Servitization and firm productivity premium across the product value chain: evidence from Russian manufacturing firms

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Abstract
Purpose – This paper aims to discuss the firm productivity premium for servitized firms. It discusses servitization across the product value chain and estimates the effects of the range and extent of servitization on productivity premium in manufacturing firms.

Design/methodology/approach – This paper develops a conceptual framework and tests the hypotheses on the effects of servitization on productivity premium using linear regression models with a sample of 20,837 Russian manufacturing firms gathered from the Ruslana Bureau van Dijk database and the Russian customs service.

Findings – Servitized firms exhibit higher total factor productivity and labor productivity. The labor productivity premium increases with the number of services offered. However, the impact of services on productivity varies along the product value chain: postmanufacturing and postsales services enhance productivity premium, while manufacturing and back-office services diminish them. The effect of establishment services remains ambiguous.

Practical implications – This paper offers an analytical framework for firms to assess their servitization strategies. These strategies should be gradual, focused on enhancing firm efficiency rather than being an end goal. Firms should initiate the process by introducing services at the postproduction and postsales stages of the product creation chain to achieve productivity premium.

Originality/value – The paper extends the evidence on firm-level productivity drivers and contributes to the servitization theory. A servitization strategy should be portfolio-based, considering both the potential gains and losses in productivity resulting from the implementation of specific services.

Keywords Servitization, Total factor productivity, Labor productivity, Manufacturing firms, Russian economy

Paper type Research paper

1. Introduction

The concept of servitization continues to attract attention from researchers, practitioners and decision-makers due to the need to comprehend the potential benefits and drawbacks associated with the business transformation that companies face when shifting from product to service competition (Baines et al., 2020; Kowalkowski et al., 2017; Baines et al., 2017). In this study, we define servitization as a phenomenon in industrial production where industrial companies not only purchase and produce more services than before but also sell and export an increased amount of services as integrated activities. This typically involves the transformation of the companies’ business models and their repositioning within value creation chains, which is consistent with recent research findings (Kowalkowski et al., 2021, 2017; Doni et al., 2019; Xing et al., 2022; Martinez et al., 2017; Baines et al., 2017). The majority of successful service-centered cases have been observed among multinational companies from developed countries, including IBM, Cisco, Apple, General Electric, Voith Group and Intel (Gebauer et al., 2021; Martinez et al., 2017). Recently, cases have also emerged from developing countries, particularly China, such as Haier and Alibaba (Fu et al., 2022; Yan et al., 2022).

The study of servitization in manufacturing has grown rapidly yet remains fragmented (Rabetino et al., 2018; Khanra et al., 2021). Evidence regarding the impact of servitization on firm performance is inconclusive, which may be partly due to...
diverging customers’ readiness and willingness to buy product-service (Morgan et al., 2019) as well as due to the uncertain implications of business model transformation resulting from servitization (Fang et al., 2008; Martinez et al., 2010; Suarez et al., 2013). The divergent effects of servitization can also be attributed to differences in value creation within adopted service business models (Uлага and Reinartz, 2011; Fang et al., 2008). Provision of services and products can sometimes increase a company’s costs (Barquet et al., 2013; Mo, 2012; Ndurupati et al., 2016) and may not always yield expected returns (Gebauer et al., 2005; MatthysSENS and Vandenbempt, 2010). The investment required for a business transitioning to the simultaneous production of goods and services may also be substantial (Neely, 2008), and the production of services by commodity producers introduces additional operational risks (Durugbo and ErkoYuncu, 2016; Li et al., 2015; Nordin et al., 2011; Reim et al., 2015). The coexistence of benefits and risks of the service business model for manufacturing firms has revealed the paradox of servitization: both high-performing and low-performing firms may experience positive effects from servitization (Blanchard et al., 2017; Kharlamov and Parry, 2021). Few studies have attempted to link the success or failure of servitization strategies in firms to the different types of services added to front-end and back-end products along the value chain (Benedettini et al., 2013, 2015). Existing explanations for the nonlinearity of servitization effects are not comprehensive, and we aim to enhance the understanding of this relationship by exploring not only the intensity of their application within a firm but also the different types of services adopted along the product value chain.

Previous studies have indicated that the ambiguous outcomes of servitization are more prevalent in less economically developed contexts (Szász et al., 2017). However, it is important to note that the number of studies focused on servitization in developing and emerging economies is considerably smaller (Guo et al., 2015; Szász et al., 2017). Indeed, despite the increasing number of servitization studies most of them are based on developed country data as demonstrated by recent studies (Chen et al., 2022a; Chun et al., 2021; Jung and Kim, 2022; Eggert et al., 2014; Kohtamäki et al., 2013; Kharlamov and Parry, 2021; Kwak and Kim, 2016; Lombardi et al., 2022), while studies on developing and emerging markets are lagging and predominantly use Chinese data (Guo et al., 2015; Hu et al., 2021; Li et al., 2015; Zhang, 2022), other recent studies are devoted to the servitization of Indonesian (Islam and Márquez-Ramos, 2023) and Sri Lankan (Weerabahu et al., 2022) manufacturing firms.

In our study, we use data on the Russian economy to examine the effects of servitization, which have previously only been considered in comparison to other economies (Song et al., 2022). Our research, therefore, extends the existing empirical evidence on servitization by providing insights specific to the Russian context. As noted by Neely (2013), the level of servitization in Russia is relatively low compared to developed countries such as Germany, the UK and the USA, and is modest compared to other BRIC countries. Nevertheless, Russian manufacturing firms have shown growing interest in incorporating business services as a factor of production (Rodriguez and Melikhova, 2015). Additionally, owing to the formal institutional constraints present in the Russian business environment, some Russian firms are forced to outsource services that they would have otherwise outsourced, resulting in the potential for ambiguous outcomes of servitization within these firms (Karhunen and Kosonen, 2013; Karhunen, 2008). We believe that our results will broaden our understanding of the effects of servitization in Russia and will be useful for discussing the effects of servitization in the catching-up economies.

