Centre for Economic Performance

Discussion Paper

ISSN 2042-2695

No.1843

April 2022

Managing export complexity: the role of service outsourcing

Giuseppe Berlingieri
Frank Pisch

THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

Economic and Social Research Council

Abstract
Exporting involves sunk and fixed costs in the form of service inputs, and whether such services are 'made' in-house or 'bought' from external agencies is a key organizational margin: it is not a core-competence of manufacturing companies and has far-reaching implications for the costs of exporting. We study such outsourcing decisions both conceptually and empirically. For guidance, we propose a theoretical framework in which firms trade off managerial strain (internal provision) and ex-post adaptation costs (external provision). Using confidential firm-level data from France and a novel instrumental variables strategy, we document the precise service inputs needed to access foreign markets and provide empirical evidence that these are typically outsourced. In line with the model, this pattern is strong for services with high costs of adaptation, and when firms have little managerial capability available. Finally, we discuss the implications of our findings for servitization and inequality.

Key words: adaptation, complexity, core competencies, firm boundaries, firm capabilities, sunk and fixed export costs, professional and business services, structural transformation.
JEL: D23; F10; F61; L22; L23; L24; 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.

This is a heavily revised and extended version of Berlingieri's doctoral thesis Chapter 2 "Exporting, Coordination Complexity, and Service Outsourcing" (Berlingieri, 2013). We would like to thank Luis Garicano and Gianmarco Ottaviano for invaluable guidance and advice. We are grateful for feedback from Pol Antràs, Alessandro Barattieri, Lorenzo Caliendo, Mattia Di Ubaldo, Miguel Espinosa, Andrei Levchenko, Marc Melitz, Rachel Ngai, Lindsay Oldenski, Emanuel Ornelas, German Pupato, Esteban Rossi-Hansberg, Catherine Thomas, Richard Upward and Luigi Ventura as well as colleagues and seminar participants at LSE, the GEP Postgraduate Conference (University of Nottingham), the MOOD doctoral workshop (EIEF), the CEP Annual Conference, the EITI Conference, the IDB-TIGN Conference, the ETSG Conference, EBRD, OECD, ESSEC Business School École Polytechnique, University of Sussex, Université Catholique de Louvain, National University of Singapore, IMT Lucca, University of Illinois Urbana-Champaign, the CESifo Venice Summer Institute, the ETSG Conference, Trinity College Dublin, Universitat Autònoma de Barcelona, Université de Cergy Pontoise, the Midwest International Economics Meeting, the RMET Conference, the Marco Fanno Alumni Workshop, the CEPR-EUI Conference, the SIOE Annual Conference, the EEA Annual Congress, the CEPR-CEBRA Conference, the AEA Annual Conference, the ESSEC-HEC-INSEAD Management Workshop, the University of St. Gallen. Access to French confidential data was made possible thanks to the secure environment provided by CASD - Centre d'accès sécurisé aux données (Ref. 10.34724/CASD).

Giuseppe Berlingieri, ESSEC Business School, Thema and Centre for Economic Performance at London School of Economics. Frank Pisch, TU Darmstadt, SIAW and Centre for Economic Performance at London School of Economics.

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

1 Introduction

Services like advertising, legal advising or market research are key inputs for all manufacturing companies in an international business environment, since they are essential for serving markets abroad. To illustrate the significance of such Professional Business Services (PBS),[1] take the case of Italian motorcycle producer Ducati, who expanded rapidly to several new destination countries in the early 2000s. In order to export its products, manuals and technical documentation had to be translated into various different languages and continuously kept aligned with the respective local regulations, which required coordination between engineers and service workers as well as constant monitoring by Ducati's management. Such PBSs constituted *sunk and fixed costs of foreign market access*. Producing these service inputs is, however, not Ducati's—or any manufacturing firm's—core-competence and internal provision puts extraordinary strain on their managers and organizations, especially when the company exports to a large and growing number of markets. As a solution, service inputs can be outsourced to external agencies, even if their more standardized inputs may not precisely fit the firm's needs. Ducati decided to contract out its document management to Xerox, who subsequently advertised these services prominently: "We focus on translating and delivering Ducati's global publications. [...] Which leaves Ducati free to focus on building amazing bikes" (XEROX, 2010). Clearly, this make-or-buy decision for 'market access' services is a central determinant of the sunk and fixed costs of exporting and, crucially, shapes their behavior and properties.

In this paper, we provide the first systematic analysis of how firms organize the provision of PBS inputs associated with serving foreign markets. We develop a stylized model of firm boundaries in the presence of managerial overload and coordinated adaptation, which delivers clear predictions that guide our subsequent empirical analyses. We propose a novel instrument for the extensive country margin at the firm level and make use of highly detailed confidential data from a panel of French manufacturing companies to document that they are more likely to *outsource market access services to domestic suppliers* when they serve (more) foreign destinations. We provide further empirical evidence on (1) the particular service types and characteristics that shape this make-or-buy strategy and (2) how managerial capabilities matter. Taken together—as we argue explicitly throughout this paper—our findings shed light on the nature and behavior of the sunk and fixed costs of exporting, and therefore on the organizational link between globalization, structural transformation, and within-country inequality.

As a first contribution, in Section 2, we present a conceptual framework that explicitly models key trade-offs involved in an exporter's choice about whether to make or buy PBSs required for serving foreign markets. Every destination-specific service task must be completed in line with a firm's overall characteristics and strategy either before or while serving a market.[2] In the case of in-house provision, a service is tailored to the firm's needs and hence requires

[1] PBS industries accounted for 16.3 percent of total employment in 2015 in France (the country we study in this paper), and for roughly half of total service sector growth over the period 1975 to 2015 (source: EU KLEMS). Moreover, with the highest forward linkage, they play a key role in production networks: 14% of the gross value of French manufacturing exports in 2015 can be traced back to PBSs (source: OECD IOTs and TiVA, 2021 ed.).

[2] Since both sunk and fixed cost components are important and hard to distinguish empirically without appealing to a structural framework, we model invariable costs generically.

little ex-post adaption, but managers have to "direct production" (Coase, 1937, p.388) and to do so have to engage in costly coordination via communication and monitoring of employees (e.g., Becker and Murphy, 1992; Crémer et al., 2007). The expanding range of service inputs as a firm adds markets abroad leads to progressive 'managerial overload' (Robinson, 1934; Kaldor, 1934; Lucas, 1978): as in the case of Ducati, manufacturing firms and their managers face a more *complex* business environment when they export to more countries, since a greater number and variety of service tasks must be completed. Managers can rid themselves of this burden by outsourcing to an external agency, but expensive ex-post adaptation is needed to align purchased service inputs with the company's needs (Bajari and Tadelis, 2001; Dessein and Santos, 2006; Costinot et al., 2011; Hart and Holmstrom, 2010). A robust implication in this model is that the costs associated with managerial overload increase in the number of destination markets at a higher rate than those associated with ex-post adaptation; the first and central testable prediction of our framework is therefore that *companies increasingly outsource PBSs when they internationalize.*[3]

As a second contribution, in Section 3, we provide empirical evidence on our model's first prediction using confidential data on the near universe of small, medium, and large French manufacturing companies between 1996 and 2007. We have detailed information about (1) expenditures on a range mainly domestically-produced *outsourced* services, including advertising and market research, as well as about (2) the universe of international goods transactions. Conditional on technology and scale controls as well as firm fixed effects, the correlation between the share of outsourced PBSs in total costs and the raw number of export destinations—our baseline measure of complexity—is positive and highly statistically significant.

To reach a causal interpretation, we propose and implement a novel instrumental variables strategy for the extensive country margin at the firm level over time. We isolate time-varying 'market access' demand shocks in foreign countries at the product-level (inter alia, from Eastern European EU member states) and use them to 'treat' our French firms based on their initial product portfolios. The 2SLS estimates confirm that firms that expand internationally tend to increase outsourcing of service inputs. This mechanism is quantitatively important: the average increase in the number of export destinations explains between 13% (OLS) and 45% (2SLS) of the rise in the outsourcing cost share of PBSs over the sample period. The average firm therefore raised its spending on external provision of such inputs by up to 685k€ due to additional market access, which is equivalent to supporting an additional 23 external service workers (at a firm's average internal wage).

We conclude that Section by refuting alternative mechanisms and interpretations of our

[3]In the taxonomy of models of the boundary of the firm by Gibbons (2005), our framework belongs to the "adaptation" class of Transaction Cost Economics (TCE) models (Simon, 1951; Williamson, 1975): integrated organizations have an inherent advantage for coordinated adaptation. In contrast to these models, our context allows us to take a precise stance on the costs of integration, namely managerial overload when coordination and monitoring activities proliferate. Moreover, despite the fact that diminishing returns to management are a staple concept in economics, it has not been part of any of the common approaches to modelling—let alone investigating empirically—the costs of vertical integration (for rare exceptions, see Williamson, 1967; Garicano, 2000). Finally, our conceptualization is also closely related to the Resource-Based-View of the firm (e.g., Wernerfelt, 1984; Barney, 1991), since managerial capability is an organisational resource of a company.

findings. For instance, we present evidence that external provision of services indeed rises more than in-house production and that trends towards 'servitization' do not explain our findings. We also show in placebo exercises that firms do not increase expenditures on external workers or subcontracted industrial production when they expand the range of foreign markets, and offer evidence that a re-organization due to exporting has both a 'sunk' and a 'fixed' component.

As a third contribution, we provide direct empirical evidence on how the characteristics of individual service types and of the manufacturer shape make-or-buy decisions and thereby shed further light on the nature of the sunk and fixed costs of market access. In Section 4, we start by refining our measure of complexity to take destination market characteristics into account. Conceptually, firms re-organize more markedly if the required *effective* number of additional service inputs is higher. This is borne out by our data: when an additional market means interacting with a different culture or when a firm enters a market that had not been served before, for example, the outsourcing cost share increases more strongly. Conversely, re-entering a market that a firm had previously exported to has no effect on firm organization. Finally, companies increase their outsourcing cost shares especially in their early stages of internationalization when they are faced with rapidly growing coordination costs. In other words, and consistent with our conceptual framework, the relationship between outsourcing and the number of markets served is concave.

To make further progress, we employ an additional and unique French survey from 2005 that provides us with firm-level make-or-buy decisions for more than 30 different types of detailed services. We show that advertising, translation, insurance, and legal services are typical services that expanding exporters procure from external agencies. By contrast, outsourcing of services such as accounting, cleaning, machinery maintenance, or warehousing does not respond.

To confirm that this pattern is consistent with our conceptual framework, we test the following predictions regarding *adaptation costs*: (1) if a service requires frequent or costly ex-post adaptation, the returns from coordinating the in-house production process are high and firms are more likely to produce such inputs in-house in general. At the same time, a substantial adaptation process creates high managerial strain and (2) such services are more readily outsourced when the business environment becomes more complex due to internationalization. To confront these ideas with the data, we propose proxies for the need and costs of ex-post adaptation associated with each of our distinct services. The probability of outsourcing to an external agent is indeed lower when ex-post adaptation is expected to be expensive and our evidence also suggests that the effect of foreign market access on the probability of outsourcing is stronger when a service requires frequent and costly adaptation.

In Section 5, we investigate how a firm's capacity to coordinate via communication and monitoring affects organizational adjustments due to foreign market access. Our conceptual model implies that higher managerial capability allows for more extensive in-house production, since overload is less of a concern, ceteris paribus. At the same time, counteracting forces result in ambiguity as to whether better managers should rely more or less on external procurement of service tasks when adding foreign export destinations compared to their less skilled peers. To confront these implications with the data, we propose three distinct novel proxies for a firm's capacity to coordinate inspired by measures of the task content of occupations: We collect information on the share of tasks related to coordinating, communicating and monitoring by occupation from the O*NET database and calculate each company's 'potential task capacity', weighting by occupation-level employment shares in the firm. Extensions of our baseline exercise provide substantial empirical support for the role of managerial overload in line with the prediction of the model, including that a firm's managerial capability is unrelated to how sensitively it adjusts its boundary when accessing new markets.

We conclude the paper with Section 6, where we discuss why these findings matter beyond international trade patterns. First, since we show that progressive foreign market entry creates demand for specialized upstream service providers, globalization is a driver of structural change towards the tertiary sector (see also Ding et al., 2020). Second, this paper establishes a new link between globalization and wage inequality due to service outsourcing (see also Bilal and Lhuillier, 2021).[4]

Our work is closely related to two main strands of literature. First, as a large body of work in international trade has shown, sunk and fixed costs of foreign market access are needed to rationalize several salient empirical patterns. For instance, only the biggest and most productive firms typically export; a higher number of firms exports to larger markets; exit rates from markets abroad are relatively low; the exporter size distribution overlaps substantially with that of domestic firms; and international production networks tend to be sparse (e.g., Bernard and Jensen, 2004; Eaton et al., 2004; Bernard and Moxnes, 2018; Alessandria et al., 2021). Moreover, sunk and fixed export costs have been linked to hysteresis in international trade and are crucial to understand gravity equations and welfare (e.g., Baldwin, 1988; Chaney, 2008, 2014). Recent structural models also feature sunk and fixed costs of market access that can vary across companies, either exogenously and in a reduced-form way (e.g., Das et al., 2007; Moxnes, 2010; Eaton et al., 2011; Adão et al., 2020), or endogenously through (past) firm decisions (e.g., Arkolakis, 2010; Morales et al., 2019).[5] Our work contributes to this literature by shining more light into the black box of sunk and fixed export costs. Like Arkolakis (2010), we conceive of them as paying for service inputs (among others, advertising) but we provide direct empirical evidence based on detailed service information. Moreover, our main focus lies on how their provision is organized by firms and what this implies for the behavior of market access costs. We also propose and test a micro-foundation based on the complexity of service tasks and firm-level managerial overload that lends structure to models with path dependence across export destinations, like (extended) gravity (Morales et al., 2019): the whole market portfolio of a company matters, since organizational decisions are taken with the entire company's managerial strain in mind, and accessing similar countries is cheaper as new tasks add little complexity.

We also contribute to the large literature on make-or-buy decisions and firm organization more generally in two precise and distinct ways. It is already well-documented that globaliza-

[4]Indeed, Song et al. (2018) conclude their seminal article on the role of firms for inequality in the US by stating that "outsourcing could be playing an important role in allowing firms to constrain inequality within firms and focus on core competency activities, spinning off nonessential activities."

[5]Arkolakis et al. (2021) relate the sunk or fixed costs of market access at the country-product(-scope) level to the presence of non-tariff measures, but do not provide a micro-foundation.

tion and trade integration shape how firms organize production (Antràs and Rossi-Hansberg, 2009). For instance, they re-arrange *internal* hierarchies and knowledge compositions, and thus become more productive in the face of increased demand from abroad (e.g., Garicano and Rossi-Hansberg, 2015; Caliendo and Rossi-Hansberg, 2012; Caliendo et al., 2015, 2020). They also adjust their *external* firm boundaries across the task spectrum (for a recent review, see Antràs, 2015). This latter body of research studies how companies take make-or-buy decisions in international production networks involving *tangible* goods; by contrast, to the best of our knowledge, we are the first to study how firms organize the production of business *services* that experience demand shocks due to internationalization.[6] More generally, we add empirical evidence—based on the link between internationalization and managerial strain[7]—to an expanding literature on firm boundaries and make-or-buy decisions regarding *service inputs* (e.g., Abraham and Taylor, 1996; Azoulay, 2004; Gil and Ruzzier, 2018; Espinosa, 2021), which is severely under-represented in the vast body of work on vertical integration.[8]

2 Conceptual Model and Predictions

In this Section, we develop a conceptual model of service input outsourcing decisions. The model is intentionally stylized to capture the main trade-off and parameters of the environment in a parsimonious way. Moreover, it generates clear predictions, which will guide our empirical analyses later on.

2.1 Technology, Contracts and Timing

For ease of exposition, as well as to reflect our within-firm analyses in the empirical part of the paper below, we focus on a representative company that serves a number of foreign markets. As is common in the international trade literature, a country-specific input i is needed to export to any such destination and a firm that enters in N countries must source a measure of N *service* inputs, independently of the quantity it ships there (e.g., Eaton et al., 2011; Helpman et al., 2008).[9] A company that supplies many destinations and thus manages the procurement of a large number of service inputs faces 'export complexity'. We treat the number of export markets as given throughout this exposition and discuss the implications of letting firms choose it endogenously in Subsection 2.3.

[6] Debaere et al. (2013) and Görg and Jabbour (2016) provide suggestive evidence consistent with a positive relationship between regional availability of services and offshoring or multinational activity, respectively. In the French context, Bergeaud et al. (2021) study the response of domestic outsourcing of both intermediates and services to the roll-out of broadband internet.

[7] There is extensive evidence that management practices and managers are determinants of firm performance, especially on international markets (Bloom et al., 2014, 2021). We complement the findings in this literature by highlighting how a particular management capability—a firm's ability to coordinate and monitor—affects how it organizes for internationalization.

[8] With certain exceptions, some of which we mention in this paper, the literature in economics and business studies focuses on physical assets, rather than human capital, and therefore involves considerations that do not apply to services.

[9] In the international business literature, this idea is popular at least since Johanson and Vahlne (1977).

Rendering a market access input requires a single worker and no capital, in line with the idea that services are knowledge-intensive and property rights considerations play little role. The company can either employ workers directly and produce the input internally or outsource the input to an external agency. Workers supply their labor inelastically with an outside option normalized to zero.

In producing the input, an employee or agent is free to do so in a way she pleases—formally, she takes an action $a(i)$ to maximize her personal benefits specified below—, but the finished service input might not fit the overall firm's needs and characteristics, and additional work must go into adapting it. For instance, Ducati's or Xerox's workers in charge of translating motorcycle instructions and documentation had ample discretion as to how diligently they would perform their tasks (effort). If their interpretations of technical, legal or marketing texts were inaccurate or did not agree with Ducati's core strategy, additional interactions and corrections were needed (adaptation). Another important example is advertising. A marketing campaign can be run according to different strategies of varying quality (effort), but early break-offs, re-launches, and modifications are necessary if the firm's or product's overall profile does not connect with the campaign (adaptation).

There is a continuum of workers and a pool of entrants, who can potentially supply any service input i. As a result, their ex-ante expected equilibrium profits $E[\pi^s(i)]$ are zero. The workers choose their actions $a(i)$ when providing the service to maximize

$$\pi^s(i) = P(i) - (a(i) - \theta(i))^2 - f, \tag{1}$$

where $\theta(i)$ is a realization of an i.i.d. random variable with mean $\hat{\theta}(i)$ and variance σ^2. We refer to it as the input condition. It characterizes the *worker's* most efficient way of producing input i. For instance, $\theta(i)$ may capture a translator's or advertiser's knowledge vis-a-vis a particular destination market for a firm's exports. To the extent that the worker performs an action that deviates from her input condition, she incurs a quadratic cost.

$P(i)$ is the worker's compensation and it can be sensitive to the action $a(i)$. A specific action, or the right to ask for a specific action later on, can be written into both employment and external contracts; i.e., the action is contractible. Whether such a contract can stand in court and lead to damages or other penalties is a question of monitoring, however: only if the manager has access to all relevant information and thus amasses sufficient evidence, the action can be induced by legal incentives; in other words, enforceability depends on managerial scrutiny.

Finally, the worker must incur a fixed cost f to learn and practice how to perform task i. Regardless of whether she is employed by the firm or acts as an external agent, these expenses have to be compensated through $P(i)$ and thus constitute a lower bound for the price of providing the input. As these fixed costs are inconsequential for the mechanisms and predictions of interest in this paper, we normalize f to zero.

The fixed costs that the company has to incur to export to a measure N of countries are given by:

$$F = \int_0^N P(i)di + \delta \int_0^N (a(i) - \hat{\theta}^c)^2 di + N^\alpha K^\beta t^\gamma, \tag{2}$$

where α, β, and $\gamma > 1$ are parameters in $\mathbb{R}$.

In the spirit of Dessein and Santos (2006), the adaptation cost $\delta(a(i) - \hat{\theta}^c)^2$ depends on the parameter $\delta \in \mathbb{R}_0^+$, which scales the adaptation costs relative to other expenses, and on the squared distance between the action $a(i)$ and $\hat{\theta}^c$. The latter is the action that provides the best fit with the firm's overall needs and to which all tasks have to be coordinated (hence the superscript). In the baseline version of the model, we take $\hat{\theta}^c$ as a parameter that characterizes the firm. In Online Appendix A.3, we study a generalization where the firm instead aims to synchronize all inputs with a common action, the simple average across all tasks, $\hat{\theta}^c \equiv 1/N \int_i a(i)\mathrm{d}i$. Since we obtain the same expressions for adaptation costs with a measure N of tasks, we present the reduced form version here.[10]

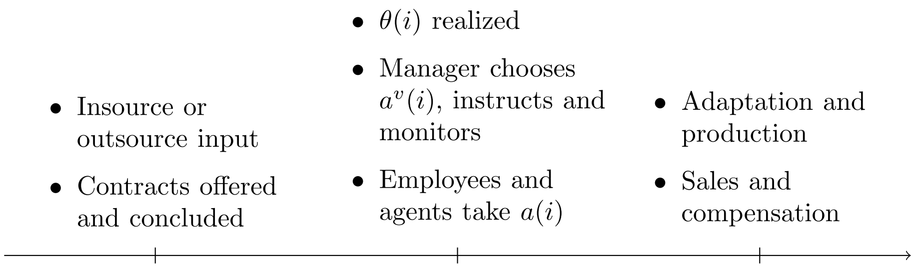
The final term captures the total coordination costs that the manager incurs while communicating and monitoring to direct in-house production; in short, managerial costs. For simplicity, we assume that a firm always consists of a single manager and her employees. The manager has to communicate with each employee (1) to advise her about the action she is supposed to take and (2) to monitor the creation of the service input. Deviations by Ducati's *in-house* translator or advertiser, for instance, could be detected and rectified immediately, and formal documentation by Ducati's managers could furthermore ensure that any contractual penalties (damages and/or demise) could be enforced in court. Generally, the costs that ensue are a function of the total measure of inputs created, N, the capability of the manager, K, and the measure of employees, t. Since each employee produces a single input, t captures both the number of employees and the number of inputs internally produced.

Several additonal comments regarding managerial costs are in order. First, note that we have assumed perfect information about all input conditions $\theta(i)$ and actions $a(i)$, regardless of whether the worker is directly employed or active as an external agent. This assumption is strong and potentially counterfactual, since communication with internal staff is typically much more frequent and managers tend to be better informed about employees (e.g., Arrow, 1975). We have solved a version of our model with imperfect information and detection by the manager through communication and, as expected, all results presented below remain unchanged: superior knowledge within firms only increases the advantage that internal provision has for coordination. Consequently, we present the simpler version with a single channel here (managerial overload).

Second, we do not rule out communication and monitoring vis-a-vis an external agent, and there are managerial costs related to such a sub-contractor, too. At the same time, communication within the firm is usually more effective, in part because of the specific corporate culture associated with a language code (Crémer et al., 2007). Moreover, the costs of internal communication and monitoring are typically more sensitive to the extent of the business in terms of

[10] As we show in Online Appendix A.3, with a finite and discrete set of export destinations and service input tasks, each action influences all other actions and workers take this into account. The main insights from our model remain intact in this case, but the analysis becomes significantly more cumbersome. We also note that in this case of a more general coordination problem, the marginal benefit of integration decreases in the number of tasks internally undertaken, thus pushing a firm even more towards outsourcing when it expands and faces additional export complexity.

Figure 1: Timing



span of control and overall complexity. To capture these ideas in our stylized framework, we interpret $N^\alpha K^\beta t^\gamma$ as the *differential* managerial costs of internalization vs. outsourcing, and normalize the informational flows with an external agent to zero.

Third, while we could rely on a more general functional form for several key insights from the model (see Online Appendix A.2), the iso-elastic managerial cost function captures several important ideas in a more explicit way. The elasticity α can be positive, which captures *managerial congestion*; more outsourced tasks raise the mental load for any manager, and communication and monitoring become more costly. Alternatively, a negative elasticity captures a reduction of mental load when more tasks are produced by external agents, who require less attention than employees (indeed, for a given t, an increase in the number of outsourced tasks results in a relatively less communication-intensive environment). Moreover, the costs of managing a firm of a given size (N, t) hinge on the manager's capability: in line with Crémer et al. (2007), we envisage the coordination and monitoring process as communication intensive and a better, higher K manager is able to establish a more efficient corporate language or code, so that $\beta < 0$ (more on this below). Managerial capability is commonly treated as a fundamental of firm heterogeneity in the international trade literature and we follow suit by keeping it exogenous. While it is an endogenous choice for firms in reality (Mion and Opromolla, 2014; Opromolla et al., 2017), the market for talent severely restricts a company's ability to adjust and formally modelling a labor market for managers would not add to the insights of this paper.

