Choice versus Necessity: Understanding Service Diversification and Firm Performance in Manufacturing*

Anwar Adem[1] Giuliana Battisti[2] Nigel Driffield[2] Andreas Schroeder[3]

[1]Aston Business School, Aston University, B4 7UP, Birmingham, United Kingdom;
[2]Warwick Business School, Scarman Rd, Coventry, CV4 7AL, United Kingdom;
[3]Lancaster University Management School, Bailrigg, Lancaster, LA1 4YX, United Kingdom

Corresponding authors' email: nigel.driffield@wbs.ac.uk

This study examines the effect of service-oriented manufacturing business models on firm performance and the drivers of the performance disparities across adopters. Drawing on the resource-based view of the firm, we identify necessary conditions for diversification into services, and also for translating this into performance. Using data from 15,732 UK manufacturing companies in the period 2010–2021, we demonstrate that service offering increases the productivity, profits, and turnover of manufacturing firms. The increase intensifies with the extent of the offering and is contingent on firm specific resources and capabilities related to implementing the business model innovation. The diversification strategy is more common in firms with large human capital resources, with financial constraints, and those facing high levels of competition. It is less likely among firms with alternative options for diversification, such as internationalization.

Keywords: Productivity, Diversification, Service Offering, Innovation, Firm Performance, UK

* The authors acknowledge the support of the ESRC under grant ES/W010194/1. The usual disclaimers apply.

Choice versus Necessity: Understanding Service Diversification and Firm Performance in Manufacturing*

Abstract

This study examines the effect of service-oriented manufacturing business models on firm performance and the drivers of the performance disparities across adopters. Drawing on the resource-based view of the firm, we identify necessary conditions for diversification into services, and also for translating this into performance. Using data from 15,732 UK manufacturing companies in the period 2010–2021, we demonstrate that service offering increases the productivity, profits, and turnover of manufacturing firms. The increase intensifies with the extent of the offering and is contingent on firm specific resources related to implementing the business model innovation. The diversification strategy is more common in firms with large human capital resources, with financial difficulties, and those facing high levels of competition. It is less likely among firms with alternative options for diversification, such as internationalization.

Keywords: Productivity, Service Offering, Innovation, Firm Performance, UK

* The authors acknowledge the support of the ESRC under grant ES/W010194/1. The usual disclaimers apply.

1. Introduction

Over the past two decades, diversification into services—whether related or unrelated to a firm's core products and markets—has become an increasingly prevalent form of business model innovation among manufacturing firms (Ulaga and Kowalkowski, 2022; Kramer et al., 2024; Taisch and Romero, 2023; Baines et al., 2024). Companies such as Hitachi, which began in electrical and heavy machinery manufacturing, have expanded into IT services. Sony, traditionally focused on electronics and entertainment products, now offers a range of unrelated services including insurance, banking, and nursing care. Nike, known for athletic footwear, has ventured into related digital fitness services such as workout programs and run tracking.

This trend is driven by a combination of pressures and opportunities. Manufacturers face declining margins and rising costs, particularly due to increased competition from low-cost economies (Kramer et al., 2024), and they seek more sustainable, outcome-based relationships with customers (Eggert et al., 2020; Visnjic and Van Looy, 2013). Simultaneously, the service sector now accounts for 62% of global value added (The World Bank, 2022), making it an attractive arena for growth.

The academic literature that examines this trend highlights two core themes: (1) the strategic motivations behind the manufacturers' diversification into services, and (2) the performance implications of such a diversification. While the number of firms pursuing service-oriented strategies continues to grow, especially in advanced economies (Crozet and Milet, 2017; Tang et al., 2022; Kramer et al., 2024), evidence on the performance benefits remains inconsistent and context-specific. To address this gap, we examine whether diversification into services helps explain performance heterogeneity among UK manufacturers, and critically, what factors drive the differing performance outcomes among those that choose to diversify.

Despite the breadth of the existing body of research exploring this research area, its theoretical and empirical foundations remain fragmented and insufficient for fully understanding the drivers and performance implications of service diversification. Many studies focus on the diversification decision itself, often drawing on a portfolio theoretical perspective (Eckert and Hüsig, 2022), which conceptualise the manufacturer's diversification as an investment behaviour where firms with sufficient managerial and financial slack expand into new markets to reduce overall operational risk (Nasirov and Castaldi, 2025). Other studies adopt a Transaction Cost Economics perspective (Ruiz-Martín and Díaz-Garrido, 2021), analysing how the costs and efficiencies associated with varying levels of service diversification guide

the strategic decisions (Kohtamäki et al., 2019). Separately, another stream of literature examines the performance disparities emerging from service diversification, using frameworks such as the Organizational Identity Perspective (Dmitrijeva et al., 2022) — which explores how the tensions arising from transitioning to a hybrid product-service offering can affect performance—and the Organizational Boundary Perspective (Bigdeli Ziaee et al., 2021), which highlights the divers resources, relational and cognition challenges, as well as their effect on performance outcomes (Parida and Jovanovic, 2022), as services alter traditional internal and external structures.

To explore whether diversification into services helps explain performance heterogeneity among UK manufacturers, and critically, what factors drive the differing outcomes among those that choose to diversify our study aligns more closely with the business model innovation literature (Velu, 2016; Velu and Jacob, 2016), which emphasizes changes in value proposition, creation, and capture, and considers how firms adapt to new market realities through partner ecosystems. Yet we advance this work by arguing, following (Wannakrairoj and Velu, 2021), for a more integrated framework—one that captures the interplay between the necessary and sufficient conditions for successful diversification and the performance implications.

In addressing this question, we bridge the primary research perspectives examining the research domains - diversification strategy and performance outcomes. We develop a framework rooted in the Resource-Based View (RBV) (Barney, 1991, 1995) that posits that competitive advantage in service diversification depends on a firm's access to Valuable, Rare, Inimitable, and Non-substitutable/Organized (VRIN/O) resources that allow firms to effectively reconfigure those resources in pursuit of new opportunities.

We test our framework using a panel dataset of UK manufacturing firms from 2010 to 2021, derived from FAME. To address endogeneity from self-selection bias, we employ an endogenous treatment effect model to assess the impact of service diversification on firm performance.

Our findings suggest that firms with larger resource bases and a stronger R&D base are more likely to diversify into services (MacDonald, 1985; Foreman-Peck and Zhou, 2023). In contrast, firms facing financial pressure, operating in highly competitive markets, or engaged in international trade exhibit more organisational inertia and are less likely to diversify. We also find a positive relationship between service diversification and firm performance, with stronger effects observed among firms offering a broader range of services.

The remainder of this paper is structured as follows: Section 2 reviews the related literature and develops our conceptual framework. Section 3 describes our data and presents preliminary analyses. Section 4 outlines our empirical strategy. Section 5 discusses the results, and Section 6 concludes with implications for research and practice.

2. Related literature and conceptual framework

2.1. Related literature

Service diversification is an increasingly popular business strategy for manufacturing firms, whereby they expand their operations by entering into multiple service markets that may be related or unrelated to their product and core competencies (Kennedy et al., 2020). Over the last decade, service diversification has attracted substantial research interest. For example, Blanchard, Fuss and Mathieu (2017) and Zhang and Banerji (2017) explore the motivations for it, while Guedes et al. (2022) and Korkeamäki, Kohtamäki and Parida (2021) focus on its effects. However, there is no unifying framework that explores the linkage between these two perspectives, or which recognises that service diversification is a strategic choice for some firms, whereas for others it is a last resort.

Typically, risk is the focus of this analysis, with research exploring the spreading of risk, or the combination of endogenous and exogenous risks attached to such a strategy (Benedettini et al, 2015). Business model innovation offers another perspective; for example, (Wannakrairoj and Velu, 2021) consider the resources required to deliver a service diversification strategy. Finally, there is the literature that highlights the pressures that can lead to service diversification decisions, exploring the threats to the business of not doing so (Visnjic et al., 2019). However, one factor that is common to much of this literature is the assumption that the decision being modelled is optimal and that the model captures both the willingness and ability of the firm to deliver such strategic change. We argue that this is incomplete. Firstly, diversification may not be the best strategy for a firm, given its internal company characteristics and resources. Secondly, empirically, these studies mostly use proxies to measure both service offering and firm performance (Lexutt, 2020), which raises concerns over the reliability of the measure and the ambiguity of the interpretation. What is missing from the literature is a unified framework that considers the determinants of the decision to diversify, the effects of service diversification, and the impact of these on performance outcomes.

Insert Table 1 about here

Table 1 provides an overview of the existing literature, and highlights why there is so much variation in the inferences that previous authors draw regarding the effectiveness of expansion into services. The essential argument that the literature adopts is that the expected outcome is positive, but the time frame for realising gains is unknown. At the same time, various outcome measures are used, some which include an element of market sentiment such Tobins Q (which also requires a firm to be listed), and similarly different measures of diversification are employed, as a different approaches to exploring the necessary and sufficient conditions to both deliver diversification and capture the value from it. These issues we discuss in more detail below.

The above critique may explain why research on service diversification's impact on firm performance yields contradictory results. There are studies that use surveys and secondary data to find a positive relationship. For instance, Aas and Pedersen (2011) show that firms focusing on service innovation have significantly higher labour productivity (sales revenue per employee) growth. Similarly, Bascavusoglu-Moreau and Tether (2011) find that service offerings increase the productivity levels of manufacturing firms, although the positive impact on firm survival occurs only at higher levels of service offerings. Moreover, Crozet and Milet (2017) show that French firms with increased intensity of service offering experienced an increase in their profit margin, employment, and total sales by 0.4%, 2.1%, and 0.6% respectively. There are also studies that find a negative relationship between service offering and firm performance. For example, Han, Kuruzovich and Ravichandran (2013) and Visnjic, Wiengarten and Neely (2016) find a negative relationship between service expansion and product sales growth. We argue that the reason for the contradictory empirical results is the partial analysis of the impact of service diversification on firm performance; that is, consideration is only given to the effect, with the determinants of such activities being neglected. It is only by understanding the firm-specific resources and competencies that lie behind firms' strategic decisions and their implementation can the heterogeneity of their performance outcomes be fully understood.

More importantly, the implications for productivity and especially the total factor productivity of business model innovation are typically overlooked in the literature. Total factor productivity provides a crucial indication of internal efficiency and, in turn, competitiveness, which the firm may then lever into financial performance through market strategies.

Finally, in our study, we explore the importance of the extent (as opposed to the mere action) of diversification. In the presence of literature that document a non-linear relationship between

service offering and firm performance, capturing not only the breadth but also the depth of service diversification is crucial.

2.2. Our framework

The discussion so far has highlighted the confusion and contradictions in the service diversification literature. We argue that these result from the range of perspectives employed, and the fact that much of the literature seeks to establish direct links between the decision and the outcome, without exploring the decision behind the strategy or the firms' capability to deliver the outcome. Therefore, a holistic view of the firm is required, integrating aspects of organizational decision-making, strategic management, and innovation to understand how internal factors influence decision-making processes and outcomes. For this reason, we adopt a framework based on the resource-based view of the firm (RBV) and argue that in order to understand both the drivers of a manufacturing firm's expansion into services and the returns from doing so, one needs to consider the nature of the resources available to the firm, and the constraints that these impose on the propensity for business model innovation.

The RBV (Barney, 1991, 1995) describes the firm's ability to sustain its competitive advantage as a function of firm-specific resources, and stresses the path-dependent nature of certain key relationships, especially in the context of diversification and performance. We seek to extend such thinking by exploring both the drivers and effects of such a strategy. The expansion into services, or indeed any other business model innovation, is costly and may cause a reduction in revenue in the shorter term. Such phenomena have been explored recently in the contexts of AI adoption (Abumalloh et al., 2023), and green technologies (Marco-Fondevila et al., 2021).

Building on this, we seek to explore the necessary and sufficient conditions for such expansion and its subsequent implications for firm performance.

We argue that two key types of firm-level resources are required: firm-specific knowledge that can be levered into new markets, and the resources for doing this. The RBV highlights the capability of firms to create or acquire these resources, and also the need to understand how such resources are combined. For example, Bıçakcıoğlu-Peynirci and Morgan (2023) outline the additional costs associated with changing the business model and focus on the ability to combine resources into new markets. This is analogous to the literature that employs a similar approach to, say, firm internationalization, in that it recognises that certain resources are required and also how such expansion subsequently confers advantages on the firm (Beamish and Chakravarty, 2021; Jovanovic and Morschett, 2022). This is particularly important when

one considers the need for richer economies to compete on innovation and value-added, and as De Backer, Desnoyers-James and Moussiegt (2015) point out, combining manufacturing and services is a key element of this.

We start therefore by focusing on the drivers and limitations of the strategy at firm level, understanding both the necessary and sufficient conditions for diversification, and building on our RBV framework. We later address the expected benefits from the adoption of diversification into services. Our hypotheses outline these in more detail.

2.2.1. Drivers and enablers of expansion into services

Building on our Resource-Based View (RBV) framework, we aim to identify the essential conditions for successful expansion into services and the necessary and sufficient conditions for using that expansion to enhance firm performance.