Our theoretical framework is firmly grounded in the resource-based approach to firm analysis. We use resource-advantage theory (RAT) as a key instrument for understanding variations in firm performance (Hunt and Davis, 2008). Building on the profound insights of RAT, which elucidates how a firm secures a competitive market position through the exploitation of its comparative advantage in resources (Situmorang, 2023; Varadarajan, 2023), our aim is to provide an understanding of firm productivity in relation to the utilization of resources defined by the process of servitization along the value chain. Within the framework of RAT, we postulate that achieving a comparative advantage in resources through servitization empowers a firm to attain a competitive edge, ultimately leading to enhanced performance and productivity. As a result, our underlying theoretical framework, which underpins the impact of servitization on firm productivity, rests upon RAT’s fundamental hypothesis that the servitization of manufacturing firms is positively associated with firm performance.

Previous studies present insightful but incomplete views on the effects of servitization at different stages of the value chain; moreover, some studies discuss the existence of a nonlinear relationship between servitization and firm performance (Burton et al., 2017; Kohtamäki et al., 2020). Servitization has been observed to change the partnerships in the value chain, giving advantages to firms that are close to the consumers of the product-service complex, while firms upward the chain are disadvantaged (Mosch et al., 2021). At the same time, a firm that chooses a servitization strategy for itself may have a question about the set of services that could not only maximize the value that the company receives from the production of the product but also increase the efficiency of the company’s resource utilization.

To address the existing gap and enhance empirical evidence, this study empirically examines the relationship between servitization and the productivity of manufacturing firms, using various servitization variables. Specifically, we investigate the impact of servitization, its intensity, as well as services along the product value chain on the productivity of Russian manufacturing firms.

Our findings further develop existing evidence, demonstrating that servitization of manufacturing firms in a developing economy, as exemplified by Russia, enables these companies to achieve higher productivity. We emphasize the importance of servitization in multiple domains, as it creates additional positive effects. Our analysis delves deeper into the relationship between servitization and performance, recognizing that although servitization enhances firm productivity, not all services produced by a manufacturing firm have a unidirectional effect on its productivity which develops ideas proposed in Altuntas Vural (2017), Eggert et al. (2014) and Mathieu (2001). This offers a further explanation to the understanding that the servitization process is nonlinear, illogical, organic and unpredictable (Martínez et al., 2017; Stegehuis et al., 2023).

Section 3 introduces the hypotheses and the conceptual model. Sections 4 and 5 present the data, methodology and empirical results, respectively. Section 6 is dedicated to the discussion of the results, and Section 7 delves into the theoretical and managerial implications.
2. Theoretical background: stating the problem

2.1 Servitization from a theoretical perspective

Incorporating services into a manufacturer’s product-based portfolio of offerings could serve as a means of enhancing product differentiation and fostering customer loyalty (Vandermerwe and Rada, 1988). This marked the inception of the theoretical discourse regarding the adoption of servitization strategies by companies. Servitization is commonly regarded as a strategic process of renewal (Piilawa et al., 2022). Servitization can be understood as an opportunity to use resources to gain a competitive advantage in meeting consumer demand. Unique resources enable the producer to generate economic rents. The process of servitization has been viewed from multiple theoretical perspectives (Ruiz-Martín and Díaz-Garrido, 2021). Building upon the existing theoretical literature on servitization and firm performance, we conceptualize servitization as a multifaceted process that necessitates a diverse array of resources and capabilities within an organization. The resource-based view (RBV) and the resource-based theory of competitive advantage (Barney, 2001; Barney and Hesterly, 2015) posit that a firm’s superior performance can be attributed to its resource advantage in specific areas. Resources play a crucial role in determining strategy and implementation, and their distribution varies across firms (Peteraf and Barney, 2003). The RAT expands upon the concepts of RBV by considering competitive advantage as a source of superior financial performance (Hunt and Morgan, 1997). We focus on service offerings at different stages of the value chain within the same company, considering them as strategic options rather than examining an interorganizational context (Stegehuis et al., 2023). In this study, we explore the classification of industrial services based on the developmental stages of the product lifecycle, spanning from presales services (e.g. design) to process consulting (e.g. retailing) and further to after-sales services (e.g. repair). Such services exhibit heterogeneity and result in significant disparities in the competitiveness of producers (Zhang et al., 2023). Building upon the RAT, we analyze the productivity effects of servitization, its intensity and specific types of services along the value chain. RAT is a framework that combines the resource-based approach (RBV) and the competence-based approach. RBV elucidates variations in firm performance contingent on resource endowments. RAT, however, extends RBV by emphasizing that a firm’s competitive advantage is often contingent on both its resources and its ability to effectively harness them, with the latter being of greater significance. Various servitization intensity ultimately exert an influence on firm productivity. Servitization at different stages of the value chain requires the involvement of additional resources, along with their effective allocation and utilization in conjunction with the resources for the core production.

The evolution of the servitization concept encompasses a progression from perceiving it as a gradual increase in the significance of services and their coverage within the entire business model of an industrial enterprise (Mathieu, 2001; Oliva and Kallenberg, 2003) to recognizing that comprehensive servitization does not guarantee market success, but necessitates a flexible approach (Kowalkowski et al., 2017; Matthysens and Vandenberghe, 2010). This is because offering services requires different competencies and resources compared to the core product (Gebauer et al., 2021; Ulaga and Reinartz, 2011). Simultaneously, servitization itself serves as a strategy for adapting to changing competitive conditions. Thus, the RAT expands the understanding of the target level of servitization, which varies for each firm based on market conditions rather than solely relying on a set of unique resources.

2.2 Ambiguity of servitization-productivity evidence

Servitization is used by manufacturers who intend to achieve or maintain a comparative advantage by extending the value chain and adding value (Naik et al., 2020; Chen, 2021). Despite significant efforts to comprehend the conditions and outcomes associated with companies’ adoption of servitization strategies, the factors contributing to success or failure along this trajectory remain inadequately elucidated (Kamal et al., 2020). Furthermore, the relationship between servitization and performance is far from being straightforward (Brax et al., 2021), and existing research has produced inconclusive findings regarding the impact of servitization on financial and economic metrics (Zhang et al., 2023). In particular, there is no consensus on the positive impact of servitization on firm profitability (Kharlamov and Parry, 2021; Lee et al., 2016; Sousa and da Silveira, 2017) and firm productivity (Zhang, 2022; Friesenbichler and Kügler, 2021). The ambiguity surrounding the impact of servitization on productivity has piqued our interest and serves as the foundation of this article.

