{t}}}{1-\delta}\sum_{j=0}^{\infty}\delta^j(1-p)^j-F^e\\
&= \frac{E\pi^d}{1-\delta(1-p)}+\frac{\delta p\tilde{\pi}^d_{\hat{t}}}{1-\delta(1-p)}+\frac{\delta^2 p\tilde{\pi}^d_{>\hat{t}}}{(1-\delta)\left[1-\delta(1-p)\right]}-F^e\\
&= \frac{1}{1-\delta(1-p)}\left[E\pi^d+\delta p\left(\tilde{\pi}^d_{\hat{t}}+\frac{\delta}{1-\delta}\tilde{\pi}^d_{>\hat{t}}\right)\right]-F^e.
\end{aligned}$$

From (7) and (8), observe also the relationship between $\tilde{\pi}^d_{\hat{t}}$ and $\tilde{\pi}^d_{>\hat{t}}$:

$$\tilde{\pi}^d_{\hat{t}}=\tilde{\pi}^d_{>\hat{t}}-F^o\left[1-H(\tilde{\mu})\right]. \tag{B.1}$$

Substituting (B.1) into the previous expression and rearranging, we obtain (9). ■

Proof of Lemma 1. First, using equation (15), we apply the Leibniz rule to calculate

$$\begin{aligned}
\frac{d\left(\tilde{\pi}^o_{>\hat{t}}-\tilde{\pi}^d_{>\hat{t}}\right)}{d\tau} &= \frac{\tau^2}{4}h(c^g+\tau)+\int_{c^g+\tau}^{\tilde{\mu}}\frac{2\left(\mu-c^g\right)-\tau}{4}dH(\mu)+\tau\frac{d\tilde{\mu}}{d\tau}\frac{2\left(\tilde{\mu}-c^g\right)-\tau}{4}h(\tilde{\mu})\\
&\quad-\frac{\tau^2}{4}h(c^g+\tau)-\frac{\tau}{4}\int_{c^g+\tau}^{\tilde{\mu}}dH(\mu)\\
&= \int_{c^g+\tau}^{\tilde{\mu}}\frac{\mu-(c^g+\tau)}{2}dH(\mu)+\frac{d\tilde{\mu}}{d\tau}\frac{\left[2\left(\tilde{\mu}-c^g\right)-\tau\right]\tau}{4}h(\tilde{\mu}).
\end{aligned}$$

This can be further simplified using the definition of $\tilde{\mu}$ from (4):

$$\frac{d\left(\tilde{\pi}^o_{>\hat{t}}-\tilde{\pi}^d_{>\hat{t}}\right)}{d\tau}=\int_{c^g+\tau}^{\tilde{\mu}}\frac{\mu-(c^g+\tau)}{2}dH(\mu)+(1-\delta)F^o h(\tilde{\mu})\frac{d\tilde{\mu}}{d\tau}. \tag{B.2}$$

Now, using equation (14), rewrite criterion (13) as

$$\begin{aligned}
CR &\equiv \left\{\left\{1-\delta\left[1-pH(\tilde{\mu})\right]\right\}F^o-\frac{\delta p}{1-\delta}\left(\tilde{\pi}^o_{>\hat{t}}-\tilde{\pi}^d_{>\hat{t}}\right)\right\}\\
&\quad-\left[I_{\{E\mu>c^g\}}\frac{\left(E\mu-c^g\right)^2}{4}-I_{\{E\mu>c^g+\tau\}}\frac{\left(E\mu-c^g-\tau\right)^2}{4}\right]\geq 0.
\end{aligned} \tag{B.3}$$

Using (B.2), the term in curly brackets of this inequality changes as follows with τ:

$$\begin{aligned}\frac{d\{.\}}{d\tau} &= \delta p F^o h(\tilde{\mu})\frac{d\tilde{\mu}}{d\tau} - \frac{\delta p}{1-\delta}\left[\int_{c^g+\tau}^{\tilde{\mu}} \frac{\mu-(c^g+\tau)}{2}dH(\mu) + (1-\delta)F^o h(\tilde{\mu})\frac{d\tilde{\mu}}{d\tau}\right] \\ &= -\frac{\delta p}{1-\delta}\int_{c^g+\tau}^{\tilde{\mu}} \frac{\mu-(c^g+\tau)}{2}dH(\mu) < 0.\end{aligned}$$

In turn, it is straightforward to see that the term in square brackets of (B.3) increases with τ. Hence, as τ rises, inequality (13) is satisfied under a smaller set of parameters. ■

