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Disentangling the Role of Modularity and Bandwidth in Entry Mode Choice: The Case of Business Services Offshoring

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Abstract

This paper investigates the role of modularity on entry mode choice of companies' offshoring of business services. We distinguish between functional modularity, which reflects the possibility to subdivide a function into smaller modules, and architectural modularity, which reflects the interdependence between these modules. Lower architectural modularity requires greater interaction (greater 'bandwidth') between the organizational units to reintegrate the individual modules. Using modularity appropriately can decrease transaction costs and reduce the risks of knowledge leakages associated with offshoring, and improve the effectiveness of the sourcing process, thus increasing the probability that firms opt for less hierarchical entry modes. Firms that are less experienced with offshoring tend to underestimate the associated resources and costs of architectural modularity and select entry modes that do not provide sufficient bandwidth to efficiently reintegrate offshored modules, increasing the risk of failure of the offshoring initiatives. Our empirical analysis, which involves 490 offshoring initiatives, supports our arguments, especially in high-tech and knowledge-intensive industries.

Keywords

Offshoring, entry mode, modularity, value chain fragmentation, outsourcing

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1 Introduction

Business services offshoring is a growing trend where firms globally source white-collar work, including R&D, technical and administrative activities, as opposed to blue-collar work, which is connected with manufacturing (Lewin and Peeters, 2006; Kenney, Massini and Murtha, 2009; Albertoni and Elia, 2014). Improvements in cross-border coordination have allowed firms to increasingly invest abroad to access qualified personnel, knowledge and new technologies (Kedia and Lahiri, 2007; Manning, Massini and Lewin, 2008; Lewin, Massini and Peeters, 2009; Elia, Caniato, Luzzini and Piscitello, 2014). Although superficially it might seem that business services offshoring is driven by a combination of cost-saving motivations and a shortage of technical talent in advanced countries, the fragmentation and fine-slicing of the value chain is also fraught with costs and risks not least because modularizing activities is not always straightforward, particularly in business services.

First, business services are subject to a larger degree of intangibility, which increases uncertainty and the probability of opportunistic behavior by external actors (Miles, 1993; Ashok, Narula and Martinez-Noya, 2014). Second, business services are produced and consumed simultaneously, meaning that the service product can often be identified with the service process itself, unlike manufacturing goods that are consumed after production (Voss and Hsuan, 2009; Bask, Lipponen, Rajahonka and Tinnilä, 2010). The simultaneity of production and consumption in business services means that the knowledge content of business services (often the firm's competitive advantage) is often difficult to transfer because it is difficult to codify. Unintentional transfers of the knowledge embedded in business services might result in a loss of competitive advantage.

Thus, offshoring of business services faces two contrasting challenges. On the one hand, they need to transfer effectively their knowledge across boundaries minimizing transaction costs and protecting their competitive advantage from knowledge leakages risks. On the other hand, they need to interact with external partners in order to secure accessing to talent, new knowledge and technology, since this is one of the most important drivers underlying the phenomenon of business services offshoring. This, in turn, increases the risk of unintentional transfer of knowledge and core competences.

Choosing the appropriate entry mode when deciding to offshore is therefore an important decision. Firms can choose between a spectrum of entry mode choices that require different degrees of resource commitment, often referred to as a make-or-buy-or-ally decision (Teece, 1986; 1996; Pisano, 1990; Narula 2001a; Cassiman and Veugelers, 2006; Mudambi and Tallman, 2010). Captive offshoring (i.e. 'make') refers to wholly-owned offshoring ventures either through mergers and acquisitions (M&A) or greenfield investments. On the other extreme, in case of offshore outsourcing (i.e. 'buy'), a company opts to select an external supplier, thus minimizing the level of commitment and direct involvement.

An intermediate level of commitment arises when companies opt for collaborative agreements (e.g. joint ventures and strategic alliances).

The novelty of this paper is to understand the challenges modularization poses to the selection of entry mode – a relationship that has been largely neglected. Fragmenting the value chain may seem simple in principle, but in practice fragmentation is not straightforward (Kotabe, Parente and Murray, 2007; Baldwin and Clark, 1997; Langlois and Robertson, 1992; Parente, Baack and Hahn, 2011), because the offshored modules must be subsequently reintegrated. To assess correctly the consequences of modularity, it is necessary to take into account the degree of interconnectivity amongst and between these modules. When the modules are strongly interdependent, or the interface between them highly complex, a larger 'bandwidth' (i.e. more frequent and intense interaction between the offshoring unit and the foreign-located unit) is required to reintegrate each module into the main system, thus increasing again transaction costs (Narula, 2014).

In this paper, we distinguish between two dimensions of modularity – functional and architectural. Functional modularity is the classic form of modularity that relates to the possibility of splitting a business function into smaller modules. Architectural modularity is the degree of interdependence among the modules (low interdependence being associated with a high architectural modularity). We postulate that both functional and architectural modularity affect entry-mode choice. Firms that are able to slice and dice their business services into smaller and independent modules can decrease transaction costs and the risk of knowledge leakages while increasing the effectiveness of transferring their core competences. As a consequence, they are able to pursue their exploration strategy through alliances or outsourcing without facing overly high costs and risks. In other words, properly determining functional and architectural modularity provides firms with a possible solution for the trade-off arising from offshoring business services, which under the appropriate circumstances can reduce the need for internalization.

We use data from 490 offshoring initiatives provided by the Offshoring Research Network (ORN) to test whether functional and architectural modularity effectively increases the probability to opt for outsourcing or an intermediate entry mode, over a captive entry mode choice. Our analysis confirms that both functional and architectural modularity increase the probability to opt for a less hierarchical entry mode, especially in high-tech and knowledge intensive industries, where firms' competitive advantages is based on complex and tacit knowledge (Cantwell and Santangelo, 2000). Firms that have previous offshoring experience are naturally more cautious about the costs of reintegration. Those new to offshoring tend underestimate the role of architectural modularity when selecting the entry mode choice, because inexperienced companies are unaware of the "hidden costs" of offshoring (Larsen, Manning and Pedersen, 2013) arising from the challenges in reintegrating the modules into the system.

Our paper provides a contribution to the literature on entry mode, by proposing a possible solution to the trade-off arising among different theories and by bridging international business, operation management and organization design literatures through the concept of modularity. We also provide some managerial implications that might assist companies that are involved in business services offshoring, by warning especially unexperienced companies from underestimating the role of architectural modularity when offshoring business services. The rest of the paper is organized as follows. Section 2 provides the theoretical framework and presents our hypotheses. Section 3 describes the data, the sample and models developed to test our hypotheses. Section 4 displays the results and section 5 provides discussion and conclusions.

2 Theoretical framework and hypotheses development

2.1 Modularity and bandwidth in business services

The relocation of business activities to offshore locations implies a value chain reconfiguration involving offshoring activities that are currently performed domestically. Vertical and horizontal disintegration require modular products and systems, i.e. the possibility of partitioning a product or a system into discrete and self-contained modules. Partitioning an activity is strictly related to the ability of the firm to fragment, "mix and match", and recompose the knowledge that is needed for that activity, without losing critical information (Brusoni and Prencipe, 2001). In other words, modularization requires the knowledge boundaries of the firms to stretch beyond their production boundaries. In fact, even if an activity is sliced into smaller components, each being associated to specialized knowledge, the firm must be able to act as a system integrator by orchestrating the network of modules, recomposing the knowledge modules and guaranteeing the overall consistency of the product/service (Brusoni, Prencipe and Pavitt, 2001; Brusoni and Prencipe, 2001, Cantwell and Santangelo, 2000). Individual components can require a high degree of interconnectivity across a number of people, sectors, technologies and products (Granstrand, Patel and Pavitt, 1997). When a high degree of interdependence exists between individual modules, they require high "bandwidth" connections, i.e. regular, efficient and intensive knowledge flows especially through systematic face-to-face meetings among scientists, engineers and managers in different units (Narula, 2014). Therefore, the effects of modularity depend also on the extent to which the single modules are interdependent and co-specialized, i.e. the extent to which they require bandwidth.