Empirical evidence indicates that the benefits of servitization on productivity are not consistent, leading to the servitization paradox, where the adoption of servitization may incur high costs without yielding proportionate returns (Chen et al., 2022b; Neely, 2008). Recent studies have examined the relationship between servitization in manufacturing and productivity using the industry level (Zhang, 2022; Friesenbichler and Kügler, 2021) and firm level (Kharlamov and Parry, 2021; Bernard et al., 2017; Blanchard et al., 2017; Bascavusoglu-Moreau and Tether, 2011) data. Firm-level studies have been conducted primarily in developed countries, including the UK (Kharlamov and Parry, 2021; Bascavusoglu-Moreau and Tether, 2011), Denmark (Bernard et al., 2017) and Belgium (Blanchard et al., 2017), and have shown ambiguous servitization effects. Specifically, Blanchard et al. (2017) found evidence of an inverted U-shaped relationship between servitization and productivity, and Kharlamov and Parry (2021) showed that nondigital servitization benefits are confirmed for medium and large firms in terms of productivity. However, this is in contrast to the findings of Crozet and Milet (2017), who did not observe a significant impact of servitization on the productivity of medium and large firms.

Recent meta-analysis studies (Brax et al., 2021; Wang et al., 2018) show that despite inconsistent and even conflicting results, the impact of servitization on firm productivity is significant and positive. To sum up, the question of whether servitization can enhance firm productivity remains unresolved. Li et al. (2022) have urged other researchers to investigate this relationship between servitization and firm productivity across various contexts and perspectives.

3. Conceptual model and hypothesis development

Existing empirical studies not only discuss the role of servitization itself and its intensity but also the role of servitization along the product value chain in enhancing enterprise productivity. Studies
on servitization have classified services based on their moment of transaction in the industrial good lifecycle – pre-transaction, transaction-related and post-transaction services (as it is discussed in the earliest studies, see, for example, Samli et al., 1992; Morris and Davis, 1992), service strategies – R&D services, basic services for the installed base, maintenance services and operational services (Gebauer et al., 2010a; Partanen et al., 2017), orientation toward single or multiple vendors and products or customers (Raddats and Easingwood, 2010; Raddats and Kowalkowski, 2014) or consider the relationship between maintenance services, R&D services and customer services (Kohtamäki et al., 2013).

To assess the impact of servitization on firm productivity, we adopt the classification of services in manufacturing proposed by Miroudot and Cadestin (2017) and integrate it with the perspective on servitization across the product value chain presented by Low and Pasadilla (2015). As depicted in Figure 1, we categorize six groups of services across the product value chain, encompassing all types of services used in manufacturing:

1. establishment services (licensing, construction, development and real estate transactions);
2. premanufacturing services (R&D, design and technology services);
3. manufacturing services (including engineering services such as cleaning, technical testing, recycling and waste management, as well as environmental services);
4. postmanufacturing services, aimed at adding value to the goods produced (wholesale/retail, transportation and logistics and installation and commissioning);
5. post-sales services (repair and after-sales services, financing and leasing and rentals); and
6. back-office services (insurance, financial services, management and legal support).

Figure 2 presents a summary of our conceptual model, which is built upon recent empirical literature on servitization and firm productivity, and includes tests of our hypotheses, which will explain further. Our model estimates the productivity premium from servitization, the premium for the intensity of servitization, and the premium for servitization in specific positions along the product value chain, while controlling for standard firm characteristics and industry fixed effects. The firm’s productivity is measured through both labor productivity and total factor productivity (TFP) indicators.

3.1 The impact of servitization on firm productivity
Servitization of manufacturing firms enhances their performance, increases revenue and improves resource utilization efficiency, leading to increased productivity. We believe that this holds true for Russian manufacturing companies as well. First, servitization affects financial indicators by enabling stable revenue generation throughout the product life cycle and economic downturns (Gebauer et al., 2010a, 2010b, 2010c), creating new revenue streams (Baines and Lightfoot, 2013; Ariu et al., 2016) and influencing revenue and profit growth (Kohtamäki et al., 2013; Eggert et al., 2011, 2014). Furthermore, servitization can enhance a firm’s entry into new markets and its overall export performance (Hu et al., 2021; Huang et al., 2022; Islam and Márquez-Ramos, 2023) as well as establishment of interfirm linkages. This includes the impact of service exports on goods exports (Ariu et al., 2016), internationalization through foreign direct investment (Görg and Jabbour, 2016) and the offshoring of intermediate inputs (Debaere et al., 2013), which also enhances efficiency and enables the generation of additional revenue. Second, servitization brings changes across the entire product value chain and impacts firm performance in several ways by altering production and organizational business models (Huang et al., 2020; Li et al., 2022). In particular, servitization leads to increased competitiveness, enhances customer value through the addition of customized services (Shelton, 2009), reduces customer uncertainty regarding new technologies used in product production (Cusumano et al., 2015), boosts customer loyalty through complementary goods and services, especially in terms of repair and after-sales services (Lee et al., 2016), fosters customer engagement and personalization of goods and services packages to meet customer needs (Baines et al., 2017; Vandermerwe and Rada, 1988) and improves firm social and environmental performance (Zhang et al., 2022). Third, while developing countries, including those in Central Eastern Europe and Russia, significantly lag behind in terms of overall servitization levels (Szász et al., 2017), servitization can still yield positive effects on productivity in these regions. Despite substantial barriers to implementing servitization in developing countries, the positive outcomes often depend on the organizational elements of firms and their resource endowment and capabilities (Lombardi et al., 2022; Weigel and Hadwich, 2018; Baines et al., 2013; Kimita et al., 2022; Gebauer, 2008; Zhang et al., 2022). Thus, the following research hypothesis is proposed:

**H1.** Servitized manufacturing firms have higher productivity.

3.2 The impact of servitization intensity on firm productivity
Servitization as a binary characteristic of a firm may not fully capture the diversity of services and their impact on productivity (Blanchard et al., 2017; Crozet and Milet, 2017; Chen, 2021). This raises the question of the need to examine the influence of
servitization intensity on firm productivity. First, from a theoretical perspective, the RAT underscores that a firm’s competitive advantages can stem from its resources and its ability to leverage them. Under this framework, a combination of intangible and tangible assets owned by the enterprise enables it to effectively deliver valuable products to specific market segments and generate profits (Zhang et al., 2022). Given that servitization provides firms with the capabilities to fully use their existing resources and develop new ones, companies implementing servitization at various stages of the product value chain and with different abilities can achieve better financial performance and higher productivity. Second, firms with a higher degree of service integration in their manufacturing processes tend to enhance their international performance (Li et al., 2018), enabling the generation of additional revenue sources and increased productivity. Furthermore, companies that closely collaborate with knowledge-intensive business service providers (Lafuente et al., 2017) and adopt digital technologies across multiple domains (Vendrell-Herrero et al., 2022) exhibit higher levels of performance. Both of these aspects lead us to consider that diversifying a firm’s activities beyond manufacturing alone contributes to productivity growth. Third, divergent findings regarding the impact of servitization on firm performance can potentially be attributed to the utilization of varied servitization measures (Calabrese et al., 2019). This makes it particularly difficult to draw consistent conclusions about the relationship between servitization and firm productivity and requires further examination with regard to servitization intensity (Raddats et al., 2019; Kohtamäki et al., 2019). Therefore, we hypothesize:

