International Journal of Production Economics

Risky Business? Shareholder Value Effects of Service Provision

--Manuscript Draft--

Manuscript Number:	PROECO-D-20-02335R2
Article Type:	Research paper
Keywords:	Servitization, Services' risk, Shareholder value, Abnormal returns, Event study
Corresponding Author:	Marko Bastl, Ph.D. Marquette University Milwaukee, WI United States
First Author:	Antonios Karatzas, PhD
Order of Authors:	Antonios Karatzas, PhD
	George Daskalakis, PhD
	Marko Bastl, Ph.D.
	Mark Johnson, PhD
Abstract:	Business model innovation by manufacturing firms, through the addition of services to the core product offerings, has been steadily on the rise. However, this can pose risks for the firms' long-term viability and profitability. Here, we examine the short-term financial effects of the sale of different product-service combinations. We use the event study methodology to investigate the stock market reaction to 1,025 new contract announcements by 41 large manufacturers from 1987 to 2016. 679 of these announcements involve the sale of standalone products, while the remaining 346 are product-service deals which we classify as low-, medium- or high-risk depending on whether they involve the provision of product-oriented (or smoothing) services, use-oriented and adapting services, and result-oriented (or substituting) services, respectively. Our results indicate that equity investors react positively to announcements of low-risk service deals. In contrast, we do not find a significant market reaction to announcements of medium- and high-risk service deals, suggesting that shareholders are not confident in the value creating potential of these types of services. We argue that this is due to the complexities characterizing medium- and high-risk services and the general lack of transparency in the agreed terms and pricing of service contracts.

Risky Business? Shareholder Value Effects of Service Provision

Antonios Karatzas

Norwich Business School, University of East Anglia, Norwich NR4 7TJ, UK

Tel.: +44 (0)1603 597763, E-mail: a.karatzas@uea.ac.uk

George Daskalakis

Prince Mohammed Bin Salman College of Business & Entrepreneurship (MBSC), 4732 Juman Street, Bay la Sun District, King Abdullah Economic City, 23965-7536, Kingdom of Saudi Arabia

Tel.: +966 12 510 6111, E-mail: gdaskalakis@mbsc.edu.sa

Marko Bastl (*corresponding author*)

Department of Management, College of Business Administration, Marquette University, Milwaukee, USA and Cyprus International Institute of Management, Nicosia, Cyprus

Tel.: +1 (414) 288 6866, E-mail: marko.bastl@marquette.edu

Mark Johnson

Warwick Business School, University of Warwick, Coventry CV4 7AL, UK

Tel.: +44 (0) 24 765 23703, E-mail: mark.johnson@wbs.ac.uk

Risky Business? Shareholder Value Effects of Service Provision

Abstract

Business model innovation by manufacturing firms, through the addition of services to the core product offerings, has been steadily on the rise. However, this can pose risks for the firms' long-term viability and profitability. Here, we examine the short-term financial effects of the sale of different product-service combinations. We use the event study methodology to investigate the stock market reaction to 1,025 new contract announcements by 41 large manufacturers from 1987 to 2016. 679 of these announcements involve the sale of standalone products, while the remaining 346 are product-service deals which we classify as low-, medium- or high-risk depending on whether they involve the provision of *product-oriented* (or *smoothing*) services, *use-oriented* and *adapting* services, and *result-oriented* (or *substituting*) services, respectively. Our results indicate that equity investors react positively to announcements of low-risk service deals and pure product sales. In contrast, we do not find an overall significant market reaction to announcements of medium- and high-risk service deals, suggesting that shareholders are not generally confident in the value creating potential of these types of services. However, post-hoc analysis suggests that the abnormal returns to service deals are affected by both firm-specific (financial leverage and service infusion level) and contract-specific (duration and value) factors. We explain these findings by considering the complexities characterizing these types of services and the general lack of transparency in the agreed terms and pricing of service contracts.

Keywords: Servitization, Services' risk, Shareholder value, Abnormal returns, Event study

1. Introduction

Approximately one third of large manufacturers have transitioned from a product- to a service-centric business model (Martinez et al., 2017). This is widely known as the "servitization" of manufacturing (Vandermerwe and Rada, 1988) and the manufacturers adopting this strategy as "servitized" (Baines et al., 2009). Servitization enhances competitiveness, satisfies customers' evolving needs, and facilitates higher profit margins and new revenue streams (Vandermerwe and Rada, 1988; Quinn et al., 1990; Wise and Baumgartner, 1999; Neely, 2008). However, it also involves significant challenges, as the transition requires substantial organizational redesign, investment into service-specific resources and development of new capabilities (Davies and Brady, 2000; Oliva and Kallenberg, 2003; Neu and Brown, 2005; Ambroise et al., 2018).

Failure to address these challenges partly explains empirical findings indicating that manufacturers are not able to fully realize the expected financial benefits of service provision (Gebauer et al., 2005; Neely, 2008; Eggert et al., 2011). These challenges might also comprise an explanation for the nonlinear nature of the relationship between service activity and financial performance (Fang et al., 2008; Suarez et al., 2013; Visnjic-Kastalli and Van Looy, 2013), and for recent examples of "deservitization". Some major industrial manufacturers and technology leaders are divesting their service business; for instance, ABB disposed of its "Full Service" (maintenance outsourcing) division, while Johnson Controls disengaged from its facility management services (Eggert et al., 2011).

Despite exhortations of "moving downstream" being a panacea to manufacturers (see Vandermerwe and Rada, 1988; Quinn et al., 1990; Wise and Baumgartner, 1999; Neely, 2008) there are risks. As the level of service infusion – i.e., the importance of service offerings for a manufacturer relative to its product offerings (Kowalkowski et al., 2017) – increases, and manufacturers move closer to becoming pure service providers, they assume increasingly higher levels of risk (Gebauer and Fleisch, 2007; Josephson et al., 2016). Higher levels of service infusion increase firm-idiosyncratic risk (Josephson et al., 2016) and the likelihood of bankruptcy (Benedettini et al., 2017), while the relationship between the proportion of service sales and financial performance seems to be curvilinear, turning positive only after service sales reach 20-25% of revenues (Fang et al. 2008). At a micro-level,

services associated with particular product lines might also show less profit than expected (Visnjic-Kastalli and van Looy, 2013).

There are different forms of servitization (Gebauer and Fleisch, 2007; Baines et al., 2009). These are based on the provision of services on continua from simple to complex, with distinct risk profiles (c.f. Nordin et al., 2011; Ambroise et al., 2018). Complex services result in higher levels of risk transfer (e.g., of financial risk) from the customer to the manufacturer (Nordin et al., 2011). As such, the adoption of service-based business models cannot be treated simplistically, and one should consider the differences in risk between different types of services. Despite its importance, this is an issue that has not been examined in the extant literature. As a result, manufacturers currently lack an understanding of what type of services, in terms of their risk, they should invest in. Corporate finance theory suggests that this should be the one that involves the provision of services with the greatest value generation potential as only then will manufacturers be able to maximize the value of their companies, and in turn, the wealth of their shareholders (Damodaran, 2015).

Answering to calls for further research in the relationship between servitization and financial performance (e.g., Feng et al., 2021), this work aims to understand the value creation potential of three types of product-service offerings that encompass services with differential risk profiles. As such, we use the event study methodology (see e.g., Brown and Warner, 1980) to examine the stock market reaction to 346 announcements of new business-to-business (B2B) and business-to-government (B2G) deals from 41 public servitized manufacturers based in 12 developed economies. Depending on whether these deals involve the provision of product-oriented/smoothing, use-oriented and adapting, or result-oriented/substituting services (Tukker, 2004; Cusumano et al., 2015), we classify them as low-, medium- or high-risk, respectively. If the provision of each of these types of services creates value for manufacturers, one would expect in an informationally efficient market (see Fama, 1970), that the corresponding announcements would result, in the short-term, in positive abnormal stock returns. This would be due to equity investors recognizing and discounting the added value of these deals. Moreover, if the provision of one of these types of services creates more value for manufacturers compared to the other two, one would further expect that the corresponding announcements would result in higher positive abnormal stock returns relative to announcements of the other types of offerings.

Our results indicate that service provision creates value for shareholders in the case of offerings that involve low-risk services. On the other hand, it seems that, on average, this is not the case for medium- and high-risk service provision as we do not find any significant market reaction. For comparison purposes we also examine the shareholder value effects to announcements of 679 pure product sales from the same manufacturers. As expected, we find a significant positive stock market reaction. However, supplementary analysis suggests that returns to the service deals increase as the manufacturer's experience and its financial leverage increase. Service contracts of larger monetary value and shorter duration also lead to higher returns. Thus, the "wisdom of the crowd" suggests that manufacturers can create value by diversifying into services, but their focus should mainly be on low-risk service provision unless specific conditions are in place.

These findings provide nuanced and granular understanding of the effects of servitization on shareholder value. Going beyond the simplistic and anecdotal product versus service value creation arguments (cf. Wise and Baumgartner, 1999; Neely, 2008), we complement the growing number of studies on the effects of service-based business models on manufacturers' financial performance (Benedettini et al., 2017; Fang et al., 2008; Neely, 2008; Suarez et al., 2013; Visnjic-Kastalli and van Looy, 2013; Eggert et al., 2014), which to date have produced mixed results at best, and irrespective of their unit of analysis, they have not accounted for specific risks inherent in different types of service provision.

The study proceeds as follows. In Section 2 we develop the conceptual background, focusing particularly on the financial implications of servitization and the inherent risks of service provision. We discuss the methodology in Section 3, and present results in Section 4. We conclude with Section 5 by discussing our findings, their implications for theory and practice, and the limitations of this research.

2. Conceptual background

2.1 Benefits, challenges, and risks of servitization

The adoption of a service-based strategy by manufacturers, comes, on the one hand, as a response to customers' increasing eagerness to outsource the risks associated with product ownership, such as the

uncertainty in relation to future maintenance and other support costs (Slack, 2005). On the other hand, servitization has been further motivated by the significant strategic, economic, and environmental benefits that service provision entails (Neely, 2008). For example, services allow manufacturers to increase the level of differentiation of their portfolio of offerings relative to competitors, and therefore, to enhance their competitiveness (Quinn et al., 1990). Furthermore, due to the long-term and complex nature of services, manufacturers can lock-in customers and lock-out competitors (Vandermerwe and Rada, 1988). Thus, services are expected to lead to repeated sales, a steady cash flow, and an increase in both revenues and profit margins (Wise and Baumgartner, 1999). Services also promote environmental sustainability as they extend the lifecycle of products and motivate customers to change their notion of ownership (Tukker, 2004). Consequently, through service provision, manufacturers can promote their corporate social responsibility, and importantly, bring environmental benefits to society.

Despite these compelling arguments favouring servitization, various studies show that diversifying into services entails significant challenges and risks for manufacturers that render the success of this strategy highly uncertain (Oliva and Kallenberg, 2003; Gebauer et al., 2005; Nordin et al., 2011). For instance, service transition results in the manufacturer breaking away from its core competencies that are associated with product innovation and cost-efficiencies. Thus, there is a risk that the company will lose its strategic focus (Fang et al., 2008). This may lead shareholders to be skeptical with respect to the manufacturer's ability to generate future sales revenues, increasing stock price volatility and firm-specific risk (Josephson et al., 2016).

Moreover, service transition requires the manufacturer to undertake a substantial organizational transformation (Ambroise et al., 2018; Davies and Brady, 2000). Organizational design and culture should change to reflect the relational nature of services (Oliva and Kallenberg, 2003), and to promote intra-organizational cooperation (Neu and Brown, 2005). For example, cooperation between operations, research and development (R&D), and sales teams is necessary for the effective provision of services. However, these organizational changes can lead to internal conflict due to existing employees resisting the adoption of the new structures and ways of operation (Fang et al., 2008). This can also be the case when newly established cross-functional teams fail to integrate or align themselves with existing factions in the organization (Josephson et al., 2016; Neu and Brown, 2005). Thus, unless these conflicts

are resolved, diversifying into services can compromise the manufacturer's operational efficiency and adversely affect future sales revenue.