This is especially true for business services, which display certain idiosyncratic characteristics that affect the dynamics of modularization. While the modularity of manufacturing activities has been largely analyzed within the industrial management literature (e.g., Langlois and Robertson, 1992; Baldwin and Clark, 1997, 2000 and 2006; Langlois, 2002), the discussion about the modularity of business services is

more recent. The simultaneity between production and consumption in business services requires continuous interfacing between people to share information (Voss and Hsuan, 2009; Bask, Lipponen, Rajahonka and Tinnilä, 2010; Ashok et al 2014). In particular, knowledge-intensive business services requires firms to act as knowledge brokers who interact with and transform knowledge of their clients, and other knowledge holders (Tether and Tajar, 2008). This implies the need for greater bandwidth as a symbiotic relationship with clients is required (Den Hertog 2000). The bandwidth of the interconnections between various actors is especially important when activities are more intangible and characterized by a higher degree of tacitness (Narula 2014). In other words, modules of business services activities are likely to require larger bandwidth than modules of goods manufacturing activities. Therefore, dealing with modularity of business services is not only about the possibility of splitting an activity into smaller modules, but also about the consequences of doing so.

There are therefore two distinct dimensions of modularization. Several categorizations have been proposed in the literature to account for these two dimensions of modularity. Sanchez (1999) distinguishes between the way in which a product or process is decomposed into individual functional components and the ways in which these functional components interact to provide overall functionalities of the system. Brusoni, Prencipe and Pavitt (2001) define a *modular innovation* as "a change in the core design concept of a component that does not affect its relationship with the others" and an *architectural innovation* as "a change in the relationships between a product's components that leaves untouched the core design concepts of components". Jacobides (2008) describes how the international expansion of the firms is affected by the interplay between capability modularity and institutional modularity of each industry, the former being associated to the number of parts composing the value chain structure and the latter to the absence of co-specialization among these parts, which typically depends on historical and institutional reasons. Finally, Brusoni and Prencipe (2001) distinguish between *product modularity* and *organizational modularization*, while MacDuffie (2013) discriminates *modularity-as-property* from *modularization-as-process*: in both studies, the former concept identifies the possibility to frame a product, organization or network in different discrete modules, while the latter refers to the level of interdependences across and between these modules.

In this paper, we argue that modularity may affect entry mode choice, and, in order to analyze how and to what extent this is the case, we refine existing literature and distinguish between two concepts, i.e. *functional modularity* and *architectural modularity*. We refer to functional modularity as the extent to which a business function can be decomposed into smaller modules, while architectural modularity is the extent to which the individual modules within an activity are independent, thus ensuring higher organizational flexibility. To provide an example, the functional modularity of the logistics service of a company refers to the extent to which it is possible to separate this function into smaller and separate tasks or sub-functions, such as: warehousing for raw materials, components or final products,

transportation between manufacturing operations, services for final assembly of the products, final delivery operations and after-sales services (Bask et al., 2010). Architectural modularity refers to the interconnectivity between these modules. An integrated warehousing system will need to coordinate simultaneously its operations with the services performed by the sub-functions that are in charge of transportation between manufacturing (to supply raw materials), final assembly (to supply intermediate components) and final delivery operations and after-sales services (to supply final products). In this case, the logistic service can rely on a high functional but on a low architectural modularity, due to the high interdependences among the sub-functions.

2.2 Entry mode and modularity: hypotheses development

Both types of modularity can affect the extent to which outsourcing and intermediate solutions can be selected instead of captive solutions, by interacting with the underlying mechanisms that drive the selection of the entry mode. In the following paragraphs, we develop hypotheses on the effect of functional and architectural modularity on entry mode choice.

2.2.1 Functional modularity and entry mode

Manufacturing industries can take advantage of modular design by exploiting common and standardized platforms that allow sharing components, thus increasing the opportunity, and decreasing the costs, of using market transaction to acquire inputs (McDermott, Mudambi and Ronaldo, 2013). Functional modularity can also benefit business services by decreasing the complexity arising from the continuous shift of worldwide knowledge and innovation frontier. Indeed, modularization provides firms with the opportunity to gain higher organizational flexibility, to learn more quickly and to adapt more rapidly to market and technology changes, thus reducing the costs, and increasing the effectiveness, of transferring knowledge across boundaries (Kotabe, Parente and Murray, 2007). Splitting business functions into smaller modules also reduces the exposure of proprietary knowledge to third parties, thus enabling value chain orchestrators to face lower transaction costs during the negotiating and monitoring phases, which in turns translates into a lower need for internalization.

Disintegrating the value chain can lead to higher efficiency in resource allocation, since it enables firms to shift some modules to new product developments and better exploit economies of scales (Baldwin and Clark, 2000). Furthermore, functional modularity improves strategic and operational flexibility. As a consequence, modularization increases firms' opportunities to interact with external suppliers for specific support functions and processes involving design, engineering, research and development, analytical processes, data processing, etc. These opportunities enable the buyer and the supplier to exchange knowledge and expertise and to leverage each other's capabilities, which in turns increases a

firm's efficiency and innovation (Baldwin and Clark, 1997 and 2000; Langlois and Robertson, 1992; Parente, Baack and Hahn, 2011).

Internalization theory and transaction cost economics (TCE) suggest that the selection of a captive entry mode allows to reduce negotiating and monitoring raising costs due to uncertainty and opportunistic behaviors, and to minimize knowledge leakages risks (Williamson, 1975; Buckley and Casson, 1976; Rugman, 1980). The Resource Based View (RBV) places more emphasis on the value rather than on the costs associated to the transfer of core competences, stating that firms aiming at exploiting their competitive advantage should adopt a captive entry mode in order to benefit from a more effective transfer of their core competences. Conversely, dynamic and organizational capabilities theories (Teece, Pisano and Shuen, 1997; Madhok, 1997) suggest that less hierarchical entry modes (e.g. strategic alliances or outsourcing) enable firms to source knowledge from other companies, to expand their core competences and to fulfill exploration strategies.

Functional modularity allow firms to: (i) reduce transaction costs, as suggested by internalization theory and TCE, because the need for captive governance mode is lower; (ii) increase the effectiveness of knowledge transfer within the company, as suggested by the RBV, because there is a lower need for a captive governance mode; and (iii) increase the effectiveness of knowledge sourcing from external companies, as suggested by dynamic and organizational capability theories, because firms are more willing to opt for less hierarchical governance modes. These arguments bring us to formulate our first hypothesis:

> Hypothesis 1: Functional modularity decreases the probability that a firm opts for a hierarchical entry mode when offshoring a business service.

2.2.2 Architectural modularity and entry mode

When modules are highly interdependent, i.e. when architectural modularity is low and the bandwidth required is high, considerable coordination efforts are required to reintegrate and bring processes and activities back together into a system. Furthermore, when architectural modularity is relatively low, negotiation and monitoring costs are more substantial, because firms need to set up and enforce contracts that guarantee the functioning of the modularized activity and the effectiveness of the reintegration process (Brusoni, Prencipe and Pavitt, 2001). Due to these interdependencies, firms typically face higher complexity and encounter the "hidden costs" of outsourcing offshoring. The latter arise not only from increased control and coordination efforts and the increased risk of undermining core competencies (Dibbern, Winkler and Heinz, 2008; Reitzig and Wagner, 2010; Larsen, Manning and Pedersen, 2013). This translates into larger transaction costs and higher risk of knowledge leakages, i.e. into an increasing need for internalization, as suggested by internalization theory and TCE.