Last, but not least, it is natural that managerial costs rise in the number of employees and that these costs become increasingly burdensome at the margin, i.e., $\gamma > 1$.[11]

To conclude the exposition, we turn to the timing of the model as summarized in Figure 1. Taking the number of destination countries/tasks N as given, the manager first decides whether to source each input i from an external agent or to produce it internally by employing a

[11] In this baseline model we assume that the employee implements the action specified by the manager without fault. This somewhat stark assumption helps focusing on the key mechanism of interest in the model. In Online Appendix A.4, we relax this assumption and pose that managers are not able to rule by fiat, but that the employee's action $a(i)$ must be implemented by the employment contract. We show that all insights from the model carry over to this scenario. Moreover, we want to highlight that our model is static at its core, so that there is no difference between sunk and fixed expenses. While our empirical findings below suggest that the procurement of foreign market access services is likely to have both fixed and sunk aspects, the main insights of this paper do not hinge on this distinction and the benefits from a complex model extension with two or more periods are small in our context.

worker directly. Furthermore, she offers every worker a contract $P(a(i))$, which the employee or agent can accept or reject (in which case the game ends immediately). On the next stage, both employees and external agents observe their input conditions $\theta(i)$, so that they are prepared to take their actions. In doing so, *external agents* simply maximize their profits (1) based on the compensation scheme they agreed upon in the beginning. By contrast, *employees* are instructed on the action $a^v(i)$ they are supposed to implement and monitored during the process.

In the final stage of the game, the firm adapts all inputs to its requirements, produces its output, sells on the N foreign markets, and uses the proceeds to pay both its employees and its external agents. Its own profits depend on the fixed costs (2), as well as on its variable costs and sales. The latter two components are immaterial for the firm boundary choices, so that we defer all related assumptions on final demand and technology.

2.2 Optimal Choices

We solve the game by backward induction and start with the equilibrium actions taken by employees and agents. We conjecture the optimal contracts to solve the model and present the proof that these contracts are indeed optimal at the first stage in Online Appendix A.5.

Conjecture 1 (Optimal Contracts)**.** *The prevailing contract with every*

- *external agent is*
$$P(a(i)) = P(i) = 0.$$
- *employee is*
$$P(a(i)) = (a^v(i) - \theta(i))^2.$$
where $a^v(i)$ is an action specified by the manager.

In the case of outsourcing, the contract is characterized by a fixed price—here equal to the knowledge costs that we normalized to zero—and this arrangement is well-known: the market gives high-powered incentives for cost reduction to the independent supplier. Employment, by contrast, is characterized by what Bajari and Tadelis (2001) refer to as C+ contracts, i.e., payment of a fixed fee (here zero) plus any cost the agent might incur in producing the service input. This arrangement mimics actual employment contracts; the manager has the authority to tell the employee what to do, but to comply with participation constraints she compensates any additional effort. As a result, the employment contract provides low-powered incentives.

Given these compensation schemes and full information about her state, the external agent has no incentive to pick any other action than $a^o(i) = \theta(i)$, i.e., the one that benefits her most *individually*. Employees implement the action instructed by the manager, who monitors their actions and can thus prevent deviations. To set $a^v(i)$ optimally, the manager balances the marginal reduction in adaptation costs when she chooses an $a^v(i)$ closer to $\hat{\theta}^c$ with the marginal decrease in compensation for an employee when she chooses an $a^v(i)$ closer to θ_i. Intuitively, the manager is in a better position to coordinate, because she can internalize the negative externality that each input imposes on the rest of the organization.

Formally, manager's problem is

$$\min_{\{a^v(i)\}} \quad \int_0^t (a^v(i) - \theta(i))^2 \text{ di} + \delta \int_0^t (a^v(i) - \hat{\theta}^c)^2 \text{ di} + \delta \int_t^N (a^o(i) - \hat{\theta}^c)^2 \text{ di}. \tag{3}$$

The solution is a weighted average of the input condition and the coordinating action:

$$a^{v*}(i) = \frac{1}{1+\delta}\theta(i) + \frac{\delta}{1+\delta}\hat{\theta}^c. \tag{4}$$

To make further progress, we have to specify the relationship between the input conditions and the firm's states. In this baseline model, where the coordinating action $\hat{\theta}^c$ is a parameter and the workers' states $\theta(i)$ are random variables, we have two reasons for ex-post adaptation. First, a variance of input conditions $\sigma^2 > 0$ implies that random shocks make adaptation necessary, i.e., adaptation to an ever-changing and uncertain environment. In our case of foreign market access, this is the skill or cost distribution of different service workers, which is shaped by their interests, knowledge, availability and so forth. Second, inputs may always require some deterministic tailoring to the exporter's characteristics. For instance, workers often follow standard procedures and produce generic services, which could be targeted at the overall market average and must be customized for any particular company. To allow for the latter, we specify:

Assumption 1 (Input States). *The mean of all input conditions lie at distance $r \geq 0$ from $\hat{\theta}^c$.*

Armed with this assumption, we exploit the fact that all input conditions are independently drawn from distributions with the same variance, so that the expected fixed costs at time zero are:

$$E[F] = \left[\frac{\delta}{1+\delta}t + \delta(N-t)\right]\psi^2 + N^\alpha K^\beta t^\gamma \tag{5}$$

with $\psi^2 \equiv \sigma^2 + r^2$. This expression captures the trade-off involved when deciding between outsourcing and integration. The first term decreases in t and captures the benefits of integration: by coordinating the actions in-house, the manager is able to internalize the externalities and achieve lower adaptation costs. On the other hand, by producing more inputs in-house, the managerial costs in the second term rise.

Moreover, the relative importance of these two components depends on the main features of the environment in an intuitive way. Ceteris paribus, if adaptation is not important, i.e., when δ is low, there is little reason to produce inputs in-house. Even if the manager can achieve better coordination, this is of secondary importance and the firm can save on managerial costs by outsourcing. Moreover, if input states are volatile (high σ^2) or if appropriate customization matters a lot (high r), expected adaptation costs are high and 'miscoordination' should best be avoided by means of integration. Finally, if the manager is skilled at communicating and monitoring (high K), her managerial costs are low and in-house production of market access inputs is attractive.

In deriving further results, we are faced with an extensive taxonomy of cases if the parameters of the managerial cost function are generic. To avoid complications that add little to the insights of the framework, from here on we rely on a specific micro-foundation:

Assumption 2 (Managerial Costs)**.**

$$N^{\alpha}K^{\beta}t^{\gamma} = \frac{t^3}{KN} \tag{6}$$

In Online Appendix A.1, we provide the formal derivations for this expression, which is based on the optimal choice of an organizational language in the setting of Crémer et al. (2007). The intuition in our context is the following. A manager must assign words to service input tasks to be able to communicate about them, and the more precisely a word relates to a particular task and not to others, the lower is the probability of miscommunication and a costly back-and-forth with the employee. Unfortunately, the manager is boundedly rational in the sense that she can only learn K different words to communicate about the continuum of input tasks t within the boundary of the firm; she must therefore apportion these words wisely. The optimal such allocation implies that frequently occurring tasks are assigned very narrow and specific words, while such a precise language is not necessary for infrequent ones. With a simple communication cost function, and given the fact that in our case every country-related task occurs with equal probability, expression (6) can be derived.

Minimizing the expected fixed costs in (5) under the parameterization of Assumption 2 gives the optimal share of inputs internally produced:

$$t^* = \delta\psi\sqrt{\frac{KN}{3(1+\delta)}}. \tag{7}$$

The expected fixed cost function becomes:

$$E[F] = \overbrace{\delta\psi^2\left(N - t^*\right)}^{F^O} + \overbrace{\frac{3+\delta}{3(1+\delta)}\delta\psi^2 t^*}^{F^I} = \delta\psi^2 N - \frac{2}{3}\frac{\delta^3\psi^3}{(1+\delta)}\sqrt{\frac{KN}{3(1+\delta)}}, \tag{8}$$

where F^O is the part of the expected fixed costs that is outsourced, while F^I is the in-house component. The total expected fixed costs of the firm increase in the need for (ψ^2) and relative cost (δ) of adaptation, as well as in the number of destination markets. They decrease in the manager's capability to coordinate (K).

We are now in a position to state a series of important implications of our model.

Proposition 1 (Task Share of Outsourcing and Market Access)**.** *The share of outsourced service tasks* $\mathcal{O} \equiv (N - t^*)/N$ *rises in the number of export destination markets, but at a decreasing rate:*

$$\frac{\partial}{\partial N}\mathcal{O} > 0 \quad \textit{and} \quad \frac{\partial^2}{(\partial N)^2}\mathcal{O} < 0$$

Proof. The proof follows directly from the definition of the share of outsourced tasks and the first order condition for the optimal share of in-house tasks (7). □

Serving foreign markets entails an increase in business complexity and thus a rise in the share of outsourced tasks. The total number of service inputs required for exporting goes up at the margin and, as a result, the increase in managerial strain—which affects all infra-marginal tasks as well—leads managers to rely more heavily on external agents. Moreover, this relationship is concave due to two distinct mechanisms. First, the outsourced task share is mechanically bounded by one. Second, the time saving effect of outsourcing captured by $\alpha < 0$ in Assumption 2 reduces managerial overload as export complexity rises (ceteris paribus), which in turn implies that the number of integrated tasks increases as well and the outsourcing share increases at a lower pace.

Importantly, these results do not hinge on the functional form we posit in Assumption 2: as long as managerial costs increase sufficiently more sharply in the number of employees t than they decrease in the total number of service input tasks N, the outsourcing share will behave as described in Proposition 1. Consequently, Proposition 1 is robust to different functional form assumptions, for instance to a congestion effect with managerial costs *increasing* in N, which reinforces the result.[12]

Inspection of (8) shows that the expected fixed costs function is monotonic in N, which is consistent with the typical modelling approach applied in international trade.[13] At the same time, in contrast to the standard assumption, it grows proportionally only if the number of destination markets is large. By re-organizing the provision of their service inputs, firms can economize on fixed market access costs, especially when they are small and in their early stages of internationalization. They do so by outsourcing non-core tasks to external agents, thus alleviating the cost pressure from increased managerial strain due to rising complexity. These considerations are captured in the following corollary.

Corollary 1 (Fixed Costs of Exporting)**.** *The sunk and fixed costs of exporting increase in the number of destination markets, but less than proportionally due to firm reorganization. Consequently, a company's fixed costs to serve a foreign market depend on the export status in all other markets. However, the returns (marginal benefits) of firm reorganization decrease as export complexity increases due to managerial overload.*

Note that since sunk and fixed costs of exporting depend on the full history of destinations previously served, heterogeneity along the country margin can give rise to exporting profiles consistent with extended gravity (Chaney, 2014; Morales et al., 2019). In particular, one may envisage that accessing a new market similar or close to an existing one is associated with

[12]See Online Appendix A.2 for the extension of Proposition 1 to more general cost functions. We stress that Assumption 2 stacks the cards *against* outsourcing service inputs when a firm exports to additional foreign markets. Since $\alpha = -1$, the relative managerial costs under vertical integration falls in the number of destinations N, for example because outsourcing some of the additional tasks reduces a manager's overload at the margin. Our micro-founded managerial cost function therefore constitutes a conservative approach and creates a plausible equilibrium which features an increase of both internally and externally produced tasks when the total number of inputs goes up.

[13]For the expected fixed costs to be weakly positive for any number of export markets, we normalize the measure of N appropriately. That is, the number of inputs internally produced t^* cannot be larger than the total number of inputs N, which is guaranteed if $N \geq \delta^2\psi^2 K/(3(1+\delta))$. Furthermore, it is easy to verify that the fixed cost function always increases in N when the function itself is positive.

considerable task-overlap or synergies, so that additional managerial strain under integration is small. Intuitively, the manager can hold efficient group meetings for employees who work on the same cultural or geographic region. As a consequence, access related costs are lower and firms are more likely to export there.

Next, we turn to an analysis of how the need for and costs of adapting a service input shape a firm's make-or-buy decisions, and how they affect the re-organization that goes hand in hand with accessing additional markets abroad. First, our model implies a smaller outsourcing share in cases of high expected adaptation costs. Intuitively speaking, the value of coordinating the production of service inputs is particularly high whenever a failure to do so creates substantial costs ex post; that is to say, when destination-specific inputs can be produced in a variety of ways and a good match with a given firm's special needs is unlikely (high r or σ^2), or when changing and adapting them ex post is difficult (high δ). The firm cannot influence an external agent's action under outsourcing and is therefore unable to improve coordination even if ex-post adaption is expected to be costly. Within a company, by contrast, some of these adaptation expenses can be avoided (albeit at slightly higher wages).

Second, the model implies that firms are particularly eager to outsource service inputs in response to foreign market access when the need for or costs of adaptation are high. Adding export destinations is especially taxing for managers when service inputs require substantial and costly adaptation. Infra-marginal inputs for existing markets already exact a company's managerial capability, so that the company operates in the very steep part of the convex managerial cost function. When even more service inputs are needed to export to new countries, there is little scope for a firm to hire and supervise employees. The outsourcing task share increases more sharply compared to a situation with low expected adaptation costs.

Proposition 2 (Adaptation)**.** *The share of outsourced service tasks $\mathcal{O}$ falls in the need for (ψ) or cost of (δ) adaptation. Moreover, $\mathcal{O}$ increases even more in the number of export destination markets when the expected costs of adaptation are high:*

$$\frac{\partial}{\partial\psi}\mathcal{O} < 0, \quad \frac{\partial}{\partial\delta}\mathcal{O} < 0 \quad \textit{and} \quad \frac{\partial^2}{\partial N \partial\psi}\mathcal{O} > 0, \quad \frac{\partial^2}{\partial N \partial\delta}\mathcal{O} > 0$$

Proof. The proof follows directly from the definition of the share of outsourced tasks and the first order condition for the optimal share of in-house tasks (7). □

Finally, we investigate the role of managerial capability K. If an organization employs able managers who have a large capacity to coordinate their subordinates, a higher number of tasks can be produced in-house without overloading managers. Accordingly, the costs of producing the service inputs required for exporting internally are lower and the optimal outsourcing task share is smaller. Furthermore, when a company decides to expand to additional foreign markets and the range of service inputs widens, better managers increase the outsourcing share more significantly. A useful intuition for this result is that capable managers already coordinate many employees and are therefore more willing to rely on external agents when the task range expands due to foreign market access.

Proposition 3 (Managerial Capability). *The share of outsourced service tasks* $\mathcal{O}$

a) falls in the managerial capability of a company (K)*,*

$$\frac{\partial}{\partial K}\mathcal{O} < 0.$$

b) increases even more in the number of export destination markets when managerial capability is high,

$$\frac{\partial^2}{\partial N \partial K}\mathcal{O} > 0.$$

Proof. The proof follows directly from the definition of the share of outsourced tasks and the first order condition for the optimal share of in-house tasks (7). □

2.3 Empirical Implementation

In the empirical part of this paper, we confront all propositions with the data. In several of these exercises below, our data do not include information on outsourcing at the task-(destination-market) level, and we study the theoretical predictions based on the *share of outsourcing in total costs*. To establish a close link between the conceptual model and our findings there, we make three additional assumptions regarding demand and technology that are standard in the international trade literature (e.g., Melitz, 2003; Chaney, 2008).

Assumption 3 (Demand and Technology). *We further specify that*

- *downstream demand in every market is derived from CES preferences/technology with elasticity of substitution* $e > 1$
- *there are destination specific iceberg trade costs* $\tau(i) \geq 1$
- *exporters produce with potentially heterogeneous constant marginal costs* $1/K > 0$

In Online Appendix A.6, we show that analogous statements to Propositions 1 and 3a) can be derived for shares of outsourced service expenditures in total costs. Moreover, since Proposition 2 is tested with more detailed data on outsourcing of detailed service inputs, no further work is required. By contrast, the equivalent of part b) in Proposition 3 is ambiguous when we study cost shares. At the same time, relying on Assumption 3 allows us to make and test additional predictions as to how our estimates should vary with foreign market size/variable cost shares in total costs, as well as with demand elasticities, see Proposition A.4 in Online Appendix A.6.2.

Note that we do not model a firm boundary decision for variable costs and we assume that they arise internally. We do so since there is no a priori reason why shipping the same quantity of a good to different numbers of countries would imply a re-organization of production. Indeed, we provide empirical evidence in Section 3.3 that outsourcing of variable inputs, namely of intermediates production and labor, responds to a firm's scale of shipments abroad, but—holding volumes fixed—not to the number of destinations.

As a final remark, we have treated the number of destination markets as given throughout this exposition, while firms pick their market portfolio endogenously. This gives rise to two implications for our empirical analyses. First, when we allow companies to choose N optimally, those with better managers can afford to export to more destinations and at the same time handle a broader range of tasks internally (see Online Appendix A.6.3). In the simple OLS regression of the outsourcing share on N, managerial capability is therefore an omitted variable that is positively correlated with the regressor and negatively with the outcome, so that we expect a downward bias in the estimates. Second, our predictions are expected to hold *especially* when firms select into new foreign markets due to exogenous factors like an increase in market potential abroad. This suggests an instrumental variables strategy that we implement below.

3 Evidence from French Firm-Level Data

3.1 Data and Empirical Approach

We provide evidence on service input outsourcing using firm-level data from France from 1996 to 2007. Our main sample is based on (1) the Enquête annuelle d'Entreprise (EAE), which collected balance sheet data and other information for all French firms with more than 20 employees and for a sample of smaller firms. Moreover, we make use of (2) the near universe of international transactions of goods from the French Customs Agency, which we match with the EAE information by means of the unique administrative identifier for French firms, the SIREN. The baseline sample is an unbalanced panel over 12 years and we focus on manufacturing firms (NACE Rev1.1 category D) for which we have information on service outsourcing throughout.

Our main measure of service input outsourcing, $\mathcal{O}^C_{it}$, is defined as firm i's share of expenditure on business services in total costs in year t.[14] The service categories we include are purchases of studies (i.e., market research), purchases of IT services and software, and advertising expenditure. All the underlying accounting items involve expenditures that are *external to a firm* according to the French accounting code Plan Comptable Général.[15] As shown in Online Appendix Table C.1, the average firm in 1996 has a service outsourcing cost share of 4.3%, with a standard deviation of 7 percentage points. These numbers increase substantially over time, especially in the right tail of the distribution. Since the outsourcing share is typically non-zero and right-skewed, we take logs throughout.[16]

This baseline outsourcing measure captures both domestic and foreign service purchases, which allows for a comprehensive analysis. To what extent firms rely on offshore providers, especially in the target market for exports, is an interesting question, though beyond the scope of our paper (for related work on service offshoring, see, for example, Berlingieri et al., 2021). At the same time, aggregate statistics imply that foreign sourcing accounts for a small share of

[14] Our main finding is fully robust to using the (logged) *expenditure* on outsourced business services as a dependent variable and controlling for total costs, see Online Appendix Table C.3.

[15] See Online Appendix B.2 for more details on these definitions.

[16] In the EAE, we cannot distinguish between true zeros and missing information, so we do not analyze the outsourcing extensive margin. By taking logs, the number of observations drops from 188k to 175k. In unreported regressions we verify that including this outsourcing extensive margin does not affect our estimates.

service spending and hence we interpret our results as pertaining to domestic procurement.[17]

In line with our model, we rely on the number of countries a firm exports to, N_{it}, as a measure of export complexity. When we explore the nature of service tasks in Section 4, we also employ other extensive margin measures that take into account that tasks may not be independent across markets (Morales et al., 2019; Arkolakis et al., 2021).

Regressing the share of service outsourcing on the number of countries is likely to give a biased estimate of their relationship due to several confounding factors. First, industry-level supply or demand shocks may affect both a firm's exporting profile and its sourcing strategy for service inputs. Among these, changes in the availability or productivity of service providers upstream are likely to play a role.[18] To address this challenge, we compare firms that belong to the same narrowly-defined industry in a year by including industry $\times$ year fixed effects in our regressions (denoted by γ_{jt}).

Second, firm characteristics like scale or technology typically affect the level of internationalization of firms and simultaneously determine a firm's boundary decisions. A large number of employees, for example, may allow a company to solve many tasks internally and, at the same time, access new markets at large and with higher probability of success. A similar argument can be made regarding the skill level of employees or a firm's technological set-up. Consequently, we rely on firm fixed effects (denoted γ_i). To the extent that scale and technology are stable over time, we can purge their influence. Since it is unlikely, however, that they experience no significant developments over our 12-years sample period, we also control directly for employment, skill intensity and capital intensity throughout (denoted by $\mathbf{X_{it}}$). In this context, we have checked that the results are robust to lagging these variables and to the inclusion of other covariates, see Online Appendix Table C.3.

Summarizing, the main specification is:

$$\mathcal{O}_{it}^{C} = \beta_1 N_{it} + \boldsymbol{X'_{it}\vartheta} + \gamma_{jt} + \gamma_i + \epsilon_{it}, \tag{9}$$

which we initially estimate by OLS with standard errors clustered at the firm level (significance levels remain unchanged when clustering by 3-digit industry, see Online Appendix Table C.3).

At least three more potential concerns about this correlation persist, even taking into account our demanding fixed effects and control strategy. First, outsourcing is often associated with a cost reduction or productivity gain—in our model captured by a decrease in the price of a service input—which may enable a firm to expand the number of foreign markets they serve (reverse causality). Second, even after controlling for a number of firm characteristics, one can think of several firm-level shocks that are difficult to observe in the data and that could induce a spurious correlation between the exporting profile and firm boundaries (omitted variables). In particular, as discussed above and formally demonstrated in Section A.6.3 in the Online

[17] Aggregate data from the OECD Input-Output database show that, in 2005, business services purchased internationally by French firms accounted for 7% of the total output of this sector. Using firm-level data from Belgium, Ornaghi et al. (2021) find that imported services account for only 0.5% of the average manufacturing firm's turnover, and that imports of business services represent on average less than one quarter of the total.

[18] Indeed, Hsieh and Rossi-Hansberg (2021) document that increasing returns have led to a rapid emergence of 'superstar' service providers in the US.

Appendix, an unobserved improvement in managerial capability may lead a company to export to more markets (Bloom et al., 2021) and may also reduce the need for outsourcing service tasks. The result is a downward bias in the OLS estimates.[19] Finally, the number of export destinations may be a crude proxy for the complexity of a company's foreign activities and this measurement error, to the extent that it introduces noise, attenuates our results.

We therefore instrument for the number of destination countries using plausibly exogenous demand shocks from abroad as suggested by our model (see Section 2.3). In our main IV exercise, we rely on increases in foreign demand due to the process of European integration and economic convergence, focusing on the Eastern European states that joined the EU in 2004. Conditional on controls, it is plausible that these shocks affected a firm's decisions to outsource service inputs only through changes in that firm's portfolio of export markets.

To have a relevant instrument, our aim is to predict the number of countries a *firm* serves based on exogenous proxies for the demand shocks. We construct our baseline instrument as

$$IV\_N_{it} = \max\left\{\max_{p \in P_{it_0}} \{N_{ipt_0} + \Delta N_{pt}\}, 1\right\}. \tag{10}$$

N_{ipt_0} is the number of destination markets for product p that firm i served in the first year of exporting t_0. The second term, ΔN_{pt}, refers to the increase in the number of countries that ship product p to one of the new EU member states between t_0 and t, i.e., the total change in supplier countries excluding France. Finally, P_{it_0} is the set of products firm i exported in the first year it was present in our sample. If the number of predicted export destinations falls to zero or below, we set the instrument to one, so that we do not predict the extensive *firm* margin of exporting with our instrument. We use the log of IV_N_{it} throughout.

Conceptually, this instrument follows a shift-share idea in that the aggregate demand shock in Eastern European countries over time is 'distributed' across firms according to a pre-determined measure of exposure. For the latter we prefer the "most successful" product (i.e., $\max_{p \in P_{it_0}}$) over a weighted average across all of a firm's varieties: A stylized fact in the multi-product literature of international trade is that there is a pecking-order across export destinations for products within the same firm; out of a range of similar varieties, a firm starts exporting its most productive or 'core' ones to any given market and adds others in increasing order of marginal costs (Mayer et al., 2014). Since sunk costs of exporting are incurred with the first market penetration—and fixed service input costs are often shared among all products—a firm's 'core' variety is expected to matter most. In line with these considerations, the number of a firm's overall export destinations is highly correlated with the number of export destinations of its most successful product in our data (corr. is 0.97 in 1996, for example).