**H2.** Manufacturing firms with higher servitization intensity have higher productivity.

### 3.3 The impact of servitization along the product value chain on firm productivity

Different services offered have different effects on firm productivity (Frank et al., 2019; Haven and Marel, 2018; Kamal et al., 2020; Zhang, 2022). In different environments, product-centric and customer-centric servitization strategies have the potential to enhance company performance (Ting, 2019), while a product-centric servitization approach may not yield a significant impact on company performance (Sousa and da Silveira, 2017). Findings from studies that examine the disaggregated allocation of services across different stages of the value chain present mixed results. For China’s growing manufacturing industry, preproduction and postproduction services, such as technological innovation and financial and business services, drive productivity growth, while postproduction services like transport and logistics have minimal impact (Zhang, 2022). On the other hand, Turkish manufacturing firms involved in premanufacturing and back-office services demonstrate relatively higher productivity, while firms engaged in postmanufacturing and establishment services exhibit lower levels of productivity (Haven and Marel, 2018).

We believe that in the case of the Russian economy, the productivity gains from servitization vary depending on the type of services provided. Services related to marketing and product customization often yield positive benefits for company productivity since they contribute to revenue growth. Service-oriented manufacturing firms prioritize market-related considerations during their early stages to gain a competitive edge in their industry, leading to significant improvements in overall enterprise performance. At this stage, firms focus on softer service-level elements, such as product customization and enhancing customer experience, rather than on the more tangible, functional-level factors like technical specifications or product quality (Feng et al., 2021; Chen, 2010). However, expanding other types of services can result in costs associated with them exceeding the expected revenue growth, which may not lead to increased performance. Engaging in soft servitization may intensify competition with upstream and downstream service providers, resulting in higher costs (Khan et al., 2017; Neely et al., 2011). As the level of service orientation increases, companies must allocate substantial human resources to services such as design, R&D and data processing. However, a company venturing into unfamiliar or noncore service areas may lead to

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**Source:** Compiled by the authors

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*Figure 2* Conceptual model

![Conceptual Model](image-url)
resource dispersion, reducing the efficiency of human resources and diminishing firm performance (Gebauer et al., 2005; Long et al., 2021). In the context of the Russian economy, it is reasonable to assume that servitization in areas that are not knowledge-intensive and do not require a significant influx of additional human resources with nonprofile competencies for the manufacturer will be positively correlated with firm productivity, while in all other cases, the impact on productivity will be negative. This is supported by the observation that in developing and emerging economies, especially former socialist economies, investments in physical capital, rather than innovation activities, are considered the primary driver of productivity growth (Fedyunina and Radosavic, 2022). Consequently, servitization may not inevitably result in higher productivity levels in the case of Russia and other developing economies. Building upon the preceding discussion, we propose the following research hypothesis:

**H3.** Productivity gains from servitization vary depending on the stage of the manufacturing value chain to which the firm’s provided services belong.

### 4. Data and methodology

#### 4.1 Method of data collection and descriptive statistics

We use the firm-level data provided by the Ruslana Bureau van Dijk database for 2011–2019 and adopt the methodology (Cadestin and Mirodot, 2020) to identify servitization. For each company, the data set has a list of OKVED [1] two-digit codes corresponding to its primary and secondary activities. We include in the sample manufacturing firms with primary OKVED codes from 10 to 32 in section C “Manufacturing industries.” If a firm has a secondary code belonging to the service sector, it implies that the firm is producing both goods and service and we consider the firm as servitized. We define a firm as servitized if it has a secondary code belonging to OKVED codes from 45 to 94. We acknowledge that if a firm is involved in the production of goods and services does not always mean that they are sold as a complex. However, firms engaged in the two types of activities are more likely to encourage customers to buy them in complexity and should not miss the opportunity to exploit synergies between their products and services, although we have no empirical way of confirming this. However, it is enough to say that the firm is involved in both manufacturing and service activities, which might be interpreted as servitization.

We extend the approach proposed by Cadestin and Mirodot (2020) proposing an additional source of servitization. We suggest that a holding firm with a subsidiary whose primary code is in services should also be considered as servitized. To account for this, we complement the codes of secondary activities with the codes of primary activities of the subsidiary firms for parent firms.

It is important to note that our database only provides primary and secondary OKVED codes as of 2019. Regrettably, this limitation hinders our ability to fully exploit the benefits of panel data, such as estimating the dynamic effects of introducing additional OKVED codes on productivity. As a result, we are constrained to narrowing our regression analysis to a cross-sectional model. Nevertheless, we will leverage the available panel data to evaluate aggregate factor productivity using the methodology proposed by Levinsohn and Petrin (2003). This approach will be further elaborated upon in Section 5.2.

To ensure the reliability of the data and results, we only include firms with more than 15 employees in 2019 and exclude microenterprises. The final database comprises 20,836 firms, with information on firm characteristics (e.g. size, age, ownership and servitization) in 2019 and financial indicators (e.g. number of employees, capital stock, cost of production and revenue) from 2011 to 2019.

We also control for exporter status, which is often considered an important factor for firm productivity (Reis and Forte, 2016) and merge the data set with data from the Russian Customs Service. To account for export intensity and to ensure that we only consider firms with substantial export activities, we define firms as exporters only if they have an export intensity of 10% or higher, in line with previous studies (Temouri et al., 2013; Lee et al., 2009).

Table 1 presents descriptive statistics for the variables.