Building on (Barney et al., 2001), we argue that the parallels offered by RBV treatments in economics (Lockett and Thompson, 2001) and entrepreneurship (Alvarez and Busenitz, 2001) highlight how the RBV offers a framework to view such reallocations of scarce resources. These approaches stress the path-dependent nature of certain key relationships, especially in the context of diversification and performance. We seek to extend such thinking by exploring both the drivers and effects of such a strategy. As Lockett and Thompson (2001) outline, early attempts to operationalise RBV in such settings encounter the problems of causation and endogeneity. The expansion into services, or indeed any other business model innovation, is costly and may cause a reduction in revenue in the shorter term. Such phenomena have been explored recently in the contexts of AI adoption (Abumalloh et al., 2023), and green technologies (Marco-Fondevila et al., 2021).

Our first necessary condition is that firms must have the appropriate resources and the ability to deploy them effectively to sustain business model innovation. While the concepts of resource availability and deployment are multifaceted, prior research suggests that firm size can serve as a strong indicator (Erramilli and D'Souza, 1993), as larger firms typically have access to greater resources and greater ability to deploy them.

Larger firms typically have more substantial financial reserves (Revilla and Fernández, 2012), which allow them to invest in service innovation and manage the associated risks. For a manufacturer, offering services necessitates an initial investment in capital resources and possibly in human capital before generating any revenue (Kohtamäki et al., 2019). Notably, Bellandi and Santini (2019) highlight the need for costly experimentation in service innovation;

services must be delivered to customers to determine their feasibility, which requires a commitment of financial resources.

In addition to financial resources, larger manufacturing firms have other critical resources that will support their successful expansion into services and use that expansion to enhance firm performance. Importantly, larger firms typically benefit from more diverse and specialized human resources and innovation practices (Audretsch and Acs, 1991). Manufacturing firms expanding into services must access or acquire new knowledge specialisations in the relevant service domains (Fliess and Lexutt, 2019), as well as the abilities to coordinate between product and service activities (Heirati et al., 2024). Larger firms can typically invest more in employee training and development (Ashton et al., 2005), which is critical to overcoming the gaps in the specific service capabilities manufacturers are suffering from (Opazo-Basáez et al., 2019). The other major resource needs of manufacturers expanding into services are the technological resources and infrastructure. Offering product-related services often depends on comprehensive product-use data, which provides essential insights that enable manufacturers to compete effectively (Opresnik and Taisch, 2015; Schroeder et al., 2019). Larger manufacturers typically have access to a more extensive portfolio of products and customers than smaller firms, allowing them to extract valuable information from data that captures a wider range of usage scenarios (Stormi et al., 2018). A further critical advantage that larger manufacturing firms possess is their expansive supply chain and network resources. Expanding into services not only impacts the manufacturer but also requires integration and alignment with additional partners (Fliess and Lexutt, 2019), particularly for service delivery (Wasserbaur et al., 2024), but also service innovation (Zhou et al., 2020). Larger companies often have well-established relationships with suppliers and distributors, which allows them to integrate services across the supply chain more efficiently (Pearcy and Giunipero, 2008). Their global reach enables them to offer standardized service contracts across multiple locations, ensuring consistency and reliability for customers.

Considering these factors, larger firms have an advantage in developing services due to their greater resource availability and deployment. Therefore, in this study, firm size is used as a proxy for resource availability. This leads to the following hypothesis:

H1: Firm size is a key determinant of the ability of manufacturing firms to move into services.

In order for a firm to derive value from its resources, it is crucial to consider not only the attributes of these resources but also the firm's capacity to exploit them effectively (Newbert,

2008). According to the organizational component of the VRIO framework, a firm must establish appropriate processes and management systems to fully leverage the value that these resources may offer (Barney and Clark, 2007). Furthermore, it provides a valuable framework for firms to prioritise their resource development efforts.

Our second necessary condition concerns the nature of the resources a firm can use and generate. Here, our focus centres on the firm's capacity to generate firm-specific assets, particularly knowledge associated with research and development (R&D). The RBV literature has approached the issue focusing primarily on the need to reconfigure firm level resources to develop the appropriate business model innovation to implement and exploit the benefits of service diversification (Kastalli et al., 2013; Visnjic et al., 2016). This literature on diversification was later synthesised and extended by Guerras-Martín et al., (2020) who illustrated the particular significance of the VRIN/O perspective on the importance of coordinating resources to deliver the appropriate business model for service diversification.

A more limited literature has explored the specific nature of the resources needed for the diversification process and in particular the role of investments in technical knowledge and new product development (Vendrell-Herrero et al., 2023). Within that literature, it has been argued that where there is more focus on technology, there is less need to expand into services or that the ambidexterity required for developing products and services in parallel puts undue pressure on the existing resources (Nijssen et al., 2006; Dörner et al., 2011), hereby limiting the scope and breadth of the innovation outcome.

Building on the more general innovation literature (Galende, 2006), we argue that product and technological investments can generate the additional competencies that are required to innovate and configure the new service offerings to new markets and to fulfil customer needs.

R&D enhance the ability to support the service diversification by tailoring technological solutions to the customer's needs generated by the service provision (Barney & Clark, 2007). It can also support the creation of service offerings that are embedded into products by providing ad-hoc solutions like technologies for remote measuring and monitoring essential for the service provision (Ruiz-Martín & Díaz-Garrido, 2021). Lastly, by generating firm-specific knowledge-based resources that are valuable, rare, inimitable, and non-substitutable (Barney, 1991), R&D facilitates customisation and service diversification increasing the uniqueness of the offering, ultimately making the service portfolio more difficult for competitors to replicate. This would explain also the additionality found in the studies of Benedettini and Kowalkowski,

(2022) or Martín-Peña et al., (2023). Therefore, the technological knowledge research and development generates is crucial in creating the complementarities necessary to shape new services besides the traditional product offerings. It also creates the additional resources and competences to align the product and service development ambidexterity into the new business model advocated by, for example, Kastalli et al., (2013) and Visnjic et al., (2016)''

In sum, our second necessary condition asserts that a firm must possess a unique value proposition, driven by product and technological innovation, which facilitates expansion into service offerings. This formulation gives rise to our second hypothesis:

H2: Firms that invest in R&D, are better placed to expand into service offering.

Our third hypothesis extends the discussion of firm-specific resources. In particular, these arguments have implications for export-focused manufacturers and their aspirations to diversify into services. The manufacturer's decisions to engage in exporting and expand into services are both motivated by the desire to reduce dependency on a single market; the former exploits their core expertise across a larger market, while the latter increases their revenue opportunities (Raddats et al., 2017).

Guerras-Martín et al. (2020) explore the existing literature on diversification from the perspective of both its drivers and its performance outcomes. This literature also highlights the challenges of simultaneously delivering diversification and internationalization. For manufacturers already involved in developing their export business, it may be more promising to continue investing in their exporting activities rather than to expand into services. In a similar vein, Sambharya (1995) observed an inverse relationship between the dimensions of diversification, arguing that product diversification and international diversification strategies require different types of skills; both are risky, as firms spread themselves out in terms of product proliferation or market proliferation. Indeed, Bengtsson (2000) describes how the internationalization efforts of high-performing Swedish companies are characterized by backwards movement in product focus.

Another factor disincentivizing exporting manufacturers from entering the services sector is rooted in the greater complexity of exporting services compared with products (Hakanen et al., 2017). Services demand an even higher focus on understanding and meeting customer needs than products, creating an additional burden for exporters who are already addressing a more diverse customer base. Furthermore, services depend heavily on business networks (Weigel and Hadwich, 2018), presenting additional challenges in an exporting context that necessitates

the coordination of a wide range of local firms. The relational nature (requiring both a physical presence and interaction) of the product-related service process (Vargo and Lusch, 2008) becomes challenging to accommodate in an export-oriented business model.

The second rationale for export intensive firms to be less likely to engage in such diversification is simply the resources required to deliver a more complex set of offerings in an international context. These issues are discussed in detail in Blesa-Pérez et al., (2023) and Agnihotri et al., (2023). The argument from the international marketing literature is essentially that the cost of delivering a complex service offering is prohibitive for many firms, while it may be a market opportunity for those who can either resource this, or to an extent outsource delivery internationally. One can however extend this with reference to our over-arching RBV framework.

This argument is similar to the concept that is known in the international business literature as the liability of foreignness. The more complicated the basket of goods and services that a firm offers, the more bespoke the offering has to be, and the wider the knowledge of the foreign environment must become. For example, in delivering a product one needs to understand the regulatory environment of that produce in the foreign market, but when delivering services (such as maintenance or finance) locally then the firm has to consider a new set of markets, legal and institutional frameworks (for example labour laws or what hours people can be expected to work) and distribution networks. Managing this is complex and requires that resources are diverted to such activities within the firm.

Hence, our third hypothesis:

H3: Firms that export are less likely to engage in expansion into services

A competing hypothesis emerges from the complexity of the relationship between financial pressures and business model innovation. Financial difficulty pose challenges, but they can also serve as a compelling incentive for innovation. The existing literature on service transformation, exemplified by Perona, Saccani and Bacchetti (2017), often showcases triumphant narratives of business model changes by drawing on case studies of large successful firms. However, these case studies also underscore the role that the need for radical reform plays in such transformations, which are often driven by financial imperatives due to shrinking markets and heightened competition (Martinez et al., 2017). In these instances, the shift towards services is viewed as essential for revenue protection, steering the firm clear of cost competition and enhancing the worth of the value chain; it thus offers an alternative explanation for

manufacturers' foray into services (Neely, 2008). This line of literature contends that financial pressures create a pressing need for business model innovation, rendering it more likely (Chesbrough, 2007). Chesbrough (2007) posits, "Ideally, a company will figure out how to innovate its business model before it is compelled to act by financial stress." (p. 17). However, the transformative nature of certain business models may necessitate a significant 'burning platform' to create organizational momentum (Kaganer et al., 2023). The notion that a burning platform helps overcome organizational inertia is widely accepted (Hildebrandt, 2018), especially in the manufacturing service context (Martinez et al., 2017). Hence, it can be argued that financial stress acts as an incentive for business model innovation, serving as a mechanism to safeguard the firm's assets. Thus, we propose:

H4: Firms in financial difficulties are more likely to expand into services.

2.2.2. The benefits of expansion into services

We now examine the potential benefits of expanding into services for firm performance. We have already argued that a necessary condition for expanding into services is the required bundle of resources. This has been explored from a number of perspectives (marketing, operations, strategy, economics, etc.) but all have a common and necessary thread: the firm's possession of some form of VRIO asset. Potentially the largest benefit of expanding into services is derived from an improved relationship between manufacturer and customer, which enables long-run relationships and mutual learning. The relationship can evolve from one that is transactional into one that is more collaborative, often leading to an increase in stickiness and possibly even improving the product offering. This is explored in detail in the operations literature (e.g. Bigdeli et al., 2018; Faramarzi, Worm and Ulaga, 2024). Such relationships facilitate a continuous revenue stream with significant operational opportunities for the manufacturer in terms of planarity and cash flow benefits, and they often have anticyclical economic properties (Gebauer et al., 2021; Linde, Frishammar and Parida, 2021).

In a similar vein, the economics literature (e.g. Ariu, Mayneris and Parenti, 2020) seeks to explore the advantages of delivering joint products and services. This literature has at its core a productivity element based on economies of scope, as well as joint learning about the production process. For example, diversification might lead to economies of scope due to better and deeper utilisation of the existing resources, reducing the costs per unit of output, enhancing services for existing markets, and leveraging existing assets to tap into new markets (Chavas and Kim, 2010). But it may also yield the ability to jointly increase the margins on sales of differentiated products or services through the bundling of goods. This literature takes the view

that such activity allows the firm to extend its market power from one venture into others where, ceteris paribus, it would have no particular competitive advantage. For a discussion of this literature, see Chambolle and Molina (2023).

These approaches collectively outline why, in the presence of unique firm-level resources, expansion into services is not simply diversification but is part of the process that allows the firm to capture new markets. Paiola and Gebauer (2020) highlight that this is particularly effective in the context of B-2-B selling, facilitating higher levels of customer engagement and allowing the firm to learn more about its product, such as maintenance schedules or the particular stresses the product undergoes (Gebauer, Fleisch and Friedli, 2005). This repeated customer interaction may also help the firm understand where a product can be simplified or better engineered, introducing important efficiency gains in the production process and/or quality improvements of the final output. Hence, we posit that:

H5a: Expansion into services improves firm performance

Our next hypothesis aims to explore the performance impacts resulting from the manufacturer's service diversification. We differentiate between internal and external returns, focusing specifically on the differences between productivity and profitability.

The literature indicates that productivity growth can stem from factors like economies of scale and scope (Nayyar, 1993). Therefore, for manufacturers, enhancing customer engagement through service delivery can promote increased interaction and knowledge sharing, which may foster innovation in product quality, delivery, and the development of new offerings, ultimately leading to further productivity improvements (Kharlamov and Parry, 2021). Additionally, optimising current work processes, such as minimising variability or altering work methods- like providing customer service online- can also enhance productivity, resulting in greater output per labour input.

Further, the literature also indicates how the manufacturers' diversification into services can also add to their profitability. Growth in profit from service diversification is frequently connected to revenue increases and the firm' s capacity to utilise existing assets in innovative ways or venture into new markets (Menon et al., 2024).