Service transition requires the manufacturer to devote significant resources to service-specific assets, infrastructure, and capabilities (Benedettini et al., 2017). However, resource constraints may lead the manufacturer to divert resources into the service business from other functional areas of the organisation, such as the product business (Oliva et al., 2012). Thus, there is a risk that resources are spread too thinly over the manufacturer's portfolio of service offerings (Bolton et al., 2007). This would be to the detriment of its customers and shareholders as it can adversely affect the efficiency of service operations and in turn, future sales revenue (Grönos and Ojasalo, 2004). Therefore, a manufacturer diversifying into services must proceed to substantial capital (including human capital) investments to ensure that its organization's operating efficiency is not compromised.

Manufacturers transitioning into services should also invest into developing new capabilities necessary for effective service provision (Galbraith, 2002; Kohtamäki et al., 2013). For instance, the manufacturer needs to have service contract negotiation and pricing capabilities so that it is properly compensated for the inherent risks of the service offerings, along with the costs for managing them (Benedettini et al., 2015; Fynes et al., 2005; Neely, 2008). This is of the outmost importance as these risks can result to various liabilities for manufacturers that can range from solely financial (i.e., reputational damage and claims for financial compensation) to criminal, when there is a service failure in a safety-critical environment, such as in commercial aviation (Makri and Neely, 2015). For example, a servitized manufacturer is exposed to both operational and performance risks when the contract requires the manufacturer to be responsible for the through-life management of the product despite the customer using it (Nordin et al., 2011).

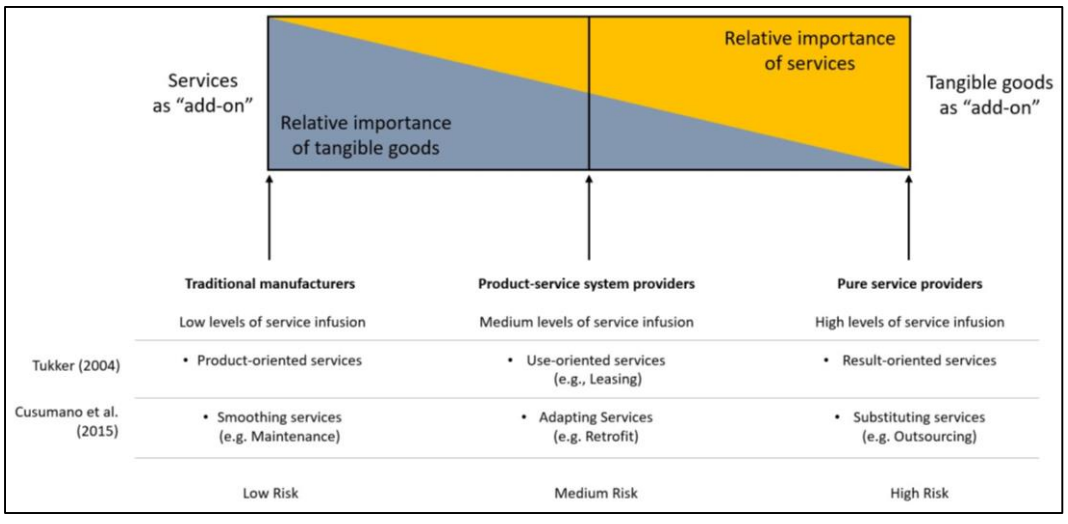
Addressing this agency problem (see Eisenhardt, 1989), and hence managing these risks, involves significant costs due to the mechanisms required to align the interests of the manufacturer, i.e., increased levels of operating efficiency, to the interests of the customer, i.e., the capability to perform operations (van der Valk and van Iwaarden, 2011; Makri and Neely, 2015). Also, the common involvement of several sub-contractors in service provision increases supply chain risk (Fynes et al., 2005; Johnson and Mena, 2008; Lockett et al., 2011), while the long-term nature of services entails

financial risk related to fluctuations in oil prices and interest rates (Neely, 2008). Managing these risks involves substantial costs, either for monitoring the performance of sub-contractors in the case of supply chain risk, or for using financial derivatives to hedge financial risk.

2.2 Servitization, financial implications and shareholder value

The natural financial objective of a company is to maximize the wealth of its shareholders, a goal that translates (in an efficient market setting) into maximizing its market value, or equivalently, its stock price (Damodaran, 2015). This implies that, from a strictly financial perspective and despite the theoretical arguments favoring servitization, manufacturers should adopt a service-based strategy only if this would allow them to create value for their company and shareholders.

Manufacturers transitioning into services must decide what services they offer, which determines where they sit on the *product-service continuum* (Martin Jr and Horne, 1992; Oliva and Kallenberg, 2003; Neu and Brown, 2005; Baines et al., 2009). This is a continuum ranging from traditional manufacturers relying on their products to create value and offering services simply as add-on, through to pure service providers that have services at the core of their value creation process, with products being the add-on (Oliva and Kallenberg, 2003). As shown in Figure 1, different positions on the product-service continuum correspond to a different form of servitization (Baines et al., 2009), and present manufacturers with unique opportunities and risks (Gebauer and Fleisch, 2007).



Source: Adapted based on Tukker (2004) and Cusumano et al. (2015)

Figure 1: Product-service continuum

To date, various empirical studies have examined the financial benefits of servitization. Studies from Fang et al. (2008), Eggert et al., (2011) and Visnjic-Kastalli and Van Looy (2013) for example, show that transition to services in general, positively affects firm value for a variety of reasons, although this relationship is not linear. Visnjic-Kastalli and Van Looy (2013) argue that providers of product-service offerings, due to the differentiation of their offering and consequent superior customer proximity, are often able to increase the price of their entire value system, and thus attain greater profits. A manufacturer's transition into more complex services, such as the provision of integrated solutions, can result in cost advantages over competitors, through the sharing of tangible and intangible resources that give rise to resource and knowledge spillovers (Fang et al. 2008). Furthermore, an increase in service content and service complexity requires increased levels of interfirm interaction, which leads to the development of more cooperative, adaptive, and trust-based relationships. This makes those providers who managed to build such relationships with buyers preferable over competitors, resulting in increased customer loyalty (Palmatier et al., 2007) and customer lock-in (Vandermerwe and Rada, 1988).

From a financial perspective, the adoption of a service-based business model has been a successful strategy for numerous manufacturers, such as IBM (see Spohrer, 2017). However, various empirical studies have also shown that many firms have struggled to achieve the suggested financial benefits of servitization (what is commonly referred to as the "service paradox"), leading them to adopt a "reverse servitization" or "deservitization" strategy (Gebauer and Kowalkowski, 2012; Finne et al., 2013; Kowalkowski et al., 2015). This entails compressing their service strategy and opting to operate at lower levels of service infusion (Kowalkowski et al., 2017).

Transition from products to services has different risk implications for manufacturers since it involves the provision of services with distinct risk profiles (Nordin et al., 2011). This is because the level of risk that manufacturers assume through services increases as they move closer to becoming pure service providers (Gebauer and Fleisch, 2007; Josephson et al., 2016). Three different types of services manufacturers commonly provide at low, medium, and high levels of service infusion are maintenance, leasing, and outsourcing, respectively. Outsourcing services are significantly more

complex than leasing services, which in turn are more complex than maintenance services. While the successful provision of maintenance services is a straightforward task for most manufacturers as they are commonly used to enhance sales (Schmenner, 2009), this is not the case for leasing or outsourcing services. The reason is that the successful provision of the latter two types of services, particularly outsourcing, requires manufacturers to have undertaken a significant organizational transformation, to have invested in service-specific resources, and to have developed a variety of new capabilities (Galbraith, 2002; Gebauer et al., 2005; Kohtamäki et al., 2013; Oliva and Kallenberg, 2003). The complexity of these services, however, means that even if the necessary investments are undertaken, and the required new capabilities have been developed, there is still a risk that the manufacturer will not be able to successfully provide them, resulting in financial liabilities (Makri and Neely, 2015).

Specifically, these types of services are differentiated in terms of the nature and level of risk that is transferred from the customer to the manufacturer. Through a maintenance service contract, customers only hedge financial risk, which is assumed by the manufacturer (Neely, 2008). This relates to the uncertainty with respect to future costs for the spare parts and labor involved, which depend on the level of interest rates, inflation, and exchange rates, among other factors. In contrast, through a leasing contract, customers hedge, in addition to financial risk, also performance risk, as it is now the manufacturer that must ensure that the product continuously operates at optimal levels of performance (Nordin et al., 2011). Leasing services entail higher financial risk for manufacturers since a product failure will likely result in claims for financial compensation for the period that the product was either not operating as expected, or not operating at all (Tukker, 2004). Finally, through a service outsourcing contract, customers hedge, in addition to financial and performance risk, also operational and supply chain risk (Nordin et al., 2011; Lockett et al., 2011). By entering into an outsourcing agreement, the customer transfers the risk of facing a loss due to operational disruption, created by its employees, an internal system failure or external events. This risk of disruption is now assumed by the manufacturer. This is also the case for supply chain risk, since the activities outsourced commonly require the involvement of external third parties, the relationships with whom need to be managed effectively (Johnson and Mena, 2008). Through an outsourcing contract, this risk is transferred to the manufacturer who is now responsible that the contracted outcome will be delivered. Thus, the risks assumed by

manufacturers agreeing to provide relatively more complex services, might compromise the achievement of the promised cash flows, and this may be recognized by investors. These considerations lead to the following hypothesis:

H1: The provision of more complex product-service offerings reflects greater risk and hence will be seen less favourably by the market.

In the next section we provide a detailed account of the methodology and the risk-based classification of product-service offerings.

3. Methodology

3.1 Method selection

We use the event study methodology to investigate the shareholder value effects of servitization (see Brown and Warner, 1985 for a description of the methodology). In Operations and Supply Chain Management (OSCM) research, event studies have been used to examine the stock market reaction to a wide variety of announcements, such as capacity expansions (Hendricks et al., 1995), delays in the launch of a new product (Hendricks and Singhal, 1997), supply chain disruptions (Hendricks and Singhal, 2003), service failures (Modi et al., 2015), voluntary emissions reductions (Jacobs, 2014), reshoring (Brandon-Jones et al., 2017), and quality, environmental and innovation awards (Hendricks and Singhal, 1996; Jacobs et al., 2010; Zhang et al., 2014, respectively). In turn, the event of interest in this study is the announcement of new B2B or B2G contracts that include service provision.

Assuming informationally efficient markets (see Fama, 1970), the rationale of this methodology is that when a new contract is publicly announced, equity investors will assess the deal in terms of its value generation potential and accordingly act upon their assessment. If the consensus among equity investors is that the deal is value creating, then most will start taking long positions in the company's stock and this increased demand will result in an "abnormal" increase in the stock price. In contrast, if the assessment of most equity investors is that the announced deal is value destructive, they will start

shorting the company's stock, adversely impacting its price. Naturally, if the consensus among equity investors is that the deal will neither create nor destroy value, the stock price will remain at the same levels as it was prior to the announcement since there will not be any change in the demand for the company's stock.

Thus, the difference between the actual stock return observed following a new contract announcement and an expected (theoretical) return computed through a financial model of stock returns, the so-called "abnormal return", represents the "wisdom of the crowd" estimate of the deal's impact on the stock price. This can be positive, negative or zero, depending on whether shareholders believe that the deal will increase, decrease, or have no effect whatsoever, on the value of the company, respectively. Consequently, by analyzing the stock market reaction to announcements of new contracts for the provision of services with different risk profiles we can determine their value creation potential from the perspective of the shareholders.