Moreover, when the competitive advantage of a firm is dependent on (or even resides in) the way in which the firm organizes the interfaces between the different components of its internal value chain, it is more difficult to recreate the same structure and bandwidth with external firms (Jacobides, 2008). Therefore, companies that aim at exploiting this advantage should probably opt for a more hierarchical entry mode, as suggested by the RBV.

When firms are involved in new product development and need to tap into new knowledge, high modularization will neither eliminate the need for high coordination among the modules nor ease inter-firm coordination (Cabigiosu, Zirpoli and Camuffo, 2013). This has been called the "paradox of modularity", since one of the benefits of modularization is to economize on component-specific knowledge, but this benefit cannot be achieved when components are strongly interdependent (Cabigiosu, Zirpoli and Camuffo, 2013). New product development requires firms to bring together knowledge that is fragmented across modules, thus making an external sourcing strategy more complex and less effective. Conversely, when architectural modularity is high firms can reintegrate and learn from each module more easily, thus increasing the effectiveness of strategies implemented through less hierarchical entry modes, as suggested by dynamic and organizational capability theories.

To summarize, high interdependence among modules is likely to offset the benefits of functional modularity. Indeed, despite the presence of modules, a low architectural modularity is likely to translate into high transaction costs and knowledge leakages risks, thus reintroducing the need for internalization. At the same time, low architectural modularity is likely to make the transfer of a competitive advantage, as well as the implementation of a knowledge sourcing strategy, less effective when adopting less hierarchical entry modes, due to the need to recreate the interdependencies among the modules and to recombine the dispersed and interconnected knowledge. Thus, our next hypothesis is the following:

> Hypothesis 2: Architectural modularity decreases the probability that a firm opts for a hierarchical entry mode when offshoring a business service.

The benefits associated to functional and architectural modularity are likely to be particularly relevant in high-tech and knowledge intensive industries, where firms base their competitive advantage on complex and tacit knowledge (Cantwell & Santangelo, 2000). Firms' offshoring business services in these industries are likely to face higher transaction costs and risks than firms offshoring business services in low-tech and less knowledge-intensive industries, whose competitive advantage is less based on technical and tacit knowledge and more oriented toward codified and standardized knowledge. Therefore, the possibility to split a business function into smaller modules that do not require large bandwidth will be more effective for firms operating in high-tech and knowledge-

intensive industries, because they are more sensitive to the costs and risks associated to transferring knowledge.

In addition, technological learning and continuous innovation are key determinants in creating and sustaining a competitive advantage in high tech and knowledge intensive industries (Cloodt, Hagedoorn and Van Kranenburg, 2006). This means that firms operating in these industries need to source external knowledge more frequently and more intensively than low-tech firms, thus making the less hierarchical entry mode an appealing strategy. Functional and architectural modularity provide such firms with the opportunity to foster innovation activity through the combination of internal and external knowledge, by enabling firms to select less hierarchical entry-modes without encountering high transaction costs and high risks of losing core competences. In other words, functional and architectural modularity allow firms to fully exploit the benefits arising from multiple embeddedness (Meyer, Mudambi, & Narula, 2011), which is particularly crucial for firms in high-tech and knowledge intensive industries. Therefore, we postulate the following hypothesis:

> Hypothesis 3: When offshoring a business service, the negative correlation between (functional and architectural) modularity and the probability that a firm opts for a hierarchical entry modes is stronger in high-tech and knowledge intensive industries (than in low-tech and less-knowledge intensive industries).

2.2.3 The role of experience.

As discussed, the costs of reintegration are greater when architectural modularity is low, since strong interdependencies among the modules require a larger bandwidth. However, this is not as obvious to firms who may be focused on fragmentation and fine-slicing as a cost-minimization strategy, because it will not be clear *a priori* what a 'high' or 'low' degree of architectural modularity implies in terms of reintegration efforts, and therefore costs of maintaining sufficient bandwidth. . Firms without offshoring experience tend to focus on the characteristics of the specific business service being offshored, while underestimating the potential difficulties associated with low architectural modularity. Firms new to offshoring will only consider functional modularity since they are not aware of the other "hidden costs" of offshoring (Larsen, Manning and Pedersen, 2013) due to their inexperience. Therefore, they are likely to be even less aware of the intensity of the bandwidth that is required to reintegrate the knowledge into the system when functional modularity favors the selection of less hierarchical entry modes.

Conversely, experienced firms are expected to learn from previous offshoring initiatives and be better positioned for considering both functional and architectural modularity when making offshoring decisions. Experienced firms will be able to better predict and estimate reintegration costs and the hidden costs associated to offshoring and, in particular, to outsourcing, thus including the extent of

architectural modularity, and its consequences, in the decision making process concerning the entry mode choice. Hence, our fourth hypothesis is:

> Hypothesis 4: The architectural modularity of a business service will decrease the probability of opting for a hierarchical entry mode only when the firm has previous offshoring experience.

3 Data and methodology

3.1 The sample

We test our hypotheses on a sample of 490 offshoring initiatives undertaken worldwide from 1964 to 2009. Data are provided by the Offshoring Research Network (ORN) and derive from a survey project launched in 2004 by the Center for International Business Education and Research (CIBER) of Duke University in the United States and which has been collecting information at the level of the individual offshoring initiatives.[i] Table 1 shows the business functions involved in the offshoring initiatives. Information technology is the function mostly subject to offshoring, accounting for 97 observations (19.8% of the sample), followed by Software Development (85 observations, 17.35% of the sample), Call Center and Customer Contact (69 observations, 14.08% of the sample), Finance and Accounting (56 observations, 11.43% of the sample) and Engineering Services (44 observations, 8.98% of the total).

– Insert table 1 about here –

Table 2 displays the main home countries of the 490 offshoring initiatives. The United States account for 312 initiatives (63.67%), followed by The Netherlands with 88 initiatives (17.96%) and Switzerland with 25 initiatives (5.10 %).

– Insert table 2 about here –

Table 3 shows the host countries of the offshoring initiatives. The main destination is India, which hosts 221 offshoring initiatives (45.10%), followed by China with 48 initiatives (9.8%) and the Philippines with 39 initiatives (7.96%).

– Insert table 3 about here –

[i] The ORN counts 13 partner universities and business schools belonging to the following countries: Australia, Belgium, Brazil, China, Denmark, Germany, France, Italy, Japan, Korea, the Netherlands, the United Kingdom, and Spain.

3.2 The variables

3.2.1 Dependent variable

Our dependent variable, *Entry mode hierarchy,* derives from the question in the ORN survey: "What is the service delivery model currently used for this offshoring implementation?". The possible answers were: Outsourced to an international third party provider offshore; Outsourced to a local third party provider at the offshore location; Partnering/teaming arrangement e.g., joint ventures, strategic alliances, build-operate-transfer; Captive (fully owned subsidiary offshore undertakes the activity). We categorized the answers as *Entry mode hierarchy=0* if companies answered "Outsourced to an international third party provider offshore" or "to a local third party provider at the offshore location"; *Entry mode hierarchy=1* if the companies answered "Partnering/teaming arrangement e.g., joint ventures, strategic alliances, build-operate-transfer", and *Entry mode hierarchy=2* if companies answered "Captive (fully owned subsidiary offshore undertakes the activity)". The categorization of the entry mode choice through a scale variable has been employed in the literature to account for the intensity of the commitment by firms engaging in foreign expansion (see, for instance, Basile, Giunta and Nugent, 2003). In our sample, 197 observations (corresponding to 40.20%) have been classified as captive, 16 observations (corresponding to 3.27%) as cooperative agreements and 277 observations (corresponding to 56.53%) as outsourcing.