[19] Another related concern may be progressing digitization (Bergeaud et al., 2021). At the same time, Malgouyres et al. (2021) show that broadband access did not have a large impact on French firms' exporting behavior and so is unlikely to be a confounder in our context.

3.2 Main Results

The first four columns of Table 1 present the results of our baseline regression exercise. Moving across the specifications, we introduce the different fixed effects and complete our preferred OLS model with controls in column (4). Consistent with Proposition 1, firms that extend their sets of export markets also expand their share of outsourced service inputs.[20] In column (5), we re-estimate our preferred model on the sub-sample of firms for which our instrument is available and report the 2SLS estimate of interest in column (6).[21] Focusing on firms that expand their sets of export destinations due to the exogenous demand shock in Eastern Europe, we continue to find a positive and highly statistically significant effect on the outsourcing share.

Table 1: Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
N	0.197***	0.197***	0.092***	0.083***	0.082***	0.282***
	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)	(0.091)
Observations	175,564	175,564	175,564	175,564	169,137	169,137
Number of firms	25,665	25,665	25,665	25,665	24,490	24,490
R-Square	0.126	0.131	0.746	0.746	0.746	0.745
Controls				Yes	Yes	Yes
KP-Stat						239.1
IV Type						NewEU-Imp exFRA
Firm FE			Yes	Yes	Yes	Yes
Year FE	Yes					
Industry FE	Yes					
Ind#Year FE		Yes	Yes	Yes	Yes	Yes

The dependent variable is the (log) share of purchased services in total costs. The main regressor N is the (log) number of export destination countries at the firm-year level. The instrument is a firm-year-level proxy for exposure to the demand shock from new Eastern European EU member states in 2004, see equation (10). Coefficient estimates for the control variables employment, skill intensity, and capital intensity (all in logs) are not shown. The full baseline sample contains all French manufacturing exporters in the EAE during 1996-2007. Common sample is imposed across columns (1)-(4). Column (5) repeats the baseline OLS specification for the IV sample in column (6). Standard errors in parentheses are clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The causal effect of business complexity due to an increasing number of export destinations on outsourcing is also economically important. To illustrate the magnitudes involved: the average increase in French firms' market access explains 45% of the total increase in the average PBS outsourcing cost share based on the full sample (see summary statistics in Online Appendix Table C.1). Bounding this effect from below, the OLS estimates imply a share of 13%, which is

[20]To reiterate, Proposition 1 can be shown to hold in terms of cost shares in a version of our model with additional assumptions about demand and technology; see Online Appendix A.6, Proposition A.1.

[21]The number of observations is lower than for the baseline, because for small export flows—i.e., those that are below the full reporting threshold and originate from simplified declarations—we do not observe the product dimension needed for the instrument.

still sizeable. The spending on external provision of such inputs therefore rose by up to 685k€ due to additional market access, which is equivalent to supporting an additional 23 external service workers (at a firm's average internal wage) per firm at the end of the period.

The IV estimate is larger than the OLS, which is consistent with two explanations that are not mutually exclusive. First, the instrument addresses the downward bias due to unobserved firm-level developments (e.g., changes in managerial capabilities) and measurement error associated with the proxy N, as discussed above. Second, the population of compliers is likely to consist of relatively smaller firms, since their larger and more productive competitors had already exported to Eastern Europe. These smaller firms are also more likely to rely on external providers for the additional inputs associated with market access, so that their outsourcing shares are more responsive.

3.3 Robustness and Further Explorations

In the next step, we corroborate our main finding. First, we provide additional evidence to support the validity and robustness of our instrumental variables strategy. Second, we investigate and rule out alternative mechanisms and interpretations of our findings.

Exclusion Restriction and Quasi-Random Assignment

First, in order to address the concern that the instrument affects firm boundary decisions through these channels we include a firm's export intensive margin (average sales across destinations), the number of origin countries for imports and the import intensive margin as controls. Consistent with the conceptual mechanism we outlined formally with our model, the IV estimates remain positive and highly significant, see columns (2) and (3) in Online Appendix Table C.5. Second, one might be concerned about correlated shocks or first-order general equilibrium effects between France and the new EU member states. Excluding all EU 15 countries in the computation of the shock variable, however, does not affect our findings, as shown in column (4). Third, the demand shocks we exploit may not be quasi-randomly assigned, thus violating a necessary condition for identification. Following the recent advances on shift-share strategies (for example, Borusyak et al., 2022), we compute the concentration/dispersion of firm exposure to the shocks as the inverse of the Herfindahl index of the average shock exposure across firms. The calculations imply that identification comes from around 380 different shocks, which is twice as many as in the prominent study of Autor et al. (2013), which Borusyak et al. (2022) consider well-identified. Moreover, in a falsification exercise we regress the 5-year lagged outsourcing share on our instrumental variable, using the same fixed effects and (lagged) controls as in our baseline specification 9 (for a similar approach, see Aghion et al., 2020). A significant correlation would suggest that our outcome predicts the assignment of the instrument conditional on controls. As column (5) shows, however, the coefficient of our instrument is precisely estimated and zero. Fourth, we want to highlight that in line with Adão et al. (2019), who recommend clustering at the level of variation of the shocks to address error correlations due to general equilibrium effects, we cluster at the 3 digit industry level in all IV regressions. In sum, we have found no evidence for a violation of exogeneity.[22]

Alternative Demand Shocks and Versions of the Instrument

There may be three types of concerns regarding our instrument: (1) the case of the new EU member states is somehow special and, in consequence, our results have little external validity; (2) the process of European integration has led to correlated shocks or simultaneous developments in France and in Eastern Europe that leave doubts about the exclusion restriction; (3) the functional form of our instrument and the assumptions we make are problematic.

To address these points, we construct alternative versions as one-step deviations from equation (10) above. First, instead of using the increase in the number of supplier countries to the new EU member states as a proxy for exogenous demand shocks, we rely on the BRICS economies (Brazil, Russia, India, China, and South Africa) or China. In both cases we omit France from the counts and the resulting estimates reported in columns (6) and (7) of Online Appendix Table C.5 are statistically significant and of the same magnitude as our baseline result.[23] Second, we in turn use the trade-weighted average as an exposure measure, replace the initial number of countries for each firm by 1, and rely only on positive shocks. As shown in columns (8) to (10) of Online Appendix Table C.5, our main result is highly robust.

Further Explorations and Alternative Mechanisms

We conduct these exercises using the OLS strategy a) to avoid focusing on a special subset of treated firms and b) to explore mechanisms that cannot be investigated with IV estimation (whenever it is possible, we confirmed the results using our baseline instrument). All results are reported in Table 2.

First, according the mechanism we put forward, international market access requires additional service inputs that are independent of the volume exported; in other words, they are fixed costs. Moreover, we hypothesize that *importing* implies a different and significantly less burdening set of tasks compared to exporting: the firm can use its existing knowledge to find a supplier active in the world market, and establish and manage a single supply relationship. By contrast, marketing a product on a new market typically involves finding several customers in an unfamiliar environment, complying with a set of potentially unknown legal regulations, and maintaining a broadening customer base (Arkolakis, 2010; Fitzgerald et al., 2020; Argente et al., 2021). The results in columns (2) and (3) of Table 2 confirm our expectations; neither the export intensive margin nor import margins matter for the outsourcing share.[24]

Second, we examine the dynamics behind firms' outsourcing decisions in connection with accessing a new market abroad. In column (4), we include the number of export destinations in

[22] One might be worried that the political and regulatory changes in Eastern Europe may have made sourcing service inputs locally easier, and to the extent that offshoring is more prone to outsourcing, the instrument may have had a direct effect on our outcome. While conceivable, this is unlikely to be a first-order concern due to our industry-year fixed effects approach and given that a large part of the variation in the instrument comes from pre-determined firm-level exposure to Eastern Europe. Finally, this threat to identification is virtually absent for the alternative instruments we present below.

[23] We have also experimented with the change in the number of *destination* countries for US *exports* (excluding France) and have obtained similar results to our baseline findings; the estimates are available upon request.

[24] In footnote 29 below, we discuss the fact that the set of services related to the importing activity of the firm is more limited and different from exporting.

the previous period, $L.N$, and the same variable for the next period, $F.N$. The estimates imply that firms prepare to enter a new market at least one year in advance and start outsourcing crucial service inputs. This process extends well into the actual year of entry as seen by the sizeable coefficient on the contemporaneous variable N, which is also consistent with a substantial fixed cost component in market access services. Finally, the small and only marginally significant estimate on $L.N$ implies that the re-organization is completed shortly afterwards.

Third, one may be tempted to think that our results reflect secular trends that are unrelated to globalization, or provide little information about the distribution of tasks within and across firms. In particular, many manufacturing firms have become more service oriented over the last few decades (Bernard et al., 2017) and an increase in external sourcing of professional business services may therefore be due to this general 'servitization', while the boundary of the firm remains unchanged. Alternatively, internationalization may itself be a driver of increased demand for service inputs, but the boundary of firms is unaffected, because their provision grows equally within and outside the firm.

Several arguments suggest, however, that neither of these alternative interpretations of our findings applies in practice. First, our dependent variable $\mathcal{O}^C$ is already defined as outsourcing expenditures *relative* to total costs—which include internal production—, and our control variable skill intensity, the ratio of skilled to unskilled employees, captures internal provision to some extent. Second, in column (5) of Table 2 we further proxy for the internal production of services by the number of hierarchical layers and the share of professionals employed by the firm (more likely to be associated with the production of services). While firm re-organization has been shown to have important implications for firm growth (Caliendo et al., 2015, 2020), we find that in our context the estimated effect of foreign market access on the outsourcing share is unchanged. Finally, any secular trend is partially picked up by our firm fixed effects. What is more, in Online Appendix Table C.3, column (5), we show that adding firm-specific time-*trends* leaves our conclusions unchanged. We thus conclude that our interpretation of an increase in outsourcing due to export complexity and managerial overload is more consistent with the empirical patterns.[25]

Next, we present four placebo exercises. Outsourcing of service inputs required for foreign market access is influenced by adding export destinations, while a larger export volume is likely to increase complexity *in production* (for example due to congestion effects or capacity constraints), in which case managers are expected to outsource other inputs like labor and intermediates. We provide supporting evidence of this idea in columns (6) to (8), where we replace the service outsourcing share by the subcontracted labor cost share, by the subcontracted industrial production cost share related to the expansion of capacity and by the subcontracted industrial

[25] In Online Appendix Table C.4, we introduce several other measures for internal production, all of which leave our conclusion unchanged. An interesting and conceivable scenario is outsourcing to other partners within the same domestic or multinational business group. In this context, we have estimated the baseline specification on sub-samples of firms (1) without any reported PBS activity in their business groups or (2) without any foreign affiliation (see columns (10) and (11) of Online Appendix Table C.3). Since the estimates are statistically indistinguishable from the baseline, the potential presence of organizational specialization at the group-level is not a concern for our conclusions.

production cost share due to the need for specialized equipment or capabilities.[26] Moreover, and slightly anticipating Section 4.2, only sophisticated market access related services should be outsourced when the number of export destination increases. In column (9) of Table 2, we use the outsourcing cost share of 'general administrative services' as a placebo outcome—which includes janitorial services and security, among others—and find that indeed export complexity plays no role for them.

To conclude this section, we test the two additional predictions from the extended model with further assumptions about demand and technology mentioned in at the end of theory Section 2 and proven in Online Appendix A.6. The elasticity of the outsourcing share with respect to the number of destination markets is particularly high when the variable component of total costs is large. The intuition is that fixed export costs—the outsourced part in particular—are very sensitive to the increase in export complexity, while variable costs increase by less because the firm sells smaller and smaller quantities in the marginal (typically more distant) foreign markets. Thus the outsourcing share reacts more strongly when the share of total costs accounted for by variable costs is large. A low degree of differentiation of a firm's products and therefore a high demand elasticity has a similar effect, since it increases the variable cost share, inter alia.

We proxy the variable cost share with the ratio of export volume to the number of countries and condition on the half sample where this fraction is higher than the median in column (10). Similarly, to measure the degree of differentiation of a firm's product mix we make use of the Rauch (1999) classification and compute the export value-weighted firm-level share of differentiated products. In column (11), we condition on the half sample where this share is large. Our main coefficient estimate of interest moves in the respective directions predicted by the model.[27]

[26]These placebo exercises are motivated by two strands of research. The employment subcontracting variable is used as a proxy for low skill outsourcing in Bilal and Lhuillier (2021). Industrial outsourcing in the French data is similar to the 'contract manufacturing services' reported in the U.S. Census of Manufacturers, in which the buyer provides instructions and technical specifications to a manufacturer who performs the physical production activity. Fort (2017) has used this measure to analyze the role of technology and skill complementarities in the firm's decision to fragment production domestically or abroad. In columns (7) and (8) we do not use logs for the dependent variable since the share of true zeros is large (see Online Appendix Section B.3).

[27]We have conducted several other robustness checks. First, we have estimated a long-difference specification for 1997 and 2006 to take into account that re-organization may take time or could be transitory. The result in column (6) of Online Appendix Table C.3 suggests that firms adapt substantially and permanently within a short window around a foreign market access event. Second, in column (7) of the same table, we add non-exporters to our sample, which allows us to investigate how firms organize their 'going international'. Since $N = 0$ for these firms, we swap the log transform by the inverse hyperbolic sine. The coefficient estimate is very similar to our baseline. Third, a complete declaration for an international transaction within the EU must only be filed if its value exceeds a certain threshold. In column (8) of Online Appendix Table C.3 we remove firms filing simplified declarations for EU exports and our finding is highly robust. Finally, in column (9), we focus on firms with more than 20 employees, because the EAE is exhaustive for such companies, and find that this restriction is innocuous.

Table 2: Further Explorations and Alternative Mechanisms

	(1) Base	(2) Out	(3) Out	(4) Out	(5) Out	(6) Empl	(7) Ind-Cap	(8) Ind-Spec	(9) Admin	(10) VarCosts	(11) Diff
N	0.083***	0.083***	0.086***	0.053***	0.083***	0.003	0.000	0.000	0.009	0.108***	0.071***
	(0.010)	(0.010)	(0.012)	(0.011)	(0.010)	(0.009)	(0.000)	(0.001)	(0.015)	(0.020)	(0.013)
Exp Intensive Margin		0.001	-0.000			0.012***	0.001***	0.001***			
		(0.005)	(0.005)			(0.004)	(0.000)	(0.000)			
N Imp			0.010								
			(0.011)								
Imp Intensive Margin			0.003								
			(0.005)								
L.N				0.020*							
				(0.011)							
F.N				0.054***							
				(0.011)							
Num. Layers					-0.000						
					(0.007)						
Professional Share (CS3)					0.057						
					(0.084)						
Observations	175,564	175,564	149,636	120,502	175,544	142,006	76,066	76,066	91,523	85,332	85,596
Number of firms	25,665	25,665	22,035	19,102	25,661	22,034	16,027	16,027	15,566	13,666	15,872
R-Square	0.746	0.746	0.753	0.777	0.746	0.681	0.682	0.811	0.735	0.780	0.734
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the (log) share of purchased services in total costs in columns (1)-(5) and (10), (11); it is the (log) total cost share of *external* expenses on labor and administrative services in columns (6) and (9), respectively; it is the outsourced cost share in total costs of physical intermediate inputs due to capacity constraints and due to required specialized equipment or capabilities in columns (7) and (8), respectively. The main regressor N is the (log) number of export destination countries at the firm-year level. Exp Intensive Margin is the (log) average sales across destinations; N Imp is the (log) number of import origin countries; Imp Intensive Margin is the (log) average imported value across origins; Num. Layers is the number of hierarchical layers; Professional Share (CS3) is the share of middle management employment—all variables are computed at the firm-year level. L and F signify time lags and leads, respectively. Coefficient estimates for the control variables employment, skill intensity, and capital intensity (all in logs) are not shown. The full baseline sample contains all French manufacturing exporters in the EAE during 1996-2007. Numbers of observations differ from the full sample and across columns due to data availability. The samples in columns (10) and (11) cover the firm-year observations where total export value divided by the number of export destinations is above the sample median, and if the value share of Rauch (1999)-differentiated products in a firm's export mix is above the sample median. Standard errors in parentheses are clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4 Service Inputs and the Nature of Tasks

In the next two parts of this paper, we shine further light into the black box of sunk and fixed costs associated with exporting and investigate their behavior in detail. To start with, in this section, we investigate refinements of our measure of complexity using destination market characteristics. We then provide empirical evidence on the identity and nature—especially the need for and cost of ex-post adaptation— of the particular input tasks that exporters need, and typically outsource, when they expand.

4.1 Investigating Market Access Complexity

Not every additional export destination presents the same challenges to a firm and requires the same organizational adjustments. The latter may depend on how 'difficult' it is to understand the workings in the destination, on how many products are to be offered there, and last but not least, on whether a firm has already gained experience in that market. In Table 3, we present empirical evidence on these margins based on slight variations on our baseline OLS model (9), i.e., interacting the number of destination countries with several different measures to investigate complexity in detail. Since we rely on within estimates and the interacted variables vary within units of the panel, we de-mean all variables by all fixed effects included in the regressions before computing the interaction terms (Giesselmann and Schmidt-Catran, 2020). As a by-product, all level effects can be interpreted directly at the mean of the interaction variable.

We first show that the outsourcing cost share as defined above is concave in the number of destination markets, i.e., that external provision of professional business services is especially important for rapidly growing companies in their early stages of internationalization. Indeed, the quadratic term on the number of export countries is negative and highly statistically significant. This result is predicted by our model, where concavity is a direct result of the fact that in-house production of PBSs is limited by a firm's capacity to coordinate and monitor employees (see Proposition 1).[28]

Next, we investigate whether there are stronger effects on outsourcing when a new foreign market adds more complexity, because the *effective* number of tasks is higher (in the jargon of our model). In particular, serving a new country where a language is spoken that an exporter previously had had no contact with is more difficult than simply expanding the regional reach, say, from Germany to Austria. To proxy for this aspect of culture-related complexity, we simply count the total number of languages spoken in a firm's export profile of countries. As shown in column (3), the coefficient on the interaction with the number of countries is positive and of the same order of magnitude as N. The large standard errors are not surprising, since our empirical specification rests on within variation and involves multiple interaction terms, so that this exercise is quite demanding of the data. Nevertheless, we view these results as supportive of the hypothesis. As an alternative, we re-weight the number of countries using the Hausmann et al. (2011) measure of economic (country) complexity, which can be thought as a proxy for

[28] As a reminder, Proposition 1 can be stated in terms of cost shares if we make additional assumptions about demand and technology, see Online Appendix A.6, Proposition A.1).

Table 3: Investigating Market Access Complexity

	(1)	(2)	(3)	(4)	(5)	(6)
N	0.101***	0.091***	0.092***	0.093***	0.074***	0.092***
	(0.013)	(0.013)	(0.020)	(0.032)	(0.014)	(0.017)
N × N		-0.047***	-0.067**	-0.118**	-0.050***	
		(0.014)	(0.029)	(0.053)	(0.019)	
Num Languages			-0.001			
			(0.016)			
N × Num Languages			0.028			
			(0.038)			
N (Complexity)				-0.001		
				(0.029)		
N × N (Complexity)				0.072		
				(0.052)		
NP					0.029***	
					(0.011)	
N × NP					0.005	
					(0.019)	
Re-entry × N						0.004
						(0.015)
New Entry × N						0.028**
						(0.014)
New&Re-entry × N						0.038**
						(0.017)
Observations	175,544	175,544	175,544	175,544	175,544	147,444
Number of firms	25,663	25,663	25,663	25,663	25,663	22,283
R-Square	0.746	0.746	0.746	0.747	0.747	0.764
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the (log) share of purchased services in total costs. The main regressor N is the (log) number of export destination countries at the firm-year level. Num. Languages is the (log) count of different primary languages spoken in a firm-year's export destinations; N (Complexity) is the (log) complexity-weighted number of export destination countries. NP is a firm-year's (log) number of exported products; Re-entry/New Entry/New&Re-entry is an indicator variable at the firm-year level, which indicates whether the exporter re-enters markets relative to the previous period and its full history in the data/ enters markets it had not exported to in its full history in the data/ simultaneously re-enters *and* enters markets for the first time (mutually exclusive categories; all irrespective of concurrent exit). Coefficient estimates for the control variables employment, skill intensity, and capital intensity (all in logs), as well as the levels of the entry indicators are not shown. Variables are standardized to compare levels more easily across different variables. All interacted variables are first de-meaned at the level of the fixed effects and then multiplied. The full baseline sample contains all French manufacturing exporters in the EAE during 1996-2007. Common sample imposed across columns (1)-(5). Column (1) replicates our baseline result for this sample and for the standardized value of (log) N. Re-entry requires at least three years of data to be defined, so the number of observations in column (6) is lower due to dropping the initial two years for every firm and year 1996 all together (trade data available only from 1995). Standard errors in parentheses are clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

how 'difficult' market access is in one country compared to others. Once again, we find evidence that after controlling for the quadratic term in N there is a positive interaction effect. The point estimate is large and the P-value is .16.

As a fourth exercise, we investigate if firms that simultaneously raise the number of products exported implement greater re-organizations when they access foreign markets. The multi-product literature in international trade typically assumes the presence of product-specific export fixed costs and notes that these are mainly made up by service inputs. For instance, Bernard et al. (2011) justify their presence by arguing that they capture the research, advertising and regulation costs to supply each product to a certain destination. Therefore, an increase in the number of products could also entail an increase in the number of service inputs needed, and consequently a rise in coordination complexity. At the same time, to the extent that companies follow a sequential entry strategy for products and trial their most successful variety before adding others to their local portfolio, it is likely that the complexity generated by adding an additional product is lower compared to entering an entirely new market; one would expect only a marginal effect on complexity from the simultaneous increase of markets and products. Consistent with these weak hypotheses, we find a positive and significant increase in the share of service outsourcing when the number of exported products increases, but the magnitude is smaller compared to adding new countries. Moreover, once again taking out the quadratic term, our prior is confirmed in that the interaction term between N and the total number of products, NP, is small and insignificant.

Finally, outsourcing the provision of a service task is expected to occur when a firm accesses a *new* market to the extent that it reflects sunk investments in the face of an increase in business complexity. *Re-entry* on the other hand, should have an effect on fixed cost-related complexity. To investigate these considerations, we interact N with an indicator variable at the firm-year level, which indicates whether the exporter (1) only re-enters markets relative to the previous period and given its entire observable history (and does not also enter a new market); (2) only enters markets it had not exported to (and does not also re-enter a market); (3) simultaneously re-enters *and* enters markets for the first time. Note that exit events are immaterial in these definitions. Interpreting the estimates in column (6) of Table 3 we find that re-entry does not affect the boundary of the firm, which is consistent with the view that some of the entry cost might be sunk in nature or that such companies never really abandoned the market and continued to pay fixed costs in the form of PBS inputs. Only entering new markets, by contrast, entails a significant increase in the cost share of outsourcing. Whenever a firm both enters and re-enters markets, there is an additional positive effect on the outsourcing share, which is consistent with the fact that simultaneous entry and re-entry typically involves larger swings in the number of destinations. Finally, while the main effect of N is driven by several sources of variation, in our French setting of international expansion it mostly reflects past entry, which shows that the export-related inputs we measure in our data are indeed components of fixed costs.

These findings so far have important implications for the patterns of how exporters grow and are therefore closely related to a recent line of research that stresses demand factors as important determinants of both firm heterogeneity and how firms grow in new markets (e.g., Hottman et al., 2016; Argente et al., 2021). Fitzgerald et al. (2020), for instance, highlights customer base accumulation by means of advertising as a determinant of success in a destination. Our findings complement these insights: Since fixed costs depend on the existing set of export destinations and their characteristics, the market access trajectory for companies is not only state-dependent within destination, but also across them. Moreover, Morales et al. (2019) shows that the probability of entering a given new market is higher when a firm's previous destinations share some similarities in terms of language, culture or location. The conceptual mechanism and empirical evidence presented in this paper provide an important narrative, or micro-foundation, for this "extended gravity": the fixed costs of exporting to a new market depend on other destinations in the portfolio due to the effect on managerial overload and subsequent re-organization. A French firm that expands from Germany to Austria is required to handle only few additional tasks (which may even closely overlap with those already performed), so that little adjustment of the firm boundary is necessary.