We should point out that even though the methodology focuses on the short-term financial effects of an event (e.g., of a new contract announcement), the analysis provides nonetheless insights for its long-term financial implications. The reason is that the stock price is a forward-looking measure of financial performance that reflects not only the value of the real assets of a company, but importantly, also of its prospects in the future.

3.2 Sample selection and data description

For generating the sample of announcements, we focus on manufacturers with two characteristics. First, those that are public companies listed in the stock exchange of a developed economy. This contingency is motivated by the fact that we examine the stock market reaction when a new contract is publicly announced, and an implicit assumption of this approach is that the financial market in which the company's stock is traded is informationally efficient. Although market efficiency is commonly assumed in the financial literature, in practice only in the case of a developed economy can one be most confident of its validity (Fama, 1998). Second, we concentrate on manufacturers that not only provide services but also supply standalone products. The reason for this constraint is that it allows us to compare the equity investors' reaction to announcements of new service contracts with various risk

profiles vis-à-vis the sale of standalone products. Thus, we can draw inferences about the types of service deals that shareholders consider a better (or worse) source of value creation relative to pure product sales. Given these considerations, we scanned extant servitization literature, in both academic and practitioner journals, for manufacturers suitable for this study. This resulted in a list of 41 public firms from North America, Europe, and Japan, presented in Table 1. The list is by no means exhaustive, nor representative across countries and industries. It does, however, include companies that have been at the forefront of servitization in recent decades.

Company	Primary Listing of Stock	
	Country	Stock Exchange (Market)
ABB Ltd	Switzerland	SIX Swiss
Airbus SE (EADS)	France	Paris
Alstom SA	France	Paris
Babcock International Group Plc	UK	London
BAE Systems Plc	UK	London
Boeing Company	USA	New York
Bombardier Inc	Canada	Toronto
Caterpillar Inc	USA	New York
Cisco Systems Inc	USA	NASDAQ
CNH Global NV	USA	New York
Deere & Company	USA	New York
General Dynamics Corporation	USA	New York
General Electric Company	USA	New York
GKN Plc	UK	London
Hewlett Packard Enterprise Company	USA	New York
Honeywell International Inc	USA	New York
Hyundai Heavy Industries Co, Ltd	South Korea	Seoul
International Business Machines (IBM) Corporation	USA	New York
Lockheed Martin Corporation	USA	New York
MAN SE	Germany	Frankfurt
Metso Oyj	Finland	Helsinki
Mitsubishi Heavy Industries Ltd	Japan	Tokyo
Mitsui Engineering & Shipbuilding Co, Ltd	Japan	Tokyo
Motorola Solutions Inc	USA	New York
Nokia Oyj	Finland	Helsinki
Northrop Grumman Corporation	USA	New York
Rockwell Collins Inc	USA	New York
Rolls-Royce Holdings Plc	UK	London
Saab AB	Sweden	Stockholm
Safran SA	France	Paris
Sandvik AB	Sweden	Stockholm
Scania AB	Sweden	Stockholm
Science Applications International (SAIC) Corporation	USA	New York
Siemens AG	Germany	Frankfurt
Siemens Gamesa Renewable Energy SA	Spain	Madrid
Telefonaktiebolaget LM Ericsson (Ericsson)	Sweden	Stockholm
Textron Inc	USA	New York
Thales SA	France	Euronext
United Technologies Corporation	USA	New York
Vestas Wind Systems A/S	Denmark	Copenhagen
Xerox Corporation	USA	New York

Table 1: Manufacturers used for compiling the announcement sample

For the 41 companies, we gather from reliable sources (e.g., Wall Street Journal, Reuters News, and Associated Press) all new B2B and B2G deals announced over the period from 1987 to 2016, using the Dow Jones Factiva business information database. Following standard practice (e.g., Jacobs et al., 2010), if an announcement appears in multiple publications, we retain the one with the earliest publication date. Moreover, for ensuring that the stock market reaction is not confounded by other events, we discard any announcement where another financially relevant event for the company occurred within a span of five business days (McWilliams and Siegel, 1997). From an initial sample of over 5,000 new contract announcements, this process results in a final sample of 1,025 unconfounded announcements; 679 of these involve the sale of standalone products, while the remaining 346 concern the provision of services for a product that the customer already owns or is delivered to the customer as part of the announced deal. Descriptive statistics for the manufacturers in the final sample of announcements are presented in the Online Supplement (Table OS-1).

Subsequently, we classify the service deals in our announcement sample in terms of their risk profile. Although various service typologies have been proposed in the literature (Ambroise et al., 2018; Cusumano et al., 2015; Mathieu, 2001; Neely, 2008; Sousa and da Silveira, 2017; Tukker, 2004), these are primarily based either on the nature of the services manufacturers provide, or on the manufacturers' motivation for offering a specific type of service, or on the implications that different types of services have for the manufacturers' business model (see Raddats et al., 2019, for a review). None of the existing typologies focusses explicitly on the nature or level of risk inherent to the service types (as we discuss below, an exception perhaps is Josephson et al., 2016). To tackle this, we adopt the service typology proposed by Tukker (2004) but complement it with the one developed by Cusumano et al. (2015). This is motivated by the fact that these two ternary service classification schemes highlight the risk of the general types of services manufacturers provide, are consistent and complementary to each other, and importantly, reflect the fact that manufacturers moving closer to becoming pure service providers assume higher levels of risk (e.g., Gebauer and Fleisch, 2007; Josephson et al., 2016).

According to Tukker (2004) there are three general types of services manufacturers provide depending on their position on the product-service continuum: product-, use-, and result-oriented

services. At low levels of service infusion, manufacturers base their value creation process on product-oriented services (or smoothing services in the typology of Cusumano et al., 2015). These are designed to support a product that a customer already owns or is sold as part of the deal (e.g., maintenance) and can be classified as low-risk services since they only entail financial risk for manufacturers (Neely, 2008). As the service infusion level increases however, manufacturers rely primarily on use-oriented services for creating value. In this type of services, customers buy the function of a product instead of the product itself (e.g., leasing) and can be classified as medium-risk services as they involve financial and performance risk for manufacturers (Nordin et al., 2011). When manufacturers come closer to becoming pure service providers though, their focus is shifted on providing result-oriented services (or substituting services in the classification scheme of Cusumano et al., 2015) for creating value. Through these, customers do not buy the product or its functions but rather its output (e.g., outsourcing). Thus, this type of services can be classified as high-risk, since, as well as financial and performance risk, they entail operational and supply chain risk (Johnson and Mena, 2008).

A shortcoming of this service typology is that it does not consider services related to the product that are designed to expand its functionality (e.g., retrofitting) rather than facilitate its use or sale. These so-called adapting services (Cusumano et al., 2015) are more complex compared to product-oriented services, commonly require significant R&D activities, and therefore, involve higher levels of risk compared to product-oriented services. Thus, we consider these to also be medium-risk services.

In summary, we classify the service deals in our sample of announcements as low-risk when they involve the provision of product-oriented (or smoothing) services, medium-risk in the case of use-oriented and adapting services, and high-risk in the case of result-oriented (or substituting) services.

We should note that Josephson et al. (2016) argued, and provided relevant evidence, that the risk a manufacturer faces when transitioning into services is moderated by what they term "service relatedness", a measure of the congruency between the service and the core product offerings. Specifically, they find that firm risk due to service transition decreases when the service offerings are closely related to the core product offerings but increases when the level of "closeness" between the service and the core product offerings is low. These findings imply a different risk-based service

classification scheme than the one adopted here; services with high, medium, and low levels of service relatedness could be classified as low-, medium- and high-risk, respectively.

To an extent, such a classification is consistent to our scheme. For example, a maintenance contract that we classify as low-risk service is indeed characterized by high levels of relatedness. Correspondingly, an outsourcing service that we classify here as high-risk is characterized by low level of relatedness as its provision commonly involves tasks that are not closely related to the manufacturer's core product offerings. However, a complication arises in the case of what we term here medium-risk services. For instance, it is not clear what level of relatedness a leasing or a retrofitting contract has. Moreover, using service relatedness as a risk-based service classification scheme has the disadvantage that this measure is dependent on the level of the manufacturer's service infusion. For instance, if a significant portion of a manufacturer's revenues comes from leasing or retrofitting services, then it could be argued that relatedness is high for such services and therefore, that these are low-risk and not medium-risk as in our classification. Following a similar line of argument, even outsourcing services can be characterized as low risk. Our classification scheme avoids such complications and importantly, is the appropriate one for addressing our research objective, which is to understand the financial implications of service provision due to the risk transferred from the customer to the manufacturer.

Three authors conducted the classification independently, and all disagreements were resolved consensually. Representative examples of the different types of service deals announcements are presented in Table 2, while a breakdown per manufacturer for all types of announcements in our sample (i.e., the three types of service deals and pure product sales) is found in Table 3.

Low-risk service provision
"Swiss engineering giant ABB said on Tuesday it had signed a four-year contract worth $26 million with Chilean copper producer Compania Minera Dona Ines de Collahuasi SCM. ABB will provide maintenance services including mechanical, electrical, hydraulic, pneumatic and lubrication systems as well as engineering, maintenance planning and scheduling at the group's ore processing plant in the north of Chile, ABB said in a statement."
"MAN (MAN.XE), said Thursday it has received a four-year maintenance order worth $30 million from Norwegian Cruise Line. MAN PrimeServ, the Florida-based MAN service brand, will maintain NCL cruise liners' engines and spare part supply."
Medium-risk service provision
"General Dynamics Corp. says it won a contract from the Canadian government worth more than $1 billion to upgrade the country's fleet of light armoured vehicles. The Falls Church, Va., company said Friday that the contract, valued at about $1.06 billion Canadian ($1.04 billion), involves 550 LAV III combat vehicles. The improvements will provide more protection against land mines and improvised explosive devices and will extend the life cycle of the fleet to 2035. General Dynamics said it expects to complete the work in 2017."
"Metso Corporation announced that it will rebuild the copy paper machine PM1 at Stora Enso Fine Paper AB's (SEO) mill in Nymoella in Sweden. The order is a part of the mill's rebuild with the total value of over EUR20 million, Metso said. The rebuilt line will start up in February 2004. In addition, Metso Automation will upgrade and extend the mill's automation and control systems."
High-risk service provision

"Xerox Corporation announced that it has been awarded a $103 million, five-year contract to provide printing services and technology for the Department of Defence. Xerox will manage the in-house printing for the Defence Logistics Agency (DLA) Document Services. The contract makes Xerox products and support available to DLA Document Services facilities nationwide, ensuring that defence agencies have access to the latest document management technology."
"Reliance Communications Limited has signed a seven-year full-scope managed services agreement with Ericsson (NASDAQ:ERIC) to operate and manage their wireline and wireless networks across India. Ericsson will also take over responsibility for the field maintenance, network operations and operational planning of Reliance Communications' 2G, CDMA and 3G mobile networks. Ericsson will be responsible for network operations, with the goal of increasing customer satisfaction and retention."