3.2.2 Explanatory variables

The two main explanatory variables are those related to modularity. *Functional modularity* is derived from the question in the ORN survey: "Does/did this implementation involve discrete tasks or entire processes?". This is operationalized as a binary variable taking a value of 1 when the company offshores a single module of a business service, and 0 when the company offshores the whole business service. Other papers in the literature have employed a binary variable to account for the modularity of a process (see for instance, Ceci and Masciarelli, 2010).[ii] Following our first hypothesis, we expect a negative correlation between the dependent variable and the proxy of functional modularity. In our sample, 306 observations refer to offshoring initiatives that have been performed for single tasks (i.e. dummy variable =1) and the remaining 184 to offshoring initiatives that have been performed for the entire process (i.e. dummy variable=0). Outsourcing is more frequent than captive when firms offshore a single task (63.4% vs. 33.3% vs., respectively), while the opposite is true when they offshore the entire process (45.1 % vs. 51.6%, respectively). This evidence seems to be supportive of hypothesis no. 1.

[ii] Our binary variable is not able to account for the scale of modularity, since we do not know whether the company is offshoring a single task out of two or several modules. In other words, this proxy is not able to capture the intensity of modularity, but only whether firms are making use of functional modularity or not. However, we believe that this variable is still able to reflect functional modularity, since a positive answer to the ORN question reveals that at least one task can be separated from the rest of the function and that the function can be modularized in at least two sub-tasks.

Architectural modularity is a scale variable whose lower values reflect high interdependence among the modules, while high values indicate that modules are independent. The proxy is computed from the answers to the question in the ORN survey: "What is the importance of each of the following risks in considering offshoring this function?" in relation to the risk of "Loss of synergy across firm activities". Given the original score (ranging from 1 to 5), we reverse code this variable by taking the negative value in order to obtain a proxy that associates a high score (i.e. –1) to low risk of losing synergy across firm activities , and a low score (i.e. –5) to high risk of losing synergy across firm activities. The use of subjective measures to assess the interdependences among modules is not new in the literature (see for instance, Gershenson, Prasad and Allamneni, 1999, who adopt a rating ranging from 1 to 5). More elaborated measures have been developed to account for interdependencies of modular systems in the literature, especially with regard to product modularity (see Gershenson, Prasad and Zhang, 2004 for an extensive review). However, while there is no consensus about the methodology to gauge product modularity yet, research concerning modularization at organizational and knowledge levels (Brusoni and Prencipe, 2001), which apply to the context of business services, is even further from being exhaustive and no specific measures have been developed to account for this phenomenon. Following our second hypothesis, we expect a negative correlation between the dependent variable and the proxy of architectural modularity. The mean value of the variable is slightly higher when considering the observations with outsourcing entry mode than with captive entry mode (–2.50 vs. –2.81, respectively), and the t-test confirms that the two means are significantly different ($p<0.01$), thus providing a first evidence towards our hypothesis no. 2.

A third explanatory variable is *High Tech and Knowledge Intensive Industries*, a binary variable taking value of 1 if the industry of the offshoring company belongs to the categories "Knowledge Intensive Service Industries", "Medium-High Tech Manufacturing Industries" and "High Tech Manufacturing Industries" according to the classification provided by OECD (2007). The variable takes value of 0 if the industry of the offshoring company belongs to the categories "Less Knowledge Intensive Service Industries", "Medium-Low-Tech Manufacturing Industries", "Low-Tech Manufacturing Industries" according to the above-mentioned classification[iii]. In our sample, 349 observations belong to high tech and knowledge

[iii] The OECD (2007) classifies as "Knowledge Intensive Services" the following industries: Water transport, Air transport, Post and telecommunications, Financial intermediation, Insurance and pension funding, Activities auxiliary to financial intermediation, Real estate activities, Renting of machinery and equipment without operator and of personal and household goods, Computer and related activities, Research and development, Other business activities, Education, Health and social work, Recreational, cultural and sporting activities. The "High Tech Manufacturing Industries" are Aerospace, Computers, office machinery, Electronics-communications, Pharmaceuticals, Scientific instruments, while the "Medium-High tech industries" are Motor vehicles, Electrical machinery, Chemicals, Other transport equipment, Non-electrical machinery. The "Less Knowledge Intensive Service Industries" are: Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel, Wholesale trade and commission trade, except of motor vehicles and motorcycles, Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods Hotels and restaurants, Land transport; transport via pipelines, Supporting and auxiliary transport activities; activities of travel agencies, Public administration and defense; compulsory social security, Sewage and refuse disposal,

intensive industries (dummy variable=1) and 141 observations belong to the other industries (dummy variable=0). The percentage of outsourcing is higher in high-tech and knowledge intensive industries (59.0%) than in low-tech and less knowledge intensive industries (50.4%), while the opposite is true as regards the captive entry mode (38.1% and 45.4%, respectively). The hybrid entry modes (e.g., joint ventures and strategic alliances) are more balanced (4.3% and 2.4%, respectively).

A fourth and final explanatory variable is *Offshoring Experience*, a binary variable taking value of 1 when the company undertaking offshoring has at least one previous offshoring activity and zero if the company has no offshoring experience. This variable is computed from the ORN database, controlling, for each observation, whether another offshoring initiative is associated to the same company in a previous year. In our sample, 221 observations display no previous offshoring experience (binary variable=0), while 269 observations display offshoring experience (binary variable=1). Outsourcing is selected more frequently by inexperienced than by experienced firms (63.8% vs. 50.6%, respectively), while the opposite is true as regards the captive entry mode (33.5% vs. 45.7%, respectively).

3.2.3 Control variables

We include some control variables that may affect the entry mode choice. The first variable is *Cultural Distance,* which is computed by applying the Kogut and Singh (1988) index to the items provided by Hofstede (2001). Since cultural distance implies larger uncertainty and higher transaction costs, we expect this variable to increase the probability to adopt a captive entry mode, as suggested by Internalization theory and by TCE.

We control for the knowledge sourcing strategy associated to the business services offshoring phenomenon through the variable *Access to Skilled Labor*, which accounts for the valuable human resources that are sought by the company. The variable derives from the ORN survey and is the score (from 1 to 5) provided to driver "Access to qualified personnel offshore" as one of the possible answers to the question: "What is the importance of each of the following drivers in considering offshoring this function?". Given the arguments provided in the theory section, we expect a negative correlation between this driver and the dependent variable, as reflected by the dynamic and organizational capabilities theory (Madhok, 1997).

Following Brouthers (2002) and Elia et al. (2014), we control for the institutional context of the host country through four variables arising from a factor analysis that has been performed on different items

sanitation and similar activities, Activities of membership organization n.e.c., Other service activities, Private households with employed persons, Extra-territorial organizations and bodies. Finally, the "Low Tech Manufacturing Industries" include: Rubber and plastic products, Shipbuilding, Other manufacturing, Non-ferrous metals, Non-metallic mineral products, Fabricated metal products, Petroleum refining, Ferrous metals; conversely, the "Low-tech manufacturing industries" are: Paper printing, Textile and clothing, Food, beverages, and tobacco, Wood and furniture.

provided by the World Competitiveness Yearbook (WCY) and the Worldwide Governance Indicators (WGI) (see table 4 for details). Using data from additional sources reduces same sample bias (e.g. common method bias) in our models (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).[iv] The four variables are *Host Political Stability*, which accounts for the quality of the political infrastructures of the host country; *Host Market Attractiveness,* which reflects the potential market growth of host countries; *Host Human Resources*, which accounts for the amount of skilled labor available in the host country; *Host Low Labor Cost*,[v] which accounts for low cost of labor in host the countries. We expect that the probability to adopt a not hierarchical, market-oriented entry mode is larger when the availability of low labor cost is high, since in this case companies will take advantage of local service providers to outsource their activity and save on costs. Outsourcing will be more likely also when political stability is low, since a less hierarchical entry mode will limit companies' risk in countries with weak and uncertain institutions, and enable them to quickly disinvest if needed. At the same time, we expect that the probability to adopt a more hierarchical entry mode is larger in case of high market attractiveness and in case of availability of skilled labor, since firms will be able to appropriate the rents arising from higher sales and from valuable resources by gaining full control over their foreign activities. Therefore, we expect a negative correlation between the dependent variable and *Low Labor Cost* and a positive correlation with the other three host countries variables.