Scholars largely agree that the services offered by manufacturers are generally more profitable than product sales (Baines et al., 2024) with empirical studies demonstrating its positive impact on profitability; manufacturers that start selling services tend to observe a notable rise in profitability, with increases of up to 8% reported (Crozet and Milet, 2017). This beneficial

effect on profitability can persist over time due to the initial learning and continuous improvement that service development fosters for manufacturers.

Increasing service offerings is viewed as a means for companies to attain new growth and profitability in markets where product sales may be stagnating or encountering fierce price competition. Services can produce significant, recurring revenue streams from a solid base of products. By focusing on value capture through services, firms can target the most profitable activities and differentiate their offerings in order to command these higher margins (Visnjic et al., 2016). Several successful cases illustrate companies acquiring new contracts and boosting revenue through service expansion (Baines et al., 2024).

In summary, the driving force behind service diversification typically revolves around enhancing profitability, with the potential for higher service margins than product margins being a crucial motivator. Additionally, market- based performance metrics, such as Tobin' s q (market value relative to book value), exhibit a positive correlation with higher levels of service diversification (Buck et al., 2025). This indicates that the market anticipates increased future profitability from more complex services compared to simpler product- related ones further underscores the profitability incentive.

Considering the various ways that service diversification impacts productivity—often associated with efficiency and process enhancements—as opposed to profitability, which is influenced by revenue growth and margin improvements, it can be expected that the potential increase in profitability could be more pronounced than the improvement in productivity.

Manufacturers often expand into services due to high-margin opportunities or emerging niches where they retain pricing power (Visnjic et al., 2016). As the market matures and margins tighten, investments focused on productivity will subsequently follow. Thus, as the anticipation of better profit margins and strategic shifts towards more lucrative activities drives the pursuit of service diversification, a stronger positive impact on profitability than merely on productivity growth rates can be expected.

Thus, even though manufacturers' service diversification is anticipated to boost its profitability and productivity, prior research supports the idea that the rise in profitability is likely of greater significance compared to the rise in productivity. This leads to the hypothesis:

H5b: Expansion into services improves both firm productivity and profitability, but increases profitability to a greater extent.

We next consider the direct effect that expanding into services can have on firm performance, extending the argument developed in hypothesis 5 to consider the intensity of the effects of expanding into services. We consider this from three perspectives. The operations and marketing literatures discussed above outline the learning processes that occur both within the service provider, and between the supplier and the customer. This has been discussed in the literature (e.g. Bıçakcıoğlu-Peynirci and Morgan, 2023; Aas and Pedersen; 2011), but the essential premise is that a greater number of service offerings deepens and extends these relationships. The greater intensity allows firms to lever their intellectual property into new markets. The economics literature has long discussed the competition policy implications of such activity (e.g. Davies, 1999)[1], but it essentially involves seeking to project the competitive advantage gained in one market into other markets. There are well-known examples of this, such as toner in photocopiers and printers, and elevators and their maintenance activities. But the premise, which dates back to Vandermerwe and Rada (1988), is that services that are linked to manufacturing facilitate an information advantage for the firm, in that it is harder for the customer to identify the cost of any particular service, and product bundling confers advantages (Chen and Riordan, 2013). Finally, the greater intensity of such offerings provides access to use-data across a wider range of service scenarios, allowing for greater levels of experimentation and innovation in both product and service delivery (Wasserbauer et al., 2023). This therefore gives us our final hypothesis:

H6: The greater the extent to which the firm is able to diversify, the greater its performance.

The framework depicted in Figure 1 illustrates the hypothesised set of relationships, describing the combination of resources and internal challenges that facilitate or inhibit the manufacturing firm's expansion into services (H1 to H4), and how these resources/difficulties translate into firm performance (H5a/b), which may depend on the depth of diversification (H6). We speculate that the impacts on performance may be distinct. For example, we have hypothesised that learning effects from diversification and other economies of scope may lead to higher productivity gains, and also to the ability to lever resources into new markets, generating sales turnover. Our framework includes a consideration of how this may be translated into profits via a reduction in the unit costs of production or an increase in market power due to the quality of the goods and services offered. This is something to which we return in the empirical section

[1] Consistent with well-known examples from competition policy, such as photocopier manufacturers expanding into servicing by supplying of peripherals and similar activities in sectors such as photography.

of the paper.

Insert Figure 1 about here
---

3. Data and descriptive analysis

3.1. Data source and descriptive statistics

The evidence used in this study is based on the financial information extracted from the company reports of UK manufacturing firms between 2010 and 2021, contained in the FAME dataset. After dropping firms with missing observations in key inputs (e.g. turnover, net-tangible assets) and restricting the sample to manufacturing firms, we obtain our working sample of 15,732 unique businesses and an unbalanced panel of 108,714 firm-year observations. The dataset contains information on various industry and company characteristics alongside the company structure, corporate family, and financial metrics. The database contains information relevant to our study; namely, firm characteristics, the extent of diversification, and various performance measures as detailed below.

3.1.1. Measure of diversification

The information contained in FAME allows us to define the service offering of a firm in two ways:

i. A dummy variable if a manufacturing firm operates in at least one services sector2 as its secondary activity.
ii. A count variable indicating the number of service sectors a firm is involved in as its secondary sector.

Insert Table 2 about here

Whilst the former allows us to identify the 'extensive' margin of service offering, and hence the decision to diversify, the latter measures the depth of service provision (number of services offered) by each firm, which we refer to as the 'intensive' margin.

Table 2 shows the percentage of firms that have diversified into services (8.67%). Table 3 shows the percentage of firms in the sample that offer services (0, 1, 2, 3, or 4 or more services). The percentage of firms decreases as the number of services increases. Of the firms that

[2] We only consider business services offered by manufacturing firms.

diversify, 86.46% offer one service, 11.48% offer two, and 2.06% offer three or more services.

Insert Table 3 about here

3.1.2. Performance measures

In capturing firm performance, we employ two measures, firm productivity, which captures the internal efficiency of the business, and profitability, which measures the ability of the firm to lever this productive capacity into goods markets. profitability is calculated using gross profits (EBITDA), and we calculate productivity in the traditional manner deriving econometrically a measure of total factor productivity (TFP). TFP is important because it captures not only the profit maximisation but also the cost minimisation aspects of a firm's objective.[3] Moreover, from a policy perspective, in advanced economies such as the UK where resources are nearly fully utilised (full employment) and allocations are nearly efficient, TFP is the main source of increasing output. We calculate TFP based on the residual of the production function (TFP_OLS) and correct for endogeneity using the control function approach (TFP_LP) of Levinsohn and Petrin (2003)[4]. While TFP_LP is the preferred estimate, throughout the paper we report the estimates for both specifications.

As a key stylised fact, the three graphs in Figure 2 (a/b/c), display the line chart of firm performance across different service intensities (from 0 services to 4 or more) through time using the three performance measurements, namely turnover, gross profits, and TFP. All figures consistently indicate that irrespective of the indicator, performance is higher for firms that have diversified than for those that have not. Moreover, performance increases with the level of service intensity, especially with reference to TFP. Finally, the performance associated with four or more service offerings is the most volatile, although this is likely due to the small sample size.

Insert Figure 2 about here
---

[3] Productivity capture efficiency of a firm in converting inputs to outputs. Unlike profit and turnover, it is not affected by market competition, monopoly power that affect demand and price of product; and unlike profit, it is not affected by input price differences that can be due to monopsony power, political favoritism and others.

[4] Figure A1 in Appendix A reports the Kernel density of the estimated productivity distribution of (TFP_LP). Alternative methods are also used as a robustness test. Appendix A presents details of the TFP estimation and the results for production function.

4. Econometric considerations: testing the main research hypotheses

In order to identify the main drivers of the decision to diversify (hypotheses 1 to 4) and the contributions of the depth and breadth of diversification to firm performance (hypotheses 5a/b and 6), we need first to disentangle the decision to diversify from its impact on the adopting firms in the sample. We then need to address the endogeneity problem. To do this, we follow a three-step approach. In the first step, we assess the significance of the postulated enablers of diversification using a probabilistic (Probit) model. In the second step, we measure the impact of diversification on firm performance using pooled Ordinary Least Squared (OLS) regression. In the third step, we use the endogenous treatment-effects model (Lee, 1978; Björklund and Moffitt, 1987) to account for endogeneity caused by self-selection into service offering, and simultaneity bias vis-à-vis firm performance. Below we explain each step in detail.

Step I: The enablers of diversification

To identify the enablers of diversification, we model likelihood to diversify via a latent variable model:

$$Probit(Service_{it} = 1|X_{it}) = \Phi(\alpha_0 + \alpha_1 X_{it} + \alpha_2 Z_{it} + \gamma_r + \eta_t + \lambda_s + \varepsilon_{it}) \qquad (1)$$

where *Probit*(.) is the conditional probability that the manufacturing firm *i* offers services (*Service)* at time *t*. Φ is the cumulative distribution function of the standard normal. X_{it} is a vector containing the variables of interest used to test the main hypotheses, Z_{it} contains the covariates used only as controls in the probit equation, plus a series of fixed effects for region γ_r, sector λ_s, and year η_t. ε_{it} is the *iid* error term and αs are the usual parameter estimates.

We specify the main control variables as follows. In order to test our first hypothesis (H1) that resources are a key driver of diversification, we use three categorical variables capturing the size of the firm. Following the ONS definition, we specify **Small size** (1 to 49 employees), **Medium size** (50 to 249 employees) and **Large size** (more than 250 employees). We expect their impact to be positive, and even more so for larger firms. To test the second hypothesis (H2) that firms with high levels of firm-specific assets are better placed to expand into service offering, we use a dummy variable (**R&D dummy**) taking value one if a firm engages in R&D and zero otherwise, or alternatively the R&D real expenditure in British pounds (**R&D expenditure**). We expect their impact to be significant and the sign to be positive. We capture our third hypothesis (H3) concerning the likelihood of an exporting firm to diversify via a dummy variable (**Export**) taking value one if the firm exports and zero otherwise. We expect its sign to be negative. To test hypothesis 4 (H4) that financial conditions are a key driver of

diversification, we use the degree of the firm's financial difficulties (**Likelihood of failure**) ranging from Low (0%) to High (100%) Risk. If the burning platform hypothesis holds, we expect it to be significant and positive.

The definitions and basic statistics of the variables of interest are reported in Appendix C. As an additional control, we use firm- and sector-level variables. As firm-level variables, we specify the age of the company **(Age)** approximated by the number of years the company is present in the FAME database, and two dummy variables measuring whether the firm is an importer **(Import)** and if it is foreign-owned **(Foreign)**. At the sector level, we use the Herfindahl Hirschman Index **(Competition)** to capture the degree of market competition in which the firm operates. The higher the index, the greater the degree of concentration.[5,]

Step II: Impact of diversification upon firm performance

To test hypotheses 5 and 6 (H5a/b and H6) concerning the impact of diversification on firm performance, we start by estimating the following specification.

$$y_{it} = \beta_0 + \beta_1 Service_{it} + \beta_2 X_{it} + \gamma_r + \eta_t + \lambda_s + \upsilon_{it} \qquad (2)$$

where y_{it} is the firm *i's* performance at time t measured in three ways: (i) our calculated revenue-based total factor productivity **(TFP)**; (ii) profit measured via EBITDA **(Profit)**; (iii) operational revenue **(Turnover)**.[6]

The main variable of interest in Equation 2 is the service offering indicator **(Service)**, which we measure as a dummy variable taking value one if the firm i has diversified and zero otherwise. Its coefficient, β_1, indicates the contribution of the service provision to firm performance (H5a). To test the hypothesis that greater intensity of service offering improves firm performance (H6), we use a discrete measure reflecting the number of services offered (**n.Services** where n = 1, 2, 3, or 4 or more services offered).

X_{it} represents the vector of firm-specific and sector-specific covariates: age, firm ownership, size, and import, export and ownership status. The remaining control variables are region γ_r, time η_t and sector λ_s fixed effects, plus the *iid* error term υ_{it}. In the baseline analysis, we estimate (2) using Ordinary Least Squared (OLS).

Step III: Accounting for endogeneity in diversification

[5] When a firm is a monopoly; the index is equal to 1. When all firms are of equal size, the index is equal to 1/n. Therefore, the index runs from 1/n and 1.

[6] In the model specifications where we use Profit and Turnover as outcome variables, we control for firm input use.

In establishing the causal link between service offering and firm performance, there is potential for simultaneity or reverse causality; that is, it could be the case that better-performing firms provide services rather than that the provision of services causes firms to perform better. Similarly, there is a potential of self-selection into service offerings—a form of endogeneity that can affect the likelihood of diversification. For instance, firms may start offering services because these generate an additional source of revenue when the firm is facing financial distress. This implies that only firms with credit and liquidity constraints will choose to offer services, but firms may also venture into alternative business models if they have slack resources.

To address these biases, we propose a treatment-effect model (Wooldridge, 2010). This model is similar to an instrumental variable (IV) approach, where the first stage is a binary response model predicting the probability of an observation falling into one of two categories. In our case, the categories are offering service or not. In the second stage, the model uses these predicted probabilities in the main regression and compares changes in performance for firms that have a similar likelihood of service offering.[7] We explain our treatment of endogeneity in more detail in Appendix B.