Proof of Lemma 2. To prove the lemma, it suffices to show that the left-hand side of (B.3) increases in c^g. First, using equation (15), we apply the Leibniz rule to calculate

$$\begin{aligned}\frac{d\left(\tilde{\pi}^o_{>\hat{t}} - \tilde{\pi}^d_{>\hat{t}}\right)}{dc^g} &= -\int_{c^g}^{c^g+\tau} \frac{\mu-c^g}{2}dH(\mu) + \frac{\tau^2}{4}h(c^g+\tau) \\ &\quad +\tau\left[-\int_{c^g+\tau}^{\tilde{\mu}} \frac{1}{2}dH(\mu) + \frac{d\tilde{\mu}}{dc^p}\frac{2(\tilde{\mu}-c^g)-\tau}{4}h(\tilde{\mu}) - \frac{\tau}{4}h(c^g+\tau)\right] \\ &= -\int_{c^g}^{c^g+\tau} \frac{\mu-c^g}{2}dH(\mu) - \int_{c^g+\tau}^{\tilde{\mu}} \frac{\tau}{2}dH(\mu) + \frac{d\tilde{\mu}}{dc^p}\frac{[2(\tilde{\mu}-c^g)-\tau]\tau}{4}h(\tilde{\mu}).\end{aligned}$$

This can be further simplified using the definition of $\tilde{\mu}$ from (4) and noticing that $\frac{d\tilde{\mu}}{dc^p} = 1$:

$$\frac{d\left(\tilde{\pi}^o_{>\hat{t}} - \tilde{\pi}^d_{>\hat{t}}\right)}{dc^p} = -\int_{c^g}^{c^g+\tau} \frac{\mu-c^g}{2}dH(\mu) - \int_{c^g+\tau}^{\tilde{\mu}} \frac{\tau}{2}dH(\mu) + (1-\delta)F^o h(\tilde{\mu}). \tag{B.4}$$

Now, using (B.4), observe that the term in curly brackets of (B.3) increases with c^g:

$$\begin{aligned}\frac{d\{.\}}{dc^g} &= \delta p F^o h(\tilde{\mu}) - \frac{\delta p}{1-\delta}\left[-\int_{c^g}^{c^g+\tau} \frac{\mu-c^g}{2}dH(\mu) - \int_{c^g+\tau}^{\tilde{\mu}} \frac{\tau}{2}dH(\mu) + (1-\delta)F^o h(\tilde{\mu})\right] \\ &= \frac{\delta p}{1-\delta}\left[\int_{c^g}^{c^g+\tau} \frac{\mu-c^g}{2}dH(\mu) + \int_{c^g+\tau}^{\tilde{\mu}} \frac{\tau}{2}dH(\mu)\right] > 0.\end{aligned}$$

Finally, observe that the term inside square brackets in (B.3) decreases with c^g:

$$\begin{aligned}\frac{d[.]}{dc^g} &= -I_{\{E\mu>c^g\}}\frac{E\mu-c^g}{2} + I_{\{E\mu>c^g+\tau\}}\frac{E\mu-c^g-\tau}{2} \\ &= -I_{\{c^g+\tau>E\mu>c^g\}}\frac{E\mu-c^g}{2} - I_{\{E\mu>c^g+\tau\}}\frac{\tau}{2} < 0.\end{aligned}$$

Since the square brackets is multiplied by -1, the left-hand side of (B.3) is strictly increasing in c^g, completing the proof. ■

Proof of Prediction 1. The probability that a given firm offshores export-related services after exporting for T periods is

$$pr(o_T) = pr(o_1) + [1 - pr(o_1)] \times pr\,(\text{switch to } o \text{ by } T)\,,$$

where $pr(o_t)$ indicates the probability that the firm offshores in period t. In turn, pr (switch to o by T) indicates the probability that a firm that entered with d will switch to o by period T. It can be expressed as

$$pr\,(\text{switch to } o \text{ by } T) = p_\mu^T\,[1 - H(\tilde{\mu})]\,.$$

Therefore,

$$pr(o_T) = pr(o_1) + [1 - pr(o_1)]\,[1 - H(\tilde{\mu})]\,p_\mu^T. \tag{B.5}$$

Hence,

$$\frac{dpr(o_T)}{dT} = [1 - pr(o_1)]\,[1 - H(\tilde{\mu})]\,\frac{dp_\mu^T}{dT} = -\,[1 - pr(o_1)]\,[1 - H(\tilde{\mu})]\,(1-p)^T\ln(1-p) > 0,$$

concluding the proof. ■

Proof of Prediction 2. We first prove (i) the statements related to the adjustment friction. We then prove (ii) the statments related to the expected profitability of the market.