– Insert table 4 about here –

We also control for firm size, home country and time of offshoring. We use *Firm Size* to control for the role of firm size on entry mode choice, as large firms, which are normally endowed of more resources compared to smaller firms, will be better positioned to select a captive entry mode, which requires higher resource commitment. The proxy is the natural logarithm of number of employees of the offshoring firm (data provided by the ORN survey). Since most of offshoring initiatives come from the United States, we introduce the dummy variable *Home USA* to control whether US companies may drive the results on entry mode choice. We control for timing by employing a variable named *Offshoring Age,* which is computed as the difference between the year 2011 (the most recent year when the survey has been released) and the year of the offshoring initiative.

Finally, we control for the propensity that some activities may present towards a certain entry mode, as a proxy for transaction costs arising from asset specificity, through 9 specific dummy variables

[iv] As regards the Common Method Bias, it is worth noting that the variables employed in our analysis are located in different parts of the questionnaire and that anonymity has been guaranteed to respondents (Podsakoff et al., 2003). In addition, the Harman's single factor test (Podsakoff et al., 2003) showed that the portion of total variance accounted for by each single factor is very limited, thus suggesting that common method bias is not a serious concern with our dataset.

[v] This variable has been reverse coded, by giving the scores a negative sign, since the original items display high values when labor costs are high. By employing the variable with negative sign, we associate high scores to countries with low cost of labor.

accounting for the 9 different business functions displayed in Table 1, by using Software Development as benchmark. We expect that those strategic business functions that are particularly crucial for the competitive advantage of the firm (such as R&D) are more likely to be subject to captive entry mode choice. This solution, indeed, ensures a more effective transfer of the competitive advantage (as suggested by RBV) as well as the internalization of high transaction costs associated to high asset specificity and the minimization of knowledge leakages (as suggested by internalization theory and by TCE).

Table 5 provides a summary of the variables employed in our analysis together with the proxies and their sources.

– Insert table 5 about here –

3.3 Models and methodology

To test the first two hypotheses, we employ the following equation model:

$$\textit{Entry mode hierarchy}_d = \alpha_d + \beta_1\ \textit{Functional Modularity}_i + \beta_2\ \textit{Architectural Modularity}_i + \beta_3\ \textit{High Tech and Knowledge Intensive Industries}_i + \beta_4\ \textit{Offshoring Experience}_i + \beta_5\ \textit{Controls}_i + \varepsilon_i \quad (1)$$

where *i* identifies the offshoring initiative and ε_i the error term. To test hypothesis 3, we create two subsamples, the first one accounting for firms operating in high-tech and knowledge intensive industries (when *High Tech and Knowledge Intensive Industries* is equal to 1) and the other for firms operating in the other industries (when *High Tech and Knowledge Intensive Industries* is equal to 0). We estimate the following equation model on each subsample:

$$\textit{Entry mode hierarchy}_d = \alpha_d + \beta_1\ \textit{Functional Modularity}_i + \beta_2\ \textit{Architectural Modularity}_i + \beta_3\ \textit{Offshoring Experience}_i + \beta_4\ \textit{Controls}_i + \varepsilon_i \quad (2)$$

Finally, to test hypothesis 4, we create two subsamples by identifying offshoring initiatives in experienced companies (when the variable *Offshoring Experience* is equal to 1) and offshoring initiatives in companies with no prior experience (when the variable Offshoring Experience is equal to 0). We estimate the following equation model on each subsample:

$$\textit{Entry mode hierarchy}_d = \alpha_d + \beta_1\ \textit{Functional Modularity}_i + \beta_2\ \textit{Architectural Modularity}_i + \beta_3\ \textit{High Tech and Knowledge Intensive Industries}_i + \beta_4\ \textit{Controls}_i + \varepsilon_i \quad (3)$$

Given the nature of our dependent variable, which quantifies hierarchical intensity from 0 (the lower value, corresponding to outsourcing) to 2 (the highest value, corresponding to captive), being 1 the

intermediate entry modes, we employed a robust ordered probit model (see Basile, Giunta and Nugent, 2003). Table 6 reports the descriptive statistics and the correlation matrix of the explicative variables employed in the analysis.

– Insert table 6 about here –

4 Results

Table 7 provides the results of our econometric analysis. Column (1) shows the results of the robust Ordered Probit applied to the full model, corresponding to equation 1. Regarding the control variables, Cultural distance displays a strong positive and significant ($p<0.05$) result, meaning that firms are more likely to adopt captive solutions to internalize transaction costs arising from uncertainty associated to cultural differences. As expected, Political stability also increases the probability of adopting a captive governance mode ($p<0.05$). Concerning Offshoring age, the positive and significant coefficient ($p<0.01$) indicates that older offshoring decisions preferred a captive more, whereas more recent offshoring initiatives tend to make more use of external providers.. Finally, the asset-specificity associated to some of the most strategic business services, i.e. Engineering Services ($p<0.10$), Finance and Accounting and R&D ($p<0.05$), increases the probability to adopt a captive governance mode, since these functions are often responsible for the main competitive advantage of the firm and entail larger transaction costs and risks of knowledge leakages.

Moving to our key explanatory variables, both Functional and Architectural Modularity display a negative and significant effect on the dependent variable (respectively with $p<0.001$ and $p<0.05$), thus supporting hypotheses 1 and 2. Marginal effects (available upon request) confirm that captive entry modes are less likely when functional and architectural modularity are present. The opposite is true when considering outsourcing initiatives. Interestingly, also hybrid entry modes seem to be negatively affected by functional and architectural modularity, even if the marginal effects are extremely low in this case.

As expected, *High Tech Manufacturing Industries* displays a negative sign as expected, however it is not significant. Conversely, *Offshoring experience* displays a positive and significant effect ($p<0.01$), suggesting that experienced firms tend to prefer captive entry modes to outsourcing. Outsourcing is probably used by inexperienced firms as a first step to invest in a foreign country, consistently with the stage strategy suggested by the Uppsala model (Johanson & Vahlne, 1977 and 2009). This may also be due to the fact that more inexperienced firms are offshoring in more recent years, when more service providers have started operations in low cost countries, which makes it easier to select this entry mode than in the past (e.g., Manning et al., 2012).

Columns (2) and (3) show the results of equation model 2 estimated on the two subsamples of companies in high-tech and knowledge intensive industries and those in other industries. Functional modularity and architectural modularity are significant ($p<0.001$ and $p<0.05$, respectively) only in the subsample of high-tech and knowledge-intensive industries, thus supporting hypothesis 3.

Finally, columns (4) and (5) report the results of model 3 estimated in the two subsamples of experienced and inexperienced firms. While the variable Functional Modularity is significant in both subsamples ($p<0.05$ and $p<0.001$ respectively), Architectural Modularity is significant only for experienced firms ($p<0.05$), thus supporting hypothesis 4.