5. Results

This section discusses the main results. We first present the findings from Step I (modelling the enablers of diversification; Hypotheses 1 to 4). The subsequent subsection presents step II, where we model the impact of service offering on firm performance (Hypotheses 5 and 6). The last section reports the results of step III, where we account for the possibilities of simultaneity and self-selection.

5.1. The enablers of diversification into services (Step I)

Table 4 reports the estimates of the factors driving the likelihood of manufacturing firms to expand their offerings to services (see Equation 1). The first column reports the variables used to test hypotheses 1 to 4. The second column includes additional covariates, and the third column includes the controls and fixed effects for region, sector, and year.

The results consistently confirm the first hypothesis that firm size, and thus the resources of the firms, are a key determinant of the ability of manufacturing firms to move into services, with larger firms being more likely to diversify. Concerning the second hypothesis, we find that

[7] In the first stage, we use additional exogenous variables to avoid the issue that the identification is driven not only by the functional form.

firms with high levels of firm-specific assets, generated through R&D, are better placed to expand their service offering. Our results, in line with hypotheses 3 and 4, also suggest that firms that export are less likely to expand into services, and that financial difficulties (hence, scarcity of resources) are key drivers of the decision to diversify.

As to the controls, we find that being foreign-owned and import-oriented reduces the likelihood of offering services. As with export orientation, this finding suggests diseconomies of scope from internationalization. The age of the firm is significant and shows a curvilinear/quadratic effect with decreasing returns. Interestingly, the likelihood of offering services increases with the degree of market competition, suggesting that diversification might be used to gain competitive advantage or, more likely, as a survival strategy, being an additional source of revenue when jointly analysed with the likelihood of failure driven indicating possibility of default.

Insert Table 4 about here

5.2. Service offering and firm performance (Step II)

Table 5 presents the pooled OLS regression where firm performance is the outcome variable (see Equation 2). The first two columns report the result for TFP estimated using OLS (TFP_OLS), and the Levinsohn and Petrin (2003) control method for endogeneity (TFP_LP). The last two columns report the results for turnover and profits.

Service captures the extensive margin, and its coefficient estimates the impact of diversification on firm performance. Its significance across specifications confirms that firms that offer services perform better than those that do not (H5a). Offering services increases productivity by 1.8%[8] to 3.2%, turnover by 4.4%, and profits by 5.5%.

Insert Table 5 about here

As postulated in (H5b), there are variations in the exploitation of benefits from service offerings. Of the three measures of performance, productivity shows the least impact, followed by sales turnover. Profits are derived from the ability to lever productivity growth into new higher returns, either through entering more profitable markets or by increasing margins in

[8] Since we are estimating a log-level model, the coefficient estimates are interpreted as a unit increase in the independent variable results in a 100 $\times\beta$ percentage increase in the dependent variable.

existing ones.

Table 6 presents the pooled regression when we use the number of services offered (*n.Services* with n = 1, 2, 3, and 4 or more services) as the main variable of interest. This captures the intensive margin. In line with hypothesis 6, the results indicate that the higher the number of services offered, the better the performance. We also find a non-linear effect, as the growth rate of the returns start decreasing for firms offering four or more services.

Insert Table 6 about here

5.3. Addressing the problem of endogeneity (Step III)

5.3.1. Endogeneity in diversification

Table 7 presents the results when we control for possible simultaneity and self-selection bias.

Insert Table 7 about here

The positive effect of service offering on productivity, turnover, and profitability confirms the validity of our research hypothesis (H5a). Service diversification significantly increases firm performance. Offering services increases productivity by up to 33.7% (the latter is calculated using LP, correction for endogeneity in TFP), turnover by 9.9%, and profits by 39.6%. The size of their impact indicates that, without correction for endogeneity, OLS underestimates (downward bias[9]) their effect upon all performance measurements. The results also provide evidence consistent with our hypothesis (H5b). The returns to diversification into services vary across the nature of the returns. The impact on profits is the highest, suggesting the presence of higher markup from offering additional services. Its magnitude (39%) can also indicate that diversification is the preferred strategy of companies with low profit margins, leading to a significant percentage improvement in their performance.

To conclude, Figure 3 illustrates the relationships identified through our analysis.

Insert Figure 3 about here

Building on Figure 1, this figure nuances our initial framework. Firstly, we have identified the relationship between the move into service offerings and firm performance as two separate

[9] OLS estimates are often downward biased since they estimate average treatment effect instead of the local treatment effect of the selection (IV). The trend could also be due to absence of measurement error in the instrument, or correction for omitted variable bias.

steps in the realisation of the benefits from diversification. In line with the RBV, we have identified the impact of firm-level resources on both activities. We have identified that these resources impact only the ability (or willingness) of firms to expand into services, compared with factors that also impact on performance. As such, we highlight the pressures that drive firms to engage in this form of diversification or expansion, and the resources required so it can deliver firm performance. Lastly, we highlight the distinction between the discrete decision to engage in such business model changes, and the additional benefits that arise from greater intensity of services. We are thus able to distinguish between one of the "treatment effects" and speculate on more dynamic benefits as the firm evolves.

6. Discussion and conclusion

The study set out to establish whether manufacturing firms' diversification into services can lead to improved performance. Unlike the extant research, we also focus on understanding the drivers of service diversification and their implication to the divergence in the existing findings. We argue that the main determinants of the observed disparities are to be found in the extent and nature of the firm's specific resources when implementing the business model innovation. We have therefore deployed the RBV framework to analyse the business model transformation required for manufacturing firms to offer services. In brief, we have focused on two crucial steps: first, the decision to diversify, and second, the capability to extract value from diversification. While the latter accounts for performance differences between manufacturing firms that offer services and those that do not, the former accounts for disparities among firms that diversify.

From our analysis, we confirm the validity of our framework and the crucial role played by internal resources in generating returns from diversification. In particular, as RBV framework predict, we find that resources (size) positively impact the firm's ability to expand into services, with larger firms having more resources than smaller firms. We also find similar results for knowledge capital (R&D spending). Besides providing new products, knowledge capital enables identification of new business opportunities outside of the firm's core area, hence facilitate diversification. On the contrary, we find that international trade status and foreign ownership and age can reduce (costly) diversification within a firm's existing markets. This can also be explained by the cost and friction firms face when venturing new business models. For instance, exporters and importers are likely to look for new exporting market and lower cost market for their growth instead or venturing into new business model innovations. In a similar

vein, older firms are less likely to adopt service diversification compared with their newer counter parts as adoption of organisational change is easier for the latter.

Furthermore, we demonstrate that service diversifications are responsible for the variation in firm performance. Our baseline analyses indicate that manufacturing firms that offer services are 1.8% more productive, 5.5% more profitable, and generate 4.4% more revenue than manufacturing firms that do not offer services, all else being equal. These figures are even higher—33.7% more productive, 39.6% more profitable, and generating 9.9% more revenue—when we correct for potential endogeneity from self-selection. This can be because only a minority of firms have embraced the diversification business model, and the gain could be higher had those firms which should adopt do adopt. The productivity figures compare very favourably with average productivity growth in the UK (are close to pre-financial crisis long run average) and almost all of the developed world. One can put forward multiple underlying mechanism as to why service diversification helps firms to achieve performance improvement. For instance, customers seem to be happy to pay a premium for a constant cost guarantee, more optionality, and lower complexity in cost structure that comes with services, especially in cost volatile sectors. Moreover, producers are also incentivised to provide better quality/performing product to reduce maintenance cost and downtime of products if that also means higher revenue from services.

Lastly, we find that the returns to diversification depend not only on the firm's decision to diversify but also on the depth of its service provision. The returns increase with the number of services offered. However, they start to decline when four or more services are offered, highlighting the constraints posed by the firm's limited resources and the crucial role these play in the implementation and exploitation of the diversification business model. This also implies decreasing return from additional services after certain point.

6.1. Theoretical implications

Arguably, service diversification can be considered a form of innovation for manufacturers, both in terms of their offering and their processes. It not only implies that manufacturers are rethinking the kind of value they offer their customers (Kohtamäki et al., 2019) but also who their customers are for this service offering and how to serve them (Bellandi and Santini, 2019). The study highlights the importance of exploring such business model innovation with a RBV framework. This framework has allowed us to identify the firm characteristics that facilitate and constrain adoption of such innovation, and crucially investigate how this innovation, in turn, explains observed firm performance differences. Diversification is not a linear process;

the transition into services demands that manufacturers allocate funds for experimentation with new offerings and for developing delivery of service-related activities Similarly, service may not be deliverable for all customers at the same rate. Larger manufacturers have an advantage when developing their service offerings due to their greater ability to absorb the necessary costs. However, they may need to differentiate between customers, especially given the differences between the domestic and foreign markets.

This study also sheds light on the resource-related prioritisation involved in a manufacturer's expansion into services. The decision to diversify into services is challenging for manufacturers due to the substantial financial resources required (Kohtamäki et al., 2019). We show that this challenge becomes even more pronounced for manufacturers that serve foreign markets, owned by foreign owners and older firms. A proposed service expansion will compete with an established export orientation for resources too.

Furthermore, this study illustrates that learning is a critical element for manufacturers wishing to capture the benefits of their service diversification. Expansion into services facilitates feedback from customers, and potentially increases absorptive capacity (Valtakoski, 2017). However, as we demonstrate, R&D spendings are a necessary condition for this to materialise.

6.2. Managerial implications

The research also presents several implications for organizational practice. In the context of manufacturing, services are frequently relegated to a secondary consideration (Dmitrijeva et al., 2020). The prevailing organizational culture within manufacturing entities predominantly revolves around products, and their incentive structures are oriented towards the augmentation of product portfolios. Our study substantiates the performance implications that involvement in services can create for manufacturers. Consequently, it is anticipated that this research will help bolster manufacturers' confidence in cultivating their service portfolio.

Two specific implications emerge for managers seeking to enhance their engagement in services. Firstly, by identifying innovation and firm-specific assets as drivers of service engagement, the study identifies the necessary precondition manufacturers' innovation efforts in relation to service diversification. Hence, when manufacturers appraise their product-innovation, they should incorporate these linkages by also assessing their potential and service benefits.

In addition, it would be important for manufacturers to explore service innovation methods (e.g. Bitner, Ostrom and Morgan, 2008) as part of their innovation process to ensure they can

exploit these service opportunities effectively. While manufacturers typically take a systematic approach to product innovation, they frequently lack clear methodologies for innovating within the service context. Hence, a strategic focus on refining the service innovation processes is necessary for optimising the exploitation of their existing expertise in this domain.

Secondly, our findings underscore the significance of resource accessibility for effective service development, effectively favouring larger firms (H1). However, the research also illuminates how smaller firms can proficiently broaden their service portfolio. The study emphasises the pivotal role that organizational momentum and leadership play in overcoming the inertia that can hamper the creation of services within a manufacturing context (H4). Such developments that are generally easier for smaller firms, which often exhibit greater agility, enabling them to pivot swiftly and capitalise on emerging opportunities (Andries and Czarnitzki, 2014). Moreover, they tend to cultivate a more profound understanding of their customers (Laforet, 2008), a critical aspect of service development that can be effectively leveraged.

It is imperative for decision-makers in Small and Medium-sized Enterprises (SMEs) to judiciously consider these advantages when assessing a service opportunity. Recognising the inherent strengths of smaller firms (e.g. agility, customer insight, leadership responsiveness; Dmitrijeva et al., (2020), can facilitate a more informed and strategic approach to service expansion within the SME context.

6.3. Limitations and future research

The study offers a number of concrete future research opportunities. It is important to expand the study scope from the manufacturer to the manufacturer-customer dyad. It is widely noted that services strengthen the relationship between manufacturer and customer (Bigdeli et al., 2021), and it is important to explore how the expansion into services not only creates productivity implications for the manufacturer but also for its customers. In terms of the policy implications of this research, it is important to identify the extent to which service engagement creates implications that extend beyond those of the manufacturers themselves.

From the perspective of the firm, understanding the drivers and the best context of adoption, and quantifying the role that a service offering can play in improving the performance of manufacturing firms are important for two main reasons. Firstly, we have demonstrated that the firm is better able to promote and benefit from adopting service offering. Secondly, we have identified the necessary conditions that need to be fulfilled for this. In addition, however, we

have demonstrated that while this form of business model innovation is important for the competitiveness of the economy, businesses may require support from public policy if they are to deliver this more generally and to finance what many will perceive to be a risky venture.

An important future research opportunity is to explore the factors mediating the service and performance relationships. While our exploration of the R&D investment is an important starting point, theory and prior research suggest there are other mediating variables that should be explored to better explain the implications of the service diversification. Further research in the area would help strengthen the policy implications because it is not sufficient to simply encourage manufacturers to expand and diversify; the translation of diversification into performance and productivity implications is not automatic, and warrants further investigation. The present study provides a starting point for these future research opportunities.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

The authors declare that they did not use any generative AI tools in the writing process of this article.

CRediT authorship contribution statement

Anwar Adem: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Software, Visualization, Conceptualization. **Giuliana Battisti:** Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Nigel Driffield:** Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization, Supervision. **Andreas Schroeder:** Writing – review & editing, Writing – original draft, Resources, Project administration, Funding acquisition, Investigation, Conceptualization.

Funding

This work was supported by the Economic and Social Research Council (ESRC) under grant number ES/W010194/1.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential. The codes/scripts used to produce the result will be made available on request.