4.2 The Identity of Service Tasks

Having explored a range of task characteristics related to the identity of the destination, we now study the outsourcing decisions by French firms at the level of different types of highly dis-aggregated business services. To do so, we work with information from the Enquête Recours aux Services par l'Industrie (ERSI), a survey of firms with more than 20 employees (exhaustive above 250 employees), which collected detailed information about service outsourcing for a single cross-section in 2005. The 4,933 manufacturing firms that responded accounted for over 50% of the total turnover of the French manufacturing sector. In all our regressions we make use of the sampling weights provided to account for stratification and oversampling of larger firms.

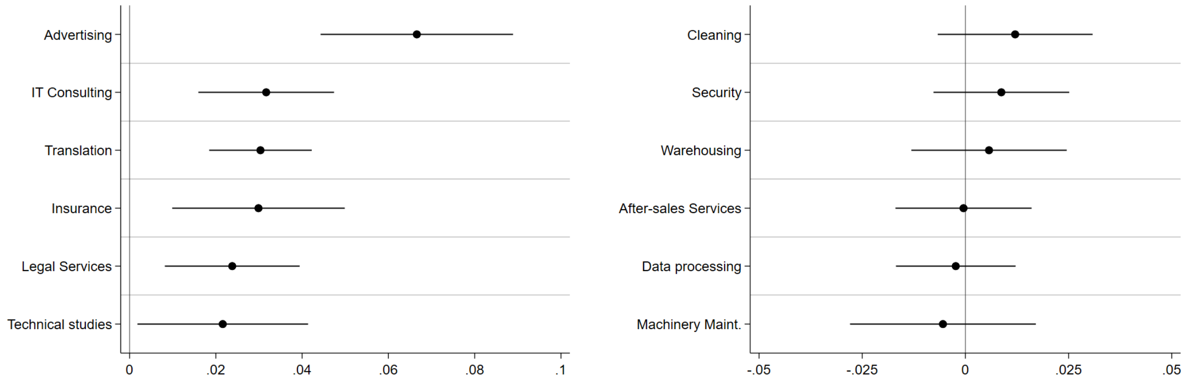
The survey provides information on whether or not a manufacturing firm outsourced any one of 34 different types of service inputs, allowing us to gain insights into firms' sourcing strategies at a highly granular and detailed level (further details are given in Online Appendix B.2.3 and basic summary statistics are shown in Online Appendix Table C.2). In addition, we match international trade flows recorded by the French customs agency and other firm-level information from the EAE in 2005 to the ERSI sample. To gauge our main relationship of interest, we estimate the following linear probability model with OLS *by service type*:

$$OUT_i = \beta_1 N_i + \boldsymbol{X_i'}\boldsymbol{\vartheta} + \gamma_j + \epsilon_i \tag{11}$$

where OUT_i is an indicator equal to one if firm i outsourced a particular service in 2005, and to zero otherwise; X_i is vector of firm controls (export intensive margin, employment, skill intensity, and capital intensity); γ_j is a 3-digit industry fixed effect, and ϵ_i is an error term that may be correlated across firms within sampling strata. All results are fully robust to estimating an analogous probit model, but since we investigate interaction effects below, we present OLS results for consistency here.

Figure 2 presents point estimates and 95% confidence intervals for the number of export markets and for a selection of service types. In line with our expectations, services directly connected to foreign market access in Panel 2a tend to respond markedly: advertising, legal services, provision of technical studies and translation are all typical examples of tasks required for exporting and are more likely to be provided by an external agency the more internationalized a company is. By contrast, warehousing, after-sales services, data processing, cleaning and security are all either related to the scale of foreign operations—and therefore constitute variable cost components—or not connected to exporting at all.[29]

Figure 2: Outsourcing Responses to Market Access by Service Type



(a) Market Access Services

(b) Placebo Services

The figure shows point estimates and 95% confidence intervals for the effect of the (log) number of export destinations on the probability to outsource any given service covered by the ERSI, a cross-section of manufacturing firms in 2005, based on empirical model (11). All underlying results are reported in Online Appendix Table C.7. All regressions contain the control variables employment, skill intensity, and capital intensity (all in logs), and 3 digit downstream industry fixed effects. Each sample contains all exporters in ERSI. Standard errors for confidence intervals are clustered at the downstream sampling strata level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3 Service Input Adaptation

Next, we provide evidence that it is the need for or cost of adaptation associated with these services that explains the outsourcing patterns we observe. We construct three novel empirical proxies that rely on altogether different ideas, but capture the relevant parameters, ψ and δ, in our model: (1) the (non-)routine task share in the upstream service industries that produce each service type, inspired by Costinot et al. (2011); (2) the inverse Herfindahl–Hirschman index of firm-level labor cost shares in an upstream service sector; (3) the (inverse) elasticity of service demand estimated following Gervais and Jensen (2019). The first two measures are constructed

[29]The results for all individual service types are reported in Online Appendix Table C.7. In that table, we also show that outsourcing of individual services is generally not systematically related to a firm's TFP, alleviating concerns about reverse causality, i.e., that outsourcing improves productivity and induces firms to export to more destinations. In unreported results, we furthermore (1) confirm that these findings are highly robust to instrumenting with our preferred IV and (2) show that the set of services that are more likely to be outsourced in relation to the importing activity of the firm is smaller and does not overlap with market access services (the only service input that reacts significantly to both the export and the import extensive margins is transportation, while outsourcing of warehousing services is positively related to both the export and import intensive margins).

using employment and labor costs information from the French matched employer-employee data (DADS), while the third is constructed using data from the EAE Services survey.

Table 4: The Need for Adaptation and Service Outsourcing

	(1) All	(2) All	(3) All	(4) All	(5) All	(6) All	(7) Median	(8) Median	(9) Median
Serv. NonRoutiness	-0.152***								
	(0.051)								
Serv. Dispersion		-0.072***							
		(0.006)							
Serv. Inv Elasticity			-0.112***						
			(0.013)						
N × Serv. NonRoutiness				0.008			0.043***		
				(0.010)			(0.013)		
N × Serv. Dispersion					0.001			0.004**	
					(0.001)			(0.002)	
N × Serv. Inv Elasticity						-0.004			0.003
						(0.003)			(0.004)
Observations	126,482	126,482	110,673	126,482	126,482	110,673	59,283	59,283	51,375
Number of firms	3,959	3,959	3,959	3,959	3,959	3,959	3,959	3,959	3,959
R-Square	0.105	0.146	0.124	0.438	0.438	0.438	0.434	0.434	0.423
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Service Cat FE				Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is an indicator equal one if a firm outsources a particular service in 2005, and zero if not. Serv. NonRoutineness is the non-routine task share for the upstream service input; Serv. Dispersion is the inverse Herfindahl–Hirschman index of firm-level labor cost shares in an upstream service sector; Serv. Inv Elasticity is the (inverse) elasticity of service demand estimated as in Gervais and Jensen (2019). All variables are in logs. The full sample contains all exporters in the ERSI, a cross-section of manufacturing firms in 2005. The sample for columns (7)-(9) is restricted to upstream 'market access' service types whose estimated elasticity with respect to the (log) number of export destinations is above the median across services in Section 4.2. The number of observations for columns (3), (6) and (9) is lower because four service types are not covered in the EAE Services data (Brokerage, Leasing, R&D, Training). Standard errors in parentheses are clustered at the downstream sampling strata by upstream service type level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The intuition behind these measures is the following. A low routine-task share implies that a service is customized and costly ex-post adaptation is therefore both more likely and more expensive. As for the second measure, a wide dispersion in service provider size suggests strong differentiation across services produced in the industry and therefore a greater need for ex-post adaptation. As argued by Sutton (1991), differentiation shields companies from price competition and productivity advantages cannot translate into high industry concentration, at least conditional on sunk entry costs. Finally, a low downstream demand elasticity for services implies few possibilities to substitute away from any given input, so that the producer is forced to make costly adaptations.

Measuring the expected costs of adaptation of services is challenging and, to the best of our knowledge, we are the first to propose these proxies. While we acknowledge the limitations of these measures, we believe that their diverse origins render them collectively useful for our purpose and that the opportunity to learn outweighs the risk of misinterpretation.

We continue with the ERSI sample and estimate the following linear probability model:[30]

$$OUT_{is} = \beta_1 Adapt_s + \beta_2 N_i \times Adapt_s + \gamma_i \, (+\gamma_s) + \epsilon_{is} \tag{12}$$

where $Adapt_s$ is one of the three proxies in 2005 and s indexes a service type; firm fixed effects (γ_i) absorb any firm-level control variable; and γ_s denotes service type fixed effects that, when included, absorb the level of our adaptation proxies and leave only the interaction with the number of export destinations (N_i) identified.

As suggested by Proposition 2, we expect β_1 to be negative. If ex-post adaptation is needed often or relatively expensive, coordinating tasks within the boundary of the firm is valuable, so that services for market access are more likely to be produced in-house. Moreover, managers operate under high managerial strain when they supervise the in-house production of service inputs with substantial expected adaptation costs, so that they cannot expand their range when additional services are required for a new export destination. Consequently, their outsourcing task share increases more for such services compared to those where a standardized outfit suffices, i.e., $\beta_2 > 0$.[31]

The empirical evidence presented in columns (1) to (3) of Table 4 lends strong support to the first implication. All coefficients are statistically significant and economically important. For instance, comparing the most to the least routine service type, the outsourcing probability increases by around 14 percentage points, over a baseline outsourcing probability of 51%.

The need for and costs of adaptation also play a key role in which services a firm outsources when it serves foreign markets. In columns (4) to (6) of Table 4, we report estimates using all services, while in the remaining columns we focus on the particular service categories we identified as export-related in the previous exercise (specifically, on those with above-median coefficient estimates on N). The results imply that the increased complexity due to exporting leads to outsourcing of those 'market access' services that require substantial ex-post adaptation.

5 The Role of Managerial Capability

Finally, we examine how managerial capability shapes the organization of market access services. Unlike the service characteristics discussed in the previous part, managerial capability is a firm-level variable and hence we return to our baseline sample provided by the EAE, where the observable outcome is the outsourcing cost share and we rely on within-firm variation over time. We re-estimate the baseline specification (9) and include proxies for a firm's capacity to monitor and coordinate, as well as their interactions with the number of foreign markets served as additional regressors.

To measure managerial capability in line with the concept K in our model, we propose three

[30]Since we are interested in interaction terms, we do not rely on a non-linear model, where coefficient estimates cannot be interpreted in a straightforward way. Our conclusions regarding the level effects of the three service characteristics on outsourcing are unchanged when we estimate a Probit model.

[31]With the ERSI, we have direct information on task outsourcing, so that we can rely on Proposition 2 without any further assumptions about demand or technology.

novel proxies. First, we make use of the 2007 O*NET database to obtain information on an *occupation*'s intensity in tasks that relate to a) monitoring, b) coordinating (with) others, and c) communicating. Using occupation-specific employment shares provided by matched employer-employee data (DADS) for the firms in our baseline sample we aggregate these capabilities up to the firm-year level, see Online Appendix B.2. The idea behind these measures is that a company with many employees whose daily work focuses on managerial activities has more capacity to deal with a complex business environment. We believe that these measures are highly appropriate in our context, but at the same time acknowledge that metering managerial capability is exceedingly hard and we have to expect considerable noise.

In the first step, we want to confirm that a firm's capacity to monitor and coordinate its employees indeed reduces the need for outsourcing of non-core business services as predicted by Proposition 3a). When we make additional assumptions regarding demand and technology as discussed in Section 2.3, we can also predict a fall in the outsourcing *cost* share, which is i) stronger when variable costs account for a large share of total expenditure, and ii) weaker when the price elasticity of demand is low. A more capable manager handles more tasks in-house (outsourced fixed costs are low) and at the same time increases sales of the firm with a consequent increase in variable costs (total costs are high); the resulting fall in the outsourcing cost share is magnified with a larger share of variable costs or higher price elasticity (see Proposition A.4 in Online Appendix A.6.2 for the formal derivation).

We report the results for these predictions in Table 5, where all variables are de-meaned within the dimensions of the fixed effects; level terms can therefore be interpreted at the mean of the interaction variable. To start with columns (1) to (3)—i.e., with the full baseline sample—the coefficient estimates for our three measures are all negative and statistically significant. To give a sense of the magnitudes involved, the point estimate for communication implies an elasticity of the outsourcing share of -1.2, for example. These findings strongly support Proposition 3a) and therefore constitute tell-tale evidence in favor of the conceptual mechanism of coordinated adaptation in a complex business environment that we underline in this paper.

To investigate the first additional prediction, we once again proxy the variable cost share by a company's average market size (total export value/number of destinations) and restrict the estimation in columns (4) - (6) to the half-sample of firm-year observations with above median variable cost shares. For the second additional prediction ii), we compute the value-weighted share of differentiated goods at the firm-year level and restrict the estimation in columns (7) - (9) to the half-sample of observations with a high share of differentiated good exports. All estimates move as implied by our conceptual framework: better managers increase the degree of vertical integration of market access services, especially when these account for a smaller cost share and when downstream demand is more elastic.

In the second step, we study Proposition 3b), namely whether better managers are more eager to outsource market access services when they expand their set of export destinations. As discussed in Section 2.3 and shown formally in Online Appendix A.6, our model does not provide an unambiguous prediction for cost shares in this case, but the prediction is more likely to hold when the variable cost share or the demand elasticity is low.

Table 5: Managerial Capability and Service Outsourcing

	(1) Full	(2) Full	(3) Full	(4) VarCosts	(5) VarCosts	(6) VarCosts	(7) Diff	(8) Diff	(9) Diff
N	0.083***	0.082***	0.083***	0.107***	0.107***	0.106***	0.071***	0.071***	0.071***
	(0.010)	(0.010)	(0.010)	(0.020)	(0.020)	(0.020)	(0.013)	(0.013)	(0.013)
Monitoring	-0.013*			-0.028**			-0.011		
	(0.007)			(0.013)			(0.011)		
Coordination		-0.024***			-0.045***			-0.006	
		(0.009)			(0.015)			(0.013)	
Communication			-0.019***			-0.031**			-0.000
			(0.007)			(0.012)			(0.009)
N × Monitoring	-0.016			-0.028			0.003		
	(0.017)			(0.037)			(0.026)		
N × Coordination		-0.005			-0.008			0.006	
		(0.020)			(0.045)			(0.029)	
N × Communication			0.008			0.004			-0.005
			(0.019)			(0.042)			(0.026)
Observations	175,544	175,544	175,544	85,320	85,320	85,320	85,583	85,583	85,583
Number of firms	25,661	25,661	25,661	13,662	13,662	13,662	15,868	15,868	15,868
R-Square	0.746	0.747	0.747	0.780	0.780	0.780	0.734	0.734	0.734
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the (log) share of purchased services in total costs. The main regressor N is the (log) number of export destination countries at the firm-year level. Monitoring/ Coordination/ Communication is a firm-year's employment-weighted monitoring/ coordination/ communication task share based on O*NET. Coefficient estimates for the control variables employment, skill intensity, and capital intensity (all in logs) are not shown. All interacted variables are first de-meaned at the level of the fixed effects and then multiplied. The full baseline sample contains all French manufacturing exporters in the EAE during 1996-2007. Common samples imposed across columns (1)-(3), (4)-(6), and (7)-(9). The samples in columns (4)-(6) and (7)-(9) cover the firm-year observations where total export value divided by the number of export destinations is above the sample median, and if the value share of Rauch (1999)-differentiated products in a firm's export mix is above the sample median. Standard errors in parentheses are clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In columns (1) - (3) of Table 5, the interaction effects in the full sample are small and insignificant, which is consistent with the model's ambiguous prediction. At the same time, they fall when we rely on the sample with a high variable cost share and rise when goods are strongly differentiated, i.e., when the demand elasticity is low (with the exception of communication). Overall, however, we find no evidence that firms with higher managerial capability deal with the additional complexity due to foreign market access differently; all companies increase the outsourced cost share in roughly the same way, albeit starting from different initial levels of integration.[32]

To summarize this section, we highlight two further implications of our findings regarding the role of managerial capability in a firm's internationalization process. First, treating the sunk or fixed costs of exporting as firm-specific—as in, for instance, Arkolakis et al. (2021) or Adão et al. (2020)—is well-grounded in the fact that a firm's managerial staff are a key determinant in the size of these costs. At the same time, they should not be independent of a company's core productivity *to the extent* that the latter reflects more than just manufacturing

[32] Controlling for concavity by including a square term in N leaves the results unchanged. In unreported exercises we furthermore check that our insights are robust to how we select the high variable cost share and differentiated output samples. Finally, using interactions produces results that are consistent with the split sample exercises.

expertise. Second, sunk and fixed firm-specific market access costs should not be independent across markets, since organizational choices are made at the firm- and not at the destination market level, and they depend on the common factor managerial capability (see Morales et al., 2019).

6 Concluding Discussion

In this paper we examine how manufacturing companies organize the provision of business services needed for foreign market access. Conceptually, exporting to more destinations raises the complexity of a firm's operations, which strains its managerial capabilities for coordinating production, and, as a consequence, service inputs like advertising and market research are typically outsourced to domestic external agencies. We provide strong and causal evidence for this pattern using confidential French firm-level information. Consistent with our theoretical framework, firms alleviate the burden of internationalization by outsourcing service inputs that require little adaption once created, or where adjustments are relatively cheap. The extent to which a manufacturer has market access services produced in-house by employees, or externally by independent agencies, hinges on its managerial capability to communicate and monitor: "better managers" are less likely to rely on outsourcing overall, but also readily hand such tasks over to external agents when a firm internationalizes to focus in their organizations. These insights are key for understanding the nature of the sunk and fixed costs associated with exporting that have taken center-stage since the inception of New Trade Theory.

In this final part, we take a broader view of our findings and discuss their direct implications for two prominent and highly topical issues. First, this paper establishes a new and quantitatively important link between globalization and wage inequality due to the former's effect on domestic service outsourcing. Second, it shows that globalization is a driver of structural change towards the tertiary sector through organizational adjustment.

Firms are known to play a central role in shaping the dynamic patterns of wage inequality, the aggregate labor share, and overall income inequality (e.g., Bloom et al., 2018; Song et al., 2018; Autor et al., 2020). Based on exploration of the underlying mechanisms, a substantial body of economic research has documented that domestic outsourcing of certain input tasks is typically associated with relatively lower wages for the (newly) external workers in low-skill occupations. This robust, quantitatively important, and arguably causal pattern has been shown in the context of, among others, France (Bilal and Lhuillier, 2021), Germany (Goldschmidt and Schmieder, 2017), Argentina (Drenik et al., 2020), and the US (Katz and Krueger, 2017), and for various service industries. There is less evidence regarding more high-skilled (service) occupations, but it is well-established that outsourcing has important implications for wage inequality.[33]

In this paper, we show that globalization, with its potential to render the corporate business environment more complex and to create demand for service inputs in traditional manufacturing,

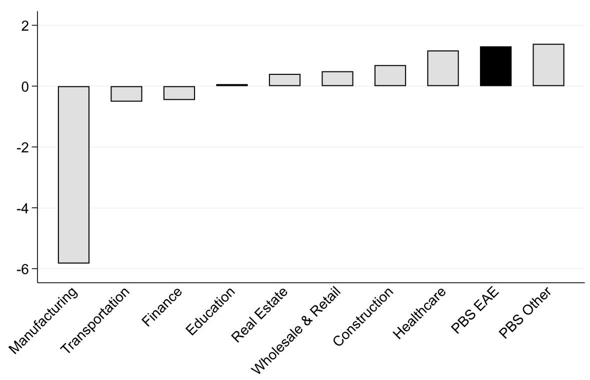
[33]Theoretical mechanisms that can explain the wage differences due to outsourcing have been suggested by, for instance, Holmes and Snider (2011) and Bilal and Lhuillier (2021).

can cause outsourcing of business services. By way of deduction, our findings therefore establish a new channel through which globalization, in the form of increased international market access, increases within-country wage inequality.[34] Interestingly, this mechanism is likely to be of first-order quantitative importance as shown above, since the average increase in the number of export destinations explains between 13% (OLS) and 45% (2SLS) of the rise in the outsourcing cost share of PBSs. It is beyond the scope of this paper to calculate the share of wage inequality in France that can be traced to market access service outsourcing and we leave it for future research.

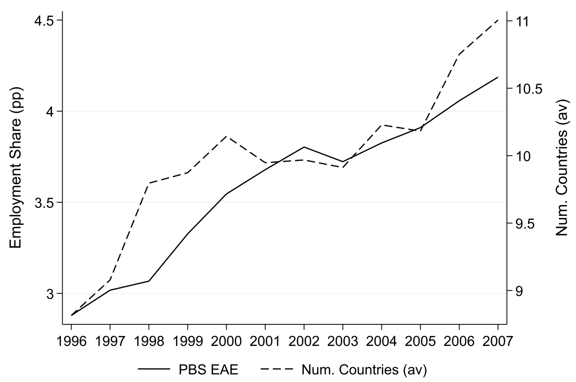
The second implication of our findings concerns the secular shift of many developed economies towards the tertiary sector. Fort et al. (2018), for example, documents a decline in U.S. manufacturing employment at the aggregate level and shows that workers in companies with some goods-producing activity are increasingly employed at establishments not classified in manufacturing. Ding et al. (2020) investigate this "within firm structural transformation" in depth and argue that it is driven by a complementarity between service and manufacturing workers in the face of declining physical input prices.

Figure 3: The Rise of Services

(a) Changes in Employment Shares 1996-2007 (percentage points)



(b) PBS Employment Shares and Export Destinations



Panel (a) plots the aggregate change in employment shares of 1-digit NACE industries over the period using data from DADS. PBS EAE indicates the Professional and Business Services industries that produce the services considered in our analysis based on EAE, which are NACE Rev 1.1 industry 72 (Computer and related activities) and part of 74 (Other business activities)—correspondence available upon request. Panel (b) focuses on the change in the share of PBS EAE services in aggregate employment, and contrasts it with the increase in the number of export destination countries for the average firm in the EAE sample.

Similar aggregate empirical patterns can be observed for the time period 1996 to 2007 in France, which we investigate in this paper. In Figure 3a, we plot the changes in aggregate employment shares by different secondary and tertiary sectors. Over the course of *a mere decade*, manufacturing has declined by nearly 6 percentage points of total employment, while the service sector as a whole has grown substantially. Notably, the largest expansion is due to PBSs.

[34] Despite extensive research, we have not been able to find a reference to this channel. A case in point is the prominent piece by Rodrik (2021), which does not mention domestic re-organization and outsourcing as one of the reasons why the general public have fallen out of love with globalization.

Zooming into the time variation of the latter in Figure 3b, where we plot annual employment shares of the industries that produce the business services we consider in the analysis based on EAE (solid line, left vertical axis), one can discern steady growth over the period.

Our findings have three implications for this development. Firstly, we highlight an important link between globalization and the rise of services. As Figure 3b illustrates, the advancing internationalization of the average French manufacturing company as it accesses more and more foreign markets (dashed line, right vertical axis) has spurred demand for services. Our findings show that this demand was predominantly satisfied by external agencies, i.e., provision of PBSs grew disproportionately outside of manufacturing companies. Secondly, and relatedly, our findings emphasize that globalization leads goods production networks to interweave ever more strongly with service production networks. The forward linkage of PBSs has increased substantially over time and this development has taken place partially through outsourcing (also see Berlingieri, 2014). Finally, and following the famous argument by Stigler (1951), globalization has increased the extent of the market for PBSs, since they are non-core activities of manufacturers for which there is strong pressure for external provision according to our findings. This has spurred upstream entry and the fast employment growth observed for services providers overall (c.f. Hsieh and Rossi-Hansberg, 2021).

References

Abraham, K. G. and Taylor, S. K. (1996). Firms' use of outside contractors: Theory and evidence. *Journal of Labor Economics*, 14(3):394–424.

Adão, R., Arkolakis, C., and Ganapati, S. (2020). Aggregate implications of firm heterogeneity: A nonparametric analysis of monopolistic competition trade models. NBER Working Papers 28081, National Bureau of Economic Research.

Adão, R., Kolesár, M., and Morales, E. (2019). Shift-share designs: Theory and inference. *The Quarterly Journal of Economics*, 134(4):1949–2010.