– Insert table 7 about here –

5 Robustness checks

We performed some robustness checks in order to improve the reliability of our results. First of all, we investigated to what extent functional and architectural modularity can be conceived as two related or unrelated concepts. Indeed, in our theoretical framework, we mainly discussed functional and architectural modularity as two related concepts pertaining a single business service, the former denoting the possibility to disintegrate a business services into smaller modules, and the latter denoting the interdependence among modules within the business service. Nevertheless, the concepts of functional and architectural modularity might apply also to a higher organizational level, and refer to the relationships among business functions (each being conceived as a single module) and the degree of interdependence among the business functions. Our proxy for functional modularity considers single business service, utilizing the question in the ORN survey related to whether a single task or the entire process has been offshored. Conversely, the proxy for architectural modularity could be applied also to the interdependences among business services, as the question enquires about synergies among activities, which might be within a business service by companies offshoring a single task, or among multiple business services by companies offshoring the entire process. Consequently, it might be argued that our analysis could refer to different levels of analysis and that the two constructs of modularity are unrelated. To better understand to what extent our proxies of functional and architectural modularity are related, we performed a regression which distinguishes between two subsamples, one where *Functional Modularity*=1 (i.e., the firm is offshoring discrete tasks) and the other having *Functional Modularity*=0 (i.e., the firm is offshoring entire processes). Table 8 shows that *Architectural Modularity* displays a negative and significant ($p<0.05$) effect on the probability to adopt a hierarchical entry mode only when functional modularity is present. This suggests that, although the proxy employed for architectural modularity might apply also to a higher level of analysis (i.e. to the interdependence among business functions within the organization), this construct is more strictly and

significantly related to those offshoring initiatives where functional modularity holds. In other words, the interrelatedness between the two concepts of functional and architectural modularity developed in the theoretical framework, and their role on entry mode choices, is also found in our empirical analysis. In addition, these results also show that our proxy for architectural modularity, although not perfect, is somehow able to reflect the degree of interdependences among modules (and its effect on the entry mode choice) when a business service in sliced into smaller tasks.

Finally, since hybrid models include both equity (i.e. joint-ventures) and non-equity (i.e. strategic alliances) agreements, being the former closer to a captive entry mode and the latter to outsourcing, the results of the ordered probit model might be biased by the presence of a not well defined intermediate group (although it represents a small percentage of the total observations). Therefore, we performed three alternative probit models: the first one considering only captive and outsourcing entry modes (corresponding to 474 observations), the second one including the hybrid entry modes in the captive observations (i.e. assuming that they are all joint ventures) and the third one including the hybrid entry modes in the outsourcing observations (i.e. assuming that they are all alliances). Results, which are available upon request, confirm that both functional and architectural modularity decrease the probability of adopting a captive entry mode in all the three probit models. In addition, hypotheses 3 and 4 are fully confirmed.

6 Discussion and conclusions

A growing number of firms have started offshoring of business services and functions in the recent years. When they make a decision to offshore, they are facing a trade-off between the need to protect their existing internal knowledge and the need to source new knowledge. Entry mode theories provide contrasting solutions to this challenge, suggesting a hierarchical model for the purpose of protecting the knowledge (and ensuring a better cross border knowledge transfer) and a market solution for the purpose of sourcing new knowledge. Functional and architectural modularity provide a novel dimension which adds a nuance to the possible solution to this trade-off, since, when they are present, they simultaneously decrease the need for internalization and increase the effectiveness of the knowledge sourcing strategy, thus pushing firms to adopt less hierarchical entry modes.

Our study contributes to the debate on entry mode choice in several ways. First, we develop our conceptual framework integrating TCE and internalization theory, as well as RBV and dynamic capability approaches, which provide complementary and deeply intertwined contributions to the study of the entry mode choice (Narula and Hagedoorn 1998, Argyres and Zenger, 2012; Argyres et al., 2012). Second, we combine these traditional theories with the notion of value chain configuration, thus bridging the industrial and operation management literatures with the international business

approach, and explicitly introduce the role of modularity in the analysis of the entry mode choice. Third, we elaborate on the notion of modularity distinguishing between functional and architectural dimensions and by doing so we disentangle the role of modularity on entry mode choices. Specifically, we shift the attention from the relationship between inter-firm interdependencies and entry mode choices to the relationship between intra-firm interdependencies and entry mode choices, considering a more comprehensive set of business functions.

In addition, our results support the recommendation by Shaver (2013) and Hennart and Slangen (2014) that entry mode studies should consider the interdependences of the value chain. Our analysis also confirms the main insights concerning the "paradox" of modularity, which arises when the disintegration of a business function into smaller modules does not produce the expected results. We show that this happens when architectural modularity is low, and that the firms has need for a larger bandwidth (Narula, 2104), in order to benefit from functional modularity. Moreover, we also show how the determinants of the entry mode choice are contingent upon the industry considered, since modularity plays a more central role in high-tech and knowledge-intensive industries. Such firms have a stronger need to reduce the transaction costs and the risk of knowledge leakages when collaborating with external partners. Finally, we show that firm-level variables affect the determinants of entry mode choice. We find that experienced firms take into account the architectural modularity in their entry mode choice, while inexperienced firms neglect this dimension of modularity, implying that they may not be fully aware of reintegration costs that arise when modularization requires a large bandwidth.

Our results have some managerial implications. Functional and architectural modularization of business services can be used as a strategy to reduce transaction costs and, above all, the risk of losing core knowledge for offshoring firms, especially when they aim at increasing their innovation capacity through external collaborations. In other words, functional and architectural modularity can be employed as a valid alternative to internalization, thus enabling firms offshoring business services to select a less hierarchical entry mode even when traditional theories would suggest to adopt a captive solution (especially in high tech and knowledge intensive industries) (for a discussion, see Ramsay et al 2001, Narula 2001b). Our results should also alert inexperienced firms to the consequences of neglecting the role of architectural modularity, which is likely to be responsible for the failure of offshoring initiatives due to underestimating hidden costs of offshoring (Larsen, Manning and Pedersen, 2013).

Future studies might develop a scale measure to account for functional modularity, in order to refine our analysis and investigate more accurately whether and to what extent the disintegration of business activities into smaller tasks and modules – and the number of modules –may affect the entry mode choice. A deeper investigation concerning the relationship between functional and architectural modularity – whether at single function or organizational level – might provide further insights on the

selection of entry mode choices when offshoring business services. Also the industrial and firm-level dimensions of firms in entry mode decisions could be better disentangled, for example, by adopting a more refined categorization of industries and experience. Finally, future studies should try to investigate at greater depth intermediate entry mode choices such as equity and non-equity collaborations. Entry mode choice can, indeed, be interpreted as a decision of whether to collaborate with external firms and to what extent (Narula and Martínez-Noya, 2015). Future studies should try to understand how functional and architectural modularity interplay with this specific choice by focusing on the different types of intermediate collaborations.

Tables

Table 1: Business functions involved in the offshoring initiatives.

Business Function	Freq.	%
Software Development	85	17.35
Call center and customer contact	69	14.08
Design	17	3.47
Engineering services	44	8.98
Finance and accounting	56	11.43
Human resources	12	2.45
Information technology	97	19.8
Knowledge services	32	6.53
Legal services	3	0.61
Marketing and sales	27	5.51
Procurement	27	5.51
Research and development	13	2.65
Other*	8	1.63
Total	**490**	**100**

* A small number of respondents have not been able to find a match between the offshored function and the ones proposed in the questionnaire

Table 2: Home countries of the offshoring initiatives.

Home countries	Freq.	%
Australia	7	1.43
Austria	1	0.2
Denmark	10	2.04
France	6	1.22
India	1	0.20
Ireland	1	0.20
Japan	1	0.20
Luxembourg	1	0.20
Netherlands	88	17.96
Norway	4	0.82
Spain	14	2.86
Switzerland	25	5.10
United Kingdom	19	3.88
United States	312	63.67
Total	**490**	**100**

Table 3: Host countries of the offshoring initiatives.