According to our estimates on the sample of 17,691 firms, except for their core industrial activities, 88% of manufacturing firms are also engaged in ancillary services activities, while only 12% of companies in the Russian manufacturing sector are engaged in manufacturing only. Across Russian manufacturing firms the most frequent types of servitization are wholesale and retail trade (41.5% of all servitized companies), construction services (13.3%) and real estate operations (6.6%). If we examine the service structure of manufacturing firms based on the grouping presented in Figure 1, several key points emerge. In Russian manufacturing, servitization primarily occurs in postproduction activities, constituting 55.2% of the total services provided. This prevalence can be attributed to the significant involvement of firms in wholesale and retail trade activities. Another notable segment is services within the production stage, accounting for 19.8%. Among these services, construction and real estate transactions stand out as being among the top three most implemented services by Russian manufacturing firms. In contrast, services at other stages of production have relatively lower shares. Specifically, back-office services (including data processing and information services, business support, health and social services and hospitality services) make up 9.7%, post-sales services (including financial services, machinery and equipment repair and installation, leasing and rental) account for 7.0%, manufacturing services (including engineering, electricity, gas and steam supply, water supply and waste management) contribute 5.5% and premanufacturing services (including R&D and design) represent 2.7%.

#### 4.2 Empirical model

We measure firm productivity using two indicators. The first indicator is TFP, which we estimate using panel data for the period 2011–2019 and a Cobb–Douglas production function following the approach developed by Levinsohn and Petrin (2003), which has become widely accepted for its simplicity and suitability for our data. To verify the stability of the results, we also use the logarithm of labor productivity, calculated as firm revenue per employee, in line with studies by Luo and Bu (2016) and Pessoa and Van Reenen (2014).
Table 1 Descriptive statistics of the variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Operationalization</th>
<th>No. of observations</th>
<th>Mean</th>
<th>SD</th>
<th>min.</th>
<th>max.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Labour (lnL)</td>
<td>Number of employees</td>
<td>20,837</td>
<td>4.272</td>
<td>1.121</td>
<td>2.8</td>
<td>10.03</td>
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<tr>
<td>Capital (lnK)</td>
<td>Capital stock in rubles, logarithm</td>
<td>19,796</td>
<td>9.907</td>
<td>2.508</td>
<td>0</td>
<td>20.228</td>
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<tr>
<td>Cost (lnM)</td>
<td>Cost of production in rubles, logarithm</td>
<td>16,015</td>
<td>12.269</td>
<td>1.751</td>
<td>0</td>
<td>19.74</td>
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<tr>
<td>Revenue (lnR)</td>
<td>Revenue in rubles, logarithm</td>
<td>20,734</td>
<td>12.126</td>
<td>1.742</td>
<td>2.2</td>
<td>19.939</td>
</tr>
<tr>
<td><strong>Independent variables</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Presence of servitization</td>
<td>Dummy = 1 if a firm has services among secondary activities</td>
<td>20,827</td>
<td>0.849</td>
<td>0.358</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Number of services</td>
<td>Number of services across the product value chain in which a firm has a secondary activity</td>
<td>20,827</td>
<td>1.579</td>
<td>1.099</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td><strong>Position of services in value chain</strong></td>
<td></td>
<td></td>
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<tr>
<td>Establishment</td>
<td>Dummy = 1 if a company has services in respective area</td>
<td>17,691</td>
<td>0.4</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Premanufacturing</td>
<td></td>
<td>17,691</td>
<td>0.08</td>
<td>0.271</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td>17,691</td>
<td>0.132</td>
<td>0.339</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Postmanufacturing</td>
<td></td>
<td>17,691</td>
<td>0.844</td>
<td>0.363</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Postsales</td>
<td></td>
<td>17,691</td>
<td>0.203</td>
<td>0.403</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Back-office</td>
<td></td>
<td>17,691</td>
<td>0.2</td>
<td>0.4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small-sized companies (15–100)</td>
<td>Dummy = 1 if the number of employees of the company for 2019 was 15–100</td>
<td>20,827</td>
<td>0.696</td>
<td>0.46</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Medium-sized companies (101–249)</td>
<td>Dummy = 1 if the number of employees of the company for 2019 was 101–249</td>
<td>20,827</td>
<td>0.163</td>
<td>0.37</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Large-sized companies (250+)</td>
<td>Dummy = 1 if the number of employees of the company for 2019 was 250</td>
<td>20,827</td>
<td>0.14</td>
<td>0.347</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Soviet (est. before 1991)</td>
<td>Company category by age (date of establishment)</td>
<td>20,836</td>
<td>0.071</td>
<td>0.257</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Post-Soviet (est. in 1992–1998)</td>
<td></td>
<td>20,836</td>
<td>0.206</td>
<td>0.405</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Est. in 1999–2010</td>
<td></td>
<td>20,836</td>
<td>0.49</td>
<td>0.5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Est. in 2011–2016</td>
<td></td>
<td>20,836</td>
<td>0.233</td>
<td>0.423</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Foreign owned</td>
<td>Dummy = 1 if the share of foreign ownership is &gt;10%</td>
<td>20,827</td>
<td>0.045</td>
<td>0.208</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Holding</td>
<td>Dummy = 1 if the company is part of a holding company</td>
<td>20,520</td>
<td>0.774</td>
<td>0.418</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Exporter</td>
<td>Dummy = 1 if the share of exports in revenue is &gt;10%</td>
<td>20,838</td>
<td>0.056</td>
<td>0.23</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Industry</td>
<td>Manufacturing industries, comprising OKVED codes 10–31</td>
<td>20,837</td>
<td>8.936</td>
<td>5.87</td>
<td>1</td>
<td>19</td>
</tr>
</tbody>
</table>