Table 2: Examples of service deals announcements

Company	Services			Products	Total
	Low risk	Medium risk	High risk		
ABB Ltd	3	7	5	37	52
Airbus SE (EADS)	2	1	0	10	13
Alstom SA	8	5	0	30	43
Babcock International Group Plc	8	11	1	5	25
BAE Systems Plc	0	3	1	9	13
Boeing Company	2	4	1	14	21
Bombardier Inc	6	2	0	24	32
Caterpillar Inc	3	1	1	13	18
Cisco Systems Inc	0	1	0	8	9
CNH Global NV	3	1	0	6	10
Deere & Company	1	0	0	4	5
General Dynamics Corporation	5	6	0	24	35
General Electric Company	5	3	1	8	17
GKN Plc	2	2	0	15	19
Hewlett Packard Enterprise Company	1	3	8	7	19
Honeywell International Inc	3	12	2	5	22
Hyundai Heavy Industries Co, Ltd	0	1	0	35	36
International Business Machines (IBM) Corporation	0	4	14	6	24
Lockheed Martin Corporation	0	7	1	13	21
MAN SE	2	0	1	18	21
Metso Oyj	2	7	0	26	35
Mitsubishi Heavy Industries Ltd	2	3	2	34	41
Mitsui Engineering & Shipbuilding Co, Ltd	1	1	1	20	23
Motorola Solutions Inc	1	1	1	7	10
Nokia Oyj	0	6	1	41	48
Northrop Grumman Corporation	1	5	1	27	34
Rockwell Collins Inc	4	2	0	18	24
Rolls-Royce Holdings Plc	9	1	2	25	37
Saab AB	2	2	0	8	12
Safran SA	3	2	1	24	30
Sandvik AB	2	0	0	9	11
Scania AB	7	2	2	21	32
Science Applications International (SAIC) Corporation	2	4	2	0	8
Siemens AG	1	1	2	17	21
Siemens Gamesa Renewable Energy SA	2	0	7	15	24
Telefonaktiebolaget LM Ericsson (Ericsson)	1	11	13	19	44
Textron Inc	2	3	0	19	24
Thales SA	3	16	2	25	46
United Technologies Corporation	5	1	0	20	26
Vestas Wind Systems A/S	12	0	0	11	23
Xerox Corporation	1	1	13	2	17
Total	117	143	86	679	1025

Table 3: Distribution of types of announcements per manufacturer

The sectorial, geographical, and yearly distributions of the manufacturers and their announcements in our sample are presented in the Online Supplement in Tables OS-2 to OS-4. As shown in these tables, even though our sample includes only unconfounded announcements, it nonetheless exhibits some of the well-known distributional characteristics of servitization (see Neely et al., 2011). For example, most deals involving low- and medium-risk services are from manufacturers operating in the Aerospace and Defense sector, whereas most announcements for the provision of high-risk services are from those in IT Services & Consulting, Communications & Networking and Office Equipment (i.e., Xerox). Moreover, most service deals announcements are from American, French, Swedish, and British manufacturers, and the majority involve deals made in the last two decades.

3.3 Event study analysis

Following established methodological norms (e.g., Hendricks et al., 1995), we use a 3-day event window starting on the day preceding an announcement and ending the day following the announcement. Thus, in event time, where all trading days are measured relative to the announcement day designated as Day 0, we use an event window that includes Days -1, 0 and +1. This allows us to capture any effects due to possible information leakage prior to the announcement (Day -1) and of asynchronous trading and delayed investor reaction (Day +1). Moreover, following methodological guidelines (e.g., MacKinlay, 1997), if an announcement is made at a time when the stock market of the company's primary listing is closed (commonly after 16:00), we consider the following trading day as the announcement day.

Consistent with most event studies in OSCM research (see the review by Ding et al., 2018), we use the *market model* for estimating abnormal returns. According to this model, the return on stock *i* on day *t* (R_{it}) is linearly related to the return on the market portfolio on day *t* (R_{mt}). In this case, following methodological guidelines for conducting multi-country event studies (Campbell et al., 2010), R_{mt} is a broad index of the home market of the firm:

$$R_{it} = \alpha_i + \beta_i \cdot R_{mt} + \varepsilon_{it} \quad (1)$$

In this specification, α_i is the intercept of the relationship, β_i is a measure of the stock's responsiveness to market-wide movements (the firm's "beta"), and ε_{it} is an error term that captures the effect of firm-specific information. For each announcement in our sample, we compute the expected stock return for the relevant manufacturer by estimating $\hat{\alpha}_i$, $\hat{\beta}_i$ and the variance of the error term $\hat{S}_{\varepsilon_i}^2$ using ordinary least squares (OLS) regression over a period of 200 trading days (similarly to, for example, Jacobs et al., 2010). In event time, the estimation window starts on Day -210 and ends on Day -11. We end the estimation window 10 trading days prior to the announcement to avoid any issues with potential non-stationarities of the estimates (see Hendricks and Singhal, 1997).

Moreover, we require a minimum of 40 return observations during the 200-trading day estimation window in order to keep an announcement in the analysis and estimate equation (1) (see McWilliams and Siegel, 1997). This results in our sample being reduced by 2 low- and high-risk service deal announcements, and by 4 announcements in the case of medium-risk service deals. As a proxy for the market portfolio, we use the stock market index of the country of primary listing for each manufacturer presented in Table 1 (see MacKinlay, 1997). The daily returns for each market index are obtained from Thomson Reuters Datastream.

The abnormal return on stock *i* on day *t* (AR_{it}) is the difference between the actual return R_{it} and the expected return $\hat{\alpha}_i + \hat{\beta}_i \cdot R_{mt}$:

$$AR_{it} = R_{it} - \left(\hat{\alpha}_i + \hat{\beta}_i \cdot R_{mt}\right) \tag{2}$$

The average abnormal return for day *t* (AAR_t) across the sample is computed by averaging with respect to the total number of announcements *N*:

$$AAR_t = \sum_{i=1}^{N} \frac{AR_{it}}{N} \tag{3}$$

The cumulative abnormal return on stock i over a time period $[t_1, t_2]$ ($CAR[t_1, t_2]$) is the sum of the daily abnormal returns of equation (2):

$$CAR[t_1, t_2] = \sum_{t=t_1}^{t_2} AR_{it} \tag{4}$$

Correspondingly, the cumulative average abnormal return across the sample over a time period $[t_1, t_2]$ ($CAAR_t[t_1, t_2]$) is the sum of the average abnormal returns of equation (3):

$$CAAR_t[t_1, t_2] = \sum_{t=t_1}^{t_2} AAR_t \quad (5)$$

We test the statistical significance of the abnormal returns of equations (3) and (5) through a battery of parametric and non-parametric tests widely used in event studies (c.f. Ding et al., 2018). Initially, we consider the dependence adjustment test of Brown and Warner (1980) and the standardized cross-sectional test proposed by Kolari and Pynnönen (2010). The former uses the sample variance of the abnormal returns over the estimation period for computing the test statistic and consequently, prevents the results from being driven by volatile stocks. The latter is like the test initially proposed by Boehmer et al. (1991), with the advantage however, that the test statistic is modified to also account for potential cross-sectional correlation among the abnormal returns.

We complement our analysis with the rank test proposed by Corrado (1989), a variation of the Wilcoxon signed-rank test, and the generalised sign test of Cowan (1992), a variation of the binomial sign test. Compared to the above parametric tests, these non-parametric ones can deal better with the non-symmetric distribution of abnormal returns (Brown and Warner, 1985). Moreover, their performance has been shown to be superior in multi-country event studies (Campbell et al., 2010), as is the case here. We use the 'Eventstudy2' module in STATA for this analysis (Kaspereit, 2019).

4. Analysis and Results

4.1 Event study results

The results of the event study analysis are presented in Table 4. Besides the test statistics, the table includes the means, medians, and ranges of all ARs and CARs. In summary, the analysis reveals a statistically and economically significant positive stock market reaction on the day of new contract announcements for the provision of offerings involving low-risk service deals and (as expected) for the sale of standalone products. In contrast, the market reaction to announcements of medium- and high-

risk service deals is either economically insignificant (i.e., virtually zero) or negative, but in both cases, it is statistically insignificant.

	Abnormal returns (AR_t)			Cumulative abnormal returns ($CAR[t_1, t_2]$)		
	Day -1	Day 0	Day 1	[-1, +1]	[-1, 0]	[0, +1]
Panel A: Announcements of low-risk service deals (*N* = 115)						
Mean (%)	-0.102	0.480	-0.020	0.356	0.377	0.460
Median (%)	-0.084	0.313	-0.072	-0.024	0.264	0.273
[Min., Max.] (%)	[-4.3, 4.1]	[-4.4, 8.2]	[-4.1, 4.7]	[-7.5, 11.4]	[-6.8, 7.5]	[-4.7, 11.9]
Crude dependence adjustment	-0.496	2.320**	-0.100	0.995	1.290	1.570
Standardized cross-sectional	-0.482	2.090**	-0.332	0.860	1.120	1.610
Rank	-0.536	2.550**	-0.750	0.719	1.410	1.240
Generalized sign	-1.490	1.860*	-0.005	0.180	1.670*	1.480
Panel B: Announcements of medium-risk service deals (*N* = 139)						
Mean (%)	-0.183	0.042	-0.168	-0.309	-0.140	-0.126
Median (%)	-0.135	0.025	-0.096	-0.170	-0.200	-0.060
[Min., Max.] (%)	[-5.2, 6.0]	[-6.1, 8.5]	[-11.5, 6.0]	[-13.3, 9.0]	[-9.0, 10.1]	[-11.1, 9.7]
Crude dependence adjustment	-1.100	0.254	-1.010	-1.070	-0.603	-0.539
Standardized cross-sectional	-1.410	0.032	-1.030	-1.470	-1.020	-0.654
Rank	-0.994	0.288	-0.847	-0.880	-0.530	-0.383
Generalized sign	-0.550	0.637	-0.380	-1.050	-0.550	-0.210
Panel C: Announcements of high-risk service deals (*N* = 84)						
Mean (%)	-0.082	-0.156	0.069	-0.169	-0.230	-0.087
Median (%)	-0.068	-0.089	0.010	-0.038	-0.038	-0.022
[Min., Max.] (%)	[-3.6, 3.5]	[-4, 3.3]	[-3.5, 3.3]	[-5.9, 6.4]	[-4.4, 5.4]	[-4.7, 4.3]
Crude dependence adjustment	-0.434	-0.822	0.363	-0.515	-0.888	-0.324
Standardized cross-sectional	-0.875	-0.800	0.373	-0.837	-1.120	-0.442
Rank	-0.664	-0.798	0.361	-0.630	-1.040	-0.291
Generalized sign	-0.504	-0.504	0.150	-0.067	-0.504	0.150
Panel D: Announcements of pure product sales (*N* = 679)						
Mean (%)	-0.039	0.193	0.098	0.253	0.154	0.292
Median (%)	-0.020	0.141	0.031	0.196	0.074	0.193
[Min., Max.] (%)	[-7.9, 8.3]	[-6.9, 7.0]	[-8.3, 6.1]	[-8.2, 12.8]	[-10.4, 10.0]	[-8.6, 8.4]
Crude dependence adjustment	-0.569	2.820***	1.430	2.130**	1.590	3.010***
Standardized cross-sectional	-0.657	2.770***	1.640	1.790*	1.140	3.220***
Rank	-0.590	3.620***	2.180**	3.040***	2.200**	4.140***
Generalized sign	0.230	2.920***	1.310	3.230***	1.690*	3.690***

Note: The crude dependence adjustment test is the one proposed by Brown and Warner (1980), while the standardized cross-sectional test is the one described in Kolari and Pynnönen (2010). Further than these parametric tests, two non-parametric are also considered: the rank test proposed by Corrado (1989) and the generalised sign test of Cowan (1992). All tests are two-tailed. *, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Table 4: Event study results

These results support our hypothesis, suggesting that as the risk inherent in the product-service offering increases (i.e., from product-oriented to use-oriented and adapting, and to result-oriented services), the shareholders' assessment is that the corresponding deals turn from value creating to potentially value destroying.