Aghion, P., Antonin, C., Bunel, S., and Jaravel, X. (2020). What are the labor and product market effects of automation? new evidence from France. CEPR Discussion Papers 14443, Centre for Economic Policy Research.

Alessandria, G., Arkolakis, C., and Ruhl, K. J. (2021). Firm dynamics and trade. *Annual Review of Economics*, 13(1):253–280.

Antràs, P. (2015). *Global Production: Firms, Contracts, and Trade Structure*. Princeton University Press.

Antràs, P. and Rossi-Hansberg, E. (2009). Organizations and trade. *Annual Review of Economics*, 1(1):43–64.

Argente, D., Fitzgerald, D., Moreira, S., and Priolo, A. (2021). How do entrants build market share? The role of demand frictions. Mimeo, Penn State University.

Arkolakis, C. (2010). Market penetration costs and the new consumers margin in international trade. *Journal of Political Economy*, 118(6):1151–1199.

Arkolakis, C., Ganapati, S., and Muendler, M.-A. (2021). The extensive margin of exporting products: A firm-level analysis. *American Economic Journal: Macroeconomics*, 13(4):182–245.

Arrow, K. J. (1975). Vertical integration and communication. *Bell Journal of Economics*, 6(1):173–183.

Autor, D., Dorn, D., Katz, L. F., Patterson, C., and Reenen, J. V. (2020). The fall of the labor share and the rise of superstar firms. *The Quarterly Journal of Economics*, 135(2):645–709.

Autor, D. H., Dorn, D., and Hanson, G. H. (2013). The china syndrome: Local labor market effects of import competition in the united states. *American Economic Review*, 103(6):2121–68.

Azoulay, P. (2004). Capturing knowledge within and across firm boundaries: Evidence from clinical development. *American Economic Review*, 94(5):1591–1612.

Bajari, P. and Tadelis, S. (2001). Incentives versus transaction costs: A theory of procurement contracts. *The RAND Journal of Economics*, 32(3):387–407.

Baldwin, R. (1988). Hyteresis in import prices: The beachhead effect. *American Economic Review*, 78(4):773–785.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1):99–120.

Becker, G. S. and Murphy, K. M. (1992). The division of labor, coordination costs, and knowledge. *The Quarterly Journal of Economics*, 107(4):1137–1160.

Bergeaud, A., Malgouyres, C., Mazet-Sonilhac, C., and Signorelli, S. (2021). Technological change and domestic outsourcing. CEP Discussion Paper 1784, Centre for Economic Performance.

Bergounhon, F., Lenoir, C., and Mejean, I. (2018). A guideline to French firm-level trade data. Mimeo, École Polytechnique.

Berlingieri, G. (2013). *Essays on international trade and firm organization.* Doctoral thesis, London School of Economics and Political Science.

Berlingieri, G. (2014). Outsourcing and the rise in services. CEP Discussion Paper 1199, London School of Economics.

Berlingieri, G., Marcolin, L., and Ornelas, E. (2021). Service offshoring and export experience. CEPR Discussion Papers 16215, Centre for Economic Policy Research.

Bernard, A. B. and Jensen, J. B. (2004). Why some firms export. *The Review of Economics and Statistics*, 86(2):561–569.

Bernard, A. B. and Moxnes, A. (2018). Networks and trade. *Annual Review of Economics*, 10(1):65–85.

Bernard, A. B., Redding, S., and Schott, P. K. (2011). Multiproduct firms and trade liberalization. *The Quarterly Journal of Economics*, 126(3):1271–1318.

Bernard, A. B., Smeets, V., and Warzynski, F. (2017). Rethinking deindustrialization. *Economic Policy*, 32(89):5–38.

Bilal, A. and Lhuillier, H. (2021). Outsourcing, inequality and aggregate output. Working Papers 2021-05, Becker Friedman Institute for Research In Economics.

Bloom, N., Guvenen, F., Smith, B. S., Song, J., and von Wachter, T. (2018). The disappearing large-firm wage premium. *AEA Papers and Proceedings*, 108:317–22.

Bloom, N., Lemos, R., Sadun, R., Scur, D., and Van Reenen, J. (2014). JEEA-FBBVA Lecture 2013: The new empirical economics of management. *Journal of the European Economic Association*, 12(4):835–876.

Bloom, N., Manova, K., Reenen, J. V., Sun, S. T., and Yu, Z. (2021). Trade and management. *The Review of Economics and Statistics*, 103(3):443–460.

Bloom, N. and Van Reenen, J. (2007). Measuring and explaining management practices across firms and countries. *The Quarterly Journal of Economics*, 122(4):1351–1408.

Borusyak, K., Hull, P., and Jaravel, X. (2022). Quasi-experimental shift-share research designs. *The Review of Economic Studies*, 89(1):181–213.

Caliendo, L., Mion, G., Opromolla, L. D., and Rossi-Hansberg, E. (2020). Productivity and organization in portuguese firms. *Journal of Political Economy*, 128(11):4211–4257.

Caliendo, L., Monte, F., and Rossi-Hansberg, E. (2015). The anatomy of french production hierarchies. *Journal of Political Economy*, 123(4):809–852.

Caliendo, L. and Rossi-Hansberg, E. (2012). The impact of trade on organization and productivity. *The Quarterly Journal of Economics*, 127(3):1393–1467.

Chaney, T. (2008). Distorted gravity: The intensive and extensive margins of international trade. *American Economic Review*, 98(4):1707–1721.

Chaney, T. (2014). The network structure of international trade. *American Economic Review*, 104(11):3600–3634.

Chen, N. and Novy, D. (2011). Gravity, trade integration, and heterogeneity across industries. *Journal of International Economics*, 85(2):206–221.

Coase, R. H. (1937). The nature of the firm. *Economica*, 4(16):386–405.

Corcos, G., Irac, D., Mion, G., and Verdier, T. (2013). The determinants of intrafirm trade: Evidence from french firms. *The Review of Economics and Statistics*, 95(3).

Costinot, A., Oldenski, L., and Rauch, J. (2011). Adaptation and the boundary of multinational firms. *The Review of Economics and Statistics*, 93(1):298–308.

Crémer, J., Garicano, L., and Prat, A. (2007). Language and the theory of the firm. *The Quarterly Journal of Economics*, 122(1):373–407.

Das, S., Roberts, M. J., and Tybout, J. R. (2007). Market entry costs, producer heterogeneity, and export dynamics. *Econometrica*, 75(3):837–873.

Debaere, P., Görg, H., and Raff, H. (2013). Greasing the wheels of international commerce: how services facilitate firms' international sourcing. *Canadian Journal of Economics*, 46(1):78–102.

Dessein, W. and Santos, T. (2006). Adaptive organizations. *Journal of Political Economy*, 114(5):956–985.

Ding, X., Fort, T., Redding, S. J., and Schott, P. K. (2020). Structural change within versus across firms: Evidence from the united states. Unpublished manuscript, Dartmouth, Princeton, Yale.

Drenik, A., Jäger, S., Plotkin, P., and Schoefer, B. (2020). Paying outsourced labor: Direct evidence from linked temp agency-worker-client data. CEPR Discussion Papers 14517, Centre for Economic Policy Research.

Eaton, J., Kortum, S., and Kramarz, F. (2004). Dissecting trade: Firms, industries, and export destinations. *American Economic Review*, 94(2):150–154.

Eaton, J., Kortum, S., and Kramarz, F. (2011). An anatomy of international trade: Evidence from french firms. *Econometrica*, 79(5):1453–1498.

Espinosa, M. (2021). Labor boundaries and skills: The case of lobbyists. *Management Science*, 67(3):1586–1607.

Fitzgerald, D., Haller, S., and Yedid-Levi, Y. (2020). How exporters grow. CESifo Working Paper Series 8077, CESifo.

Fort, T., Pierce, J., and Schott, P. K. (2018). New perspectives on the decline of US manufacturing employment. *Journal of Economic Perspectives*, 32(2):47–72.

Fort, T. C. (2017). Technology and production fragmentation: Domestic versus foreign sourcing. *The Review of Economic Studies*, 84(2):650–687.

Garicano, L. (2000). Hierarchies and the organization of knowledge in production. *Journal of Political Economy*, 108(5):874–904.

Garicano, L. and Rossi-Hansberg, E. (2015). Knowledge-based hierarchies: Using organizations to understand the economy. *Annual Review of Economics*, 7(1):1–30.

Gervais, A. and Jensen, J. B. (2019). The tradability of services: Geographic concentration and trade costs. *Journal of International Economics*, 118(C):331–350.

Gibbons, R. (2005). Four formal(izable) theories of the firm? *Journal of Economic Behavior & Organization*, 58:200–245.

Giesselmann, M. and Schmidt-Catran, A. (2020). Interactions in fixed effects regression models. SocArXiv m78qf, Center for Open Science.

Gil, R. and Ruzzier, C. A. (2018). The impact of competition on "make-or-buy" decisions: Evidence from the spanish local tv industry. *Management Science*, 64(3):1121–1135.

Goldschmidt, D. and Schmieder, J. F. (2017). The rise of domestic outsourcing and the evolution of the german wage structure. *The Quarterly Journal of Economics*, 132(3):1165–1217.

Görg, H. and Jabbour, L. (2016). Availability of business services and outward investment: Evidence from french firms. *Review of International Economics*, 24(4):797–819.

Hart, O. and Holmstrom, B. (2010). A theory of firm scope. *The Quarterly Journal of Economics*, 125(2):483–513.

Hausmann, R., Hidalgo, C. A., Bustos, S., Coscia, M., Chung, S., Jimenez, J., Simoes, A., and Yıldırım, M. A. (2011). *The Atlas of Economic Complexity: Mapping Paths to Prosperity*. MIT Press, 1st edition.

Helpman, E., Melitz, M., and Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *The Quarterly Journal of Economics*, 123(2):441–487.

Holmes, T. J. and Snider, J. T. (2011). A theory of outsourcing and wage decline. *American Economic Journal: Microeconomics*, 3(2):38–59.

Hottman, C. J., Redding, S. J., and Weinstein, D. E. (2016). Quantifying the sources of firm heterogeneity. *The Quarterly Journal of Economics*, 131(3):1291–1364.

Hsieh, C.-T. and Rossi-Hansberg, E. (2021). The industrial revolution in services. CES Working Papers 21-34, Center for Economic Studies, U.S. Census Bureau.

INSEE (2013). DADS: guide méthodologique. Technical report, Direction des Statistiques Démographiques et Sociales, Institut National de la Statistique et des Études Économiques (INSEE).

Johanson, J. and Vahlne, J.-E. (1977). The internationalization process of the firm—a model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies*, 8(1):23–32.

Kaldor, N. (1934). The Equilibrium of the Firm. *The Economic Journal*, 44(173):60–76.

Katz, L. F. and Krueger, A. B. (2017). The role of unemployment in the rise in alternative work arrangements. *American Economic Review*, 107(5):388–92.

Lucas, Jr., R. E. (1978). On the size distribution of business firms. *Bell Journal of Economics*, 9(2):508–523.

Malgouyres, C., Mayer, T., and Mazet-Sonilhac, C. (2021). Technology-induced trade shocks? evidence from broadband expansion in France. *Journal of International Economics*, 133(C).

Mayer, T., Melitz, M. J., and Ottaviano, G. I. P. (2014). Market size, competition, and the product mix of exporters. *American Economic Review*, 104(2):495–536.

Mayer, T. and Zignago, S. (2011). Notes on CEPII's distances measures: The GeoDist database. Working Papers 2011-25, CEPII research center.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71(6):1695–1725.

Mion, G. and Opromolla, L. D. (2014). Managers' mobility, trade performance, and wages. *Journal of International Economics*, 94(1):85–101.

Morales, E., Sheu, G., and Zahler, A. (2019). Extended gravity. *Review of Economic Studies*, 86(6):2668–2712.

Moxnes, A. (2010). Are sunk costs in exporting country specific? *Canadian Journal of Economics/Revue canadienne d'économique*, 43(2):467–493.

Nunn, N. (2007). Relationship-specificity, incomplete contracts, and the pattern of trade. *The Quarterly Journal of Economics*, 122(2):569–600.

Opromolla, L. D., Mion, G., and Sforza, A. (2017). The Diffusion of Knowledge via Managers' Mobility. Working Papers w201701, Banco de Portugal, Economics and Research Department.

Ornaghi, C., Van Beveren, I., and Vanormelingen, S. (2021). The impact of service and goods offshoring on employment: Firm-level evidence. *Canadian Journal of Economics/Revue canadienne d'économique*, 54(2):677–711.

Rauch, J. E. (1999). Networks versus markets in international trade. *Journal of International Economics*, 48(1):7–35.

Robinson, A. (1934). The problem of management and the size of the firm. *The Economic Journal*, 44(174):242–257.

Rodrik, D. (2021). A primer on trade and inequality. NBER Working Papers 29507, National Bureau of Economic Research.

Simon, H. A. (1951). A formal theory of the employment relationship. *Econometrica*, 19(3):293–305.

Song, J., Price, D. J., Guvenen, F., Bloom, N., and von Wachter, T. (2018). Firming up inequality. *The Quarterly Journal of Economics*, 134(1):1–50.

Stigler, G. J. (1951). The division of labor is limited by the extent of the market. *Journal of Political Economy*, 59(3):185–193.

Sutton, J. (1991). *Sunk Costs and Market Structure*. MIT Press.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2):171–180.

Williamson, O. E. (1967). Hierarchical control and optimum firm size. *Journal of Political Economy*, 75:123–138.

Williamson, O. E. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. The Free Press, New York.

Wooldridge, J. M. (2009). On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters*, 104(3):112–114.

XEROX (2010). We focus on translating and delivering Ducati's global publications. *The Times*, page 17.

Online Appendix to

Managing Export Complexity: The Role of Service Outsourcing

Giuseppe Berlingieri
ESSEC Business School, *CEP* and *Thema*

Frank Pisch
TU Darmstadt, *CEP* and *SIAW*

A Theory Appendix

A.1 A Micro-Foundation for Managerial Costs

In this Section we outline a micro-foundation for the managerial cost function based on organizational communication codes as in Crémer et al. (2007).

The manager has to communicate with every employee $i \in t$ to instruct her on the action she is supposed to take and then monitor during the process. To do so, she can use 'words' or 'code', i.e., a correspondence between real life task i and an abstract uttering; in other words, a language. If she could attribute a single word to every task, each code would be unique and very precise, so that misunderstandings would be impossible or at least minimized. Designing such a detailed organizational language is, however, extremely inefficient, since managers are boundedly rational and therefore effectively unable to converse in this perfect tongue.

To capture this idea formally, we assume that managers can only learn K words and this number can potentially differ across managers, making it their type. As a consequence, they are forced to use the same word for interacting with multiple employees working on different tasks. Formally, every word k is connected to a measure of tasks z_k, which we refer to as the "breadth" of word k. This imprecision in organizational code in turn creates miscommunication and therefore "diagnosis costs": there is always a certain amount of 'back-and-forth' between each employee and the manager to verify signals and remove ambiguities in the process of coordination and monitoring, which naturally comes at certain opportunity costs. The greater the breadth of a word z_k, the higher is the chance of misinterpreting signals and therefore the diagnosis cost $c(z_k)$ for all tasks $i \in t$.

A manager has a total and limited amount of work-time available to her and any resources spent on communication have opportunity costs. Better managers are more productive in all areas, and we capture these ideas by normalizing their work-time to K—Crémer et al. (2007) call the equivalent concept the "diagnosis cost" parameter, which converts communication costs into output units. She splits her resources between in-house communication and monitoring on the one hand, and coordination with external agents on the other. The total communication costs incurred by a firm that exports to N markets are

$$C^{com}(t,N) = \underbrace{K \cdot \frac{t}{N} \cdot \sum_{k=1}^{K} p(z_k)c(z_k)}_{\substack{\text{internal} \\ \text{communication}}} + \underbrace{K \cdot \frac{N-t}{N} \cdot 0}_{\substack{\text{external} \\ \text{communication}}}. \tag{A.1}$$

The expected costs of internal communication—to advise on actions to be taken by employees and to monitor them during the production process—are the sum of expected diagnosis costs associated with the different words k in the code. These in turn depend on the time spent using each word, $p(z_k)$ and the broader it is, i.e., the more tasks are assigned to the word, the more time is required. They also depend on the breadth of the word through the imprecision of code described above, $c(z_k)$.

Finally, as discussed in the main text, we assume that the managerial costs $M(t,N,K)$ are the *differential* costs of internal management and communication. Employees require instruction and monitoring, while these activities are much more limited in external relationships, which is often a crucial consideration in favor of outsourcing in the first place. Therefore, we normalize communication costs for outsourced tasks to zero.

When designing the organizational language, i.e., attributing tasks to words, the manager minimizes total expected diagnosis costs (A.1) across all in-house tasks, respecting her constraint on the number of words she can learn,

$$\sum_{k=1}^{K} z_k = t.$$

In general, different tasks i could occur with different frequencies, which directly affects how often the manager has to use the associated word, $p(z_k)$. In Crémer et al. (2007), for example, tasks correspond to unforeseen problems or events during daily business, which emerge randomly and with different probabilities. In that setting, an optimal allocation of words involves relatively precise terms for frequent problems and relatively coarse words for bundles of rare ones.

By contrast, in our setting all service inputs have to provided if the company's intention is to serve the full measure of countries N. While it is conceivable that there is some prioritization over time especially if service input quality is a concern, but in general our "probabilities"—i.e., the share of time a manager has to devote to tasks $i \in t$—are all the same for each task, so that $p(z_k) = z_k/t$.

The diagnosis costs $c(z_k)$ can be modelled in several different meaningful ways and the functional form of the managerial costs $M(t,N,K)$ depends crucially on this assumption. First, let $c(z_k) = z_k^2$, so that diagnosis costs are quadratic in, and therefore increase convexly with the breadth of a word. In this case, the solution to the minimization problem is

$$M(t,N,K) \equiv \min_{\substack{\{z_k\}_{k=1}^{K} \\ \text{s.t. } \sum_{k=1}^{K} z_k = t}} C^{com}(t,N) = K\frac{t}{N}\frac{t^2}{K^2} = \frac{t^3}{NK}.$$

This is the explicit functional form we posit in Assumption 2 in the main text. Intuitively, these costs equal the total time spent with employees times the average communication cost. Holding t fixed, outsourcing more tasks as N increases reduces managerial overload by freeing up some of the manager's time.

More generally, there could be economies of scale or congestion effects in communication due to the whole range of service inputs N that need to be produced, so that $c(z_k) = c(z_k, N) = z_k^\zeta N^\eta$ with $\zeta > 0, \eta \in \mathbb{R}_0$. The managerial cost function for coordination and monitoring becomes

$$M(t, N, K) = \frac{t^{1+\zeta}}{K^{\zeta-1} N^{1-\eta}},$$

which corresponds directly to the general iso-elastic form in equation (2) in the main text if $\alpha = \eta - 1$, $\beta = 1 - \zeta$, and $\gamma = 1 + \zeta$.

A.2 Proposition 1 with General Managerial Costs

In this Section we re-derive Proposition 1 with the general iso-elastic managerial cost function in equation (2) in the main text.

Minimizing the fixed costs (2) with respect to the measure of in-house tasks t yields

$$t^* = \left[\frac{\psi^2}{\gamma} \frac{\delta^2}{1+\delta}\right]^{\frac{1}{\gamma-1}} N^{-\frac{\alpha}{\gamma-1}} K^{-\frac{\beta}{\gamma-1}}.$$

It is straightforward to verify that

$$\frac{\partial}{\partial N}\mathcal{O} > 0 \iff \mathcal{E}_{t^*,N} < 1 \iff \gamma - 1 > -\alpha.$$

The firm therefore outsources additional market access service inputs if managerial overload reacts strongly to complexity, and serving many markets does not lead to strong economies of scope in communication and monitoring. Since one would expect that, if anything, a large number of markets puts *more* strain on managers (perhaps due to communication and monitoring outsourced tasks), this condition is likely to be satisfied empirically in virtually all settings.

As it turns out, $\gamma - 1 > -\alpha$ is a sufficient condition for *all* propositions provided $\beta < 0$ as discussed in the main text. Taking the relevant derivatives and cross-derivatives shows that as long as the main prediction holds—i.e., the outsourcing task share increases in the number of export markets—all other propositions follow.

We can also state the necessary and sufficient conditions under which Proposition 1 holds with a fully generic managerial cost function. The optimal number of inputs produced in-house is pinned down by:

$$\frac{\delta^2}{1+\delta}(\sigma^2 + r^2) - M_t(t^*, N, K) = 0$$

where $M_t(t, N, K)$ is the marginal cost with respect to an increase in the number of inputs internally produced.

The main finding in the empirical results corresponds to the condition $\mathcal{E}_{t^*,N} < 1$ stated above. This condition is equivalent to a local restriction on the monitoring function:

$$\mathcal{E}_{t^*,N} < 1 \iff -\frac{\mathcal{E}_{M_t,N}}{\mathcal{E}_{M_t,t}}\bigg|_{t^*} < 1 \tag{A.2}$$

where $\mathcal{E}_{M_t,N}$ and $\mathcal{E}_{M_t,t}$ are the elasticities of the marginal cost with respect to the number of countries and the number of inputs internally produced, respectively. A global ranking of these elasticities in line with this condition as in the iso-elastic case is sufficient for Proposition 1.

Assuming that marginal managerial costs rise in t, i.e., assuming that there is managerial overload due to in-house provision of non-core services, the inequality (A.2) is clearly satisfied if $\mathcal{E}_{M_t,N} > 0$. This is tantamount to a congestion effect due to export complexity, for example if all tasks require managerial resources, regardless of whether they are performed by employees or external agents. Condition (A.2) is also satisfied if scale effects due to N are sufficiently weak as in the micro-foundation we use in the main text. Even if outsourcing some of the service tasks gives the manager additional room to breathe and reduces overload at the margin, this effect may very well be dominated by the workload afforded by internal communication and monitoring. Only if a higher number of export markets in fact reduces business complexity overall, would the result be overturned.

A.3 Adapting to the Average Action

In this appendix we solve a version of the model where the firm's objective is to coordinate its employees' actions not on an exogenous firm characteristic, but instead on a single and a priori arbitrary common action. For simplicity, we take the average action across employees although other assumptions are of course conceivable. To show the full set of implications, we start with a setting where N is discrete—and the coordination problem particularly interesting—, and then move to the continuous case.

The problem of the manager, once the input conditions $\theta(i)$ have been realized, becomes:

$$\min_{\{a^v(i)\}} \sum_{i\in T}(a^v(i)-\theta(i))^2 + \delta\sum_{i\in T}(a^v(i)-\bar{a})^2 + \delta\sum_{j\notin T}(a^o(j)-\bar{a})^2,$$

where $\bar{a} = 1/N\sum_0^N a(i)$, and T is the set of inputs produced in-house. We solve for the t optimal internal actions inverting a t-by-t matrix using the Sherman–Morrison formula:

$$\begin{aligned} a^{v*}(i)(\{\theta(i)\},\{\theta(j)\}) = \hat{a}^v + \frac{1}{1+\delta}(\theta(i)-\hat{\theta}(i)) + \frac{\delta}{1+\delta}\frac{1}{N+\delta(N-t)}\sum_{i\in T}(\theta(i)-\hat{\theta}(i)) \\ + \delta\frac{1}{N+\delta(N-t)}\sum_{j\notin T}(\theta(j)-\hat{\theta}(j)) \end{aligned}$$

where

$$\hat{a}^v = \frac{1}{1+\delta}\hat{\theta}(i) + \frac{\delta}{1+\delta}\tilde{\hat{\theta}},$$

with $\tilde{\hat{\theta}}$ being a weighted average of the expected values of the input conditions, $\hat{\theta}(.)$, defined as

$$\tilde{\hat{\theta}} = \frac{1}{N+\delta(N-t)} \sum_{i\in T} \hat{\theta}(i) + \frac{1+\delta}{N+\delta(N-t)} \sum_{j\notin T} \hat{\theta}(j).$$

The actions are fully interdependent, since the optimal action for input i depends on all other actions, which are determined by the realizations of all input conditions.[35] The realization of the local input condition i gets a higher weight compared to all other internal input conditions, but, in order to internalize all externalities, the manager puts less weight on $\theta(i)$ to accommodate all other inputs.