**Source:** Authors’ calculation, data from Ruslana Bureau van Dijk

For this study, we generate three models corresponding to three hypotheses and estimate each of the three equations for both TFP and labor productivity, resulting in a total of six equations. Specifically, equations (1)–(3) estimate the impact of servitization on TFP, while equations (4)–(6) estimate the impact of servitization on labor productivity:

\[
TPF = \alpha + \beta_1 \times \text{serv} + \beta_2 \times \text{size} + \beta_3 \times \text{foreign} + \beta_4 \times \text{holding} + \beta_5 \times \text{exports} + \beta_6 \times \text{age} + \beta_7 \times \text{industry} + \varepsilon \quad (1)
\]

\[
TPF = \alpha + \beta_1 \times \text{serv}_{\text{number}} + \beta_2 \times \text{size} + \beta_3 \times \text{foreign} + \beta_4 \times \text{holding} + \beta_5 \times \text{exports} + \beta_6 \times \text{age} + \beta_7 \times \text{industry} + \varepsilon \quad (2)
\]

\[
TPF = \alpha + \beta_1 \times \text{X} + \beta_2 \times \text{size} + \beta_3 \times \text{foreign} + \beta_4 \times \text{holding} + \beta_5 \times \text{exports} + \beta_6 \times \text{age} + \beta_7 \times \text{industry} + \varepsilon \quad (3)
\]

\[
\ln(\text{LabProd}) = \alpha + \beta_1 \times \text{serv} + \beta_2 \times \text{size} + \beta_3 \times \text{foreign} + \beta_4 \times \text{holding} + \beta_5 \times \text{exports} + \beta_6 \times \text{age} + \beta_7 \times \text{industry} + \varepsilon \quad (4)
\]

\[
\ln(\text{LabProd}) = \alpha + \beta_1 \times \text{serv}_{\text{number}} + \beta_2 \times \text{size} + \beta_3 \times \text{foreign} + \beta_4 \times \text{holding} + \beta_5 \times \text{exports} + \beta_6 \times \text{age} + \beta_7 \times \text{industry} + \varepsilon \quad (5)
\]

\[
\ln(\text{LabProd}) = \alpha + \beta_1 \times \text{X} + \beta_2 \times \text{size} + \beta_3 \times \text{foreign} + \beta_4 \times \text{holding} + \beta_5 \times \text{exports} + \beta_6 \times \text{age} + \beta_7 \times \text{industry} + \varepsilon \quad (6)
\]
where serv is a dummy variable which measures equals 1 if a firm has at least 1 secondary activity in the service sector, serv_number measures the number of services across the product value chain that are among secondary activities of the firm, X is a set of dummy variables measuring the presence services implemented in a firm across the product value chain (including establishment, premanufacturing, manufacturing, postmanufacturing, post-sales and back-office). In addition, the model includes a set of control variables which are usually considered as significant determinants of productivity at the firm level and are discussed in empirical studies as sources of heterogeneity in servitization (Blanchard et al., 2017; Crozet and Milet, 2017; Dachs et al., 2014; Martin-Peña et al., 2019). We include size is a set of dummy variables reflecting small, medium and large size according to the number of employees, foreign measures the existence of foreign ownership, holding reflects the firm’s participation in a group of companies, age is a set of dummy variables to control for company age, particularly, we distinguish between firms established during the soviet period, during the early post-soviet transition (before, 1998) and during two modern periods – 1999–2010 and 2011–2016, industry is a set of dummies measuring industry-level fixed effects.

In our paper we evaluate servitization premium through empirical analysis by using ordinary least squares (OLS) estimator, the approach is similar to Crozet and Milet (2017) who also estimated the average performance gap (i.e. the premium) between pure manufacturers and firms with a given service intensity within the same year and industry. We assume the possibility of an endogeneity problem in the OLS estimation that could be caused by unobserved firm-level features. To avoid this simultaneous bias, we perform robustness check procedure and separately estimate the model for the subsample for servitized firms only. We use industry-level fixed effects to capture unobserved industry-specific effects that could affect the results. Finally, we use robust standard errors that help us to downsize the probability of heteroscedasticity presence and have more accurate estimations.

5. Results

The preliminary evidence, as indicated by descriptive statistics, suggests a correlation between servitization and firm productivity. Specifically, the average TFP and average labor productivity indicators rise with an increase in the number of services offered across the product value chain. Furthermore, the firms that exhibit the highest extent of servitization not only display higher average productivity but also exhibit a smaller dispersion of productivity, as shown in Figure 3.

The results of the econometric analysis for the productivity premium are presented in Table 2. The dependent variables in equations (1)–(3) are TFP, while the dependent variables in equations (4)–(6) are the logarithm of labor productivity.

We evaluate H1 to examine the positive impact of servitization on firm productivity, and our findings confirm this hypothesis. Specifically, we observe a significant productivity premium associated with servitization, with a servitized firm having 0.12 higher TFP and 11.4% higher labor productivity, all else being equal. Next, we test H2, aiming to estimate the productivity premium linked to the intensity of servitization across the product value chain. While we are able to partially confirm this hypothesis, there are variations in the results. Notably, we find a substantial and positive premium for labor productivity but an insignificant impact on TFP. Our results indicate that the introduction of additional services within a firm leads to a 1.96% increase in labor productivity. Finally, H3 explores whether productivity gains from servitization differ based on the stage of the manufacturing value chain where the firm’s services are positioned. Our findings yield mixed results. Postproduction and post-sales services are associated with increased productivity premiums. Specifically, if a manufacturing firm provides postproduction services, there is a 0.19 increase in TFP and an 11% increase in labor productivity. When a firm offers post-sales services, TFP rises by 0.16 and labor productivity increases by 6.8%. On the other hand, manufacturing and back-office services are linked to a decrease in productivity premiums for both indicators. Establishment services exhibit an ambiguous effect, reducing the premium for TFP but increasing it for labor productivity. The effect of premanufacturing services is negative but statistically insignificant. Among other variables, we find that firms with foreign ownership, firms affiliated with holding companies and exporting firms exhibit higher TFP and labor productivity. Furthermore, we observe that the productivity premium increases with firm size; larger companies tend to have larger premiums.

To check the robustness of the results, we estimate equations (3) and (6) on the subsample of servitized firms. The results shown in Table 3 indicate that all the empirical observations from the full sample remain robust for the sub-sample of servitized firms. Specifically, we observe that servitized firms exhibit a positive productivity premium from their involvement in postmanufacturing and post-sales activities, whereas a negative premium results from their involvement in manufacturing and back-office activities.

6. Discussion

Our results demonstrate that servitization has a positive impact on TFP and labor productivity. Further, we establish that the extent of servitization positively affects labor productivity, with firms that have implemented a large number of services exhibiting a higher labor productivity premium. These findings are in line with recent empirical studies (Crozet and Milet, 2017; Kharlamov and Parry, 2021) and meta-analyses (Wang et al., 2018). Our results make a contribution to the literature by exploring the relationship between servitization and firm productivity, while most existing studies examine the impact of servitization on firm profitability and sales growth. This is important since productivity is shown to be a significant driver of profitability and firm growth (Yazdanfar, 2013). Our findings suggest that improved productivity resulting from servitization may partially explain the positive impact on firm performance documented in previous studies. This highlights the complex relationship between servitization and firm performance indicators (Martin-Peña et al., 2019; Kohtamäki et al., 2013).