Host countries	Freq.	Percent
India	221	45.1
China	48	9.8
Philippines	39	7.96
Brazil	12	2.45
Mexico	12	2.45
Singapore	12	2.45
Canada	11	2.24
Czech Republic	9	1.84
Argentina	8	1.63
Costa Rica	8	1.63
Malaysia	8	1.63
Romania	8	1.63
Russia	8	1.63
Poland	7	1.43
Germany	6	1.22
Hungary	6	1.22
United States	6	1.22
Indonesia	5	1.02
Sweden	5	1.02
United Kingdom	5	1.02
Italy	4	0.82
South Africa	4	0.82
France	3	0.61
Norway	3	0.61
Slovakia	3	0.61
Australia	2	0.41
Denmark	2	0.41
El Salvador	2	0.41
Finland	2	0.41
Japan	2	0.41
Luxembourg	2	0.41
Pakistan	2	0.41
Vietnam	2	0.41
Other countries*	13	2.6
Total	490	100

*Other countries include: Colombia, Ecuador, Estonia, Ireland, Jamaica, The Netherlands, Peru, Portugal, South Korea, Taiwan, Thailand, Turkey and Uruguay, each hosting only one initiative.

Table 4: Factor analysis for the host country variables

First order construct	Items	Source	Description	Scale	Loading	Alpha
Market Attractiveness	Gross Domestic Product	WCY	Gross Domestic Product	US$ billions	0.9864	**0.7939**
	Gross Fixed Capital Formation	WCY	Inward Foreign direct investments	US$ billions	0.9519	
	Direct Investment Inflows Inward	WCY	Direct Investment Inflows Inward	US$ billions	0.8724	
	Government Consumption Expenditure	WCY	Government Consumption Expenditure	US$ billions	0.9726	
	Household Consumption Expenditure	WCY	Household Consumption Expenditure	US$ billions	0.9698	
Political Stability	Political Stability and Absence of Violence/Terrorism	WGI	Perception of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.	–2.5/2.5	0.8783	**0.9696**
	Government Effectiveness	WGI	Perception of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	–2.5/2.5	0.8556	
	Regulatory Quality	WGI	Perception of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	–2.5/2.5	0.9011	
	Rule of Law	WGI	Perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	–2.5/2.5	0.8859	
	Control of Corruption	WGI	Perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	–2.5/2.5	0.8544	
Location Costs	Remuneration Call Center Agent	WCY	Gross annual income including supplements such as bonuses – Call Center Agents	US$	0.7480	**0.7849**
	Remuneration Manufacturing Worker	WCY	Total hourly compensation for manufacturing workers (wages + supplementary benefits)	US$	0.7606	
	Remuneration Department Head	WCY	Gross annual income including supplements such as bonuses – Department Head	US$	0.7254	
	Remuneration Personal Assistant	WCY	Gross annual income including supplements such as bonuses – Personal Assistant	US$	0.7622	
High Value-Added Resources	Information Technology Skills	WCY	The extent to which the country can rely on information technology skills	0/10	0.8036	**0.9237**
	Qualified Engineers	WCY	The extent to which qualified engineers are available in labor market	0/10	0.9310	
	Skilled Labor	WCY	The extent to which skilled labor is readily available in labor market	0/10	0.9000	

Note: The factor analysis has been performed on 60 countries. The items have been included in the factor analysis as the average value of the period 2004–2011. Higher values reflect better outcomes for all items. WCY stands for World Competitiveness Yearbook (WCY), published by the International Institute for Management Development (IMD) of Lausanne (http://www.imd.org/wcc/), while WGI stands for Worldwide Governance Indicators (WGI), published by the World Bank (http://info.worldbank.org/governance/wgi/index.asp).

Table 5: Summary of the variables, proxies and sources employed in our analysis.

Variable	Proxy	Source
Entry mode hierarchy	Variable ranging from 0 (Outsourcing) to 2 (Captive), being 1 cooperative agreements (e.g. joint ventures and alliances)	ORN Survey – answer to the question: "What is the service delivery model currently used for this offshoring implementation?"
Functional Modularity	Dummy variable taking value of 1 when the company offshores only a module of a business service, and 0 when the company offshores the whole business service	ORN Survey – answer to the question: "Does/did this implementation involve discrete tasks or entire processes?"
Architectural Modularity	Variable ranging from –5 to –1, where the lower values (–5) reflect a high interdependence among the modules, while high values (–1) mean that modules are independent	ORN Survey- Scores provided on a Likert scale to the risk "Loss of synergy across firm activities" in answering the question: "What is the importance of each of the following risks in considering offshoring this function?" (The proxy has been computed by taking the negative values of the scores)
High Tech and Knowledge Intensive Industries	Dummy variable taking value of 1 if the industry of the offshoring company belongs to the categories "Knowledge Intensive Service Industries", "Medium-High Tech Manufacturing Industries" or "High Tech Manufacturing Industries", and 0 if it belongs to the categories "Less Knowledge Intensive Service Industries", "Medium-Low-Tech Manufacturing Industries", and "Low-Tech Manufacturing Industries"	OECD (2007).
Offshoring Experience	Dummy variable taking value of 1 when the company undertaking offshoring has at least one previous offshoring experience, and zero if the company is inexperienced	ORN Survey – our elaboration obtained by identifying companies with previous offshoring experiences in relation to the focal initiative.
Cultural Distance	Kogut and Singh (1988) index	Hofstede (2001)
Firm Size	Number of employees owned by the offshoring company	ORN survey
Access to Skilled Labor	Variable on a Likert scale (ranging from 1 to 5)	ORN survey – score provided to the driver "Access to qualified personnel offshore" as one of the possible answers to the question: "What is the importance of each of the following drivers in considering offshoring this function?"
Host Political Stability	Score from a factor analysis	Worldwide Governance Indicators (see table 4 for details)
Host Market Attractiveness	Score from a factor analysis	World Competitiveness Yearbook (see table 4 for details)
Host Human Resources	Score from a factor analysis	World Competitiveness Yearbook (see table 4 for details)
Host Low Labor Cost	Score from a factor analysis	World Competitiveness Yearbook (see table 4 for details)
Home USA	Dummy taking value of 1 if the offshoring firm is from The United States	ORN Survey– our elaboration
Offshoring Age	Difference between the year 2011 (year the survey has been released) and the year of the offshoring initiative	ORN Survey – our elaboration
Function Dummies	A dummy for each offshored function	ORN Survey – our elaboration

Table 6: Correlation matrix and descriptive statistics of the dependent and explicative variables