Acknowledgment

The authors would like to thank the editors and the two anonymous reviewers for their constructive comments and suggestions.

References

Aas, T.H. and Pedersen, P.E. (2011) The Impact of Service Innovation on Firm-level Financial Performance. *The Service Industries Journal*, 31 (13): 2071–2090.

Abumalloh, R.A., Nilashi, M., Ooi, K.B., et al. (2023) The adoption of metaverse in the retail industry and its impact on sustainable competitive advantage: moderating impact of sustainability commitment. *Annals of Operations Research*, pp. 1–42.

Ackerberg, D.A., Caves, K. and Frazer, G. (2015) Identification properties of recent production function estimators. *Econometrica*, 83 (6): 2411–2451.

Agnihotri, A., Bhattacharya, S., Yannopoulou, N., et al. (2023) Foreign market entry modes for servitization under diverse macroenvironmental conditions: taxonomy and propositions. *International Marketing Review*, 40 (4): 561–584.

Alvarez, S.A. and Busenitz, L.W. (2001) The entrepreneurship of resource-based theory. *Journal of management*, 27 (6): 755–775.

Andries, P. and Czarnitzki, D. (2014) Small firm innovation performance and employee involvement. *Small business economics*, 43: 21–38.

Ariu, A., Mayneris, F. and Parenti, M. (2020) One way to the top: How services boost the demand for goods. *Journal of International Economics*, 123: 103278.

Ashton, D., Sung, J. and Raddon, A. (2005) *A case where size matters: A preliminary investigation into the institutionalisation of skill formation and firm size*.

Audretsch, D.B. and Acs, Z.J. (1991) Innovation and size at the firm level. *Southern Economic Journal*, pp. 739–744.

Baines, T., Bigdeli, A.Z. and Kapoor, K. (2024) *Servitization Strategy: Delivering Customer-Centric Outcomes Through Business Model Innovation*. Springer Nature.

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

Barney, J., Wright, M. and Ketchen Jr, D.J. (2001) The resource-based view of the firm: Ten years after 1991. *Journal of management*, 27 (6): 625–641.

Barney, J.B. (1995) Looking inside for competitive advantage. *Academy of Management Perspectives*, 9 (4): 49–61.

Barney, J.B. and Clark, D.N. (2007) *Resource-based theory: Creating and sustaining competitive advantage*. Oup Oxford.

Bascavusoglu-Moreau, E. and Tether, B. (2011) "Servitization, survival and productivity." In *DRUID Summer Conference on Innovation, Strategy, and Structure-Organizations, Institutions, Systems and Regions, at Copenhagen Business School, Denmark*. 2011.

Beamish, P.W. and Chakravarty, D. (2021) Using the resource-based view in multinational enterprise research. *Journal of Management*, 47 (7): 1861–1877.

Bellandi, M. and Santini, E. (2019) Territorial servitization and new local productive configurations: the case of the textile industrial district of Prato. *Regional Studies*, 53 (3): 356–365.

Benedettini, O. and Kowalkowski, C. (2022) "Servitization and innovation strategy-the trade-off between product RD and service investments." In *Research handbook on services management*. Edward Elgar Publishing. pp. 23–35.

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

Bengtsson, L. (2000) Corporate strategy in a small open economy: Reducing product diversification while increasing international diversification. *European Management Journal*, 18 (4): 444–453.

Bigdeli Ziaee, A., Baines, T., Schroeder, A., et al. (2018) Measuring servitization progress and outcome: the case of 'advanced services'. *Production Planning & Control*, 29 (4): 315–332.

Bigdeli Ziaee, A., Kapoor, K., Schroeder, A., et al. (2021) Exploring the root causes of servitization challenges: an organisational boundary perspective. *International Journal of Operations & Production Management*, 41 (5): 547–573.

Bitner, M.J., Ostrom, A.L. and Morgan, F.N. (2008) Service blueprinting: a practical technique for service innovation. *California management review*, 50 (3): 66–94.

Bıçakcıoğlu-Peynirci, N. and Morgan, R.E. (2023) International servitization: theoretical roots, research gaps and implications. *International Marketing Review*, 40 (2): 338–364.

Björklund, A. and Moffitt, R. (1987) The estimation of wage gains and welfare gains in self-selection models. *The Review of Economics and Statistics*, pp. 42–49.

Blanchard, P., Fuss, C. and Mathieu, C. (2017) *Why do manufacturing firms produce services? Evidence for the servitization paradox in Belgium*. NBB Working Paper.

Blesa-Pérez, A., Ripollés-Meliá, M., Rialp-Criado, A., et al. (2023) Introduction to the special issue: Digitalisation and servitisation in international entrepreneurship. *Journal of International Entrepreneurship*, 21 (2): 150–156.

Buck, C., Floegel, N.-O., Stöter, M.B., et al. (2025) The performance effects of innovative service transition strategies. *Journal of Innovation & Knowledge*, 10 (2): 100687.

Chambolle, C. and Molina, H. (2023) A buyer power theory of exclusive dealing and exclusionary bundling. *American Economic Journal: Microeconomics*, 15 (3): 166–200.

Chavas, J.-P. and Kim, K. (2010) Economies of diversification: A generalization and decomposition of economies of scope. *International Journal of Production Economics*, 126 (2): 229–235.

Chen, Y. and Riordan, M.H. (2013) Profitability of product bundling. *International Economic Review*, 54 (1): 35–57.

Chesbrough, H. (2007) Business model innovation: it's not just about technology anymore. *Strategy & leadership*, 35 (6): 12–17.

Crozet, M. and Milet, E. (2017a) Should everybody be in services? The effect of servitization on manufacturing firm performance. *Journal of Economics & Management Strategy*, 26 (4): 820–841.

Crozet, M. and Milet, E. (2017b) The servitization of French manufacturing firms. *L. Fontagne, & A. Harrison, The factory-free economy: outsourcing servitization, and the future of industry*, pp. 111–135.

Davies, A. (1999) *A strategic approach to corporate governance*. Gower Publishing, Ltd.

De Backer, K., Desnoyers-James, I. and Moussiegt, L. (2015) *"Manufacturing or Services-That is (not) the Question": The Role of Manufacturing and Services in OECD Economies*.

Dmitrijeva, J., Schroeder, A., Bigdeli, A.Z., et al. (2022) Paradoxes in servitization: A processual perspective. *Industrial Marketing Management*, 101: 141–152.

Dmitrijeva, J., Schroeder, A., Ziaee Bigdeli, A., et al. (2020) Context matters: how internal and external factors impact servitization. *Production Planning & Control*, 31 (13): 1077–1097.

Dörner, N., Gassmann, O. and Gebauer, H. (2011) Service innovation: why is it so difficult to accomplish? *Journal of Business Strategy*, 32 (3): 37–46.

Eckert, T. and Hüsig, S. (2022) Innovation portfolio management: A systematic review and research agenda in regards to digital service innovations. *Management Review Quarterly*, 72 (1): 187–230.

Eggert, A., Ulaga, W. and Gehring, A. (2020) Managing customer success in business markets: Conceptual foundation and practical application. *SMR-Journal of Service Management Research*, 4 (2–3): 121–132.

Erramilli, M.K. and D'Souza, D.E. (1993) Venturing into foreign markets: The case of the small service firm. *Entrepreneurship Theory and Practice*, 17 (4): 29–41.

Faramarzi, A., Worm, S. and Ulaga, W. (2024) Service strategy's effect on firm performance: A meta-analysis of the servitization literature. *Journal of the Academy of Marketing Science*, 52 (4): 1018–1044.

Fliess, S. and Lexutt, E. (2019) How to be successful with servitization–Guidelines for research and management. *Industrial Marketing Management*, 78: 58–75.

Foreman-Peck, J. and Zhou, P. (2023) Specialisation precedes diversification: R&D productivity effects☆. *Research Policy*, 52: 104808.

Galende, J. (2006) Analysis of technological innovation from business economics and management. *Technovation*, 26 (3): 300–311.

Gebauer, H., Fleisch, E. and Friedli, T. (2005) Overcoming the service paradox in manufacturing companies. *European management journal*, 23 (1): 14–26.

Gebauer, H., Paiola, M., Saccani, N., et al. (2021) Digital servitization: Crossing the perspectives of digitization and servitization. *Industrial Marketing Management*. 93 pp. 382–388.

Guedes, M.J., Patel, P.C., Kowalkowski, C., et al. (2022) Family business, servitization, and performance: Evidence from Portugal. *Technological Forecasting and Social Change*, 185: 122053.

Guerras-Martín, L.Á., Ronda-Pupo, G.A., Zúñiga-Vicente, J.Á., et al. (2020) Half a century of research on corporate diversification: A new comprehensive framework. *Journal of Business Research*, 114: 124–141.

Hakanen, T., Helander, N. and Valkokari, K. (2017) Servitization in global business-to-business distribution: The central activities of manufacturers. *Industrial Marketing Management*, 63: 167–178.

Han, S., Kuruzovich, J. and Ravichandran, T. (2013) Service expansion of product firms in the information technology industry: An empirical study. *Journal of Management Information Systems*, 29 (4): 127–158.

Heirati, N., Leischnig, A. and Henneberg, S.C. (2024) Organization architecture configurations for successful servitization. *Journal of Service Research*, 27 (3): 307–326.

Hildebrandt, M. (2018) Algorithmic regulation and the rule of law. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 376 (2128): 20170355.

Jovanovic, J. and Morschett, D. (2022) Under which conditions do manufacturing companies choose FDI for service provision in foreign markets? An investigation using fsQCA. *Industrial Marketing Management*, 104: 38–50.

Kaganer, E., Gregory, R.W. and Sarker, S. (2023) A process for managing digital transformation: An organizational inertia perspective. *Journal of the Association for Information Systems*, 24 (4): 1005–1030.

Kastalli, I.V., Van Looy, B. and Neely, A. (2013) Steering manufacturing firms towards service business model innovation. *California management review*, 56 (1): 100–123.

Kennedy, R., Eli, J., Joe, S., et al. (2020) *Strategic Management*. Blacksburg: Virginia Tech Publishing. Available at: https://doi.org/10.21061/strategicmanagement.

Kharlamov, A.A. and Parry, G. (2021) The impact of servitization and digitization on productivity and profitability of the firm: a systematic approach. *Production Planning & Control*, 32 (3): 185–197.

Kohtamäki, M., Parida, V., Oghazi, P., et al. (2019) Digital servitization business models in ecosystems: A theory of the firm. *Journal of Business Research*, 104: 380–392.

Korkeamäki, L., Kohtamäki, M. and Parida, V. (2021) Worth the risk? The profit impact of outcome-based service offerings for manufacturing firms. *Journal of Business Research*, 131: 92–102.

Kramer, V., Krafft, M. and Storbacka, K. (2024) A configurational approach to understanding relationship characteristics in differing levels of servitization. *Industrial Marketing Management*, 117: 42–65.

Laforet, S. (2008) Size, strategic, and market orientation affects on innovation. *Journal of business Research*, 61 (7): 753–764.

Lee, L.-F. (1978) Unionism and wage rates: A simultaneous equations model with qualitative and limited dependent variables. *International economic review*, pp. 415–433.

Levinsohn, J. and Petrin, A. (2003) Estimating production functions using inputs to control for unobservables. *The review of economic studies*, 70 (2): 317–341.

Lexutt, E. (2020) Different roads to servitization success–A configurational analysis of financial and non-financial service performance. *Industrial Marketing Management*, 84: 105–125.

Linde, L., Frishammar, J. and Parida, V. (2021) Revenue models for digital servitization: a value capture framework for designing, developing, and scaling digital services. *IEEE Transactions on Engineering Management*, 70 (1): 82–97.

Lockett, A. and Thompson, S. (2001) The resource-based view and economics. *Journal of management*, 27 (6): 723–754.

MacDonald, J.M. (1985) R & D and the directions of diversification. *The Review of Economics and Statistics*, pp. 583–590.

Marco-Fondevila, M., Llena-Macarulla, F., Callao-Gastón, S., et al. (2021) Are circular economy policies actually reaching organizations? Evidence from the largest Spanish companies. *Journal of Cleaner Production*, 285: 124858.

Martinez, V., Neely, A., Velu, C., et al. (2017) Exploring the journey to services. *International Journal of Production Economics*, 192: 66–80.

Martín-Peña, M.-L., Sánchez-López, J.-M., Kamp, B., et al. (2023) The innovation antecedents behind the servitization–performance relationship. *R&D Management*, 53 (3): 459–480.

Menon, R.R., Bigdeli, A., Adem, A., et al. (2024) Unpacking the triple Nexus: Environmental performance, economic performance and servitization–A systematic review and theoretical reflections. *Journal of Cleaner Production*, p. 142459.

Nasirov, S. and Castaldi, C. (2025) Servitization as a strategy for diffusing radical technologies: An analysis of US top corporate R&D investors. *Research Policy*, 54 (1): 105123.

Nayyar, P.R. (1993) Performance effects of information asymmetry and economies of scope in diversified service firms. *Academy of Management journal*, 36 (1): 28–57.

Neely, A. (2008) Exploring the financial consequences of the servitization of manufacturing. *Operations management research*, 1: 103–118.