Specifically, for low-risk service contracts there is a positive AAR of approximately 0.48% on the day of the announcement (Day 0), with test statistics generally >2 and significant at the 5% level (see Panel A). Due to the considerably smaller median of 0.31% (indicating a right-skewed distribution)

we further scrutinized the results and found two announcements with ARs >0.7% (while all other ARs were <0.6%). To test whether the baseline result is driven by these large values, we re-ran the analysis after excluding these two announcements. The AAR decreased to 0.35%, but test statistics remained statistically significant, albeit at the 10% level. We thus conclude that there is at least mild statistical evidence for a positive market reaction on the day of the announcement of low-risk service deals. Interestingly though, because of a negative AR on the day preceding the announcement, CARs for low-risk service deals are generally statistically insignificant, even though they are large and positive (>0.3%). Their significance may be undermined by the relatively small sample size (N=115), especially when considering that CARs for pure product deals, with a sample size almost 6 times as large, are statistically significant despite their smaller magnitude. The large magnitude of the Day 0 AAR, as well as all CARs, imply a detectable economic impact of low-risk services, so it could be argued that the returns are economically significant (despite their statistical insignificance).

When the announcements concern the provision of medium-risk services (see Panel B), the AAR on Day 0 becomes virtually zero (about 0.042%). However, Day -1 and +1 ARs are negative (albeit, statistically insignificant), suggesting possible information leakage and unfavorable delayed investor reaction. These ARs lead to a relatively large and negative 3-day CAAR of -0.31%. Despite it being insignificant, it suggests that the market does not react favorably to medium-risk service deals. The results are similar for high-risk service deals (see Panel C). Mean and median CARs are negative, but in this case the adverse market reaction is centered on the announcement day (AAR = -0.156%). In conjunction, these two findings suggest that investors do not believe in the value-creating potential of riskier service deals; if anything, their assessment of the future cash flow generation potential of such deals seems to be negative.

Finally, as expected and in stark contrast to the preceding results, the AAR on Day 0 for announcements of pure product sales is positive (about 0.19%) and strongly significant, with all tests producing statistics with p-values < 0.01 (see Panel D). Mean and median CARs are also large and statistically significant.

4.2 Robustness tests

Despite the appropriateness of the event study test-statistics for detecting abnormal returns, these tests are unable to account for external, possibly confounding factors. As such, following established convention of event study papers in OSCM research (e.g., Jacobs, 2014; Modi et al., 2015), we probe the baseline results in a multiple regression framework as a first robustness test. This allows us to directly compare the CARs produced by announcements of the four different types of offerings considered, while controlling for various confounding factors. Specifically, as we have a random sample of deals (and associated CARs) per provider, and our choice of the set of providers suggests that our inferences could be generalized to the population of manufacturers from developed economies, we use a hierarchical (multi-level) random-effects model. The regression results are presented in Table 5.

Model	(1)	(2)	(3)	(4)	(5)	(6)
$CAAR[t_1, t_2]$	[-1, +1]	[-1, 0]	[0, +1]	[-1, +1]	[-1, 0]	[0, +1]
Low-risk services	-0.200	0.054	-0.110	-0.360	0.068	-0.160
	(0.330)	(0.260)	(0.240)	(0.360)	(0.330)	(0.30)
Medium-risk services	-0.700**	-0.430*	-0.460*	-0.720**	-0.360	-0.470*
	(0.270)	(0.220)	(0.240)	(0.290)	(0.270)	(0.260)
High-risk services	-0.560*	-0.480**	-0.340	-0.750*	-0.670*	-0.430
	(0.319)	(0.230)	(0.260)	(0.420)	(0.350)	(0.300)
Tobin's Q	0.100*	0.065*	0.091	0.008	-0.011	0.011
	(0.060)	(0.037)	(0.065)	(0.068)	(0.056)	(0.056)
Debt-equity ratio (D/E)	0.010***	0.005**	0.015***	0.017***	0.007**	0.018***
	(0.003)	(0.002)	(0.005)	(0.004)	(0.003)	(0.006)
Employee number (Natural Log.)	0.130	-0.036	-0.190	0.028	0.004	-0.200
	(0.300)	(0.260)	(0.230)	(0.350)	(0.280)	(0.270)
Duration revealed? (Yes = 1)	-0.110	-0.081	-0.049	-0.180	-0.090	-0.130
	(0.190)	(0.130)	(0.710)	(0.250)	(0.160)	(0.220)
Value revealed (Yes = 1)	-0.280	-0.240	-0.150			
	(0.260)	(0.260)	(0.210)			
Contract value (Natural Log.)				0.160***	0.140***	0.130***
				(0.050)	(0.050)	(0.044)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	984	984	984	777	777	777

Note: CARs are expressed in percentage. In all models, pure product sales are the reference group. Robust standard errors clustered at the firm level are presented in parentheses. All models include a constant and both time and industry dummies to account for any unobserved year- and industry-specific characteristics that may influence the CARs and the distribution of the types of offerings. Following Mundlak (1978) and Antonakis et al. (2021), the firm-level means of all continuous explanatory variables, as well the firm-specific proportions of all dummies, are included in all models to account for firm-specific unobserved heterogeneity and possible violation of the random effects assumption. *, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Table 5: Regression results

CARs over the three event windows are the dependent variables. All models include three dummy variables that operationalize the offering type (i.e., low-, medium- and high-risk services). Product sales

comprise the reference category, so the coefficients of the three dummies represent the differential market reaction to the three types of service deals when compared to pure product sales. In all models we control for the manufacturers' financial performance (Tobin's Q), financial leverage (debt-to-equity ratio) and firm size (number of employees). We further control for time- and industry-specific characteristics by including two respective sets of dummy variables. Their coefficients, not reported here for brevity, do not suggest significant differences at the industry level, nor any discernable year-on-year effect. We do not explicitly control for the duration of the announced contracts, but instead for whether this information is provided in the announcements. The reason is that contract duration does not seem to have any effect when included in the models, while this would also substantially reduce the sample size (by about 40%) as it is very often not disclosed. Finally, we include a dummy variable denoting the disclosure (or not) of the financial details of the contract, but models (4)-(6) include the actual contract value (as reported in the announcement). This reduces the sample by about 20%.

Overall, the regression analysis results provide further credence to the results of the event study. Specifically, all models indicate that there is no statistically significant difference in terms of market reaction between deals of pure product sales and those involving the provision of low-risk services. In contrast, it seems that equity investors are less confident in the value generation potential of medium- and high-risk service deals, compared to those involving the sale of standalone products. This is evidenced by the negative and statistically significant coefficients for new contract announcements involving these two types of services. Importantly, according to model (4), our preferred specification since it concerns the [-1, +1] event window and controls for contract value, the progressively negative and statistically significant coefficients obtained when moving from low- to medium- and to high-risk services, indicate that as the risk of the service offerings increases, the assessment of equity investors is that their value generation potential becomes less promising. It is also worth noting that opting for a fixed-effects approach (with the inclusion of a dummy variable for each firm) instead of a random-effects multi-level model, leads to virtually identical coefficients for all variables of immediate interest.

As a second robustness test, and to ensure that our findings are not driven by the choice of the model used to compute abnormal returns, we supplement our analysis by calculating ARs using the market-adjusted model (see Brown and Warner, 1985). This assumes that each manufacturer in our

sample has similar characteristics with the market (i.e., $\hat{\alpha}_i = 0$ and $\hat{\beta}_i = 1$ in equation (2)) and, therefore the AR is simply the difference between the observed stock return and the return on the market portfolio (stock market index). The results (Table OS-5 in the Online Supplement) are almost identical to those obtained using the market model (equation (1)) and presented in Table 4. Similar results are obtained when using the mean-adjusted model, which computes ARs relatively to the average stock return over the 200-day estimation window.

Third, with the announcements in our sample concerning B2B and B2G deals that commonly have substantial value, one cannot rule out the possibility for rumors to influence the market for several days before the actual contract is signed and announced. Moreover, it is not uncommon for additional information to become known in the days following the announcement. Therefore, the reason we do not observe a statistically significant market reaction in the case of announcements involving the provision of medium- and high-risk services might be that equity investors had anticipated the new service deal (hence stock prices during the event window already reflected this) or because they did not react to the announcement until more detailed information regarding the new deal was released. Thus, we repeat our analysis for an extended event window that includes Days -4 to +4, that is, a 9-day event window instead of the 3-day one considered before. However, we again do not find statistically (or economically) significant abnormal returns in Days -4 to -2, or in Days +2 to +4.

Fourth, focusing again on our results for announcements involving medium- and high-risk service provision, it may be the case that we do not find a statistically significant abnormal return because the value of the announced new contract is sufficient to only compensate shareholders for the additional risk that the new deal brings to the company. Put simply, although shareholders may consider the new deal in these two types of services to be value creating, the manufacturer's beta may also increase because of the deal (see equation (1)), with the two effects cancelling each other out and resulting in zero abnormal returns for shareholders. If that was the case, following a medium- or high-risk service deal announcement we would observe a structural break in the stock return series of the manufacturer involved in the deal due to the change in the company's equity beta. To investigate this issue, we follow Hendricks and Singhal (1996) and perform a *t*-test for the mean difference between the prior- and post-announcement equity betas for all manufacturers, by type of service deal. The results

suggest that this difference is not significantly different to zero and therefore, that medium- and high-risk service deals do not increase the firms' risk (beta). In turn, this implies that we do observe a statistically insignificant abnormal return for announcements involving these types of service deals not due to an increase in the manufacturers' systematic risk, but rather due to a reluctance of equity investors to recognize that such deals are value creating.

4.3 Supplementary analysis: Under which conditions can service deals create value?

The analysis thus far suggests that deals involving the provision of services are not, on average, seen positively by the market, except for the case of low-risk service deals. Even then, there is uncertainty associated with the corresponding result due to the insignificant mean and median CARs obtained. Therefore, a natural question arising is whether there are specific conditions that can lead to higher CARs to announcements of service deals. Put differently, are there any specific factors that moderate the market reaction to such announcements? To investigate this issue, we focus on the sub-sample of service deals and analyse the CARs in a hierarchical random-effects regression framework. We consider the following factors in this analysis.

Firm size. Extant research suggests that it is more difficult for larger manufacturers to benefit financially from service provision as it is much harder for them to transform their organization into effective service providers, particularly for providing what we have defined here as medium- and high-risk services (Neely, 2008). If this is indeed a concern shared by equity investors, one would expect that abnormal returns to service deal announcements by larger manufacturers will be relatively lower. To examine this, we measure firm size in a similar manner as in the preceding analysis, that is, using the natural logarithm of the number of full-time employees in the year prior to the announcement.

Financial leverage. To invest into high leveraged firms, investors demand a premium as compensation for the relatively increased probability that the firm will not be able to satisfy its debt payments and potentially get into financial distress (Berk and DeMarzo, 2019). Hence, one can argue that equity investors will react less favorably to announcements of new deals for the provision of services by manufacturers with high levels of debt in their capital structure, compared to similar announcements made by manufacturers with low debt levels. On the other hand, it can also be argued

that the market will react favorably to such announcements by high leveraged firm for the following reason. Firms operating at high levels of debt are commonly in the mature stage of their lifecycle, since it is at that point that they can straightforwardly finance their operations with increased levels of debt rather than with equity, that is, with the cheapest and therefore, preferred form of external financing (Damodaran, 2015). However, the opportunities to create value for their shareholders at that stage in their lifecycle are rather limited as, for example, it is difficult for mature companies to expand their customer base. Complex product-service offerings allow them to do just that. Consequently, even though the provision of medium- and high-risk services entails substantial risk for manufacturers, it might also be the only way for mature firms to create value. To examine this, similarly to the preceding analysis, we include as a measure of leverage the debt-to-equity ratio.