(i) From equation (B.5), we have that the probability that a firm offshores after exporting for T periods varies with the friction τ according to:

$$\begin{aligned}\frac{dpr(o_T)}{d\tau} &= \frac{dpr(o_1)}{d\tau} - \frac{dpr(o_1)}{d\tau}\,[1 - H(\tilde{\mu})]\,p_\mu^T - [1 - pr(o_1)]\,p_\mu^T h(\tilde{\mu})\frac{d\tilde{\mu}}{d\tau} \\ &= \frac{dpr(o_1)}{d\tau}\left\{1 - [1 - H(\tilde{\mu})]\,p_\mu^T\right\} - [1 - pr(o_1)]\,p_\mu^T h(\tilde{\mu})\frac{d\tilde{\mu}}{d\tau}.\end{aligned}$$

The second term is positive because $\frac{d\tilde{\mu}}{d\tau} < 0$. Furthermore,

$$\frac{dpr(o_1)}{d\tau} = \frac{dM\left(\widetilde{c^g}\right)}{d\tau} = m\left(\widetilde{c^g}\right)\frac{d\widetilde{c^g}}{d\tau} = -m\left(\widetilde{c^g}\right)\frac{\partial CR/\partial\tau}{\partial CR/\partial c^g} > 0, \tag{B.6}$$

where CR is defined in (B.3) and the sign follows from Lemma 1 (which implies $\partial CR/\partial\tau < 0$) and Lemma 2 (which implies $\partial CR/\partial c^g > 0$). Hence, $\frac{dpr(o_T)}{d\tau} > 0$ at any T.

Observe now that

$$\frac{d^2pr(o_T)}{d\tau dT} = -\frac{dpr(o_1)}{d\tau}\,[1 - H(\tilde{\mu})]\,\frac{dp_\mu^T}{dT} - [1 - pr(o_1)]\,h(\tilde{\mu})\frac{d\tilde{\mu}}{d\tau}\frac{dp_\mu^T}{dT}.$$

This expression has an ambiguous sign, because the first term is negative whereas the second is positive. However, we know from (B.6) that $\frac{dpr(o_1)}{d\tau}$ is proportional to the mass of firms around the cutoff to enter with offshoring, $m\left(\widetilde{c^g}\right)$. If that value is sufficiently small, the positive effect dominates.

(ii) We need to show first that the probability that a firm offshores in a given period, as defined in equation (B.5), increases as we move from distribution H_2 to distribution H_1, where H_1 first-order stochastically dominates ($FOSD$) H_2. An implication of H_1 $FOSD$ H_2 is that $H_2(\mu) \geq H_1(\mu)$ at any μ. Another is that $E(\mu; H_1) > E(\mu; H_2)$.

We start by showing that $pr(o_1)$ increases as we move from distribution H_2 to distribution H_1. To see that, recall from equation (13) that a firm chooses domestic sourcing at entry if

$$(1-\delta)F^o + \delta p H(\tilde{\mu})F^o - \frac{\delta p}{1-\delta}\left(\tilde{\pi}^o_{>\hat{t}} - \tilde{\pi}^d_{>\hat{t}}\right) \geq \left[E\pi^o - E\pi^d\right]. \tag{B.7}$$

We will show that the right-hand side (rhs) of (B.7) is greater and the left-hand side (lhs) of (B.7) is smaller under H_1 than under H_2, implying that firms are more likely to enter with o then with d in markets with better distribution of μ.

First, recall from equation (14) that the rhs of (B.7) is equivalent to

$$I_{\{E\mu>c^g\}}\frac{(E\mu-c^g)^2}{4}-I_{\{E\mu>c^g+\tau\}}\frac{(E\mu-c^g-\tau)^2}{4}.$$

Thus, it only depends on the expected value of the distribution. If $E\mu \geq c^g$, we have that

$$\frac{d\left[E\pi^o-E\pi^d\right]}{dE\mu}=\frac{\tau}{2}>0,$$

so the rhs of (B.7) is greater under H_1 than under H_2, since $E(\mu;H_1)>E(\mu;H_2)$. For $E\mu<c^g$, the effect is amplified. Hence, under H_1 (relative to H_2), the rhs of (B.7) increases, making offshoring relatively more attractive.