Variable	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)
1) *Hierarchical Intensity*	1.000													
2) *Functional Modularity*	–0.183	1.000												
3) *Architectural Modularity*	–0.131	–0.067	1.000											
4) *High Tech Manufacturing Industries*	–0.075	–0.111	–0.064	1.000										
5) *Offshoring Experience*	0.131	–0.034	–0.047	–0.169	1.000									
6) *Cultural Distance*	0.059	–0.018	0.073	–0.218	0.068	1.000								
7) *Firm Size*	–0.025	–0.074	–0.118	–0.124	0.116	–0.003	1.000							
8) *Access to Skilled Labor*	–0.057	0.027	–0.129	0.254	–0.135	–0.084	–0.036	1.000						
9) *Host Political Stability*	0.168	–0.081	–0.177	–0.017	0.058	–0.269	–0.100	–0.010	1.000					
10) *Market Attractiveness*	–0.040	0.069	0.048	0.110	–0.048	–0.159	–0.049	0.099	–0.270	1.000				
11) *Host Human Resources*	–0.113	–0.009	–0.030	0.141	–0.097	–0.250	0.297	–0.011	0.068	0.051	1.000			
12) *Host Low Labor Cost*	0.043	0.011	–0.058	–0.084	0.073	–0.129	0.011	0.051	0.230	0.077	–0.012	1.000		
13) *Home USA*	–0.118	0.063	–0.019	0.270	0.117	–0.189	0.169	0.134	–0.042	0.137	0.224	–0.073	1.000	
14) *Offshoring Age*	0.179	–0.015	–0.003	–0.252	–0.123	–0.043	–0.006	–0.035	0.257	–0.058	–0.048	0.145	–0.213	1.000
Observations	490	490	490	490	490	490	490	490	490	490	490	490	490	490
Mean	0.837	0.624	–2.647	0.712	0.549	2.175	8.616	3.627	23.816	40.692	44.222	26.251	0.637	7.435
Std. Dev.	0.971	0.485	1.142	0.453	0.498	1.096	2.759	1.320	11.549	14.608	16.594	10.493	0.481	4.936
Min	0.000	0.000	–5.000	0.000	0.000	0.020	0.693	1.000	4.000	4.000	3.000	2.000	0.000	2.000
Max	2.000	1.000	–1.000	1.000	1.000	5.933	12.766	5.000	56.000	58.000	57.000	57.000	1.000	47.000

Table 7: Results of the robust ordered probit models.

Variables	Model 1	Model 2		Model 3	
	Full model (1)	High-Tech (2)	Low-Tech (3)	With experience (4)	Without Experience (5)
Functional Modularity	–0.508***	–0.698***	–0.143	–0.413*	–0.698***
	(–3.92)	(–4.28)	(–0.55)	(–2.24)	(–3.49)
Architectural Modularity	–0.139*	–0.155*	–0.083	–0.188*	–0.103
	(–2.50)	(–2.37)	(–0.59)	(–2.39)	(–1.23)
High Tech Manufacturing Industries	0.043			0.243	0.017
	(0.28)			(1.11)	(0.07)
Offshoring Experience	0.359**	0.337*	0.222		
	(2.72)	(2.07)	(0.79)		
Cultural Distance	0.115*	0.066	0.269*	0.163*	0.053
	(2.03)	(0.98)	(2.03)	(2.27)	(0.50)
Firm size	–0.009	0.005	–0.112	–0.010	–0.003
	(–0.36)	(0.17)	(–1.42)	(–0.25)	(–0.09)
Access to Skilled Labor	–0.022	–0.013	0.083	–0.064	–0.048
	(–0.44)	(–0.19)	(0.68)	(–0.87)	(–0.57)
Host Political Stability	0.014*	0.009	0.032*	0.012	0.012
	(2.42)	(1.38)	(2.07)	(1.52)	(1.08)
Host Market Attractiveness	0.005	–0.004	0.015	–0.000	0.010
	(1.00)	(–0.78)	(1.45)	(–0.01)	(1.34)
Host Human Resources	–0.006	–0.001	–0.009	–0.005	–0.005
	(–1.41)	(–0.12)	(–1.18)	(–0.82)	(–0.66)
Host Low Labor Cost	–0.002	–0.004	–0.007	–0.000	–0.008
	(–0.33)	(–0.57)	(–0.56)	(–0.03)	(–0.71)
Home USA	–0.164	–0.048	0.082	–0.238	–0.093
	(–1.14)	(–0.28)	(0.20)	(–1.08)	(–0.43)
Offshoring Age	0.050**	0.034†	0.046†	0.061†	0.041**
	(3.18)	(1.81)	(1.77)	(1.74)	(2.61)
Call center and customer contact	–0.127	–0.426	0.309	–0.224	–0.098
	(–0.54)	(–1.48)	(0.56)	(–0.67)	(–0.28)
Design	–0.108	–0.144	–0.109	–0.185	–0.011
	(–0.31)	(–0.28)	(–0.16)	(–0.41)	(–0.02)
Engineering services	0.453†	0.312	0.654	0.617†	0.243
	(1.96)	(1.10)	(1.28)	(1.68)	(0.77)
Finance and accounting	0.536*	0.679*	–0.364	0.277	0.850*
	(2.22)	(2.48)	(–0.59)	(0.76)	(2.47)
Human resources	0.649	0.789	–4.456***	0.271	1.020†
	(1.47)	(1.53)	(–6.75)	(0.42)	(1.77)
Information technology	0.096	0.174	–0.164	0.131	–0.029
	(0.47)	(0.77)	(–0.34)	(0.39)	(–0.10)
Knowledge services	0.178	0.058	0.256	–0.022	0.374
	(0.61)	(0.18)	(0.29)	(–0.05)	(0.84)
Legal services	–0.033	–0.168	.	0.313	–4.203***
	(–0.05)	(–0.26)	.	(0.36)	(–9.52)
Marketing and sales	0.413	–0.044	0.951	0.336	0.331
	(1.39)	(–0.10)	(1.55)	(0.85)	(0.57)
Other	–0.045	–5.098***	1.030	–4.990***	0.628
	(–0.09)	(–16.40)	(1.37)	(–13.15)	(0.98)
Procurement	0.180	1.562*	–0.051	–0.077	0.629
	(0.51)	(2.48)	(–0.08)	(–0.16)	(0.95)
Research and development	0.910*	0.795†	6.013***	1.055	0.818
	(1.99)	(1.65)	(12.67)	(1.39)	(1.40)
No. of observations	490	349	141	269	221
Chi-Square	76.272***	1010.040***	1944.820***	1067.603***	381.079***
Pseudo R-Square	0.113	0.142	0.257	0.118	0.138

Please note: † if $p < 0.10$, * if $p < 0.05$; ** if $p < 0.01$; *** if $p < 0.001$. Z-statistics between brackets

Appendix

Table 8: Results of the robust ordered probit models applied to the subsamples derived from functional modularity.

Variables	With Functional Modularity	Without Functional Modularity
Architectural Modularity	–0.194* (–2.43)	–0.056 (–0.59)
High Tech Manufacturing Industries	0.001 (0.00)	0.371 (1.44)
Offshoring Experience	0.408* (2.23)	0.460* (2.07)
Cultural Distance	0.173* (2.15)	0.035 (0.39)
Firm size	0.016 (0.47)	–0.053 (–1.08)
Access to Skilled Labor	–0.124† (–1.77)	0.081 (0.88)
Host Political Stability	0.016† (1.90)	0.019† (1.78)
Host Market Appealing	0.004 (0.63)	0.010 (1.32)
Host Human Resources	–0.005 (–1.01)	–0.005 (–0.70)
Host Low Labor Cost	0.002 (0.32)	–0.014 (–1.31)
Home USA	–0.086 (–0.42)	–0.373 (–1.63)
Offshoring Age	0.030† (1.67)	0.088** (2.96)
Call center and customer contact	0.253 (0.83)	–0.322 (–0.84)
Design	–0.025 (–0.04)	–0.181 (–0.42)
Engineering services	0.476† (1.66)	0.708 (1.45)
Finance and accounting	0.676* (2.02)	0.599 (1.53)
Human resources	0.766 (1.46)	0.457 (0.58)
Information technology	0.084 (0.31)	0.394 (1.07)
Knowledge services	–0.149 (–0.35)	0.709 (1.44)
Legal services	–4.024*** (–11.89)	5.181*** (10.99)
Marketing and sales	0.500 (1.50)	–0.102 (–0.14)
Other	0.439 (0.42)	–0.011 (–0.02)
Procurement	0.105 (0.25)	0.707 (1.00)
Research and development	1.432* (2.30)	0.385 (0.57)
No. of observations	306	184
Chi-Square	520.163***	398.009***
Pseudo R-Square	0.131	0.138

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