

# Does buyers' dependence translate into financial performance?

## An empirical analysis of manufacturer-service provider relationships

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### Why this paper might be of interest to Alliance Partners:

It may be beyond the capabilities of individual firms, or not be economically viable, to provide directly all the services related to a core product. For example, manufacturers of capital equipment often decide to supply services to certain customers/markets themselves, while also enabling distributors or other intermediaries to plan, install, integrate, support, optimise the product for the customer and provide product-related training. In such instances, the question arises of how should the manufacturer structure the ensuing supplier-buyer relationship with third-party providers of product-related services. Drawing upon supply chain management (SCM) research and the theoretical lens of relational embeddedness, this study investigates the effects of a service provider's "dependency" on a manufacturer's financial performance in supplier-buyer relationships involving a servitized manufacturer and a third-party provider of product-related services. Using financial-statement-based data from 190 servitized manufacturer-service provider relationships, we find that a service provider's dependency increases the manufacturer's performance in terms of return-on-assets (ROA), return-on-sales (ROS) and asset turnover (ATO). However, as service provider dependency increases, the manufacturer experiences diminishing returns; as dependency increases beyond a certain, the negative outcomes offset benefits. Thus, overall, the study finds evidence of an inverted U-shaped relationship between a service provider's dependency and a manufacturer's financial performance.

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# Does buyers' dependence translate into financial performance? An empirical analysis of manufacturer-service provider relationships

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Drawing upon supply chain management research and the theoretical lens of relational embeddedness, our study develops the hypothesis of an inverted U-shaped relationship between the dependence of a third-party provider of service related to a servitized manufacturer's product(s) and the manufacturer's financial performance. This proposition is tested empirically using financial-statement-based data from 190 manufacturer-service provider relationships. The results confirm the presumed diminishing returns of service provider's dependence. They further show that the economic effects of dependence concern the manufacturer's ability to profit from sales (as measured by ROS) as well as the ability to generate sales (as measured by ATO).

## **Introduction**

It may be beyond the capabilities of individual firms, or not be economically viable, to provide directly all the services related to a core product (Gebauer et al., 2013). Therefore, achieving 'service-led growth' (cf. Spring and Araujo, 2016) may depend upon product firms' ability to leverage on the contribution of outside actors.

The literature recognises that manufacturers' servitization or service-led growth is often a network phenomenon (e.g. Forkmann et al., 2016), where additional actors, such as distributors, specialised consultants, or third party service providers ensure access to the requisite competences and resources (e.g. Mathieu, 2001; Kowalkowski et al., 2013). Yet, extant literature focuses on the context of relationship structures where servitized manufacturing companies outsource service operations to external suppliers that act on their behalf, not really considering that ancillary providers may also act as distinct suppliers for the services related to a manufacturer's product. For example, manufacturers of capital equipment may supply services to certain customers/markets themselves, while also enabling distributors or other intermediaries to plan, install, integrate, support, optimise the product for the customer and provide product-related training (Hakanen et al., 2016).

In such instances, the question arises of how should manufacturers structure the ensuing supplier – buyer relationship with external service providers. Our study aims to investigate this question drawing upon supply chain management (SCM) research and the theoretical lens of *relational embeddedness*. The logic of relational embeddedness suggests that higher levels of "dependence" increase service provider's commitment to the relationship

with the manufacturer, leading to cooperative interactions such as information sharing, joint action, and business process coordination (Uzzi, 1996; Bernardes, 2010; Kim and Henderson, 2015). However, the notion of embeddedness would also suggest that, for instance, high levels of dependence from a single manufacturer may lead a service provider to lose touch with other manufacturers' innovative ideas and, therefore, be unable to feed important information about market developments to the manufacturer (Uzzi, 1997; Noordhoff et al., 2011; Villena et al., 2011). Accordingly, our study tests empirically the proposition of an inverted U-shaped relationship between product-related service providers' dependence and servitized manufacturers' financial performance.

## Theory and hypotheses

### *The concept of relational embeddedness*

The concept of social capital or *relational embeddedness* refers to the quality of the relationship between adjacent SC members (Bernardes, 2010; Kim, 2017). Uzzi (1996), among others, identifies the distinguishing characteristics of embedded relationships as: trust, fine-grained information sharing, and joint problem solving. **Trust** stems from reciprocity norms of embedded relationships that reduce the likelihood of opportunistic behaviours and is reflected in voluntary, non-obligating exchanges of know-how and information. As trust is built, firms also exhibit greater behavioural transparency, communication openness, and willingness to engage in more risky business interactions (Villena et al., 2011). Thus, trust promotes a governance mechanism (Uzzi, 1996) that transforms firms from self-centered partners into members of a relationship that pursues shared interest and common benefits (Gulati and Sytch, 2007; Kim, 2017). **Fine-grained information** is more likely to flow through embedded ties than through arm-length relationships (Uzzi, 1997). Relational embeddedness makes firms more concerned about the accuracy and detail of information exchanges (Gulati and Sytch, 2007). Fine-grained information sharing helps to increase the understanding of each other's operations and resources, of the business environment, and of emerging customer needs (Gulati, 1998; Bernardes, 2010). Not only does the transfer of fine-grained information (including proprietary and tacit know-how) increase, but also the quality and value of the information is enhanced because social ties make it credible and interpretable. Finally, **joint problem solving** involves developing bilateral solutions to a wide range of problems, such as operational issues, cost control and quality improvements. In the development of relational embeddedness, firms are likely to develop shared cognition (Bernardes, 2010), which in turn will lead to reduced conflicts, congruent goals, attitudinal convergence, and common frameworks for action (Villena et al., 2011). In these ways, embedded firms become predisposed to carrying out joint operational actions.