Now, recalling equation (15), the lhs of (B.7) is equivalent to

$$(1-\delta)F^o+\delta pH(\tilde{\mu})F^o-\frac{\delta p}{1-\delta}\left[\int_{c^g}^{c^g+\tau}\frac{(\mu-c^g)^2}{4}dH(\mu)+\tau\int_{c^g+\tau}^{\tilde{\mu}}\frac{2(\mu-c^g)-\tau}{4}dH(\mu)\right].$$

Integrating by parts, this expression can be rewritten as

$$\begin{aligned}
&(1-\delta)F^o+\delta pH(\tilde{\mu})F^o-\frac{\delta p}{1-\delta}\left\{\frac{(\mu-c^g)^2}{4}H(\mu)\bigg|_{c^g}^{c^g+\tau}-\int_{c^g}^{c^g+\tau}\frac{d\frac{(\mu-c^g)^2}{4}}{d\mu}H(\mu)d\mu\right.\\
&\left.+\tau\left[\frac{2(\mu-c^g)-\tau}{4}H(\mu)\bigg|_{c^g+\tau}^{\tilde{\mu}}-\int_{c^g+\tau}^{\tilde{\mu}}\frac{d\frac{2(\mu-c^g)-\tau}{4}}{d\mu}H(\mu)d\mu\right]\right\}\\
=\;&(1-\delta)F^o+\delta pH(\tilde{\mu})F^o-\frac{\delta p}{1-\delta}\left\{\frac{\tau^2}{4}H(c^g+\tau)-\int_{c^g}^{c^g+\tau}\frac{\mu-c^g}{2}H(\mu)d\mu\right.\\
&\left.+\tau\left[\frac{2(\tilde{\mu}-c^g)-\tau}{4}H(\tilde{\mu})-\frac{\tau}{4}H(c^g+\tau)-\int_{c^g+\tau}^{\tilde{\mu}}\frac{1}{2}H(\mu)d\mu\right]\right\}\\
=\;&(1-\delta)F^o+\delta pH(\tilde{\mu})F^o\\
&-\frac{\delta p}{1-\delta}\left\{\frac{2(\tilde{\mu}-c^g)-\tau}{4}\tau H(\tilde{\mu})-\int_{c^g}^{c^g+\tau}\frac{\mu-c^g}{2}H(\mu)d\mu-\int_{c^g+\tau}^{\tilde{\mu}}\frac{\tau}{2}H(\mu)d\mu\right\}.
\end{aligned}$$

Using the definition of $\tilde{\mu}$ in equation (4), we have that $\frac{2(\tilde{\mu}-c^g)-\tau}{4}\tau=(1-\delta)F^o$, so the expression above simplifies to

$$(1-\delta)F^o+\frac{\delta p}{1-\delta}\left\{\int_{c^g}^{c^g+\tau}\frac{\mu-c^g}{2}H(\mu)d\mu+\int_{c^g+\tau}^{\tilde{\mu}}\frac{\tau}{2}H(\mu)d\mu\right\}.$$

Since $H_2(\mu)\geq H_1(\mu)$, this expression – which corresponds to the lhs of equation (B.7) – is lower under H_i than under H_2, making offshoring more attractive under H_i than under H_2. We have therefore showed that $pr(o_1;H_1)>pr(o_1;H_2)$.

Let us now rewrite (B.5) as

$$\begin{aligned} & pr(o_1) + [1 - pr(o_1)]\,[1 - H(\tilde{\mu})]\,p_\mu^T \\ = \;& pr(o_1)\left\{1 - [1 - H(\tilde{\mu})]\,p_\mu^T\right\} + [1 - H(\tilde{\mu})]\,p_\mu^T \\ = \;& pr(o_1)\left\{1 - p_\mu^T + H(\tilde{\mu})p_\mu^T\right\} + [1 - H(\tilde{\mu})]\,p_\mu^T \\ = \;& pr(o_1)\left(1 - p_\mu^T\right) + [1 - H(\tilde{\mu}) + pr(o_1)H(\tilde{\mu})]\,p_\mu^T \\ = \;& pr(o_1)\left(1 - p_\mu^T\right) + \{1 - H(\tilde{\mu})\,[1 - pr(o_1)]\}\,p_\mu^T. \end{aligned}$$

Observe that, as we move from H_2 to H_1, $pr(o_1)$ increases, so the first term above rises. Moreover, $H(\tilde{\mu})$ falls, so $H(\tilde{\mu})\,[1 - pr(o_1)]$ decreases and the second term above also rises. Hence, $pr(o_T; H_1) > pr(o_T; H_2)$ and a better distribution of μ (in the sense of FOSD) makes offshoring more likely.

Finally, we need to show that this effect increases with export experience, T. To see that, it is equivalent (for determining the sign) to see how the change of (B.5) with respect to p_μ^T depends on the distribution. First, observe that

$$\frac{d(B.5)}{dp_\mu^T} = [1 - pr(o_1)]\,[1 - H(\tilde{\mu})]\,.$$

As we move from H_2 to H_1, $[1 - pr(o_1)]$ decreases and $[1 - H(\tilde{\mu})]$ increases. However, under the assumption of little mass at the cutoff, the effect on $[1 - pr(o_1)]$ is second-order and the positive effect dominates, completing the proof. ■

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