Exploiting the independence of the random variables, the expected costs are:

$$E[F] = \left[\frac{N+\delta(N-t)-1}{N+\delta(N-t)}\frac{\delta}{1+\delta}t + \frac{N+\delta(N-t)-(1+\delta)}{N+\delta(N-t)}\delta(N-t)\right]\sigma^2 + \\ + \frac{\delta}{1+\delta}\sum_{i\in T}(\hat{\theta}(i)-\tilde{\hat{\theta}})^2 + \delta\sum_{j\notin T}(\hat{\theta}(j)-\tilde{\hat{\theta}})^2 + M(t,N,K).$$

Further assuming that all input conditions have the same expected value, total expected fixed costs are

$$E[F] = \left[\frac{N+\delta(N-t)-1}{N+\delta(N-t)}\frac{\delta}{1+\delta}t + \frac{N+\delta(N-t)-(1+\delta)}{N+\delta(N-t)}\delta(N-t)\right]\sigma^2 + M(t,N,K). \quad \text{(A.3)}$$

In this more general setting, the returns of integration are not constant, and depend on both t and N. It is possible to show that t and N are complementary, so that integration becomes more appealing in a very complex environment. At the same time, the returns to integration decrease in t; they are strong initially but tend to diminish when the number of internalized inputs becomes large, since the manager finds it increasingly difficult to coordinate all inputs.

To find the solution in the setting with a measure N, we can proceed in a similar way and find an analogous expression for optimal internal actions. However, in expectation, all the strategic terms have measure zero because they are of higher order. Alternatively we can think of the limit of the discrete case or let the strategic effects between actions go to zero from the beginning, as if the manager disregarded the effects of changing the (infinitesimal) action $a(i)$ on $\bar{a}$. As expected, in this case the fixed cost function takes the same form as in the baseline model

$$E[F] = \left[\frac{\delta}{1+\delta}t + \delta(N-t)\right]\psi^2 + M(t,N,K),$$

with $\psi^2 = \sigma^2$, given that there is no deterministic part of adaption when all input conditions have the same mean. When the number of inputs grows large, externalities across actions become small and the firm no longer needs to internalize them. Since the expected fixed cost function is the same as in the model presented in the main text, all the results there apply.

[35] It is easy to extend the current framework to a situation in which the manager does not observe the input conditions of outsourced tasks, each action $a^{v*}(i)$ would be a function of the expected value of external input conditions rather than their actual realizations.

A.4 No Fiat within the Firm

In this appendix we study a version of the model where the manager can communicate with, and monitor all employees, but she is no longer in a position to impose the optimal coordinating action on them. Instead, the manager has to propose a contract that incentivizes an employee accordingly.

We start by noting that an optimal contract strikes a balance between minimizing intermediate input costs and minimizing ex-post adaptation costs. Minimizing input costs is straightforward: a fixed price contract $P(i) = f \equiv 0$ sets input costs to zero (and is the lowest compensation that respects the agent's participation constraint). Regarding adaptation, the expected costs for an individual input i are $\mathbb{E}[\delta(a(i)) - \hat{\theta}(i)^c)]$, which are minimized when the employee chooses $a(i) = \hat{\theta}(i)^c$. The only contract that ensures this action is

$$P(i) = [a(i) - \theta(i)]^2 - \left[a(i) - \hat{\theta}(i)^c\right]^2.$$

The optimal contract offered by the firm must be a combination of these two extreme compensation schemes when it comes to performance pay $P(i)^p$, and still respect the employee's participation constraint. Formally, let $\omega^* \in [0, 1]$ be the weight on adaptation costs chosen optimally on the first stage. Then the employee faces

$$P(i)^p = \omega^* \left\{[a(i) - \theta(i)]^2 - \left[a(i) - \hat{\theta}(i)^c\right]^2\right\}$$

on the second stage.

The action taken on the second stage maximizes

$$\omega^* \left\{[a(i) - \theta(i)]^2 - \left[a(i) - \hat{\theta}(i)^c\right]^2\right\} - [a(i) - \theta(i)]^2 = (\omega^* - 1)\,[a(i) - \theta(i)]^2 - \omega^* \left[a(i) - \hat{\theta}(i)^c\right]^2.$$

The optimal choice is

$$a(i)^* = \omega^* \left[\hat{\theta}(i)^c - \theta(i)\right] + \theta(i).$$

If the firm puts all the weight on minimizing adaptation costs on the first stage ($\omega^* = 1$), the employee plays the coordinating action $a(i)^* = \hat{\theta}(i)^c$. By contrast, if the firm intends to minimize intermediate inputs costs, it implements $\omega^* = 0$ and the employee plays $a(i)^* = \theta(i)$.

To find the optimal contract on the first stage, the firm internalizes the employee's participation constraint (with equality due to monopsony power)

$$\mathbb{E}\left[P(a(i,\omega)) - (a(i,\omega) - \theta(i))^2\right] = 0 \iff \Delta(\omega) = \omega(1-\omega)\left[\hat{\theta}(i)^c - \theta(i)\right]^2,$$

where $\Delta(\omega)$ is the fixed transfer the firm has to pay in order for the employee to accept the contract, i.e., $P(i,\omega) = \Delta(\omega) + P(i,\omega)^p$.

Finally, the firm has to pick the optimal incentive scheme ω by minimizing

$$P(i,\omega) + \delta \left[a(i,\omega)^* - \hat{\theta}^c\right]^2 =$$

$$\Delta(\omega) + \omega \left\{ [a(i,\omega)^* - \theta(i)]^2 - \left[a(i,\omega)^* - \hat{\theta}(i)^c\right]^2 \right\} + \delta \left[a(i,\omega)^* - \hat{\theta}^c\right]^2 =$$

$$\left[\hat{\theta}^c - \theta(i)\right]^2 \left[\omega^2 + \delta(1-\omega)^2\right].$$

The solution is

$$\omega^* = \frac{\delta}{1+\delta} \ \in \ [0,1).$$

Moreover, the weight on minimizing adaptation costs increases in δ as expected.

The optimal employment contract is less high-powered than the outsourcing contract, as the firm shares in the inconvenience costs of its employees. At the same time, since it does not amount to buying the shop ($\omega^* < 1$), it provides stronger incentives than under fiat.

The remaining derivations are analogous to the main text, where Conjecture 1 becomes

Conjecture 2 (Optimal Contracts Without Fiat)**.** *The prevailing contract with every*

- *external agent is*

$$P(a(i)) = P(i) = 0.$$

- *employee is*

$$P(a(i)) = \Delta(\omega^*) + \omega^* \left\{ [a(i) - \theta(i)]^2 - \left[a(i) - \hat{\theta}(i)^c\right]^2 \right\},$$

  where

$$\omega^* = \frac{\delta}{1+\delta}.$$

A.5 Proof of Contract Optimality

In this Section we prove that it is indeed optimal for the firm to offer the contracts in Conjecture 1 and for the external agent and employee to accept them at the first stage of the game.

We begin by restating the worker's participation constraint. Since the firm is a full monopsonist vis-a-vis the workers it matches with, this is the key consideration both for the worker and for the company.

Statement 1 (Participation Constraint (PC))**.** *The worker's participation constraint is*

$$\mathbb{E}\left[\pi^s(i)\right] = \mathbb{E}\left[P(i) - (a(i) - \theta(i))^2 - f\right] = \mathbb{E}\left[P(a(i)) - (a(i) - \theta(i))^2\right] \geq 0.$$

The second equality stems from normalizing the costs of training f to zero, and the right hand side of the inequality captures the worker's outside option, which we normalized to zero, too. Just to reiterate, neither of these assumptions is substantive in our model.

Beginning the actual proof, first note that each worker will accept the contract conjectured in 1 on the first stage if she is hired as an external agent. In the absence of verifiable actions—monitoring is assumed to be impossible under outsourcing—, the expected optimal action by the external agent is $a(i) = \theta(i)$, so that

$$\mathbb{E}\left[\pi^{OUT}(i)\right] = \mathbb{E}\left[P(i)\right] = 0$$

with the conjectured contract. Not accepting yields the outside option of zero as well and we assume that worker accepts in case of indifference.

A worker faced with the conjectured employment contract is fully compensated for any action the firm demands of her, so that

$$\mathbb{E}\left[\pi^{IN}(i)\right] = 0.$$

Clearly, once again the worker is indifferent between accepting and taking the outside option and we assume she accepts. And note that neither worker is in a position to choose between employment and working as an external agent due to monopsony power.

Second, we have to make an additional assumption regarding the firm's outside option, which we left unspecified in the main text. One could consider that a task i is not completed and the company cannot access that particular market abroad if the respective worker's participation constraint is not satisfied by the contract offered ("output lost"). Alternatively, the firm could procure the input on a secondary market at a certain price ("secondary procurement"). Since this second assumption is much more involved and requires substantial detail without adding any additional insights, we do not pursue this avenue and instead rely on output lost.[36]

To investigate whether there is a profitable deviation from the conjectured contract for the firm given the workers' participation constraints, first note that it is optimal for the firm to offer a fixed price contract to the external agent, since no action is verifiable by either party. Offering $P(i) > 0$ for any one task i reduces the firm's profits in equilibrium by an (infinitesimally) positive amount, so that no such deviation is profitable. Imposing the learning costs on, or even taxing any agent for the production of i by choosing $P(i) < 0$ leads to a violation of that agent's participation constraint and output (and profit) is lost. These considerations carry over to alternative strategies where the firm offers different contracts to any non-zero measure of tasks.

Finally, consider the employment contracts. Offering compensation that exceeds the conjectured "buying the shop" or C+ strategy will never be profitable for the firm, since it has no effect on the employee's optimal action under fiat, or provides incentives for an action other than $a^{v*}(i)$, or both. Any compensation scheme that pays less than the full costs of inconvenience caused by the company's fiat action will furthermore violate the worker's participation constraint and output (and profit) is lost.

[36] One could also assume that the firm offers the employment contract if negotiations for an external agency are unsuccessful, and vice versa. Provided both conjectured contracts are optimal, however, this simply shifts the problem of break-down to a different level.

QED

A.6 Testable Predictions for Cost Shares

In this appendix, we derive the conditions under which our propositions not only hold for the outsourced share of tasks, $\mathcal{O}$, but also for the share of outsourced service expenditures in total costs, $\mathcal{O}^C$.

Each firm can enter a measure of foreign markets N with its own variety of a differentiated good. Once it has done so, the manager receives a realization for her level of managerial capability K as a draw from an exogenous probability distribution. Besides affecting the fixed costs of market access, this ability of the manager determines the variable costs of producing a quantity q of the good, q/K, expressed in labor units (wage is normalized to one). Given the large literature on the importance of managerial practises (e.g., Bloom and Van Reenen, 2007), it is natural to assume that marginal costs are a function of managerial ability. However, none of our results hinge on this, and the firm could be characterized by a technological productivity draw that is independent of managerial skills.

Consumers in each destination market maximize a standard CES utility function with an elasticity of substitution $e = 1/(1-\rho) > 1$. These preferences generate a total expenditure on each good equal to $R(p/P)^{1-e}$, where R denotes aggregate expenditure and P the aggregate price index. All aggregates are unaffected by a single exporter's decisions. Moreover, there is monopolistic competition in each country, so that each manager follows the standard constant-markup pricing rule: $p = 1/\rho K$.

The variable trade cost of exporting to country i takes the standard form of an "iceberg" transportation cost: if one unit of any differentiated good is shipped to country i, only a fraction $1/\tau(i)$ arrives ($\tau(i) > 1$). The total expected profit of a firm that exports to N destination markets is

$$\mathbb{E}[\pi] = (1-\rho)R\,(\rho K P)^{\frac{\rho}{1-\rho}} \int_0^N \left(\frac{1}{\tau(i)}\right)^{\frac{\rho}{1-\rho}} di - fN - \delta\psi^2 N + \frac{2}{3}\frac{\delta^2}{1+\delta}\psi^2 t^*, \tag{A.4}$$

where countries are ranked with respect to the their variable trade cost $\tau(i)$. For simplicity, this is the only dimension of heterogeneity across countries, but all results below are easily generalizable for a generic market potential, $R(i)\,[P(i)/\tau(i)]^{\frac{\rho}{1-\rho}}$.

Note that when the importance of adaptation goes to zero ($\delta \to 0$ or $\psi \to 0$) the expression for fixed costs simplifies to the standard case of exogenous fixed costs (e.g., Melitz, 2003), and all service tasks are outsourced by the firm to domestic suppliers.

In the next Section, we re-derive Propositions 1 and 3 in terms of costs shares, taking the number of exports destinations as given. Then we derive additional predictions as to how the relationships in these propositions vary with average export market size/variable costs and the price elasticity of demand. Finally, we discuss the implications of endogenizing N.

A.6.1 Propositions 1 and 3 for Cost Shares

Normalizing $f = 0$ without loss as in the baseline model, the corresponding total expected costs are

$$\mathbb{E}\left[C^T\right] = \underbrace{\rho R \left(\rho K P\right)^{\frac{\rho}{1-\rho}} \int_0^N \left(\frac{1}{\tau(i)}\right)^{\frac{\rho}{1-\rho}} di}_{\equiv C^V} + \underbrace{\delta\psi^2 N - \frac{2}{3}\frac{\delta^2}{1+\delta}\psi^2 t^*}_{\equiv F},$$

where C^V and F are expected total variable and total fixed costs, respectively. We can denote the outsourcing share in total costs as

$$\mathcal{O}^C = \frac{\delta\psi^2(N - t^*)}{C^V + F} = \frac{F^O}{C^V + F} \equiv \frac{\widetilde{F}^O}{C^V/N + \widetilde{F}},$$

where $\widetilde{F}^O$ and $\widetilde{F}$ are, respectively, the outsourced part and the total expected fixed cost per destination market. Note that for this expression we assume that variable costs arise exclusively in-house. While this is a strong assumption, it (1) has empirical support as discussed in Section 3.3 of the main text, and (2) stacks the deck against the theoretical prediction that an increase of complexity due to more export markets leads to more outsourcing, as we shut down an additional outsourcing channel: contracting variable costs out.

Letting $\mathcal{E}_{y,x}$ denote the elasticity of y with respect to x, we can restate Propositions 1 and 3 in terms of total costs.

Proposition A.1 (Cost Share of Outsourcing and Market Access)**.** *The share of outsourced service expenditures in total costs rises in the number of export destination markets, but at a decreasing rate:*

$$\frac{\partial}{\partial N}\mathcal{O}^C > 0 \quad \textit{and} \quad \frac{\partial^2}{(\partial N)^2}\mathcal{O}^C < 0$$

Proof. We prove the first part of the statement by computing the elasticity of the share of outsourced service expenditures in total costs with respect to the number of export destination markets, $\mathcal{E}_{\mathcal{O}^C,N}$, which is the object that we estimate empirically. This elasticity can be defined as

$$\mathcal{E}_{\mathcal{O}^C,N} = \frac{\partial \mathcal{O}^C}{\partial N}\frac{N}{\mathcal{O}^C} = \mathcal{E}_{F^O,N} - \mathcal{E}_{C^V,N}\frac{C^V}{C^V + F} - \mathcal{E}_{F,N}\frac{F}{C^V + F},$$

where

$$\mathcal{E}_{F^O,N} = 1 + \mathcal{E}_{\widetilde{F}^O,N} = 1 + \mathcal{E}_{\mathcal{O},N} = 1 + \frac{1}{2}\frac{t^*}{N - t^*},$$

$$\mathcal{E}_{F,N} = 1 + \mathcal{E}_{\widetilde{F},N} = 1 + \frac{1}{\widetilde{F}}\frac{1}{3}\frac{\delta^2}{1+\delta}\psi^2\frac{t^*}{N},$$

$$\mathcal{E}_{C^V,N} = \frac{\left(\frac{1}{\tau(N)}\right)^{\frac{\rho}{1-\rho}} N}{\int_0^N \left(\frac{1}{\tau(i)}\right)^{\frac{\rho}{1-\rho}} di} = \frac{\tau(N)^{1-e}N}{\int_0^N \tau(i)^{1-e} di}.$$

Since countries are ranked with respect to variable trade costs ($\partial\tau(i)/\partial i \geq 0$), we have that

$\mathcal{E}_{C^V,N} < 1$: the variable trade costs to reach the N^{th} country are higher than for the average country, because the firm enters countries with low variable trade costs first. It follows that $\mathcal{E}_{C^V,N} < \mathcal{E}_{F,N}$ and that $\mathcal{E}_{\mathcal{O}^C,N} > \mathcal{E}_{F^O,N} - \mathcal{E}_{F,N}$. We can further show that $\mathcal{E}_{F^O,N} - \mathcal{E}_{F,N} = \mathcal{E}_{\widetilde{F}^O,N} - \mathcal{E}_{\widetilde{F},N} > 0$ because

$$F > \frac{2}{3}\frac{\delta^2}{1+\delta}\psi^2(N-t^*) \iff N\delta\psi^2\frac{3+\delta}{3(1+\delta)} > 0.$$

Intuitively, when the number of destination markets increases, the outsourced part of fixed costs increases more rapidly than the total fixed costs, precisely because the manager reacts to the higher complexity by outsourcing a higher share of tasks.

It follows that $\mathcal{E}_{\mathcal{O}^C,N} > 0$, which completes the first part of the proof.

To show that that the share of outsourcing in total costs is concave in the number of countries, we can compute

$$\frac{\partial^2 \mathcal{O}^C}{(\partial N)^2}\frac{N^2}{\mathcal{O}^C} = \frac{\partial^2 F^O}{(\partial N)^2}\frac{N^2}{F^O} - \frac{\partial^2 C^T}{(\partial N)^2}\frac{N^2}{C^T} - 2\mathcal{E}_{F^O,N}\mathcal{E}_{C^T,N} + 2\mathcal{E}^2_{C^T,N} =$$

$$\frac{F}{C^T}\left[\underbrace{-\frac{3}{2}\left(\mathcal{E}_{\widetilde{F}^O,N} + \mathcal{E}_{\widetilde{F},N}\right)}_{\text{I}}\underbrace{-2\mathcal{E}_{\widetilde{F},N}\left(\mathcal{E}_{\widetilde{F}^O,N} - \frac{F}{C^T}\mathcal{E}_{\widetilde{F},N}\right)}_{\text{II}}\underbrace{-2\frac{C^V}{C^T}\left(1+2\mathcal{E}_{\widetilde{F},N}\right)\left(1-\mathcal{E}_{C^V,N}\right)}_{\text{III}}\right] +$$

$$\frac{C^V}{C^T}\left[\underbrace{-\mathcal{E}_{\widetilde{F}^O,N}\left(2\mathcal{E}_{C^V,N} - \frac{1}{2}\right)}_{\text{IV}}\underbrace{-\frac{\rho}{1-\rho}\mathcal{E}_{C^V,N}\mathcal{E}_{\tau(N),N}}_{\text{V}}\underbrace{-2\frac{C^V}{C^T}\mathcal{E}_{C^V,N}\left(1-\mathcal{E}_{C^V,N}\right)}_{\text{VI}}\right], \quad \text{(A.5)}$$

where the second equality follows from

$$\frac{\partial^2 F^O}{(\partial N)^2}\frac{N^2}{F^O} = 2\mathcal{E}_{\widetilde{F}^O,N} + \frac{\partial^2 \widetilde{F}^O}{(\partial N)^2}\frac{N^2}{\widetilde{F}^O} = \frac{1}{2}\mathcal{E}_{\widetilde{F}^O,N}$$

and

$$\frac{\partial^2 C^T}{(\partial N)^2}\frac{N^2}{C^T} = \frac{\partial^2 C^V}{(\partial N)^2}\frac{N^2}{C^V}\frac{C^V}{C^T} + \left(2\mathcal{E}_{\widetilde{F},N} + \frac{\partial^2 \widetilde{F}}{(\partial N)^2}\frac{N^2}{\widetilde{F}}\right)\frac{F}{C^T} = \frac{\rho}{1-\rho}\mathcal{E}_{C^V,N}\mathcal{E}_{\tau(N),N}\frac{C^V}{C^T} + \frac{7}{2}\mathcal{E}_{\widetilde{F},N}\frac{F}{C^T},$$

which in turn use the following definitions:

$$\frac{\partial^2 \widetilde{F}^O}{(\partial N)^2}\frac{N^2}{\widetilde{F}^O} = -\frac{3}{4}\frac{t^*}{N-t^*} = -\frac{3}{2}\mathcal{E}_{\widetilde{F}^O,N},$$

$$\frac{\partial^2 \widetilde{F}}{(\partial N)^2}\frac{N^2}{\widetilde{F}} = \frac{1}{\widetilde{F}}\frac{1}{2}\frac{\delta^2}{1+\delta}\psi^2\frac{t^*}{N} = \frac{3}{2}\mathcal{E}_{\widetilde{F},N},$$

$$\frac{\partial^2 C^V}{(\partial N)^2}\frac{N^2}{C^V} = \frac{\rho}{1-\rho}\frac{\tau(N)^{1-e}N}{\int_0^N \tau(i)^{1-e}di}\frac{\partial\tau(N)}{\partial N}\frac{N}{\tau(N)} = \frac{\rho}{1-\rho}\mathcal{E}_{C^V,N}\mathcal{E}_{\tau(N),N}.$$

We can show that, under mild conditions, the expression in Equation (A.5) is negative. The terms in the second line (I, II, III) are scaled by total (expected) fixed costs and are strictly negative because $\mathcal{E}_{\widetilde{F}^O,N} > \mathcal{E}_{\widetilde{F},N}$ and $\mathcal{E}_{C^V,N} < 1$, as shown above. The third line is scaled by total variable costs and the terms V and VI are strictly negative, because all elasticities are positive and $\mathcal{E}_{C^V,N} < 1$. The term IV is also negative if $\mathcal{E}_{C^V,N} > 1/4$, i.e., if trade costs do not increase too fast. This sufficient condition is likely to be met. For instance Chen and Novy (2011) find that trade frictions increase only moderately with distance, with an elasticity significantly lower than one. Alternatively, it is sufficient that this term is lower in absolute value than the sum of the other five terms, or that the share of fixed costs is large enough. □

Proposition A.3 (Managerial Capability)**.** *The share of outsourced service expenditures in total costs $\mathcal{O}^C$*

a) falls in the managerial capability of a company (K),

$$\frac{\partial}{\partial K}\mathcal{O}^C < 0.$$

b) displays a cross partial derivative with respect to the number of export destination markets and managerial capability that decreases in the share of variable costs in total costs and in the elasticity of demand e:

$$\frac{\partial^2}{\partial N \partial K}\mathcal{O}^C = f\left(\underbrace{\frac{C^V}{C^V+F}}_{-}, \underbrace{e}_{-}\right).$$

Proof. To prove the first part of the statement, we compute the elasticity of the share of outsourced service expenditures in total costs with respect to managerial capability, $\mathcal{E}_{\mathcal{O}^C,K}$, which is defined as

$$\mathcal{E}_{\mathcal{O}^C,K} = \frac{\partial \mathcal{O}^C}{\partial K}\frac{K}{\mathcal{O}^C} = \mathcal{E}_{F^O,K} - \mathcal{E}_{C^V,K}\,\frac{C^V}{C^V+F} - \mathcal{E}_{F,K}\,\frac{F}{C^V+F},$$

where

$$\mathcal{E}_{F^O,K} = \mathcal{E}_{\widetilde{F}^O,K} = \mathcal{E}_{\mathcal{O},K} = -\frac{1}{2}\frac{t^*}{N-t^*},$$

$$\mathcal{E}_{F,K} = \mathcal{E}_{\widetilde{F},K} = -\frac{1}{\widetilde{F}}\frac{1}{3}\frac{\delta^2}{1+\delta}\psi^2\frac{t^*}{N},$$

$$\mathcal{E}_{C^V,K} = \frac{\rho}{1-\rho}.$$

Since $\mathcal{E}_{C^V,K} > 0$ and $\mathcal{E}_{F,K} < 0$, we have that $\mathcal{E}_{\mathcal{O}^C,K} < \mathcal{E}_{F^O,K} - \mathcal{E}_{F,K} = \mathcal{E}_{\widetilde{F},N} - \mathcal{E}_{\widetilde{F}^O,N}$. It follows that $\mathcal{E}_{\mathcal{O}^C,K} < 0$, because $\mathcal{E}_{\widetilde{F}^O,N} - \mathcal{E}_{\widetilde{F},N} > 0$, as we have shown in the proof of Proposition A.1 above. Note that this result does not rest on the assumption that marginal costs are a function of managerial ability: the proposition continues to hold even if marginal costs are a function of an exogenous productivity draw and independent of managerial capabilities (i.e., if $\mathcal{E}_{C^V,K} = 0$). This completes the proof of the first part.