### *Hypothesis development*

The value-generating potential of relational embeddedness is well documented in the SCM literature. For instance, several studies have emphasised the operational benefits and transaction cost reductions that can accrue from commitment, cooperation and resource pooling in embedded relationships (Gulati and Sytch, 2007; Lanier et al., 2010; Kim and Wemmerlov, 2015; Kim, 2017). Bernardes (2010) and Villena et al. (2011) develop the argument that relational embeddedness can foster organisational learning and creativity, thereby making firms further able to provide fast and innovative responses to emerging

customer needs. Similarly, by virtue of promoting a shared understanding of the utility of mutually beneficial behaviour, embedded relationships have been argued to enable firms to tackle new external contingencies in ways that are difficult to emulate in arm-length ties (Uzzi, 1996).

Although the literature has largely focused on the benefits for buyers of embedded ties with suppliers, some studies have surmised benefits also for suppliers, suggesting a causal link between a buyer's relational embeddedness and the supplier's financial performance. In this study, we posit that such link exists also in relationships between servitized suppliers and third-party providers of services related to their products.

Some strategy scholars have further identified a "dark side" (Anderson and Jap, 2005; Villena et al., 2011) or paradox (Uzzi, 1997; Kim and Henderson, 2015) of embeddedness, which suggests that relational embeddedness entails not only benefits but potential negative consequences as well. We find that at least three of the negative consequences of embeddedness proposed in the literature are relevant to the context of this study; that is, may reduce the returns that servitized manufacturers achieve from the dependency of third-party providers of services related to their products.

First, high levels of embeddedness may make firms too concerned about avoiding conflicts in order to maintain harmony in the relationship, and may prevent them from providing accurate and appropriate feedback to their counterpart. This hinders inter-firm learning and ability to detect changes, thereby jeopardising performance (Villena et al, 2011; Kim and Henderson, 2015). For instance, service providers may avoid reporting problems (e.g. with meeting normative or customer requirements), and thus impair manufacturers' ability to adapt their products, processes and routines to environmental changes and emerging customer expectations. Second, as embeddedness increases, the information exchanged begins to be less valuable. The risk is that too much information that is not critical to the relationship is transferred from one party to the other, which creates confusion and progressively lowers effective decision making (Villena et al., 2011). Third, high levels of embeddedness may hamper creativity and ability to innovate by providing too much isolation from external developments (Kim and Henderson, 2015). As embeddedness rises to high levels, there remain few or no links to other firms outside the relationship who can contribute innovative ideas (Uzzi, 1997) or better ways to do things (Anderson and Jap, 2005). These conditions restrict organisational learning and increase exposure to competitive pressures. Therefore, high levels of relational embeddedness with a single manufacturer may lead a service provider to lose touch with other manufacturers' innovative ideas and, in turn, be unable to feed important information about market developments to the manufacturer (Noordhoff et al., 2011). Similarly, excessive levels of embeddedness may lead to "isomorphism" (Uzzi, 1997; Villena et al., 2011) and loss of independent thinking. For instance, buyers strongly embedded in a relationship with a supplier will align their routines and mental models to those of the supplier and, hence, be less likely to present alternative views and stimulate creativity.

Hence, we posit that a servitized manufacturer will experience diminishing returns from the dependency of third-party providers of services related to its products; as dependency increases beyond a certain point, negative outcomes offset benefits. The embeddedness of

a relationship, as consistently recognised in the literature (e.g. Kim and Henderson, 2015), is largely driven by the dependency between the parties. Therefore, we directly investigate relational embeddedness as service provider's dependency, which gives us the following hypothesis:

*Hypothesis: In a supplier-buyer dyad involving a servitized manufacturer and a third-party provider of product related services, the service provider's dependency has an inverted U-shaped relationship with the manufacturer's financial performance.*

## **Method**

### *Data collection*

The sampling frame consists of U.S. public companies that reported at least one "major" customer in their 2015 annual financial statements (because the data were collected in late 2016), thus providing a starting point to find matched supplier-buyer relationships. Major customer disclosures mandatorily include any customer that represents 10% or more of a company's consolidated revenue (Statement of Financial Accounting Standards (SFAS) No. 131). In addition, many companies voluntarily report (in annual 10-K filings or through other means, such as press releases and 8-K forms) information about customers that, though accounting for less than 10% of total revenue, are important to their business. Restricting the investigation to critical customers ensures a certain involvement of the suppliers in the relationship with the customers. The dollar amount of annual revenue generated from each major customer is given by the Compustat Customer Segment Files, which also provide the types and names of major customers.