Financial performance. A firm's strong financial performance, particularly when such an assessment is based on forward-looking market-based measures, is a strong indicator of managerial prowess (Damodaran, 2015). Therefore, it is common for shareholders to base their assessment about the performance of the senior managers running their companies on such measures (Berk and DeMarzo, 2019). Consequently, it can be argued that in the case of servitized manufacturers with relatively stronger financial performance, announcements of service-based contracts, especially those involving medium- and high-risk services, may be viewed more favorably by the market compared to when such announcements are made by manufacturers with relatively weak financial performance. This may be because the manufacturer's strong financial performance signals to equity investors that the firm's managers can more competently mitigate the risks associated with the provision of complex product-service offerings. As in the preceding analysis, we use Tobin's Q as a market-based proxy for firm financial performance.

Contract duration. A widely cited benefit of servitization is that manufacturers can lock-in customers and lock-out competitors due to the complex nature of services and the fact that service contracts are commonly long-term (Vandermerwe and Rada, 1988). Therefore, one can argue that an announcement about a service contract with relatively longer duration will be viewed more favorably by the market as it would imply that the manufacturer might be able to benefit from a steady stream of cash flows over a longer period. However, it can also be argued that with long service contract duration,

the manufacturer will be exposed to the risks associated with service provision for a longer time interval, which, as discussed, can be substantial for medium- and high-risk services, resulting in a less favorable equity market reaction. For examining this issue, we measure service contract duration through the number of months until the end of the provider's commitment as disclosed in the announcement text.

Contract value. Straightforwardly, the higher the value of a service deal, the more favorable the equity investors' reaction to the corresponding announcement is expected to be. As in our preceding analysis, we measure contract value in base US dollars as disclosed in the announcement text.

Country risk. Compared to investing in the domestic market, investors demand a premium when investing in a foreign country as compensation for the higher risk that stems from various geopolitical and macroeconomic risk factors (Chan et al., 1992; Ibbotson and Brinson, 1993). This so-called country risk premium is generally higher for developing markets than for developed ones (Godfrey and Espinosa, 1996). With B2B and B2G service contracts commonly involving the provision of the service in a foreign country, one can argue that equity investors may react less favorably when the service is to be delivered in a developing country compared to a developed one. We examine this issue by using a dummy variable to distinguish between announcements in terms of the country in which the deal is agreed to be undertaken (developing vs. developed).

Experience with service provision (service infusion). It can be argued that as manufacturers accumulate experience in designing, pricing, and delivering services, they become more competent in mitigating the related risks, for example, by including explicit clauses in the contracts and through more effective risk-management during the actual service provision. Put differently, manufacturers that have already moved along the product-service continuum and operate at high levels of service infusion (Neu and Brown, 2005; Baines et al., 2009), had the opportunity to learn from trial-and-error during this transition and therefore, are better equipped to manage the risks associated with the provision of complex product-service offerings. If this is indeed recognized by equity investors, one would expect that they will react more favorably to announcements for the provision of medium- and high-risk services when these are made by manufacturers operating at high levels of service infusion, compared to when such announcements are from manufacturers with low levels of service infusion. To examine this issue, we compute for each manufacturer-year, Fang's et al. (2008) widely used "service ratio" –

the ratio of revenues from service sales to total sales – to measure service infusion (as in, for example, Suarez et al., 2013; Josephson et al., 2016). To this end, we use COMPUSTAT Business Segments to obtain the necessary data and follow closely the process detailed in Visnjic et al., (2019). However, we should note that since segment-by-segment revenues are available almost exclusively for US firms, the sample size for this analysis reduces considerably.

Table 6 presents the pairwise correlations between the above variables, while Table 7 summarizes the results from the hierarchical random-effects regression.

Measures	1	2	3	4	5	6	7	8
1. CAR [-1, +1]	1.0000							
2. Employee number (Natural Log.)	-0.0631	1.0000						
3. Debt-equity ratio (D/E)	0.0878	0.0519	1.0000					
4. Tobin's Q	-0.0281	-0.0112	-0.0206	1.0000				
5. Contract duration	0.0401	0.1350**	-0.0360	0.0762	1.0000			
6. Contract value (Natural Log.)	0.1417**	0.3327***	-0.0421	0.0127	0.4357***	1.0000		
7. Developing country (Yes = 1)	-0.0881	-0.0150	0.0367	-0.0134	-0.108*	-0.1500**	1.0000	
8. Level of service infusion	0.1086	0.4066***	-0.0779	-0.0363	0.1435*	0.2970***	-0.1021	1.0000

Note: *, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Table 6: Pairwise Pearson correlation coefficients

In every model, two dummy variables are included to denote medium- and high-risk service deals (low-risk service deals are the reference category). Models (1)-(7) introduce the factors of interest one at a time. Model (8) includes all variables, with a resulting drastic reduction in sample size. The sub-sample on which Model (8) is run involves the service deals for which it can be assumed that "perfect information" is available, in the sense that equity investors have access to all relevant firm- and deal-specific variables to assess the value-generating potential of the deals. The results based on this model suggest that *ceteris paribus*, the higher the manufacturer's financial leverage and its experience in providing service offerings, the higher its 3-day CARs for all service deals. Additionally, the larger the contract value and the shorter its duration, the higher the abnormal returns.

	$CAR_t[-1,+1]$							
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Medium-risk services	-0.230	-0.280	-0.290	-0.970**	-0.220	-0.170	0.630	-0.490
	(0.400)	(0.410)	(0.390)	(0.470)	(0.380)	(0.390)	(0.550)	(0.430)
High-risk services	-0.410	-0.390	-0.360	-1.350**	-1.060*	-0.260	1.020*	-0.660
	(0.480)	(0.470)	(0.490)	(0.660)	(0.610)	(0.480)	(0.610)	(0.780)

Employee number (Natural Log.)	-0.240							-0.790
	(0.550)							(1.740)
Debt-equity ratio (D/E)		0.024						0.060***
		(0.016)						(0.010)
Tobin's Q			0.550					1.120
			(0.400)					(0.690)
Contract duration				-0.010				-0.250***
				(0.030)				(0.050)
Contract value (Natural Log.)					0.300***			0.620***
					(0.110)			(0.090)
Developing country (Yes = 1)						-0.530		0.070
						(0.450)		(0.610)
Level of service infusion							-0.590	3.960*
							(1.410)	(2.190)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	333	335	333	247	252	338	189	112

Note: CARs are expressed in percentages. In all models, low-risk service deals are the reference group. Robust standard errors clustered at the firm level are presented in parentheses. All models include a constant and both time and industry dummies to account for any unobserved year- and industry-specific characteristics that may influence the cumulative mean abnormal returns and the distribution of the types of offerings. Following Mundlak (1978) and Antonakis et al., (2021), the firm-level means of all continuous explanatory variables, as well the firm-specific proportions of all dummies, are included as appropriate to account for firm-specific unobserved heterogeneity and possible violations of the random-effects assumption.
*, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Table 7: Supplementary analysis

Finally, a couple of comments based on Models (1)-(7). Model (4) suggests that for contracts with the same duration, the market considers medium- and high-risk service deals as significantly less promising in terms of value creation than lower-service deals. Model (5) also suggests that when the contract value is known (and held constant), high-risk service deals generate significantly lower CARs. It is worth noting that in a model that accounts for all factors apart from the level of service infusion (not reported here for brevity but available upon request), this gradual unattractiveness to the market, of deals involving higher levels of risk continues to hold: the coefficients for medium- and high-risk services are -0.012 and -0.018 respectively, and both are statistically significant ($p<0.05$). This increases our confidence in the results of the main analysis and the risk-based classification of deals involving different types of services.

5. Discussion and Conclusion

The aim of this research was to investigate the shareholder value effects of servitization by evaluating the short-term market reaction to announcements of four types of product-service offerings, and to

understand if value creation is contingent upon the risk profile of the services offered. In doing so, this research makes important theoretical and practical contributions.

5.1 Theoretical contributions

This work contributes to the servitization literature by complementing studies examining the effects of service-based business models on manufacturers' financial performance. Previous studies that have examined the implications of introducing such models for manufacturers' revenues, profitability, and firm survival (Benedettini et al., 2017; Fang et al., 2008; Neely, 2008; Suarez et al., 2013; Visnjic-Kastalli and van Looy, 2013; Eggert et al., 2014), have produced mixed results.

At the level of business units and product lines, servitization can lead to enhanced profits and revenues only after the prevalence of services within a manufacturer's portfolio reach a certain level (Fang et al., 2008; Suarez et al., 2013; Visnjic-Kastalli and van Looy, 2013), or if the manufacturer offers a breadth of services (Eggert et al., 2014). Our study adds further granularity to these findings, by going beyond simplistic, anecdotal "product versus service" arguments and examining the differential value-creation potential of three distinct offerings involving services of differential risk (Tukker, 2004; Cusumano et al., 2015). In support of our hypothesis, we find that firm value increases with B2B and B2G deals for product-service offerings that involve product-oriented services, but not when they involve the provision of use-oriented and adapting services, or result-oriented services. In fact, the latter two types of services produce, on average, negative (albeit statistically insignificant) returns, suggesting that in the eyes of equity investors, the risks assumed by the manufacturer outweigh the potential benefits. However, the supplementary analysis suggests that the higher the firm's financial leverage and service infusion level, and the higher the value of the contract and the lower its duration, the more likely is the firm to create value from service deals, *irrespective of* their risk profile. These findings provide an additional angle to the prevailing "service paradox" (Gebauer et al., 2005), which prevents manufacturers from realising the expected financial benefits from moving into services. We offer several explanations for these findings.

First, manufacturers have been providing product-oriented services for decades to boost their product sales (Schmenner, 2009). This long history and experience with this type of services, their

"relatedness" with a manufacturer's product business (Josephson et al., 2016), and the relatively low levels of risk involved (Tukker, 2004), must have increased the confidence of shareholders that the provision of such services will create value for manufacturers. As a result, the market reaction to such contract announcements is generally positive (especially on the day of the announcement) when the manufacturer is operating in a developed economy and its stock is traded in a reasonably efficient market (Fama, 1988), as is the case in our sample. In contrast to product-oriented services, use-oriented and adapting, and result-oriented services are relatively more complex, and their successful provision requires the manufacturer to have developed a variety of new capabilities, and to have transformed their organization's structure and culture to reflect the relational nature of such offerings (Burton et al., 2017; Eggert et al., 2011; Gebauer et al., 2005). As a result, equity investors do not seem to generally recognize the value creation potential of these types of services. This may indicate a lack of confidence in the ability of the manufacturer to successfully provide these service offerings, and in turn, an uncertainty for shareholders regarding the impact the provision of such services will have on future firm cash flows. This intuition is supported by the finding that as the firm's service infusion level increases (and consequently, its experience with providing complex services) its market returns to medium- and high-risk service deals announcements also increase. This is consistent with (and complementary to) Josephson et al. (2016), who found that as the service infusion level at which a manufacturer operates increases – and the manufacturer's value creation process is based on the provision of medium- and high-risk services – there is an increase in its stock price volatility.