To show how the share of outsourced service expenditures in total costs varies when both the number of countries and managerial ability change, we compute

$$\frac{\partial^2 \mathcal{O}^C}{\partial N \partial K}\frac{NK}{\mathcal{O}^C} = \frac{\partial^2 F^O}{\partial N \partial K}\frac{NK}{F^O} - \frac{\partial^2 C^T}{\partial N \partial K}\frac{NK}{C^T} - \mathcal{E}_{F^O,N}\mathcal{E}_{C^T,K} - \mathcal{E}_{F^O,K}\mathcal{E}_{C^T,N} + 2\mathcal{E}_{C^T,K}\mathcal{E}_{C^T,N} =$$
$$\frac{F}{C^T}\left[\left(\mathcal{E}_{\widetilde{F}^O,N} - \mathcal{E}_{\widetilde{F},N}\right)\left(\frac{1}{2} + 2\mathcal{E}_{\widetilde{F},N}\right)\right] +$$
$$\frac{F}{C^T}\frac{C^V}{C^T}\left[\left(\mathcal{E}_{\widetilde{F},N} + \mathcal{E}_{C^V,K}\right)\left(\mathcal{E}_{\widetilde{F},N} + 1 - \mathcal{E}_{C^V,N}\right)\right] +$$
$$\frac{C^V}{C^T}\left[\underbrace{-\mathcal{E}_{\widetilde{F}^O,N}\left(\frac{1}{2} + \mathcal{E}_{C^V,K} - \mathcal{E}_{C^V,N}\right)}_{\text{I}}\underbrace{-\mathcal{E}_{C^V,K}\left(1 - \mathcal{E}_{C^V,N}\right)}_{\text{II}}\right], \tag{A.6}$$

where the second equality follows from

$$\frac{\partial^2 F^O}{\partial N \partial K}\frac{NK}{F^O} = \frac{\partial^2 F^O}{\partial N \partial K}\frac{K}{\widetilde{F}^O} = \mathcal{E}_{\widetilde{F}^O,K} + \frac{\partial^2 \widetilde{F}^O}{\partial N \partial K}\frac{NK}{\widetilde{F}^O} = -\frac{1}{2}\mathcal{E}_{\widetilde{F}^O,N}$$

and

$$\frac{\partial^2 C^T}{\partial N \partial K}\frac{NK}{C^T} = \frac{\partial^2 C^V}{\partial N \partial K}\frac{NK}{C^V}\frac{C^V}{C^T} + \left(\mathcal{E}_{\widetilde{F},K} + \frac{\partial^2 \widetilde{F}}{\partial N \partial K}\frac{NK}{\widetilde{F}}\right)\frac{F}{C^T} = \mathcal{E}_{C^V,K}\mathcal{E}_{C^V,N}\frac{C^V}{C^T} - \frac{1}{2}\mathcal{E}_{\widetilde{F},N}\frac{F}{C^T},$$

which in turn use the following definitions:

$$\frac{\partial^2 \widetilde{F}^O}{\partial N \partial K}\frac{NK}{\widetilde{F}^O} = \frac{1}{4}\frac{t^*}{N - t^*} = \frac{1}{2}\mathcal{E}_{\widetilde{F}^O,N},$$

$$\frac{\partial^2 \widetilde{F}}{\partial N \partial K}\frac{NK}{\widetilde{F}} = \frac{1}{\widetilde{F}}\frac{1}{6}\frac{\delta^2}{1+\delta}\psi^2\frac{t^*}{N} = \frac{1}{2}\mathcal{E}_{\widetilde{F},N},$$

$$\frac{\partial^2 C^V}{\partial N \partial K}\frac{NK}{C^V} = \frac{\rho}{1-\rho}\frac{\tau(N)^{1-e}N}{\int_0^N \tau(i)^{1-e}di} = \mathcal{E}_{C^V,K}\mathcal{E}_{C^V,N}.$$

We can show that the sign of the expression in Equation (A.6) is in general ambiguous and depends on the share of variable costs in total costs. The second line is scaled by total (expected) fixed costs and is strictly positive due to $\mathcal{E}_{\widetilde{F}^O,N} > \mathcal{E}_{\widetilde{F},N}$, as shown in the proof of Proposition A.1. The third line is positive due to $\mathcal{E}_{C^V,N} < 1$, but it is a mixed term of lower order compared to the other terms of the expression. The fourth line is scaled by total variable costs and the term II in square brackets is negative due to $\mathcal{E}_{C^V,N} < 1$. The term I is also negative as long as

$$\mathcal{E}_{C^V,K} > \frac{1}{2} \Longleftrightarrow e > \frac{3}{2}.$$

Therefore, under the mild sufficient condition that the products are not too differentiated, the fourth line in Equation (A.6) is negative.

We conclude the proof by noting that, in the presence of fixed costs only ($F \to C^T$), we are back to the result in Proposition 3 and the share of outsourced service in total costs rises even more in the number of export destination markets when managerial capability is high. This result is overturned, however, if the share of variable costs is high enough. In particular, the effect of the interaction of N and K on the share of outsourced service expenditures in total costs tends to decrease, and possibly becomes negative, if the share of variable costs in total costs (C^V/C^T) is high enough and if the elasticity of variable costs to managerial ability ($\mathcal{E}_{C^V,K}$) rises, i.e., in our setting, when the elasticity of demand rises. Indeed, one can show that the partial derivative of the expression in Equation (A.6) with respect to e is negative. $\square$

A.6.2 Additional Predictions under Assumption 3

The assumptions on demand and technology allow us to obtain additional insights on the response of the main elasticities to changes in the share of variable costs and the elasticity of demand, which we test empirically by using a proxy for the share of variable costs and a measure of product differentiation.

Proposition A.4 below states that the elasticity of outsourcing with respect to both the number of destination markets and to managerial ability is larger in absolute value when the share of variable costs is higher. Indeed, the outsourced component of fixed costs (the numerator of the outsourced cost share) is more sensitive to changes in the number of destination countries or managerial ability than total costs (the denominator). The intuition is the following. As discussed in the main text, the manager reacts to the higher export complexity by outsourcing a higher share of tasks, or takes advantage of her higher ability by handling more tasks in-house, to decrease ex-post adaptation costs. The outsourced share of fixed costs is larger with more export destinations, while it is smaller when a capable manager is in charge. At the same time, a given increase in the number of countries or managerial capability has a small effect on total costs when variable costs are high.

The effect of the price elasticity of demand works via its effects on variable costs, which are less sensitive to changes in complexity or managerial ability compared to the outsourced part of fixed costs. A firm that faces more elastic demand lowers prices, sells more, and has higher variable costs. Moreover, high managerial ability implies large variable costs in a similar vein, and this effect is particularly sizeable when demand is elastic. Finally, a higher elasticity makes variable trade costs even less sensitive to changes in complexity, because, due to high competition, the firm is not able to expand much in the marginal markets as these are characterized by high variable trade costs.

Proposition A.4 (Magnitude of Outsourcing Elasticities)**.** *The magnitude of the elasticities of the share of outsourced service expenditures in total costs with respect to the number of destination countries and managerial capability increases in the share of variable costs in total costs and in the elasticity of demand e:*

$$\frac{\partial \mathcal{E}_{\mathcal{O}^C,N}}{\partial C^V} > 0, \frac{\partial \mathcal{E}_{\mathcal{O}^C,N}}{\partial e} > 0 \qquad \textit{and} \qquad \frac{\partial \mathcal{E}_{\mathcal{O}^C,K}}{\partial C^V} < 0, \frac{\partial \mathcal{E}_{\mathcal{O}^C,K}}{\partial e} < 0$$

Proof. The proof follows from partially differentiating the elasticities obtained in Propositions A.1 and A.3 with respect to variable costs and the elasticity of demand. First,

$$\frac{\partial \mathcal{E}_{\mathcal{O}^C,N}}{\partial C^V} = \frac{F}{(C^V + F)^2} \left(\mathcal{E}_{F,N} - \mathcal{E}_{C^V,N} \right) > 0,$$

because $\mathcal{E}_{F,N} > \mathcal{E}_{C^V,N}$, as shown in the proof of Proposition A.1.

Moreover,

$$\frac{\partial \mathcal{E}_{\mathcal{O}^C,N}}{\partial e} = -\frac{C^V}{C^V + F} \frac{\partial \mathcal{E}_{C^V,N}}{\partial e} + \frac{\partial \mathcal{E}_{\mathcal{O}^C,N}}{\partial C^V} \frac{\partial C^V}{\partial e} > 0,$$

where the result follows from partially differentiating the elasticity of variable costs with respect to N introduced in the proof of Proposition A.1,

$$\frac{\partial \mathcal{E}_{C^V,N}}{\partial e} = \mathcal{E}_{C^V,N} \left[\frac{\int_0^N \tau(i)^{1-e} \ln(\tau(i)) di}{\int_0^N \tau(i)^{1-e} di} - \ln(\tau(N)) \right] < 0,$$

and from the fact that $\partial C^V / \partial e > 0$, at least for sufficiently productive firms. The intuition for this last statement is that a relatively productive firm that faces a more elastic demand lowers its price and sells more. The formal derivation is most illustrative when we assume that there is no heterogeneity in variable trade costs:

$$\frac{\partial \ln C^V}{\partial e} = \underbrace{\ln\left(1 - \frac{1}{e}\right) + \frac{1}{e-1}}_{>0} \underbrace{+ \ln\left(\frac{KP}{\tau}\right)}_{>0 \iff KP > \tau}.$$

We can further show that

$$\frac{\partial \mathcal{E}_{\mathcal{O}^C,K}}{\partial C^V} = -\frac{F}{(C^V + F)^2} \left(\mathcal{E}_{C^V,K} - \mathcal{E}_{F,K} \right) < 0,$$

because $\mathcal{E}_{C^V,K} = e - 1 > 0$ and $\mathcal{E}_{F,K} < 0$, as shown in the proof of Proposition A.3.

Finally, using previous results, we can show that

$$\frac{\partial \mathcal{E}_{\mathcal{O}^C,K}}{\partial e} = -\frac{C^V}{C^V + F} \frac{\partial \mathcal{E}_{C^V,K}}{\partial e} + \frac{\partial \mathcal{E}_{\mathcal{O}^C,K}}{\partial C^V} \frac{\partial C^V}{\partial e} < 0,$$

which completes the proof. Note again that our assumption that marginal costs are a function of managerial ability is not fundamental in any of the results, which would hold even in a setting in which managerial ability has no impact on marginal costs ($\mathcal{E}_{C^V,K} = 0$). □

A.6.3 Endogenous N and the Role of Managerial Capabilities

The manager chooses the optimal number of destination markets by maximizing the total profits in Equation (A.4). The optimal number of destination countries N^* is implicitly defined by the first order condition (normalizing $f = 0$):

$$\mathcal{F}(K, N^*) = (1-\rho)\, R \left(\frac{\rho K P}{\tau(N^*)}\right)^{\frac{\rho}{1-\rho}} - \delta\psi^2 + \frac{\delta^3\psi^3}{[3(1+\delta)]^{\frac{3}{2}}} K^{\frac{1}{2}} (N^*)^{-\frac{1}{2}} = 0$$

This allows us to relate the number of destination countries to the ability of the manager. In particular, even in our setting with endogenous organizational choices, we find that better managed firms participate more and more strongly in international trade, in line with the empirical evidence presented in Bloom et al. (2021).

Proposition A.5 (Optimal N and Managerial Capability)**.** *A firm with a more capable manager exports to a higher number of destination markets.*

$$\mathcal{E}_{N^*,K} > 0$$

Proof. The proof follows immediately from total differentiating the implicit function $\mathcal{F}(K, N^*)$ above. The elasticity of the optimal country with respect to managerial ability is given by

$$\mathcal{E}_{N^*,K} = -\frac{\mathcal{F}_K K}{\mathcal{F}_{N^*} N^*},$$

where

$$\mathcal{F}_K K = \rho R \left(\frac{\rho K P}{\tau(N^*)}\right)^{\frac{\rho}{1-\rho}} + \frac{1}{2}\frac{\delta^3\psi^3}{[3(1+\delta)]^{\frac{3}{2}}} \left(\frac{K}{N^*}\right)^{\frac{1}{2}},$$

$$\mathcal{F}_{N^*} N^* = -\rho R \left(\frac{\rho K P}{\tau(N^*)}\right)^{\frac{\rho}{1-\rho}} \mathcal{E}_{\tau(N^*),N^*} - \frac{1}{2}\frac{\delta^3\psi^3}{[3(1+\delta)]^{\frac{3}{2}}} \left(\frac{K}{N^*}\right)^{\frac{1}{2}}.$$

□

B Data Appendix

B.1 Data sets used

The French micro-data come from the following five main data sources:

1. The Enquête annuelle d'Entreprise (EAE) that collects balance sheet data on all French firms with more than 20 employees and a sample of smaller firms;
2. The Déclaration annuelle de données sociales (DADS) that collects employment data on all firms with paid employees; the data used are aggregated at the establishment level;
3. Transaction-level import-export data provided by the French Directorate-General of Customs and Indirect Taxes (DGDDI).
4. The Liaisons Financières entre sociétés (LiFi) database, which collects information on the financial links between enterprises incorporated in France as well as their foreign owners and affiliates;
5. Finally the service outsourcing data contained in the EAE are integrated with the Enquête Recours aux Services par l'Industrie (ERSI), a survey of firms with more than 20 employees and the census of firms with more than 250 employees that collects detailed information about service outsourcing policies for the year 2005. The total response rate of the survey is 85% and is well-balanced across industries and firm sizes.

We also make use of the following aggregate or otherwise publicly available data:

- Aggregate trade data from the World Integrated Trade Solution (WITS) database;
- Gravity variables are provided by Mayer and Zignago (2011);
- Information on foreign market complexity comes from Hausmann et al. (2011);
- Information on the degree of product differentiation comes from Rauch (1999);
- Task-related information comes from the 2007 O*NET v12.0 Database, combined with employment information from the 2007 Occupational Employment Statistics (OES) Survey of the Bureau of Labor Statistics.

B.2 Variable Definitions

B.2.1 The Enquête annuelle d'Entreprise and DADS

The main variables constructed using the EAE and DADS databases are defined as follows.

PBS outsourcing share: It is defined as the sum of purchases of studies (D321), purchases of IT services (D329), non-capital expenditures on software purchases (D511), and advertising (D360) over total costs. Purchases of studies correspond to item 604 of the French accounting rules (Plan Comptable Général - PCG), which belongs to the set of contracted-out goods and services that integrate directly the production cycle of the firm. Advertising corresponds to item 623 of the PCG, which belongs to 'Other external services' (item 62). Non-capital expenditures on software purchases are also classified in other external services within the EAE and are distinct from software developed in-house (variable D510). Finally the description of the EAE variable D329 explicitly states that IT services are purchased from external suppliers.

Total costs: It is the sum of purchases of goods (R210), purchases of raw materials (R212), other purchases and charges (R214), total wages and salaries (R216), social contributions (R217), and other charges (R222).

Employment: Total number of full time equivalent employees (yearly average, E101).

Skill intensity: Ratio of skilled workers to unskilled workers (from DADS). The number of skilled workers is the sum over all establishments of non-secondary jobs at the end of the year for the following categories: chief executives (chefs d'entreprises salariés), managers and professional occupations (cadres et professions intellectuelles supérieures), intermediate professions and technicians (professions intermédiaires). Unskilled workers include the following categories: sales and administrative occupations (employés), qualified and unqualified operators and laborers (ouvriers). All of the previous categories include ordinary employment only and exclude for instance interns and apprentices.

Capital intensity: Ratio of the total capital stock to total employment, where the capital stock is measured as the total of tangible capital assets at end of year (I150) and total employment is the total number of full time equivalent employees (E101).

Num. Layers: It is the number of hierarchical layers, defined as in Caliendo et al. (2015). It counts the number of one-digit occupational categories (catégories socioprofessionnelles) with positive employment within the firm. It takes values between 1 and 5.

Professional share (CS3): It is the share of workers classified as middle managers and professional occupations (cadres et professions intellectuelles supérieures) in total employment. It comes from DADS and it is another proxy for internal production of PBS services, given that they are mainly produced by professionals.

Employment outsourcing sh: It is the share of expenditures on external labor (D350) over total costs. The expenditures on external personnel correspond to item 621 of the PCG, and cover temporary workers as well as seconded or borrowed employees. The variable has been recently used by Bilal and Lhuillier (2021).

Industrial (Capacity & Specialization) outsourcing sh: It is the share of expenditures on industrial outsourcing over total costs. It is split between outsourcing due to capacity constraints (D327) and to the need for specialized equipment or capabilities (D328). Industrial outsourcing corresponds to the 'contract manufacturing services' reported in the U.S. Census of Manufacturers, in which buyer provides design and production criteria to a manufacturer who performs the physical transformation activities (Fort, 2017). Capacity industrial outsourcing is a situation in which the buyer has the capability and equipment inside the firm but decides to subcontract production to an external supplier either occasionally (due to peaks in demand or breakdowns) or more permanently (to avoid scaling up and yet maintaining the internal know-how). Specialization industrial outsourcing corresponds to situations in which the buyer subcontracts production to a specialized supplier because it does not possess the know-how, capabilities, equipment or inputs to carry out production and it does not intend to acquire them for strategic reasons.[37]

Administrative task outsourcing sh: It is the share of expenditures on general subcontracting (D323) over total costs. The expenditures are reported under item 611 of the French account-

[37]For the definitions provided by the INSEE, see https://www.insee.fr/fr/metadonnees/definition/c1670.

ing rules (PCG), which include any other subcontracting activity not reported elsewhere (e.g., purchases of studies, D321, corresponding to item 604 of the PCG). Examples of such activities include remote secretarial services, security and janitorial services, waste processing services (e.g., eco-contribution) etc.

Serv. NonRoutineness: It is the non-routine task share for the upstream service input. It corresponds to the inverse of the average task routineness in the service sector constructed following Costinot et al. (2011). Task routineness for an occupation is measured as: $r(o) = 100 - i(o)$, where $i(o)$ is the importance of 'Making Decisions and Solving Problems' (on a scale 0 to 100) available in the 2007 O*NET v12.0 Database. Occupation measures are first transformed to 4-digit 2002 NAICS industries using employment weights from the 2007 Occupational Employment Statistics (OES) Survey of the Bureau of Labor Statistics, and then to NACE Rev 1.1 using a concordance table available upon request. The task routineness measure is then aggregated up at the service type level using employment weights from DADS.

Serv. Dispersion: It is the inverse Herfindahl–Hirschman index of firm-level labor cost shares in an upstream service sector. The firm-level labor costs are proxied with the total wage bill from DADS (S_BRUT), which does not include the firm's social security contributions. The service sectors are defined at the level of the ERSI service types (see Section B.2.3).

Serv. Inv Elasticity: It is the (inverse) elasticity of service demand estimated as in Gervais and Jensen (2019). It corresponds to the median value of the ratio between value added and operating profits for the firms operating in the industries that produce a certain service type (see Section B.2.3). Value added is defined as turnover and other products (R310 + R315) minus purchases of goods (R210), purchases of raw materials (R212), and other purchases and charges (R214). Operating profits are defined as value added minus labor costs (R216 + R217 + R222) and taxes (R215).

TFP: It is computed using the methodology proposed by Wooldridge (2009). The coefficient of a Cobb-Douglas value-added production function are estimated at the 3 digit NACE industry level using intermediate inputs (R210 + R212 + R314) as the proxy for the productivity shock. Real value added is obtained by double-deflation as the difference between real output and real intermediate expenditures using deflators from the OECD STAN database. TFP at the firm level is then calculated as a residual between the actual and predicted value added using the estimated coefficient.

Monitoring: It captures the firm-level task share devoted to monitoring activities, a measure of managerial intensity within the firm. We first use of the 2007 O*NET database to obtain a measure of monitoring intensity for an occupation by averaging the importance of: i) 'Guiding, Directing, and Motivating Subordinates'; ii) 'Staffing Organizational Units'; iii) 'Monitoring and Controlling Resources'. We then concord the 6-digit O*NET occupations (classified according to the 2006 Standard Occupation Classification) to the 1-digit French occupational categories (catégories socioprofessionnelles) and use firms' employment shares in each occupation to obtain a firm-year level measure.

Coordination: It captures the firm-level task share devoted to coordination activities, a measure of managerial intensity within the firm. It is constructed similarly to *Monitoring*, with the difference that the coordination intensity for an occupation is obtained by averaging the importance of: i) 'Scheduling Work and Activities'; ii) 'Organizing, Planning, and Prioritizing Work'; iii) 'Coordinating the Work and Activities of Others'.

Communication: It captures the firm-level task share devoted to communication activities within the firm, a measure of managerial intensity in line with the micro-foundation proposed in our conceptual model. It is constructed similarly to *Monitoring*, with the difference that the communication intensity for an occupation is obtained by averaging the importance of: i) 'Interpreting the Meaning of Information for Others'; ii) 'Communicating with Supervisors, Peers, or Subordinates'.

B.2.2 Customs data

The main variables constructed using the French customs data are defined as follows.

N: Number of export destinations of the firm.

Exp intensive margin: It is the average intensive margin across export destinations of the firm, obtained as the total value of exports divided by the number of export destinations.

N imp: Number of import origins of the firm.

Imp intensive margin: It is the average intensive margin across import origins of the firm, obtained as the total value of imports divided by the number of import origins.

Differentiation: It is a measure of firm export differentiation, obtained as the a weighted average of the differentiation of the firm's exported products, with weights equal to the shares of each product in the total firm export value. An exported product is considered as differentiated if it is neither sold on an organized exchange nor reference priced. We use the Rauch's (1999) 'Liberal' classification as in Nunn (2007) and Corcos et al. (2013).

Num languages: It is the number of distinct official languages spoken in the firm's export destinations, obtained by combining the Customs data with the geo_cepii database (Mayer and Zignago, 2011).

N (Complexity): It is the number of export destinations of the firm weighted by the (rescaled) index of economic complexity proposed by Hausmann et al. (2011).

NP: Number of exported products. This information is not available for exporters that file simplified declarations. The full reporting threshold is 38k€(250k French Francs) before 2001, 100k€in the 2001-2006 period, 150k€in 2007. See Bergounhon et al. (2018) for further details.

Entry: It is an indicator variable that takes value equal to one if the exporter *only* re-enters markets relative to the previous period and its full history in the data; two if the exporter *only* enters markets it had not exported to in its full history in the data; three if the exporter simultaneously re-enters *and* enters markets for the first time. The variable construction requires at least three years of trading history to be defined, so it is missing in the initial two years of exporting activity of new exporters and in year 1996 because we use trade data starting in 1995.

B.2.3 ERSI

The ERSI survey contains information about 34 types of services; in particular for each service type it provides a binary variable equal to one if the service is outsourced by the firm. Hence the OUT_{is} variable corresponds to the B* variables contained in the survey. We use the revised version of the variables, adjusted to remove internal inconsistencies. The service types are:

1. ICT Services
   - 1.1: IT consulting
   - 1.2: Software and IT third party maintenance
   - 1.3: Data processing and IT management
   - 1.4: Telecommunications
2. R&D and Professional Services
   - 2.1: Research and development
   - 2.2: Architecture, engineering and technical studies
3. Transportation Services and Logistics
   - 3.1: Railways, air, water and land transport
   - 3.2: Handling and warehousing
   - 3.3: Packaging
   - 3.4: Courier and post
   - 3.5: Chartering and international transport
4. Administrative Services
   - 4.1: Secretariat, translation and interpreting
   - 4.2: Vocational training
   - 4.3: Business and management consultancy
   - 4.4: Legal services
   - 4.5: Accounting, book-keeping and auditing
   - 4.6: Labor recruitment and provision of permanent personnel
   - 4.7: Temporary work
   - 4.8: Brokerage and fund management
   - 4.9: Insurance and other financial services
   - 4.10: Leasing
   - 4.11: Invoicing/billing and debt recovery
5. Commercial Services
   - 5.1: Advertising, marketing and communication
   - 5.2: After-sales services
6. Maintenance and General Services
   - 6.1: Car, equipment and machinery maintenance
   - 6.2: Buildings maintenance
   - 6.3: Cleaning
   - 6.4: Investigation and security activities
   - 6.5: Sewage and sanitation
   - 6.6: Refuse collection, treatment and recycling
   - 6.7: Real estate

6.8: Renting of machinery, car and transport equipment

7. Personnel Services

   7.1: Restaurants, canteens and catering

   7.2: Day care, nurseries and personal services

The correspondence between the service types and the 4-digit NAF (Nomenclature d'Activités Française) Revision 1 industries is available upon request.