The analysis of the impact of particular services along the product value chain on productivity provides ambiguous results. We observe a positive impact on productivity from postmanufacturing and post-sales services, which are typically transactional and do not require significant investments.
Conversely, we find a negative impact on TFP and labor productivity from manufacturing and back-of-fice services, which require close collaboration with customers and result in high-value offerings. Results for establishment services are mixed, with a negative impact on TFP but a positive impact on labor productivity. These findings are in line with the literature, which suggests that low-level investments that do not significantly reconfigure value chain activities tend to reduce payback times and increase financial performance, while investments in new capabilities and operational processes increase implementation costs and result in missed returns (Wamba et al., 2017).

In conclusion, on average, servitization has a positive impact on productivity for manufacturing firms, and a higher extent of servitization leads to an increased premium. However, the distribution of gains and losses in productivity from the implementation of servitization is different among servitized firms and has implications for servitization strategy, which will be discussed in the following section.

7. Implications of the study

7.1 Theoretical implications

Previous research on the relationship between servitization and performance has produced ambiguous and even contradictory results. This study aimed to contribute to this research area by exploring how servitization across the product value chain affects productivity.

Our study shows that the measurement of servitization has a significant impact on the observed relationship between servitization and performance. In our study, we put forward three hypotheses and tested three different measures of servitization: presence or servitization, servitization intensity and servitization across particular stages of the value chain. We show that while the presence of servitization has a positive effect on a firm’s productivity, the effects of servitization at particular stages of the product value chain vary significantly. These findings are consistent with an assertion that multiple-item measurement of constructs is more valid than single-item measurement. However, it is important to note that our approach to defining servitization along the product value chain might be imperfect, as discussed above in the methodological section. Therefore, future empirical studies should carefully consider how servitization across the product value chain is measured.

This study builds upon prior research (Hu et al., 2021; Zhang et al., 2022) by offering an explanation for the heterogeneous effects of industrial firms’ adoption of servitization strategies in terms of distinct service types based on the stage of product value creation. The findings of this study contribute to the existing body of knowledge on the benefits that manufacturing companies gain from servitization highlighting the importance of servitization in multiple areas to achieve a positive overall productivity premium. The diverse approach to service offerings aligns with the resource-based understanding of the motivations behind servitization. This can be attributed to the inherent nature of servitization.

This study extends the RAT to explain the relationship between firm productivity and various servitization measures, including servitization itself, its intensity and individual services along the product value chain within the same firm. From a RAT perspective, servitization offers manufacturing companies an effective avenue to attain a competitive advantage and realize intangible benefits (Fang et al., 2008). However, implementing servitization requires a significant investment of resources and may not yield immediate returns. Furthermore, the creation of a competitive advantage through servitization is intricately linked to the size and quality of resources on one hand and the service mix and stage of the value chain on the other. This complexity highlights the necessity for further research on the firm’s internal environment.

Using the example of a growing economy with resource constraints and an imperfect external environment, we demonstrate that companies with different resources and competencies engage in different types of servitization, which leads to varying advantages, ultimately reflecting differences in firm productivity levels. This discovery helps to explain the “servitization paradox” phenomenon and reinforces the intricate relationship...
Table 2  Productivity premium for Russian manufacturing firms

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Total factor productivity (1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of servitization</td>
<td>0.122*** (0.0460)</td>
<td></td>
<td></td>
<td>0.114*** (0.0205)</td>
<td></td>
<td>0.0196** (0.0069)</td>
</tr>
<tr>
<td>Number of services</td>
<td>0.00001 (0.0152)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establishment</td>
<td></td>
<td>-0.0809* (0.0353)</td>
<td></td>
<td></td>
<td>0.0472*** (0.0155)</td>
<td></td>
</tr>
<tr>
<td>Premanufacturing</td>
<td>-0.0343 (0.0688)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>-0.267*** (0.0497)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postmanufacturing</td>
<td>0.189*** (0.0368)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postsales</td>
<td>0.122*** (0.0450)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back-office</td>
<td>-0.0903* (0.0451)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exporter</td>
<td>0.345*** (0.0742)</td>
<td>0.346*** (0.0743)</td>
<td>0.361*** (0.0744)</td>
<td>0.356*** (0.0361)</td>
<td>0.355*** (0.0361)</td>
<td>0.360*** (0.0361)</td>
</tr>
<tr>
<td>Small (15–100)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium (101–249)</td>
<td>0.276*** (0.0386)</td>
<td>0.279*** (0.0388)</td>
<td>0.291*** (0.0387)</td>
<td>0.276*** (0.0186)</td>
<td>0.275*** (0.0187)</td>
<td>0.281*** (0.0187)</td>
</tr>
<tr>
<td>Large (250+)</td>
<td>0.752*** (0.0423)</td>
<td>0.758*** (0.0430)</td>
<td>0.812*** (0.0440)</td>
<td>0.323*** (0.0202)</td>
<td>0.318** (0.0205)</td>
<td>0.350** (0.0209)</td>
</tr>
<tr>
<td>Foreign owned</td>
<td>0.574*** (0.0734)</td>
<td>0.574*** (0.0733)</td>
<td>0.558*** (0.0733)</td>
<td>0.839*** (0.0388)</td>
<td>0.840*** (0.0388)</td>
<td>0.837*** (0.0388)</td>
</tr>
<tr>
<td>Holding-structured</td>
<td>0.204*** (0.0381)</td>
<td>0.204*** (0.0382)</td>
<td>0.204*** (0.0381)</td>
<td>0.119*** (0.0173)</td>
<td>0.119*** (0.0173)</td>
<td>0.119*** (0.0172)</td>
</tr>
<tr>
<td>Soviet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Soviet</td>
<td>-0.216*** (0.0681)</td>
<td>-0.216*** (0.0682)</td>
<td>-0.208*** (0.0680)</td>
<td>-0.132*** (0.0326)</td>
<td>-0.131*** (0.0327)</td>
<td>-0.131*** (0.0326)</td>
</tr>
<tr>
<td>Est. in 1999–2010</td>
<td>-0.198*** (0.0630)</td>
<td>-0.199*** (0.0630)</td>
<td>-0.188*** (0.0629)</td>
<td>-0.146*** (0.0304)</td>
<td>-0.146*** (0.0304)</td>
<td>-0.146*** (0.0304)</td>
</tr>
<tr>
<td>Est. in 2011–2016</td>
<td>-0.201*** (0.0684)</td>
<td>-0.203*** (0.0684)</td>
<td>-0.196*** (0.0682)</td>
<td>-0.150*** (0.0323)</td>
<td>-0.151*** (0.0323)</td>
<td>-0.152*** (0.0323)</td>
</tr>
<tr>
<td>Constant</td>
<td>5.807*** (0.0800)</td>
<td>5.903*** (0.0737)</td>
<td>5.780*** (0.0767)</td>
<td>7.551*** (0.0396)</td>
<td>7.619*** (0.0366)</td>
<td>7.567*** (0.0379)</td>
</tr>
<tr>
<td>Industry effects</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Observations</td>
<td>15,251</td>
<td>15,251</td>
<td>15,251</td>
<td>20,405</td>
<td>20,405</td>
<td>20,405</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td>0.17</td>
<td>0.17</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses. *** Significance level (p < 0.01); ** significance level (p < 0.05)