Second, in the case of medium- and high-risk service provision, our findings can also be explained by considering the risk/return tradeoff of the announced deals. From a theoretical perspective, shareholders should be content with deals of any risk profile if the agreed value of the contract fully reflects the intrinsic value of the service to be offered and properly compensates for its inherent risks (Sharpe, 1964; Lintner, 1965; Black, 1972). Therefore, if the contracts involving the provision of such services in our sample were priced fairly, our results can be explained on the basis of the shareholders' uncertainty with respect to the true value of these contracts. This can be the case especially with new services for new products where there is no baseline to inform the pricing within the contract. This situation can be aggravated because announcements of new service deals commonly contain limited

information, such as the parties involved, and a brief description of the service to be offered. Given the complexity of medium- and particularly high-risk services, this lack of information can make it particularly difficult for equity investors to confidently determine the value of a new service contract, or equivalently, to accurately assess whether the agreed value is indeed appropriate. It is no surprise then, that the higher the contract value (when it is disclosed), the more favourable the market reaction is to *all* service deals, since investors are more likely to be confident that the price adequately compensates for the assumed risks. Even so however, it may still be the case that the manufacturer has decided to enter the deal on strategic, rather than financial considerations, or it may be that the contract is the result of the "winner's curse" effect (Kern et al., 2002). The latter refers to the case where, due to competition among manufacturers, the winner of a specific service contract is the manufacturer that has agreed with the customer to a value that is less than the intrinsic value of the product-service offering. Therefore, the uncertainty that shareholders may have with respect to the pricing of a new contract for the provision of medium- or high-risk services will be signalled by not reacting positively to its announcement. These insights may also provide an explanation for the recent decision of many servitized manufacturers to adopt a "deservitization" strategy, that is, to proceed to service dilution by reducing the importance and number of service elements in their offerings (Kowalkowski et al., 2017).

5.2 Practical contributions

From a practical perspective, our results suggest that manufacturers should initially focus on low-risk service provision for creating value, and as a result, choose to operate at low levels of service infusion. This should be the case at least until they have developed the required capabilities and undertaken the investments and organizational transformation necessary for the successful provision of more complex services. Moreover, when manufacturers decide to increase their service infusion level and start offering services associated with medium or high levels of risk, they should take actions to boost their shareholders' confidence that they understand what the shift to these types of services requires and are well-prepared for it. This can be achieved by communicating to their shareholders their plan and specific actions already taken for becoming successful service providers. As a result, the uncertainty that

shareholders may have with respect to the manufacturer's ability to offer medium- and high-risk services will be reduced, if not eliminated altogether.

Furthermore, manufacturers offering medium- and high-risk services should also address the lack of transparency characterizing announcements of these types of deals in order to boost their shareholders' confidence with respect to the pricing of these contracts. A way to achieve this is for the manufacturer to provide shareholders, or at least those holding a significant stake in the company, with a "service deal" prospectus. Through that, the manufacturer can highlight that it is aware of the challenges and risks that a contract involving the provision of a complex service entails for the organization, and importantly, that the agreed value fully compensates for these risks, beyond the intrinsic value of the service to be offered. To this end, including in this prospectus a detailed risk assessment, along with information with respect to the "through-life accountability" of the service to be provided, that is, a breakdown of the accountability and potential liability that each party involved in the deal will have throughout its life (see Fielder et al., 2014), would certainly be beneficial.

5.3 Limitations and further research

We recognize that our study has limitations. First, the announcement sample was compiled from 41 large manufacturers, most of which have featured in the academic or business press as characteristic examples of servitization. These are large, diversified manufacturers operating in multiple industries, with few exceptions (e.g., Metso, Vestas). It is by no means exhaustive, nor representative of the entire population of servitized manufacturers. Thus, including in the analysis smaller-scale manufacturers has the potential to provide further useful insights.

Furthermore, we have tried to account for the level of service infusion at which the manufacturers in our sample were operating at the time of the announcement (measured through Fang's et al., 2008 "service ratio"), but these data were available only for a sub-sample of firms. In addition, the measure itself has limitations as it relies on managerial discretion to split total revenues by segment, and to appropriately title those segments (so the researcher can identify the revenues from service activity). A more appropriate and granular measure reflecting "experience" in service provision (and its role in increasing the confidence of the market) is a promising direction for further research.

Finally, this work focused entirely on the short-term shareholder value effects of distinct agreements between the manufacturer and a client. A future study could focus on the effects of such deals on the client's long-term stock-market performance. Event studies concerned with longer-term effects of major product-service deals, or of other relevant events (e.g., announcements of the creation of a new service business unit) seem worthwhile.

Acknowledgements

Part of this research was undertaken while George Daskalakis was visiting at the Cambridge Service Alliance (CSA), Institute for Manufacturing (IfM), University of Cambridge and would like to thank them for their hospitality and comments provided on an earlier version of this study. We are indebted to Ivanka Visnjic for sharing with us her 'codebook' for classifying COMPUSTAT business segments. We would also like to thank three anonymous referees for their insightful comments and suggestions. All remaining errors and omissions remain our own. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

Ambroise, L., I. Prim-Allaz, C. Teyssier. 2018. Financial performance of servitized manufacturing firms: A configuration issue between servitization strategies and customer-oriented organizational design. Industrial Marketing Management 71(May) 54-68.

Antonakis, J., Bastardoz, N., and Rönkkö, M. 2021. On ignoring the random effects assumption in multilevel models: Review, critique, and recommendations. Organizational Research Methods 24(2), 443–483.

Baines, T.S., H.W. Lightfoot, O. Benedettini, J.M. Kay. 2009. The servitization of manufacturing: A review of literature and reflection on future challenges. Journal of Manufacturing Technology Management 20(5) 547-567.

Benedettini, O., A. Neely, M. Swink. 2015. Why do servitized firms fail? A risk-based explanation. International Journal of Operations & Production Management 35(6) 946-979.

Benedettini, O., M. Swink, A. Neely. 2017. Examining the influence of service additions on manufacturing firms' bankruptcy likelihood. Industrial Marketing Management 60(January) 112-125.

Berk, J., P. DeMarzo. (2019). Corporate Finance, 5th Edition. (Pearson, London).

Black, F. 1972. Capital market equilibrium with restricted borrowing. Journal of Business 45(3) 444-455.

Boehmer, E., J. Musumeci, A.B. Poulsen. 1991. Event study methodology under conditions of event-induced variance. Journal of Financial Economics 30(2) 253-72.

Bolton, R., D. Grewal, M. Levy. 2007. Six strategies for competing through service: An agenda for future research. Journal of Retailing 83(1) 1-4.

Brandon-Jones, E., M. Dutordoir, J.Q.F. Neto, B. Squire. 2017. The impact of reshoring decisions on shareholder wealth. Journal of Operations Management 49-51(March) 31-36.

Brown, S., J. Warner. 1980. Measuring security price performance. Journal of Financial Economics 8(3) 205-258.

Brown, S., J. Warner. 1985. Using daily stock returns: The case of event studies. Journal of Financial Economics 14(1) 3-31.

Burton, J., Story, V. M., Raddats, C., & Zolkiewski, J. 2017. Overcoming the challenges that hinder new service development by manufacturers with diverse services strategies. International Journal of Production Economics, 192, 29–39.

Campbell, C.J., A.R. Cowan, V. Salotti. 2010. Multi-country event-study methods. Journal of Banking & Finance 34(12) 3078-3090.

Chan, K.C., G.A. Karolyi, R.M. Stulz. 1992. Global Financial Markets and the risk premium on U.S. equity. Journal of Financial Economics, 32, 132-167.

Corrado, C. J. 1989. A non-parametric test for abnormal security price performance in event studies. Journal of Financial Economics 23(2) 385-395.

Cowan, A.R. 1992. Nonparametric event study tests. Review of Quantitative Finance and Accounting 2(4) 343-358.

Cusumano, M.A., S.J. Kahl, F.F. Suarez. 2015. Services, industry evolution, and the competitive strategies of product firms. Strategic Management Journal 36(4) 559-575.

Damodaran, A. 2015. Applied Corporate Finance, 4th ed. (John Wiley and Sons, New York).

Davies, A., T. Brady. 2000. Organizational capabilities and learning in complex product systems: Towards repeatable solutions. Research Policy 29(7-8) 931-953.

Ding, L., H. K.S. Lam, T.C.E. Cheng, H. Zhou. 2018. A review of short-term event studies in operations and supply chain management. International Journal of Production Economics 200(June) 329-342.

Eggert, A., J. Hogreve, W. Ulaga, E. Muenkhoff. 2011. Industrial services, product innovations, and firm profitability: A multiple-group latent growth curve analysis. Industrial Marketing Management 40(5) 661-670.

Eggert, A., J. Hogreve, W. Ulaga, E. Muenkhoff. 2014. Revenue and profit implications of industrial service strategies. Journal of Service Research 17(1) 23-39.

Eisenhardt, M. 1989. Agency theory: An assessment and review. Academy of Management Review 14(1) 57-74.

Fama, E. F. 1998. Market efficiency, long-term returns, and behavioral finance. Journal of Financial Economics 49(3) 283-306.

Fama, E.F. 1970. Efficient capital markets: A review of theory and empirical work. Journal of Finance 25(2) 383-417.

Fang, E., R.W. Palmatier, E.M. Steenkamp. 2008. Effect of service transition strategies on firm value. Journal of Marketing 72(5) 1-14.

Feng, C., Jiang, L., Ma, R., and Bai, C. 2021. Servitization strategy, manufacturing organizations and firm performance: a theoretical framework. Journal of Business & Industrial Marketing (online).

Fielder, P., A. Roper, B. Walby, J. Fuse, A. Neely, C. Pearson. 2014. Product safety in a world of services: Through-life accountability. Cambridge Service Alliance, Institute for Manufacturing, Cambridge University, Cambridge, UK.

Finne, M., Brax, S., Holmström, J. 2013. Reversed servitization paths: A case analysis of two manufacturers. Service Business 7(4) 513–537.

Fynes, B., C. Voss, S. de Burca. 2005. The impact of supply chain relationship dynamics on manufacturing performance. International Journal of Operations & Production Management 25(1) 6-19.

Galbraith, J. R. 2002. Organizing to deliver solutions. Organizational Dynamics 31(2), 194-207.

Gebauer H., E. Fleisch, T. Friedli. 2005. Overcoming the service paradox in manufacturing companies. European Management Journal 23(1), 14-26.

Gebauer, H. E. Fleisch. 2007. An investigation of the relationship between behavioral processes, motivation, investments in the service business and service revenue. Industrial Marketing Management 36(3) 337-48.

Gebauer, H., C. Kowalkowski. 2012. Customer-focused and service-focused orientation in organizational structures. Journal of Business & Industrial Marketing 27(7), 527–537.

Godfrey, S., R. Espinosa. 1996. A practical approach to calculating the cost of equity for investments in emerging markets. Journal of Applied Corporate Finance 9(3), 80-90.

Grönos, C., K. Ojasalo. 2004. Service productivity: Towards a conceptualisation of the transformation of inputs into economic results in services. Journal of Business Research 57(4), 414-423.

Hendricks, K.B., V.R. Singhal, C.I. Wiedman. 1995. The impact of capacity expansion on the market value of the firm. Journal of Operations Management 12(3-4) 259-272.

Hendricks, K.B., V.R. Singhal. 1996. Quality awards and the market value of the firm: An empirical investigation. Management Science 42(3), 415-436.

Hendricks, K.B., V.R. Singhal. 1997. Delays in new product introductions and the market value of the firm: The consequences of being late to the market. Management Science 43(4) 422-436.

Hendricks, K.B., V.R. Singhal. 2003. The effect of supply chain glitches on shareholder wealth. Journal of Operations Management 21(5) 501-522.

Ibbotson, R.G., G.P. Brinson. 1993. Global Investing. (McGraw-Hill, New York).

Jacobs, B.W. 2014. Shareholder value effects of voluntary emissions reduction. Production and Operations Management 23(11) 1859-1874.

Jacobs, B.W., V.R. Singhal, R. Subramanian. 2010. An empirical investigation of environmental performance and the market value of the firm. Journal of Operations Management 28(5) 430-441.

Johnson, M., C. Mena. 2008. Supply chain management for servitized products: A multi-industry case study. International Journal of Production Economics 114(1) 27-39.

Josephson, B.W., J.L. Johnson, B.J. Mariadoss, J. Cullen. 2016. Service transition strategies in manufacturing: Implications for firm risk. Journal of Service Research 19(2) 142-157.

Kaspereit, T. 2019. eventstudy2 - A program to perform event studies with complex test statistics in Stata (Version 3.0).