Newbert, S.L. (2008) Value, rareness, competitive advantage, and performance: a conceptual-level empirical investigation of the resource-based view of the firm. *Strategic management journal*, 29 (7): 745–768.

Nijssen, E.J., Hillebrand, B., Vermeulen, P.A., et al. (2006) Exploring product and service innovation similarities and differences. *International journal of research in marketing*, 23 (3): 241–251.

Opazo-Basáez, M., Vendrell-Herrero, F. and Bustinza, O.F. (2019) "Talent for services: How gaining access to talent enables successful servitization." In *Research Handbook of International Talent Management*. Edward Elgar Publishing. pp. 35–59.

Opresnik, D. and Taisch, M. (2015) The value of big data in servitization. *International journal of production economics*, 165: 174–184.

Paiola, M. and Gebauer, H. (2020) Internet of things technologies, digital servitization and business model innovation in BtoB manufacturing firms. *Industrial Marketing Management*, 89: 245–264.

Parida, V. and Jovanovic, M. (2022) Servitization in global markets: role alignment in global service networks for advanced service provision. *R&D Management*, 52 (3): 577–592.

Pearcy, D.H. and Giunipero, L.C. (2008) Using e-procurement applications to achieve integration: what role does firm size play? *Supply Chain Management: An International Journal*, 13 (1): 26–34.

Perona, M., Saccani, N. and Bacchetti, A. (2017) Research vs. practice on manufacturing firms' servitization strategies: A gap analysis and research agenda. *Systems*, 5 (1): 19.

Raddats, C., Zolkiewski, J., Story, V.M., et al. (2017) Interactively developed capabilities: evidence from dyadic servitization relationships. *International Journal of Operations & Production Management*, 37 (3): 382–400.

Revilla, A.J. and Fernández, Z. (2012) The relation between firm size and R&D productivity in different technological regimes. *Technovation*, 32 (11): 609–623.

Ruiz-Martín, A. and Díaz-Garrido, E. (2021) A review of servitization theoretical foundations. *Journal of Industrial Engineering and Management (JIEM)*, 14 (3): 496–519.

Sambharya, R.B. (1995) The combined effect of international diversification and product diversification strategies on the performance of US-based multinational corporations. *MIR: Management International Review*, pp. 197–218.

Schroeder, A., Ziaee Bigdeli, A., Galera Zarco, C., et al. (2019) Capturing the benefits of industry 4.0: a business network perspective. *Production Planning & Control*, 30 (16): 1305–1321.

Stormi, K., Laine, T., Suomala, P., et al. (2018) Forecasting sales in industrial services: Modeling business potential with installed base information. *Journal of Service Management*, 29 (2): 277–300.

Taisch, M. and Romero, D. (2023) *2023 World Manufacturing Report: New Business Models for the Manufacturing of the Future*.

Tang, Y., Zhu, S., Luo, Y., et al. (2022) Input servitization, global value chain, and carbon mitigation: An input-output perspective of global manufacturing industry. *Economic Modelling*, 117: 106069.

The World Bank (2022) *Manufacturing and services value added indicators, the world bank dataset*. Available at: https://data.worldbank.org/indicator/NV.SRV.TOTL.CD?locations=1W.

Ulaga, W. and Kowalkowski, C. (2022) Servitization: a state-of-the-art overview and future directions. *The Palgrave handbook of service management*, pp. 169–200.

Valtakoski, A. (2017) Explaining servitization failure and deservitization: A knowledge-based perspective. *Industrial Marketing Management*, 60: 138–150.

Vandermerwe, S. and Rada, J. (1988) Servitization of business: Adding value by adding services. *European management journal*, 6 (4): 314–324.

Vargo, S.L. and Lusch, R.F. (2008) Service-dominant logic: continuing the evolution. *Journal of the Academy of marketing Science*, 36: 1–10.

Velu, C. (2016) Evolutionary or revolutionary business model innovation through coopetition? The role of dominance in network markets. *Industrial Marketing Management*, 53: 124–135.

Velu, C. and Jacob, A. (2016) Business model innovation and owner–managers: the moderating role of competition. *R&D Management*, 46 (3): 451–463.

Vendrell-Herrero, F., Bustinza, O.F., Opazo-Basaez, M., et al. (2023) Treble innovation firms: Antecedents, outcomes, and enhancing factors. *International Journal of Production Economics*, 255: 108682.

Visnjic, I., Ringov, D. and Arts, S. (2019) Which service? How industry conditions shape firms' service-type choices. *Journal of Product Innovation Management*, 36 (3): 381–407.

Visnjic, I. and Van Looy, B. (2013) Successfully implementing a service business model in a manufacturing firm. *Cambridge Service Alliance*, 54 (6): 1161–1179.

Visnjic, I., Wiengarten, F. and Neely, A. (2016) Only the brave: Product innovation, service business model innovation, and their impact on performance. *Journal of product innovation management*, 33 (1): 36–52.

Wannakrairoj, W. and Velu, C. (2021) Productivity growth and business model innovation. *Economics Letters*, 199: 109679.

Wasserbauer, R., Schroeder, A. and Beltagui, A. (2023) A Complex Adaptive Systems perspective on servitization: The case of Heat-as-a-Service (HaaS). *Production Planning and Control*.

Wasserbaur, R., Schroeder, A. and Beltagui, A. (2024) Heat-as-a-Service (HaaS): a Complex Adaptive Systems perspective on servitization. *Production Planning & Control*, 35 (12): 1451–1465.

Weigel, S. and Hadwich, K. (2018) Success factors of service networks in the context of servitization–Development and verification of an impact model. *Industrial Marketing Management*, 74: 254–275.

Wooldridge, J.M. (2010) *Econometric analysis of cross section and panel data*. MIT press.

Zhang, W. and Banerji, S. (2017) Challenges of servitization: A systematic literature review. *Industrial Marketing Management*, 65: 217–227.

Zhou, D., Yan, T., Zhao, L., et al. (2020) Performance implications of servitization: does a Manufacturer's service supply network matter? *International Journal of Production Economics*, 219: 31–42.

Tables

Table 1 Literature Summary

No	Study	Outcomes Measures	Service Measure	Finding	Data	Analysis method	Sample size
1	Aas and Pedersen (2011)	Financial (Multiple): Operating results	Service Innovation	Positive Effect on productivity; no-effect on profit; Long run postive	Archival data	Z-value (Mann–Whitney–Wilcoxon test)	3575 Norwagian Firms
2	Benedettini and Neely (2019)	ROA/ROS/Asset turnover	Service Providers	Inverted U-Shape on Ruturn on Assets	Archival data	Regression analysis (OLS)	190 dyadic relationships
3	Benedettini et al. (2017)	Financial	Service breadth	Positive Effect	Archival data	Logistic regression analysis	273 Global Firms
4	Benedettini, Neely, and Swink (2015)	Bancrapcy likelihood	Service breadth	Positive Effect*	Archival data	ANOVA	129 Global Firms
5	Crozet and Milet (2017	Profit and Employment	Service share	Positive Effect on both profit and employment	Archival data	Regression analysis	34,243 French Firms
6	Fang, Palmatier, and Steenkamp (2008)	Tobin's Q	Service share	Non-linear and Positive Effect from 20-30% servitization	Archival data	Regression analysis	477 Publicly traded US Firms
7	Guedes, Patel, Kowalkowski, and Oghazi (2022)	Revenue	Service share	Positive Effect	Archival data	Regression analysis	35,329 Portuguese Firms
8	Han, Kuruzovich, and Ravichandran (2013)	Financial	Service share	Negative Effect	Archival data	Regression analysis	152 Global Firms
9	He and Lai (2012)	Financial	Service offering	Positive Effect	Survey	CB-SEM	229 Chinese Firms
10	He et al. (2015)	Financial	Service offering	Positive Effect	Survey	CB-SEM	365 Global Firms
11	Kohtamäki et al. (2015)	Financial	Service offering	Positive Effect	Survey	CB-SEM	115 Finish Firms
12	Visnjic and Looy (2013)	Financial, i.e., Total profit margin.	Service share	Negative Effect	Archival data	Regression analysis	44 national subsidiaries of a global firm
13	Kwak and Kim (2016)	Financial	Service revenue and service breadth	Positive Effect	Archival data	Regression analysis	202 Korean Firms
14	Li et al. (2015)	Financial	Service breadth	Positive Effect	Archival data	Regression analysis	134 Chinese Firms
15	Oliva et al. (2012)	Financial and non-financial performance	Service breadth	Positive Effect	Survey	CB-SEM	216 Fims from Austria, Germany and Switzerland
16	Tian et al. (2012)	Financial	Service offering	Positive Effect	Survey	Hierarchical regression analysis	719 Global Firms
17	Kohtamäki, Partanen, Parida, and Wincent (2013)	Sales growth	Service offering	Non-linear effect of the service offering on sales growth.	Survey	Regression analysis	91 Finnish Firms
18	Martín-Peña, Sánchez-López, and Díaz-Garrido (2020)	Total sales	Service share	Postive Effect from Servitization and digitalization	Archival data	Regression analysis	828 Spanish firms
19	Neely (2008)	Total Revenue/Profit/working capital	Service breadth; text analysis	Negative Effect	Archival data	Regression analysis	10,846 US Firms
20	Sousa and da Silveira (2017)	Sales/Profit	Service Offering	U-Shape; Negative Effect for basic, and Postive Effect for advanced	Survey	PLS-SEM	763 Gllobal Firms
21	Suarez, Cusumano, and Kahl (2013)	Financial, i.e., overall operating margins	Service share	Negative Effect / convex and non-linear.	Archival data	Regression analysis using GMM	3273 North American Firms
22	Szász, Demeter, Boer, and Cheng (2017)	Sales over Total Sales	Service Provision and breadth	Positive Effect on service return	Survey	CB-SEM	554 Global Firms
23	Visnjic and Van Looy (2013)	Financial	Service revenue	Negative Effect	Archival data	Regression analysis using GMM	308 Global Firms
24	Visnjic, Wiengarten, and Neely (2016)	EBIT margin/Tobin's Q	Service breadth	Negative Effect in short term and Postive long term effect	Archival data	Regression analysis	522 Global Firms

Table 2

Manufacturing Firms Offering Services (Service)

	Freq.	Percent	Cum.
No	99,293	91.33	91.33
Yes	9,421	8.67	100
Total	108,714	100	

Table 3

Number of Services Offered (n.Services)

	Freq.	Percent	Cum.
0	99,293	91.33	91.33
1	8,145	7.49	98.83
2	1,082	1.00	99.82
3	176	0.16	99.98
4 or more	18	0.02	100
Total	108,714	100	

Table 4

The enablers of diversification into services: Pooled Probit

	(1)	(2)	(3)
Middle Size	0.330***	0.315***	0.348***
	(0.016)	(0.017)	(0.017)
Large Size	0.553***	0.547***	0.622***
	(0.019)	(0.021)	(0.022)
R&D expenditure	0.0391***	0.0444***	0.0357***
	(0.002)	(0.003)	(0.003)
Export	-0.889***	-0.446***	-0.482***
	(0.012)	(0.022)	(0.023)
Likelihood of Failure	0.0227***	0.0178***	0.0164***
	(0.002)	(0.002)	(0.002)
Age		0.0165***	0.00398
		(0.005)	(0.006)
Age^2		-0.00125***	-0.000434
		(0.000)	(0.000)
Foreign		-0.373***	-0.370***
		(0.013)	(0.014)
Import		-0.444***	-0.464***
		(0.022)	(0.023)
Competition		0.413***	-0.113
		(0.082)	(0.344)
Cons	-1.291***	-1.160***	-1.497***
	(0.015)	(0.031)	(0.051)
N	102297	96168	95674

Notes: Robust standard errors in parentheses. The outcome variable is service offering. Region, year and sector FE included in the last specification. *significance at the 10% level, **significance at the 5% level, ***significance at the 1% level.

Table 5

Service offering and firm performance: Regression results

	(1) TFP_OLS	(2) TFP_LP	(3) Turnover	(4) Profits
Service	0.0319***	0.0179***	0.0440***	0.0546***
	(0.003)	(0.003)	(0.007)	(0.011)
Middle Size	-0.0435***	0.105***	-0.0997***	-0.143***
	(0.002)	(0.002)	(0.006)	(0.010)
Large Size	-0.00333	0.350***	-0.0336***	0.0806***
	(0.003)	(0.003)	(0.011)	(0.018)
Export	0.000440	-0.00203	0.000994	0.0343***
	(0.003)	(0.003)	(0.006)	(0.010)
Age	0.00573***	0.00518***	-0.0208***	-0.00951***
	(0.001)	(0.001)	(0.002)	(0.003)
Age^2	-0.000178***	-0.000221***	0.00126***	0.000484***
	(0.000)	(0.000)	(0.000)	(0.000)
Foreign	0.0134***	0.0174***	0.0140***	0.0313***
	(0.002)	(0.001)	(0.003)	(0.006)
Import	0.0250***	0.0377***	0.0705***	0.0983***
	(0.003)	(0.002)	(0.006)	(0.009)
Competition	-0.0349***	-0.176***	0.0468	0.0899
	(0.011)	(0.018)	(0.101)	(0.157)
Capital			0.0499***	0.219***
			(0.002)	(0.003)
Material			0.697***	0.421***
			(0.005)	(0.005)
Labour			0.151***	0.153***
			(0.005)	(0.007)
Constant	-0.0383***	2.115***	2.289***	0.593***
	(0.007)	(0.005)	(0.031)	(0.038)
R^2	0.00997	0.230	0.911	0.722
N	102105	96644	102072	99873

Notes: Robust standard errors in parentheses. Outcome variables are in logs. Region, year and sector FE included. *significance at the 10% level, **significance at the 5% level, ***significance at the 1% level.