B.2.4 Robustness Checks

The main variables used in the robustness exercises contained in the paper are defined as follows.

Contract intensity: The variable is constructed using the information about firms' imports. The firm-level contract intensity is therefore a weighted average of the contract intensity of the firm's imported products, where the measure of contract intensity is taken from Rauch (1999), and the weights are the shares of each product in the total firm imports. An imported good is considered as contract intense if it is neither sold on an organized exchange nor reference priced, we use the Rauch's (1999) 'Liberal' classification as in Nunn (2007) and Corcos et al. (2013).

HQ Share (Rev): the share of the firm revenues accounted for by branches of the firm that produce services (Nace codes from 50 to 93, often the headquarters). The EAE survey provides firm-level information at the level of branch of activity; i.e., revenues, employment and other firm-level information reported at the 4-digit NAF industry level. There is no one-to-one correspondence between branches and establishments, and a single branch can re-group the 4-digit industry-specific activities of multiple establishments or just represent part of the activity a single establishment.

HQ Share (Empl): the share of the firm workers employed in branches of the firm that produce services (Nace codes from 50 to 93, often the headquarters).

PBS Share (Rev): the share of the firm revenues accounted for by branches of the firm that produce business services (defined as ERSI categories 1, 2, and 5, see Section B.2.3).

PBS Share (Empl): the share of the firm workers employed in branches of the firm that produce business services (defined as ERSI categories 1, 2, and 5, see Section B.2.3).

HQ Est. (Salaries): the share of the firm total wage bill accounted for by establishments classified as headquarters by the firm itself (values 10, 27, 80, 87 of the variable FTNET, reporting the function of the establishment).

HQ Est. (Empl): the share of the firm workers employed in establishments classified as headquarters by the firm itself (values 10, 27, 80, 87 of the variable FTNET, reporting the function of the establishment).

B.3 Data Cleaning

All variables from EAE before 2001 and salary from DADS before 2000 are transformed into euro. Unfortunately there are no missing values in the database and all variables are zeros even when they are clearly missing. So we set the relevant variables to missing in the following cases:

- If all balance sheet variables are zeros (E* R* D* I* S*);
- If all income statement variables are zeros (R1* R2* R3* R40* D* S001);
- If all cost variables are zeros (R2*);
- If all employment variables are zeros (E* S003 D350 D351 D352 - after having performed the adjustments described below);
- If employment is zero (E101) but total salaries are positive (R216);
- If all intangible investment variables are zeros;
- If capital stock is zero (I150);
- If purchases of studies (D321) and purchases of materials (D322) are zeros but the variable containing their sum (D314) is positive;
- If all outsourcing and external charges are zeros (D3* D5*);

The following adjustments are also performed.

Capital (I150): whenever possible, we obtain the end of the year capital stock from the stock at the beginning of the year by adding acquisitions and revaluations and subtracting decumulation and disposals.

Other purchases and charges (R214): whenever it is zero or too small we take the sum of its components, which, according to the French accounting rules (Plan Comptable Général), are: outsourcing of non-core activities (D323), payments for leasing (D330), salaries to external employees (D350), advertising (D360).

Employment (E101): employment is measured as the total number of full time equivalent employees (annual average). Whenever possible, we replace the zeros with the sum of the annual average employment over all branches (S003), or with employment at the end of the year (E200), or with with the sum of the annual average employment over all establishments (V001), or, finally, with the sum of non-secondary jobs at the end of the year over all establishments from DADS (EFF_3112_ET). We use employment at the end of the year from DADS instead of the annual average employment (EFF_MOY_ET) because the latter is not available before 2002; non-secondary jobs (postes non annexes) exclude secondary jobs that last or are paid too little (see INSEE, 2013).

HQ Share (Empl) and *PBS Share (Empl)*: they are set to missing in 2007 because very few firms report employment by branch in that year.

Outsourcing shares: they are set to missing if they exceed one.

Industrial (Capacity & Specialization) outsourcing sh: we set the observations to missing whenever the variables providing the split between capacity and specialization do not sum up to 100. Conversely, we consider zero values for capacity and specialization outsourcing as genuine whenever the total expenditures on industrial outsourcing is positive.

Purchases of goods (R210), *Purchases of raw materials* (R212): they are set to missing if negative (only few cases in 1996).

Purchases of Studies (D321): to impute missing values we take advantage of the variable overall outsourcing (D314), which contains the sum of purchases of studies (D321) and of purchases of (contracted-out) materials, equipment and works (D322, item 605 of the PCG). We compute the 2-digit industry-level average share of purchases of studies in the total, and use this average and the firm-level expenditure on overall outsourcing to impute missing values in the variable purchase of studies. We cannot impute missing values for the food and beverage industry (NACE 15) because no firm is reporting the subcategories.

Value Added: we set negative observations to missing.

Total wages and salaries (R216): when we take total employment from DADS we also replace the total wage bill with the sum of gross salaries over all establishments from DADS (S_BRUT). We do so only when total costs are non-missing, otherwise total costs would be heavily underestimated (would contain wages only).

Total costs: instead of purchases of goods (R210), purchases of raw materials (R212), and other purchases and charges (R214), we use their reported sum (total purchases and external charges, R771) whenever the value is larger.

Turnover (R310): if it is zero, it is set equal to the sum of turnover over all branches (S001) when this is positive. We also use turnover from branches if reported exports are larger than turnover but smaller than turnover from branches (only two cases in 2005).

Trade variables: for the robustness exercise with non-exporters, we typically set trade variables to zero if the corresponding value is not reported in the trade data. There are two exceptions in which we set values to missing instead of zero: i) the non-exporter reports positive exports in the EAE survey; ii) for the number of products when the firm exports a positive amount but it files simplified declarations that do not report product information.

Finally we drop the observations in the following cases:

- Turnover comes entirely from branches classified in services;
- Turnover is lower than total exports. More precisely we allow for a 10% reporting error, hence we drop the observation if total exports are 10% larger than turnover.

C Additional Results

Table C.1: Summary Statistics Baseline Sample (EAE)

	1996						2007					
	mean	sd	p25	p50	p75	obs	mean	sd	p25	p50	p75	obs
PBS outsourcing sh	0.042	0.070	0.0027	0.013	0.047	17,702	0.047	0.078	0.0023	0.013	0.055	15,290
PBS outsourcing (k€)	1507.4	14018.6	13.7	81.0	385.1	17,703	3030.4	45484.3	20	136	695	15,290
Firm average wage (k€)	22.7	8.19	18.0	21.3	25.5	17,993	30.1	10.8	24.2	28.1	33.5	15,579
# export destinations (N)	11.8	15.4	2	6	15	18,033	14.1	17.3	3	7	19	15,692
Export intensive margin (k€)	327.7	1381.6	19.9	67.0	217.8	18,033	620.8	4404.5	33.0	112.6	360.4	15,692
# import origins	5.33	5.42	1	4	8	18,033	7.14	6.88	2	6	10	15,692
Import intensive margin (k€)	488.5	2358.0	36.2	110.3	332.6	14,797	823.1	5371.4	71.5	203.6	574.7	13,347
# products (NP)	13.4	24.8	2	6	14	18,033	15.2	29.4	2	6	16	15,692
# exp. dest., complexity-weighted	15.7	17.8	3.46	9.00	21.5	18,033	18.2	20.1	3.69	10.7	25.6	15,692
# languages	8.20	7.18	3	6	11	18,033	9.87	8.64	4	7	13	15,692
Employment	153.6	786.5	30	47	109	18,026	158.7	862.3	31	49	119	15,670
Skill intensity	0.62	2.50	0.17	0.30	0.54	16,984	1.22	17.0	0.24	0.41	0.77	15,297
Capital intensity	81.9	2125.0	16.8	32.5	59.3	17,996	111.8	1874.0	23.0	47.7	93.4	15,582
# hierarchical layers	4.33	0.78	4	4	5	17,047	4.26	0.73	4	4	5	15,408
Professional share (CS3)	0.080	0.099	0.026	0.054	0.098	17,047	0.13	0.14	0.047	0.087	0.15	15,408
Employment outsourcing sh	0.011	0.023	0	0.0022	0.013	17,699	0.019	0.028	0	0.0090	0.026	15,286
Industrial outsourcing sh	0.063	0.099	0	0.019	0.085	17,703	0.063	0.099	0	0.020	0.086	15,290
Administrative task outsourcing sh	0.022	0.057	0	0	0.012	17,703	0.019	0.049	0	0.00031	0.013	15,290
Variable costs ratio	4.17	1.84	2.99	4.20	5.38	18,033	4.67	1.87	3.50	4.72	5.89	15,692
Differentiation of exp. products	0.76	0.39	0.62	1.00	1	18,033	0.74	0.40	0.47	1.00	1	15,692
Monitoring capability	33.0	1.31	32.3	32.8	33.4	17,047	33.0	1.15	32.3	32.8	33.4	15,408
Coordination capability	56.4	0.95	56.0	56.4	56.8	17,047	56.6	0.92	56.1	56.6	57.0	15,408
Communication capability	68.2	1.11	67.9	68.5	68.9	17,047	68.6	1.01	68.2	68.8	69.2	15,408

The table shows summary statistics for the full sample of exporting manufacturing firms in the EAE in 1996 and 2007.

Table C.2: Summary Statistics Service Type Sample (ERSI)

	mean	sd	p25	p50	p75	obs
Panel A. Variables in ERSI (2005 only)						
Service out. indicator	0.51	0.16	0.41	0.52	0.62	4,033
MA Service out. indicator	0.55	0.20	0.40	0.53	0.67	4,033
# export destinations (N)	20.9	22.2	5	13	30	4,033
Employment	370.9	1757.1	56	138	329	4,029
Skill intensity	1.51	4.99	0.29	0.49	1	3,976
Capital intensity	173.9	3476.7	25.7	53.1	102.2	4,023
Panel B. Service Characteristics (2005 only)						
Service Routiness	32.1	6.18	28.3	33.0	35.0	32
Service HHI DADS	0.038	0.081	0.0040	0.013	0.037	32
Service Elasticity	3.13	4.05	1.75	2.19	2.88	28

The table shows summary statistics for the full sample of exporting manufacturing firms in the ERSI survey in 2005. *Service out. indicator* reports the summary statistics for the firm-level average probability of outsourcing across all service types. *MA Service out. indicator* reports the statistics restricted to 'market access' services only, i.e., characterized by an above median elasticity with respect to the (log) number of export destinations.

Table C.3: Miscellaneous Robustness Exercises

	(1) Clust Ind	(2) No Frac	(3) Lag Ctrls	(4) Extra Ctrls	(5) Firm trends	(6) Long Diff	(7) Non-exp	(8) No $<$ Thr	(9) $>$ 20 Empl	(10) No PBS Group	(11) No For Group
N	0.083***	0.080***	0.087***	0.091***	0.040***	0.094***		0.086***	0.083***	0.075***	0.074***
	(0.014)	(0.010)	(0.011)	(0.012)	(0.011)	(0.021)		(0.011)	(0.011)	(0.012)	(0.011)
NC (ihs)							0.086***				
							(0.009)				
Observations	175,564	175,568	152,255	143,390	175,564	33,286	220,082	163,647	169,029	102,826	143,164
Number of firms	25,665	25,666	23,194	21,290	25,665	13,488	32,169	24,356	24,442	18,289	22,767
R-Square	0.746	0.830	0.761	0.751	0.838	0.783	0.746	0.749	0.744	0.759	0.747
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm trends					Yes						

The dependent variable is the (log) share of purchased services in total costs, apart from column (2) where it is the (log) *expenditure* on purchased services. The main regressor N is the (log) number of export destination countries at the firm-year level. Coefficient estimates for the baseline control variables employment, skill intensity, and capital intensity (all in logs) are not shown. The full baseline sample contains all French manufacturing exporters in the EAE during 1996-2007. In column (2), we control for total costs (in logs). In column (3), we lag the baseline controls by one period. In column (4), we include the export intensive margin, the number of origins, the import intensive margin, the number of imported products, and a measure of contract intensity of as additional control variables (all in logs). In column (5), we add firm-level time trends. In column (6), we estimate a long difference specification with 1996 and 2007. In column (7), we add non-exporters to the baseline sample and use the inverse hyperbolic sine transformation. In column (8), we eliminate exporters who trade volumes below the full reporting threshold (for which we do not have product-level information). In column (9), we use only firms with more than 20 employees, where the EAE is a census. In column (10), we exclude firms that belong to business groups that include: i) firms operating in the PBS industries that produce the services considered in our analysis (correspondence available upon request); ii) firms in the industry 'Management activities of holding companies' (741J in the NAF Rev. 1 classification), i.e., the headquarters that may provide these services. In column (11), we exclude firms that belong to foreign business groups. Numbers of observations differ across columns due to sample restrictions and data availability. Standard errors in parentheses are clustered at the 3 digit industry level in column (1), and at the firm level in all other exercises. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table C.4: Controlling for Internal Service Production

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
N	0.083***	0.078***	0.083***	0.078***	0.083***	0.083***	0.083***	0.083***
	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
Num. Layers	-0.001	0.001	-0.001	0.001	-0.001	-0.000	-0.000	-0.000
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
HQ Share (Rev)	-0.065							-0.065
	(0.042)							(0.042)
HQ Share (Empl)		-0.012						
		(0.048)						
PBS Share (Rev)			-0.068					
			(0.355)					
PBS Share (Empl)				-0.206				
				(0.417)				
HQ Est. (Salaries)					0.051			
					(0.070)			
HQ Est. (Empl)						0.007		
						(0.075)		
Professional Share (CS3)							0.057	0.065
							(0.084)	(0.083)
Observations	175,337	161,652	175,337	161,652	175,421	175,466	175,544	175,317
Number of firms	25,653	24,958	25,653	24,958	25,649	25,656	25,661	25,649
R-Square	0.747	0.751	0.747	0.751	0.747	0.746	0.746	0.747
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the (log) share of purchased services in total costs. The main regressor N is the (log) number of export destination countries at the firm-year level. Controls for internal service production are the number of hierarchical layers in a company Num. Layers; the share of the firm revenues (*HQ Share (Rev)*) or employees (*HQ Share (Empl)*) generated by establishments classified in services (often the headquarters); the share of the firm revenues (*PBS Share (Rev)*) or employees (*PBS Share (Empl)*) generated by establishments classified in business service industries; the share of the firm wage bill (*HQ Est. (Salaries)*) or employment (*HQ Est. (Empl)*) accounted for by establishments classified as headquarters by the firm itself; the share of professionals in the total firm employment Professional Share (CS3). Coefficient estimates for the control variables employment, skill intensity, and capital intensity (all in logs) are not shown. The full baseline sample contains all French manufacturing exporters in the EAE during 1996-2007. Common sample imposed across columns (1)-(4). Column (5) repeats the baseline OLS specification for the IV sample in column (6). Standard errors in parentheses are clustered at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table C.5: IV Robustness

	(1) Base	(2) Exp Ctrl	(3) Imp Ctrl	(4) Excl EU15	(5) Base L5	(6) Brics Imp	(7) China Imp	(8) Avw	(9) NoLev1 max	(10) Base Pos
N	0.282***	0.290***	0.245**	0.273***		0.264**	0.349***	0.255***	0.450*	0.323***
	(0.091)	(0.094)	(0.111)	(0.090)		(0.131)	(0.106)	(0.094)	(0.239)	(0.085)
Exp Intensive Margin		-0.011*	-0.008							
		(0.006)	(0.007)							
N Imp			-0.016							
			(0.018)							
Imp Intensive Margin			-0.001							
			(0.006)							
IV (N)					0.009					
					(0.020)					
Observations	169,137	169,137	146,078	169,137	62,828	169,177	168,693	169,137	169,137	169,137
Number of firms	24,490	24,490	21,353	24,490	12,890	24,491	24,442	24,490	24,490	24,490
R-Square	0.745	0.745	0.752	0.745	0.788	0.745	0.743	0.745	0.741	0.744
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KP-Stat	239.1	249.3	311.8	238.7		134.0	143.7	267.4	61.9	218.5
IV Type	NewEU-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exEU15		Brics-Imp exFRA	China-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exFRA
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the (log) share of purchased services in total costs. The main regressor N is the (log) number of export destination countries at the firm-year-level. Exp Intensive Margin is the (log) average sales across destinations; N Imp is the (log) number of import origin countries; Imp Intensive Margin is the (log) average imported value across origins. Coefficient estimates for the baseline control variables employment, skill intensity, and capital intensity (all in logs) are not shown. The full baseline sample contains all French manufacturing exporters in the EAE during 1996-2007. Column (1) reports the baseline for comparison. In column (2), we include a firm's export intensive margin, and in column (3) the number of origin countries for imports, and import intensive margin as further controls. In column (4), we exclude all EU 15 countries in the computation of the shock variable. In column (5), we regress the 5-year lagged outsourcing share on the baseline instrumental variable. In column (6), we use the baseline instrument based on the BRICS economies. In column (7), we use the baseline instrument based on China. In column (8), we use the trade volume-weighted mean as a measure of exposure in the instrument. In column (9), we replace the initial number of destination countries, NC_{ipt_0}, by 1 for all firms in the computation of the instrument. In column (10), instead of truncating our instrument whenever the predicted shock drops below one, we rely on only positive shocks for estimation, i.e., $\Delta N'_{pt} = \Delta N_{pt}$ if $\Delta N_{pt} > 0$ and $\Delta N'_{pt} = 0$ otherwise. Numbers of observations differ across columns due to data availability. Standard errors in parentheses are clustered by 3 digit industry. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table C.6: First Stages for IV Robustness

	(1) Base	(2) Exp Ctrl	(3) Imp Ctrl	(4) Excl EU15	(6) Brics Imp	(7) China Imp	(8) Avw	(9) NoLev1 max	(10) Base Pos
IV	0.090***	0.086***	0.090***	0.093***	0.053***	0.088***	0.087***	0.024***	0.115***
	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.007)	(0.005)	(0.003)	(0.008)
Exp Intensive Margin		0.048***	0.035***						
		(0.004)	(0.005)						
N Imp			0.156***						
			(0.007)						
Imp Intensive Margin			0.029***						
			(0.003)						
Observations	169,137	169,137	146,078	169,137	169,177	168,693	169,137	169,137	169,137
Number of firms	24,490	24,490	21,353	24,490	24,491	24,442	24,490	24,490	24,490
R-Square	0.917	0.918	0.921	0.917	0.916	0.917	0.917	0.916	0.918
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KP-Stat	239.1	249.3	311.8	238.7	134.0	143.7	267.4	61.9	218.5
IV Type	NewEU-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exEU15	Brics-Imp exFRA	China-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exFRA	NewEU-Imp exFRA
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind#Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table shows the first stage regressions for the 2SLS results in Online Appendix Table C.5 and columns are numbered in the same way, see notes therein.

Table C.7: Results for Individual Services

Service Type		Outsourcing			TFP	
Num.	Description	N	Exp. Int.	Obs.	Out	Obs.
5.1	Advertising	0.067***	-0.015	3882	0.034	3817
1.1	IT Consulting	0.032***	-0.002	3882	-0.027	3817
4.1	Translation	0.030***	0.015***	3882	0.056**	3817
4.9	Insurance	0.030**	-0.01	3882	0.04	3817
1.2	IT Maintenance	0.029*	0.003	3882	-0.012	3817
3.1	Transportation	0.027***	-0.004	3882	-0.011	3817
2.1	R&D	0.026*	0.005	3882	0.007	3817
4.4	Legal Services	0.024**	-0.011	3882	-0.006	3817
2.2	Technical studies	0.022*	0.002	3882	0.032	3817
3.3	Packaging	0.021***	0.006	3882	0.02	3817
3.5	Chartering	0.020*	0.014**	3882	0.051*	3817
6.6	Refuse collection	0.021	0.003	3882	-0.021	3817
4.7	Temporary work	0.019	0	3882	0.093***	3817
4.2	Training	0.015	-0.004	3882	0.01	3817
4.6	Recruitment	0.015	0.002	3882	0.034	3817
6.3	Cleaning	0.012	0.003	3882	0.095***	3817
6.8	Machinery Renting	0.011	-0.007	3882	0.006	3817
4.11	Debt recovery	0.01	-0.013	3882	-0.135***	3817
6.4	Security	0.009	0.005	3882	0.058**	3817
6.2	Buildings Maint.	0.007	0.013	3882	0.073***	3817
3.2	Warehousing	0.006	0.026***	3882	0.049	3817
4.8	Brokerage	0.006	0.005	3882	0.026	3817
6.5	Sewage	0.006	0.007	3882	0.006	3817
4.10	Leasing	0.002	-0.017**	3882	-0.034*	3817
4.5	Accounting	0.002	0.002	3882	0.007	3817
4.3	Business Consulting	0.001	-0.002	3882	-0.037	3817
5.2	After-sales Services	0	-0.006	3882	-0.003	3817
1.3	Data processing	-0.002	0.001	3882	0.013	3817
6.7	Real estate	-0.002	-0.004	3882	0.022	3817
6.1	Machinery Maint.	-0.005	-0.004	3882	0.033	3817
7.1	Catering	-0.018	0.006	3882	0.04	3817

Every row reports estimates from a separate OLS regression where the dependent variable is an indicator equal one if a firm outsources the named service in 2005, and zero if not. The regressors N and Exp. Int. are the (log) number of export destination countries and the (log) export intensive margin at the firm-year level. The last two columns report the results of separate OLS regressions where the firm's TFP is regressed on the outsourcing indicator variable for each service type. Coefficient estimates for the the control variables employment, skill intensity, and capital intensity (all in logs) are not shown. The full sample contains all exporters in the ERSI survey, a cross-section of manufacturing firms in 2005. Common sample imposed. For the regressions of outsourcing, standard errors are clustered at the downstream sampling strata by upstream service type level; for the regressions of TFP, standard errors are clustered at the 3-digit industry level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

CENTRE FOR ECONOMIC PERFORMANCE
Recent Discussion Papers

1842	Hites Ahir Nicholas Bloom Davide Furceri	The world uncertainty index
1841	Tomaz Teodorovicz Andrew L. Kun Raffaella Sadun Orit Shaer	Multitasking while driving: a time use study of commuting knowledge workers to access current and future uses
1840	Jonathan Gruber Grace Lordan Stephen Pilling Carol Propper Rob Saunders	The impact of mental health support for the chronically ill on hospital utilisation: evidence from the UK
1839	Jan Bietenbeck Andreas Leibing Jan Marcus Felix Weinhardt	Tuition fees and educational attainment
1838	Jan De Loecker Tim Obermeier John Van Reenen	Firms and inequality
1837	Ralph De Haas Ralf Martin Mirabelle Muûls Helena Schweiger	Managerial and financial barriers during the green transition
1836	Lindsay E. Relihan	Is online retail killing coffee shops? Estimating the winners and losers of online retail using customer transaction microdata
1835	Anna D'Ambrosio Vincenzo Scrutinio	A few Euro more: benefit generosity and the optimal path of unemployment benefits
1834	Ralf Martin Dennis Verhoeven	Knowledge spillovers from clean and emerging technologies in the UK

1833	Tommaso Sonno Davide Zufacchi	Epidemics and rapacity of multinational companies
1832	Andreas Teichgraeber John Van Reenen	A policy toolkit to increase research and innovation in the European Union
1831	Antonin Bergeaud Jean-Benoît Eyméoud Thomas Garcia Dorian Henricot	Working from home and corporate real estate
1830	Simon Briole Marc Gurgand Éric Maurin Sandra McNally Jenifer Ruiz-Valenzuela Daniel Santín	The making of civic virtues: a school-based experiment in three countries
1829	Niklas Gohl Peter Haan Claus Michelsen Felix Weinhardt	House price expectations
1828	Max Marczinek Stephan Maurer Ferdinand Rauch	Trade persistence and trader identity - evidence from the demise of the Hanseatic League
1827	Laura Alfaro Cathy Bao Maggie X. Chen Junjie Hong Claudia Steinwender	Omnia Juncta in Uno: foreign powers and trademark protection in Shanghai's concession era
1826	Thomas Sampson	Technology transfer in global value chains
1825	Nicholas Bloom Leonardo Iacovone Mariana Pereira-López John Van Reenen	Management and misallocation in Mexico

The Centre for Economic Performance Publications Unit
Tel: +44 (0)20 7955 7673 Email info@cep.lse.ac.uk
Website: http://cep.lse.ac.uk Twitter: @CEP_LSE