Kern, T., L.P. Willcocks, E. Van Heck. 2002. The winner's curse in IT outsourcing: Strategies for avoiding relational trauma. California Management Review 44(2) 47-69.

Kohtamäki, M., J. Partanen, V. Parida, J. Wincent. 2013. Non-linear relationship between industrial service offering and sales growth: The moderating role of network capabilities. Industrial Marketing Management 42(8) 1374-1385.

Kolari, J.W., S. Pynnönen. 2010. Event study testing with cross-sectional correlation of abnormal returns. Review of Financial Studies 23(11) 3996-4025.

Kowalkowski, C., Gebauer, H., Kamp, B., Parry, G. 2017. Servitization and deservitization: Overview, concepts, and definitions. Industrial Marketing Management 60(January) Pages 4–10.

Kowalkowski, C., Windahl, C., Kindström, D., Gebauer, H. 2015. What service transition? Rethinking established assumptions about manufacturers' service-led growth strategies. Industrial Marketing Management 45(1), 59–69.

Lintner, J. 1965. The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. Review of Economics and Statistics 47(1)13-37.

Lockett, H., M. Johnson, S. Evans, M. Bastl. 2011. Product service systems and supply network relationships: An exploratory case study. Journal of Manufacturing Technology Management 22(3) 293-313.

MacKinlay, A.C. 1997. Event studies in economics and finance. Journal of Economic Literature 35(1) 13-39.

Makri, C.A., A. Neely. 2015. Through-life accountability: Managing complex services. Cambridge Service Alliance, Institute for Manufacturing, Cambridge University, Cambridge, UK.

Martin Jr., C.R., D.A. Horne. 1992. Restructuring towards a service orientation: The strategic challenges. International Journal of Service Industry Management 3(1) 25-38.

Martinez, V., A. Neely, C. Velu, S. Leinster-Evans, D. Bisessar. 2017. Exploring the journey to services. International Journal of Production Economics 192(October) 66-80.

Mathieu, V. 2001. Product services: From a service supporting the product to a service supporting the client. Journal of Business & Industrial Marketing 16(1) 39-61.

McWilliams, A., D. Siegel. 1997. Event studies in management research: Theoretical and empirical issues. Academy of Management Journal 40(3) 626-657.

Modi, S.B., M.A. Wiles, S. Mishra 2015. Shareholder value implications of service failures in triads: The case of customer information security breaches. Journal of Operations Management 35(May), 21-39.

Mundlak, Y. 1978. Pooling of time-series and cross-section data. Econometrica 46(1), 69-85.

Neely, A. 2008. Exploring the financial consequences of the servitization of manufacturing. Operations Management Research 1(2) 103-118.

Neely, A., O. Benedettini, I. Visnjic. 2011. The servitization of manufacturing: Further evidence. Cambridge Service Alliance, Institute for Manufacturing, Cambridge University, Cambridge, UK.

Neu, W.A., S.W. Brown. 2005. Forming successful business-to-business services in goods-dominant firms. Journal of Service Research 8(1) 3-17.

Nordin, F., D. Kindström, C. Kowalkowski, J. Rehme. 2011. The risks of providing services: Differential risk effects of the service-development strategies of customisation, bundling, and range. Journal of Service Management 22(3) 390-408.

Oliva, R., H. Gebauer, J.M. Brann. 2012. Separate or integrate? Assessing the impact of separation between product and service business on service performance in product manufacturing firms. Journal of Business-to-Business Marketing 19(4), 309-334.

Oliva, R., R. Kallenberg. 2003. Managing the transition from products to services. International Journal of Service Industry Management 14(2) 160-172.

Palmatier, Robert W., Rajiv P. Dant, and Dhruv Grewal 2007. A Comparative Longitudinal Analysis of Theoretical Perspectives of Interorganizational Relationship Performance, Journal of Marketing, 71 (October), 172–94.

Quinn, J.B., T.L. Doorley, P.C. Paquette. 1990. Beyond products: Services-based strategy. Harvard Business Review 68(2) 58-67.

Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J., and Gebauer, H. 2019. Servitization: A contemporary thematic review of four major research streams, Industrial Marketing Management, 83, 207-223.

Schmenner, R.W. 2009. Manufacturing, service, and their integration: Some history and theory. International Journal of Operations & Production Management 29(5) 431-443.

Sharpe, W. F. 1964. Capital asset prices: A theory of market equilibrium under conditions of risk. Journal of Finance 19(3) 425-442.

Slack, N. 2005. Patterns of servitization: Beyond products and service. Cambridge Service Alliance, Institute for Manufacturing, Cambridge University, Cambridge, UK.

Sousa, R., G.J.C. da Silveira. 2017. Capability antecedents and performance outcomes of servitization: Differences between basic and advanced services. International Journal of Operations & Production Management 37(4) 444-467.

Spohrer, J. 2017. IBM's service journey: A summary sketch. Industrial Marketing Management 60(January) 167–172.

Suarez F.F., M.A. Cusumano, S.J. Kahl. 2013. Services and the business models of product firms: An empirical analysis of the software industry. Management Science 59(2) 420-435.

Tukker, A. 2004. Eight types of product-service system: Eight ways to sustainability? Experiences from Suspronet. Business Strategy and the Environment 13(4) 246-60.

van der Valk, W., J. van Iwaarden. 2011. Monitoring in service triads consisting of buyers, subcontractors and end customers. Journal of Purchasing & Supply Management 17(3) 198-206.

Vandermerwe S., J. Rada. 1988. Servitization of business: Adding value by adding services. European Management Journal 6(4) 314-324.

Visnjic-Kastalli I., B. Van Looy. 2013. Servitization: Disentangling the impact of service business model innovation on manufacturing firm performance. Journal of Operations Management 31(4) 169-180.

Visnjic, I., Ringov, D., & Arts, S. (2019). Which Service? How Industry Conditions Shape Firms' Service-Type Choices. Journal of Product Innovation Management, 36(3), 381–407.

Wise, R., P. Baumgartner. 1999. Go downstream: The new profit imperative in manufacturing. Harvard Business Review 77(5) 133-41.

Zhang, G.P., J. Yu, Y. Xia. 2014. The payback of effective innovation programs: Empirical evidence from firms that have won innovation awards. Production and Operations Management 23(8) 1401-1420.

Online supplement: Risky Business? Shareholder Value Effects of Service Provision

	Mean	Median	St. Dev.	Minimum	Maximum
Net sales (x 1,000 $)	22,853,735	15,000,000	25,579,004	635,435	180,000,000
R&D expenditures (x 1,000 $)	1,166,874	586,000	1,499,495	0	7,600,000
Employees	85,453	55,710	88,033	4,604	484,000
Debt-equity ratio (D/E)	1.63	0.63	9.82	0	161.74
Earnings-per-share (EPS)	1.86	0.86	7.73	-67.73	74.97
Return-on-equity (ROE)	0.05	0.06	0.31	-5.21	0.78
Tobin's Q	1.66	1.38	1.50	0.84	23.93

Note: Financial data are obtained from Thomson Reuters Datastream. Sample statistics are based on the most recent fiscal year completed prior to the date of an announcement.

Table OS-1: Descriptive statistics for the manufacturers in the announcement sample

Sector	Companies	Services			Products	Total
		Low risk	Medium risk	High risk		
Aerospace & Defence	13	39	54	9	240	342
Auto, Truck & Motorcycle Parts	2	9	4	2	36	51
Communications & Networking	3	2	13	14	34	63
Computer Hardware	1	1	3	8	7	19
Construction & Engineering	1	8	11	1	5	25
Heavy Electrical Equipment	2	11	12	5	67	95
Heavy Machinery & Vehicles	5	14	3	2	61	80
Industrial Conglomerates	4	11	19	7	64	101
Industrial Machinery & Equipment	2	4	7	0	35	46
IT Services & Consulting	2	2	8	16	6	32
Office Equipment	1	1	1	13	2	17
Phones & Handheld Devices	1	0	6	1	41	48
Renewable Energy Equipment & Services	2	14	0	7	26	47
Shipbuilding	2	1	2	1	55	59

Note: The sector classification is obtained from Thomson Reuters Eikon.

Table OS-2: Sectorial distribution of manufacturers and announcement sample

Country	Companies	Services			Products	Total
		Low risk	Medium risk	High risk		
Canada	1	6	2	0	24	32
Denmark	1	12	0	0	11	23
Finland	2	2	13	1	67	83
France	4	16	24	3	89	132
Germany	2	3	1	3	35	42
Japan	2	3	4	3	54	64
South Korea	1	0	1	0	35	36
Spain	1	2	0	7	15	24
Sweden	4	12	15	15	57	99
Switzerland	1	3	7	5	37	52
UK	4	19	17	4	54	94
USA	18	39	59	45	201	344

Table OS-3: Geographical distribution of manufacturers and announcement sample

Year	Companies	Services			Products	Total
		Low risk	Medium risk	High risk		
1987	3	0	1	0	2	3
1988	13	0	1	0	22	23
1989	13	3	1	1	15	20
1990	13	2	1	0	19	22
1991	15	2	1	0	25	28
1993	15	0	2	0	28	30
1994	18	0	4	0	22	26
1995	18	3	4	1	31	39
1996	18	3	1	1	32	37
1997	18	6	6	3	28	43
1998	18	1	11	3	14	29
1999	19	3	4	2	23	32
2000	16	7	6	1	18	32
2001	23	2	8	3	30	43
2002	24	5	5	3	25	38
2003	21	9	4	0	23	36
2004	25	4	9	5	30	48
2005	23	9	8	5	31	53
2006	23	6	8	9	39	62
2007	32	16	9	7	33	65
2008	23	3	6	7	24	40
2009	26	14	7	5	23	49
2010	23	4	11	9	31	55
2011	18	1	5	3	19	28
2012	18	2	5	7	20	34
2013	15	4	4	3	19	30
2014	12	1	3	3	14	21
2015	11	2	3	2	8	15
2016	13	4	1	3	13	21

Table OS-4: Yearly distribution of manufacturers and announcement sample

	Abnormal returns (AR_t)			Cumulative abnormal returns ($CAR[t_1, t_2]$)		
	Day -1	Day 0	Day 1	[-1, +1]	[-1, 0]	[0, +1]
Panel A: Announcements of low-risk service deals (N = 115)						
Mean (%)	-0.106	0.497	0.033	0.424	0.391	0.530
Crude dependence adjustment	-0.489	2.290**	0.152	1.130	1.270	1.730*
Rank	-0.452	2.440**	-0.598	0.802	1.400	1.290
Panel B: Announcements of medium-risk service deals (N = 139)						
Mean (%)	-0.175	0.049	-0.099	-0.226	-0.126	-0.050
Crude dependence adjustment	-1.040	0.293	-0.593	-0.802	-0.550	-0.218
Rank	-0.829	0.362	-0.174	-0.376	-0.373	0.133
Panel C: Announcements of high-risk service deals (N = 84)						
Mean (%)	-0.088	-0.145	0.065	-0.168	-0.233	-0.080
Crude dependence adjustment	-0.451	-0.748	0.335	-0.848	-0.499	-0.291
Rank	-0.587	-0.731	0.371	-0.546	-0.942	-0.242
Panel D: Announcements of pure product sales (N = 679)						
Mean (%)	-0.019	0.197	0.148	0.326	0.178	0.346
Crude dependence adjustment	-0.295	2.980***	2.230**	2.830***	1.890**	3.680***
Rank	-0.603	3.460***	2.780***	2.130**	3.340***	4.490***

Note: The crude dependence adjustment test is the one proposed by Brown and Warner (1980), while the rank test is that of Corrado (1989). All tests are two-tailed. *, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Table OS-5: Event study results using the market-adjusted model for expected returns