Table 6

Total number of services offering and firm performance: Regression Results

	(1)	(2)	(3)	(4)
	TFP_OLS	TFP_LP	Turnover	Profit
1.Service	0.0293***	0.0171***	0.0389***	0.0555***
	(0.004)	(0.003)	(0.008)	(0.012)
2.Services	0.0263***	0.0145	0.0657***	-0.0115
	(0.008)	(0.009)	(0.021)	(0.033)
3.Services	0.184***	0.0689***	0.159***	0.486***
	(0.024)	(0.027)	(0.041)	(0.074)
4 or more Services	0.200***	0.106***	0.157	-0.420***
	(0.005)	(0.012)	(0.117)	(0.085)
Middle Size	-0.0435***	0.105***	-0.0994***	-0.142***
	(0.002)	(0.002)	(0.006)	(0.010)
Large Size	-0.00340	0.350***	-0.0332***	0.0815***
	(0.003)	(0.003)	(0.011)	(0.018)
Export	-0.0000750	-0.00222	0.000491	0.0328***
	(0.003)	(0.003)	(0.006)	(0.010)
Age	0.00575***	0.00520***	-0.0209***	-0.00958***
	(0.001)	(0.001)	(0.002)	(0.003)
Age^2	-0.000179***	-0.000221***	0.00126***	0.000487***
	(0.000)	(0.000)	(0.000)	(0.000)
Foreign	0.0135***	0.0174***	0.0141***	0.0312***
	(0.002)	(0.001)	(0.003)	(0.006)
Import	0.0252***	0.0378***	0.0707***	0.0993***
	(0.003)	(0.002)	(0.006)	(0.009)
competition	-0.0343***	-0.175***	0.0462	0.0895
	(0.011)	(0.019)	(0.101)	(0.157)
Capital			0.0498***	0.219***
			(0.002)	(0.003)
Material			0.697***	0.422***
			(0.005)	(0.005)
Labour			0.150***	0.153***
			(0.005)	(0.007)
Cons	-0.0383***	2.115***	2.290***	0.594***
	(0.007)	(0.005)	(0.031)	(0.038)
R2	0.0104	0.230	0.911	0.723
N	102105	96644	102072	99873

Notes: Robust standard errors in parentheses. Outcome variables are in logs. In the last two columns, Region, year and sector FE included. *significance at the 10% level, **significance at the 5% level, ***significance at the 1% level.

Table 7

Selection model results for estimation of firm performances

	(1) TFP_OLS	(2) TFP_LP	(3) Turnover	(4) Profit
		Main Equation		
Service	0.0629***	0.337***	0.0994***	0.396***
	(0.007)	(0.005)	(0.014)	(0.036)
Middle size	-0.0473***	0.0914***	-0.105***	-0.159***
	(0.003)	(0.002)	(0.005)	(0.009)
Large size	-0.00985***	0.325***	-0.0554***	0.0342**
	(0.003)	(0.003)	(0.008)	(0.016)
Exporter	-0.00236	0.0257***	0.00148	0.0634***
	(0.003)	(0.003)	(0.005)	(0.010)
Age	0.00538***	0.00798***	-0.0211***	-0.00510*
	(0.001)	(0.001)	(0.001)	(0.003)
Age^2	-0.000165***	-0.000312***	0.00127***	0.000311**
	(0.000)	(0.000)	(0.000)	(0.000)
Importer	0.0315***	0.0579***	0.0784***	0.126***
	(0.003)	(0.003)	(0.005)	(0.010)
Foreign	0.0159***	0.0310***	0.0192***	0.0515***
	(0.002)	(0.002)	(0.003)	(0.006)
Competition	-0.0276**	-0.195***	0.108	0.245*
	(0.012)	(0.020)	(0.074)	(0.144)
Capital			0.0497***	0.224***
			(0.001)	(0.002)
Material			0.710***	0.430***
			(0.001)	(0.003)
Labour			0.153***	0.158***
			(0.003)	(0.005)
Cons	-0.0372***	2.046***	2.155***	0.353***
	(0.007)	(0.005)	(0.014)	(0.029)
N	96017	90918	96017	94158

Notes: Robust standard errors in parentheses. Outcome variables are in logs and they are TFPs, Turnover and Profits. Region, year and sector FE included. *significance at the 10% level, **significance at the 5% level, ***significance at the 1% level.

Figures

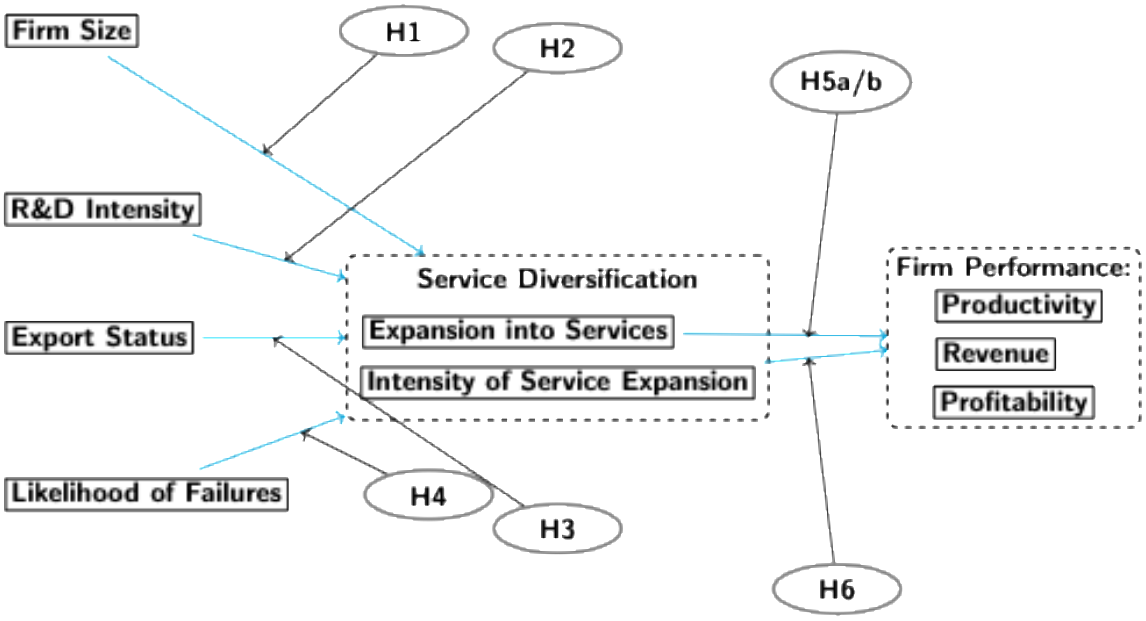
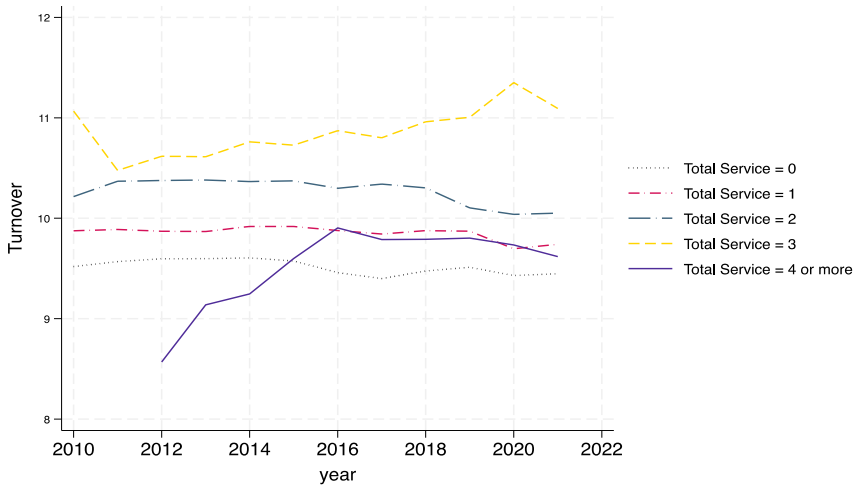
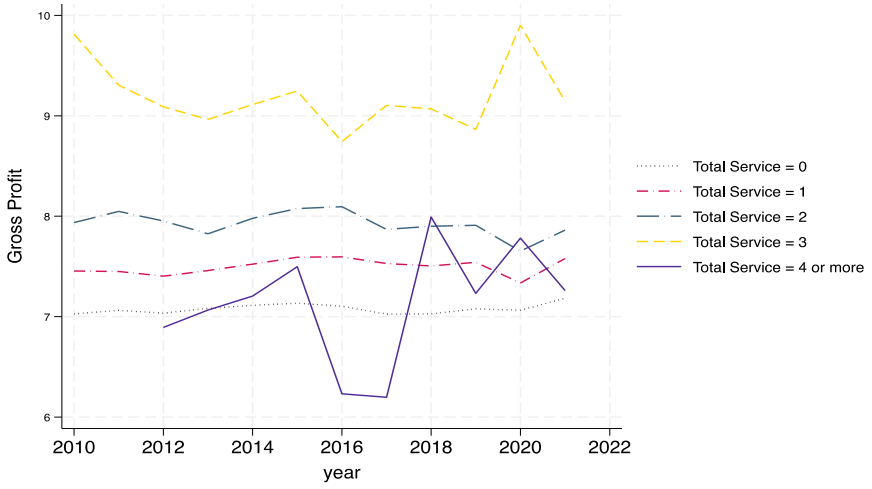


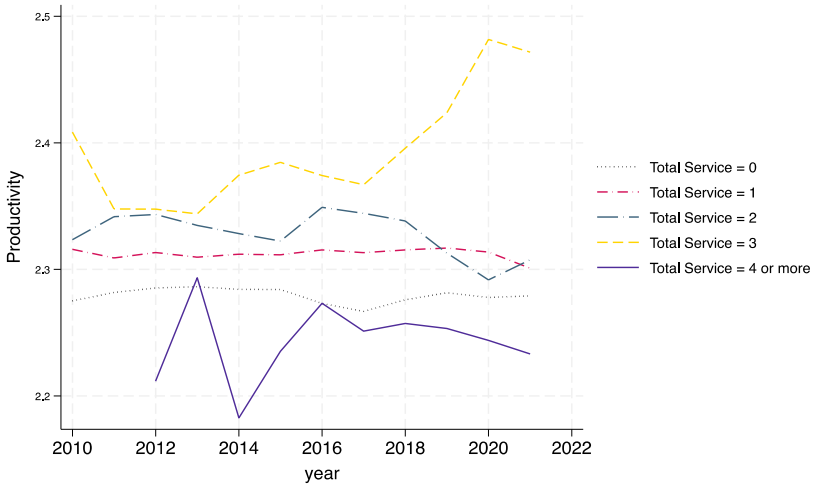
Figure 1. Conceptual Framework



(a) Revenue: Turnover (in logs)



(b) Profitability: Gross profits or EBITDA (in logs)



(c) Productivity: Total Factor Productivity (in logs)

Figure 2. Firm Performance by Service Intensity

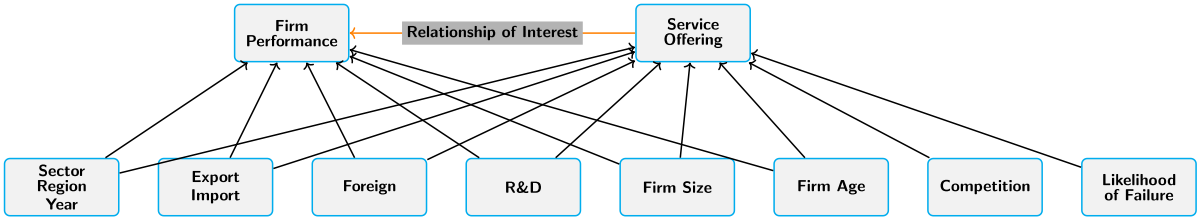


Figure 3. Model Illustration

Appendix

A. Production function estimation

i. Endogeneity in TFP estimates

There are multiple endogeneities at play that might affect our estimates. From the TFP analysis, we have selection through entry and exit and also omitted variable bias from unknown productivity terms.

To calculate TFP we use the basic firm Cobb-Douglas production function:

$$Y_{it} = \Omega_{it} K_{it}^{\alpha k} L_{it}^{\alpha l} M_{it}^{\alpha m} \qquad \text{(A1)}$$

where Y_{it} is deflated revenue for firm i and time t; Ω_{it} stands for Hicks-neutral productivity term; K_{it}, $L_{it,}$ and M_{it} represent capital, labour, and materials (intermediate input) respectively; and αs represent input elasticities.