Source: Authors’ calculations, data from Ruslana Bureau vn Dijk
between servitization and firm productivity. Therefore, we believe that our results suggest that the sign of effects of servitization at both ends of the value chain are more conditional and are contingent on several factors, which needs further research.

7.2 Managerial implications
Our findings suggesting that productivity gains from servitization depends on whether the services require significant resources and competences, provide valuable insights for managerial decision-making, highlighting the importance of considering the relationship between servitization and firm performance, the stage of development and the position in the value chain when developing a servitization strategy. Furthermore, the use of data from companies in a less-developed economic context provides additional insights into the reasons for the success or failure of both individual firms and countries during the process of industrial servitization.

From a managerial standpoint, this study sheds light on the significance of servitization as a strategic tool. It is important to note that servitization should be viewed as a means to enhance efficiency and competitiveness rather than an end in itself. Consequently, firms’ management should carefully consider the relationship between servitization and firm performance, its position in the value chain and the stage of servitization development when formulating a servitization strategy. This can help to overcome the servitization paradox (Martín-Peña et al., 2019). It is recommended to implement servitization gradually (Sousa and da Silveira, 2017; Kohtamäki et al., 2013), taking into consideration the internal capabilities of the firm as well as the industry environment. The initial phase should focus on low-value-added activities that leverage existing manufacturing capabilities, and then gradually transition to more complex and investment-intensive services that require new capabilities. The implementation of complex services that demand radical business model transformation and capability acquisition may result in prolonged payback periods, missed returns and negative productivity premiums. To mitigate these risks, firms should invest in personnel development and establish a performance monitoring system during and after servitization.

7.3 Limitations and future research
Our study has some limitations that offer avenues for future research. First, due to data constraints, we analyzed the servitization premium, which reflects the performance gap between servitized and nonservitized firms in aggregate as well as with respect to specific types of services, but did not examine the dynamic relationship between servitization and productivity. Further studies should consider the causal impact of servitization on firm productivity, and specifically examine the unobserved factors that may simultaneously influence the decision to implement services and firm productivity. Second, given the cross-sectional nature of the data, the findings on the servitization premium across the product value chain are based on observations of firms at different stages of servitization. It would be valuable for future studies to investigate how firms make decisions on servitization, taking into account their current servitization portfolio. Finally, to broaden the evidence for different economic systems and to increase the validity of the results, future studies could benefit from using multi-country data sets, which would allow for estimation of differences in the

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Table 3 Productivity premium for servitized firms

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Total factor productivity</th>
<th>Ln (labor productivity)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Establishement</td>
<td>−0.0918** (0.0373)</td>
<td>0.0374** (0.0164)</td>
</tr>
<tr>
<td>Premanufacturing</td>
<td>−0.0423 (0.0693)</td>
<td>−0.0200 (0.0293)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>−0.274*** (0.0507)</td>
<td>−0.0589*** (0.0233)</td>
</tr>
<tr>
<td>Postmanufacturing</td>
<td>0.178*** (0.0497)</td>
<td>0.0905*** (0.0219)</td>
</tr>
<tr>
<td>Postsales</td>
<td>0.157*** (0.0460)</td>
<td>0.0676*** (0.0207)</td>
</tr>
<tr>
<td>Back-office</td>
<td>−0.0847 (0.0456)</td>
<td>−0.131*** (0.0204)</td>
</tr>
<tr>
<td>Exporter</td>
<td>0.434*** (0.0803)</td>
<td>0.373*** (0.0389)</td>
</tr>
<tr>
<td>Small (15–100)</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Medium (101–249)</td>
<td>0.278*** (0.0419)</td>
<td>0.272*** (0.0202)</td>
</tr>
<tr>
<td>Large (250+)</td>
<td>0.776*** (0.0470)</td>
<td>0.343*** (0.0220)</td>
</tr>
<tr>
<td>Foreign owned</td>
<td>0.537*** (0.0779)</td>
<td>0.824*** (0.0406)</td>
</tr>
<tr>
<td>Holding-structured</td>
<td>0.188*** (0.0414)</td>
<td>0.104*** (0.0185)</td>
</tr>
<tr>
<td>Soviet</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Post-Soviet</td>
<td>−0.220*** (0.0746)</td>
<td>−0.124*** (0.0349)</td>
</tr>
<tr>
<td>Est. in 1999–2010</td>
<td>−0.190*** (0.0691)</td>
<td>−0.146*** (0.0324)</td>
</tr>
<tr>
<td>Est. in 2011–2016</td>
<td>−0.208*** (0.0753)</td>
<td>−0.165*** (0.0346)</td>
</tr>
<tr>
<td>Constant</td>
<td>5.796*** (0.0937)</td>
<td>7.591*** (0.0436)</td>
</tr>
<tr>
<td>Industry Effects</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Observations</td>
<td>13,046</td>
<td>17,333</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.08</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses. **Significance level (p < 0.01); ***significance level (p < 0.05); *significance level (p < 0.1)
Source: Authors’ calculations, data from Ruslana Bureau van Dijk
servitization premium in different economic contexts and provide further empirical evidence on latecomer countries in the servitization process.

Note
1 OKVED – All-Russian classifier of types of economic activity, which is identical to NACE Rev. 2 – Statistical classification of economic activities in the European Community.

References
Baines, T., Bigdeli, A.Z., Bustinza, O.F., Shi, V.G., Baldwin, J.


Further reading


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