Taking the log of the above equation gives us the following expression:

$$y_{it} = \alpha_0 + \alpha_k k_{it} + \alpha_l l_{it} + \alpha_m m_{it} + \omega_{it} + \varepsilon_{it} \qquad \text{(A2)}$$

Calculating the productivity term ωit from the above equation using Ordinary Least Squares (OLS) is problematic due to selection and simultaneity biases. Selection bias implies non-random entry and exit dynamics of firms (less productive firms are likely to exit). Simultaneity bias indicates the presence of unobservable (to the researcher) factors that correlate with both productivity and input choices of firms. To address these problems, we follow the control function approach developed by, which uses material as a proxy. This is what we refer to as TFP_LP. We also experimented using alternative correction methods such as the (TFP_wrdg) and the LP version later extended by Ackerberg et al. (2015).

ii. Measuring productivity

Table A reports the parameters (input elasticities) of the Cobb-Douglas function estimated using Ordinary Least Squares (OLS) and the Levinsohn and Petrin (2003) correction method for endogeneity (LP). Besides the two estimation methods, and to triangulate the results, we also estimated TFP_wrdg (Wooldridge, 2009), and LP using the version later extended by Ackerberg et al. (2015).

The Levinsohn and Petrin (2003) variant (ACF_LP) provide results and parameters that

are consistent and in line with the simple LP version (LP) reported in the tables. For this reason, in the paper, we report only the latter estimates, which we refer to as TFP_LP.

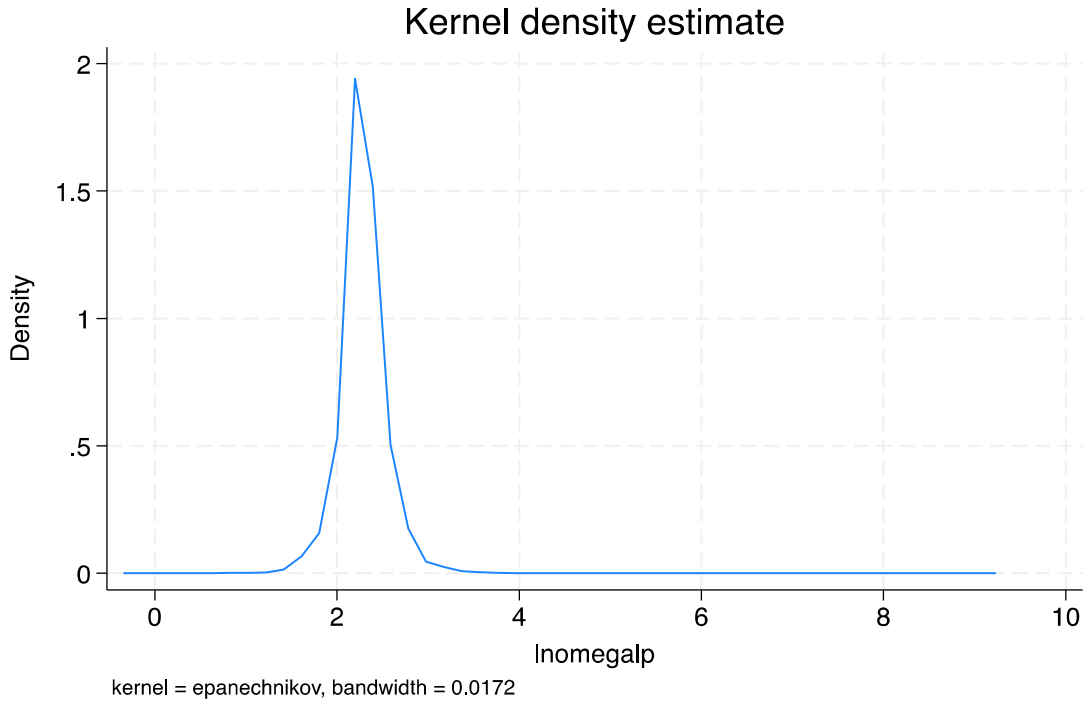
Table A1

Production function coefficient estimates using alternative correction for endogeneity.

	TFP_OLS	TFP_LP	TFP_wrdg	TFP_ACF_LP
Capital	0.0331***	0.0394***	0.0407***	0.0476***
	(0.002)	(0.006)	(0.002)	(0.000)
Labour	0.120***	0.109***	0.103***	0.198***
	(0.006)	(0.004)	(0.001)	(0.000)
Material	0.793***			
	(0.007)			
Cons	1.453***			
	(0.037)			
R^2	0.959			
N	108350	101790	85146	101790

Notes: Robust standard errors in parentheses. Outcome variables are in logs. Region, year and sector FE included. *significance at the 10% level,**significance at the 5% level, ***significance at the 1% level.

Figure A1 reports the estimated probability distribution of TFP.



Source: Authors' computation

Figure A1. Productivity distribution

B. Treatment for endogeneity in service offering

When identifying the effect of service offering on firm performance, the OLS estimate may be biased because firms self-select into offering services. Correcting for this endogeneity is therefore essential to find the correct parameter of interest. To account for the impact of self-selection into service offering on Equation 2, we use the endogenous treatment-effects model (ETE) which accounts for the large number of companies in the sample that do not offer services but would be eligible to do so (see for example, Björklund and Moffitt, 1987; Lee, 1978). Moreover, the ETE model is used to correct for endogeneity caused by simultaneity of the decision to diversify and its impact on firm performance (see Figure 3). Therefore, this model allows us to simultaneously estimate the enablers of diversification (Step I) and the impact of diversification on firm performance (Step II), which corrects for another endogeneity, namely, reverse causality. In other words, by treating the endogenous variable (S) as the treatment variable, the model corrects for the under/over estimation of the parameters estimates which would result from OLS in the absence of correction.

The ETE treatment effect model is expressed in two equations. The first models the impact of diversification on firm performance y_{it} (Equation 2), and the second models whether the company has diversified, $Service_{it}$, (Equation 1):

Regression equation:

$$y_{it} = \beta_0 + \beta_1 Service_{it} + \beta_2 X_{it} + \gamma_r + \eta_t + \lambda_s + \upsilon_{it}, \quad \text{(B1)}$$

Selection equation:

$$Service_{it}^{*} = \alpha_0 + \alpha_1 X_{it} + \alpha_2 Z_{it} + \gamma_r + \eta_t + \lambda_s + \varepsilon_{it}. \quad \text{(B2)}$$

Where $Service_{it} = 1$ *if* $Service^{*}_{it} > 0$; *and* $Service_{it} = 0$ *otherwise.*

All variables are as defined above. Equation (B1), the main regression equation, treats the predicted $Service_{it}$ in Equation (B2) as the treatment variable. If the latent variable $Service_{it}^{*}$ is greater than a threshold value, then the observed dummy variable $Service_{it} = 1$ indicating that the company diversifies, and $Service_{it} = 0$ in all the other cases, indicating that the company does not diversify; Z are the vectors of exogenous variables determining the selection process Equation B2, but not the outcome of the Equation B1. ε_{it} and υ_{it} are *iid* error terms and are jointly bivariate normal with mean zero.

Note that the model expressed by Equations Equation B1 and Equation B2 is a switching regression. The switching regression model explicitly states that there are two regimes: treatment and non-treatment. For treated participants, the outcome model is $y_{it} = \beta X_{it} + (\gamma Z_{it} + \varepsilon_{it}) + \upsilon_{it}$; whereas, for non-treated participants, the outcome model is $y_{it} = \beta X_{it} + \upsilon_{it}$.[10]

C. Variables of interest

Table C1

Descriptive Statistics (2010-2019)

Variable	Obs	Mean	Std.dev.	Min	Max
Enablers					
Company Size (H1)	108,714	1.899	0.657	1	3
R&D Dummy (H2)	108,714	0.166	0.372	0	1
R&D Expenditure†(H2)	108,543	0.953	2.302	-1.075	13.737
Export (H3)	108,714	0.648	0.478	0	1
Likelihood of failure (H4)	102,457	2.035	2.779	0.9	19.4
Controls					
Age	102,300	11.859	4.673	0	19
Foreign	108,714	0.556	0.497	0	1
Import	108,714	0.611	0.487	0	1
Competition (HHI)	108,714	0.061	0.076	0.0042	0.7370
Outcomes					
Turnover†	108,614	9.546	1.618	-2.989	17.267
Profit†	93,566	7.123	1.726	-6.986	16.349
Variables used to calculate TFP					
Capital† (K)	108,714	7.535	2.337	-7.227	17.835
Material† (M)	108,714	9.142	1.761	-6.255	17.109
Labour† (L)	108,714	4.444	1.393	0.000	11.846

Note: Monetary Units are in 2015 GBP, and outcome values are in logs. †Log transformed.

[10] The treatment effect model differs from the sample selection model—the form of Heckman model—in two aspects: (1) a dummy variable indicating the treatment condition $Service_{it}$ (i.e. $Service_{it} = 1$ if participant i at time t is in the treatment condition, and $Service_{it} = 0$ otherwise) is directly entered into the regression equation and (2) the outcome variable y_{it} of the regression equation is observed for both $Service_{it} = 1$ and $Service_{it} = 0$.

Table C2

Definitions of Main Variables of Interest

Variables	Definition
Age	Number of years in the database.
Foreign	An indicator for foreign ownership.
Import	An indicator if a firm imports at least one product.
Export	An indicator if a firm exports at least one product.
Company Size	A category for the size of the company. ONS definition: small firms (1 to 49 employees), medium size firms (50 to 249 employees), and large firms (more than 250 employees).
R&D Dummy	An indicator for positive spending in Research and Development activities.
R&D Expenditure	The amount of Pound Sterling spent on Research and Development activities.
Capital	The Pound sterling value of Fixed assets.
Material	The Pound sterling value spent on the cost of sales. This is used as a material expenditure.
Labour	The number of employees in a firm.
Competition (HHI)	The Herfindahl-Hirschman Index (HHI).
Likelihood of failure	Possibility of Default that takes the following values: 0.00% - 0.30% for Low Risk, 0.31% - 0.70% for Lower than Average Risk, 0.71% - 3.00% for Average Risk 3.01% - 8.00% for Moderate Risk, 8.01% - 30.00% for Medium Risk and 30.01% - 95.53% for High Risk.
Turnover	Operational revenue in Pound sterling.
Profit	Profit in Pound sterling, EBIDTA.

D. The full result of endogenous treatment-effects model

Table D1

Full Selection model results

	(1) OLS	(2) LP	(3) Turnover	(4) Profit
		Main Equation		
Service	0.0629***	0.337***	0.0994***	0.396***
	(0.007)	(0.005)	(0.014)	(0.036)
Middle size	-0.0473***	0.0914***	-0.105***	-0.159***
	(0.003)	(0.002)	(0.005)	(0.009)
Large size	-0.00985***	0.325***	-0.0554***	0.0342**
	(0.003)	(0.003)	(0.008)	(0.016)
Exporter	-0.00236	0.0257***	0.00148	0.0634***
	(0.003)	(0.003)	(0.005)	(0.010)
Age	0.00538***	0.00798***	-0.0211***	-0.00510*
	(0.001)	(0.001)	(0.001)	(0.003)
Age^2	-0.000165***	-0.000312***	0.00127***	0.000311**
	(0.000)	(0.000)	(0.000)	(0.000)
Importer	0.0315***	0.0579***	0.0784***	0.126***
	(0.003)	(0.003)	(0.005)	(0.010)
Foreign	0.0159***	0.0310***	0.0192***	0.0515***
	(0.002)	(0.002)	(0.003)	(0.006)
Competition	-0.0276**	-0.195***	0.108	0.245*
	(0.012)	(0.020)	(0.074)	(0.144)
Capital			0.0497***	0.224***
			(0.001)	(0.002)
Material			0.710***	0.430***
			(0.001)	(0.003)
Labour			0.153***	0.158***
			(0.003)	(0.005)
Cons	-0.0372***	2.046***	2.155***	0.353***
	(0.007)	(0.005)	(0.014)	(0.029)
		Selection Equation		
Age	-0.0906***	-0.0602***	-0.0906***	-0.0930***
	(0.005)	(0.005)	(0.005)	(0.005)
Age^2	0.00413***	0.00325***	0.00413***	0.00428***
	(0.000)	(0.000)	(0.000)	(0.000)
R&D expenditure	0.0408***	0.0457***	0.0403***	0.0482***
	(0.003)	(0.003)	(0.003)	(0.003)
Middle Size	0.207***	0.426***	0.209***	0.214***
	(0.016)	(0.019)	(0.016)	(0.017)
Large Size	0.457***	0.481***	0.458***	0.453***
	(0.021)	(0.022)	(0.020)	(0.021)
Importer	-0.468***	-0.327***	-0.468***	-0.482***
	(0.018)	(0.019)	(0.022)	(0.023)
Exporter	-0.508***	-0.412***	-0.511***	-0.521***
	(0.018)	(0.019)	(0.022)	(0.023)
Foreign	-0.408***	-0.344***	-0.408***	-0.400***
	(0.014)	(0.013)	(0.014)	(0.014)
Likelihood of Failure	0.00238	-0.0195***	0.00180	-0.000158
	(0.002)	(0.002)	(0.002)	(0.002)
Competition	-2.153***	-0.933***	-2.120***	-2.033***
	(0.330)	(0.304)	(0.330)	(0.334)
N	96017	90918	96017	94158

Notes: Robust standard errors in parentheses. Outcome variables are in logs and they are TFPs, Turnover and Profits. Region, year and sector FE included*significance at the 10% level, **significance at the 5% level, ***significance at the 1% level.