We limited the supplier sample to the manufacturing sector (SIC Codes 20 to 39), to ensure that suppliers may potentially be servitized. The initial sampling frame consisted of 10317 supplier-buyer relationships that involved a manufacturing supplier and were reported in the 2015 Compustat Segment Files. We removed buyers with the following characteristics: (i) the Compustat customer type was "MARKET" or "GEOREG", because we were only interested in corporate customers; (ii) governmental customers, because of the different nature of their activities; (iii) customers whose identity was not disclosed (SFAS requirements include the existence but not the identity of major customers). Moreover, given that we were going to use sales information to measure buyer dependence, we further eliminated major customers with no sales data (companies that choose to disclose major customers may not report corresponding sales). The results of this initial screening procedure are summarised in Table 1.

*Table 1 – Initial sample screening*

Supplier-buyer relationships, reported in 2015 Compustat Customer Segment Files and involving a manufacturing supplier	10318
(1) Supplier-buyer relationships, after eliminating buyers of type 'MARKET'	8792
(2) Supplier-buyer relationships, after eliminating buyers of type 'GEOREG'	5382
(3) Supplier-buyer relationships, after eliminating buyers of types 'GOVDOM', 'GOVFRN', 'GOVLOC' and 'GOVSTATE'	5137
(4) Supplier-buyer relationships, after eliminating buyers whose identity was not disclosed	2656
(5) Supplier-buyer relationships, after eliminating buyers with no sales data	1666

We inspected every supplier-buyer relationship by hand-collecting information from the Standard & Poor's Capital IQ database. Each supplier and customer name was matched to the registered name of one of the companies listed in the Capital IQ database. Given that Compustat records customer names as disclosed by suppliers, i.e. often using abbreviations and different naming conventions, we examined every supplier-buyer dyad and manually corrected cases of inaccurate customer identification. In very few cases where a match could not be found in Capital IQ, supplier-buyer relationships were removed from the sample.

From the companies' business descriptions in Capital IQ, we then identified servitized manufacturers as suppliers offering one or more of the service categories identified by either Rabetino et al. (2015) or Benedettini et al. (2017). This condition sufficed our needs since, as previously outlined, the supplier sample only comprised manufacturing companies. For each supplier-buyer dyad involving a servitized supplier, we then scrutinised the business description of the buyer. We required each buyer to: (i) be a service provider, offering one or more of the service categories identified by either Rabetino et al. (2015) or Benedettini et al. (2017); (ii) have services related to the supplier's product(s) in its service base. Thus, we removed from the buyers' sampling frame any manufacturing company, like companies that use the supplier's product as a component of their product(s). On the contrary, we included system integrators who develop unique systems for their clients by aggregating multiple vendors' products. We also eliminated utility providers and other service companies who use the supplier's product to produce/deliver their services. After removing unsuitable supplier-buyer dyads, the final sample consists of 261 unique servitized manufacturer-service provider relationships.

### *Measures*

#### *Service Provider's Dependency*

Researchers have captured the level of dependency between adjacent SC members as the magnitude of trade between the members, relative to the size of their respective operations (e.g. Krause et al., 2007; Kim, 2017). In line with previous research, we measure dependency of a service provider (SP\_DEP) as the proportion of its annual cost of goods sold constituted by purchases from the manufacturing supplier (Kim and Henderson, 2015; Kim, 2017):

$$\text{Service Provider's Dependency (SP\_DEP)} = \frac{\text{Service provider's annual purchases from the manufacturer}}{\text{Service provider's annual cost of goods sold}} \quad (1).$$

Service provider's purchases in equation (1) represent the manufacturer's revenue generated by the service provider in 2015, as given by the Compustat Customer Segment Files. We centred the SP\_DEP value obtained from equation (1) by subtracting the sample mean to reduce collinearity between direct and quadratic term in the model (Cohen et al., 2003).

#### Manufacturer's performance

In our analysis, the overall impact on financial performance is measured by manufacturing suppliers' return-on-assets (ROA) (ROA = ratio of net income over total assets). DuPont analysis decomposes a company's ROA into return-on-sales (ROS) and asset turnover (ATO), where  $ROA = ROS \times ATO$ . ROS (net income / sales) captures the profit margin achieved on sales. ATO (sales / total assets) indicates asset efficiency in generating sales (Soliman, 2008). Breaking down ROA into ROS and ATO allows to understand the reasons behind company financial performance (Soliman, 2008). Along the lines of Patatoukas (2012) and Kim and Henderson (2015), among others, we test ROA and both its components.

#### Control variables

Extraneous effects are controlled with several variables related to industry and firm. Indicator variables representing the two-digit SIC codes of manufacturing suppliers are included to control for industry-specific effects (Patatoukas, 2012) and reduce the potential correlation of performance indicators within a specific industry (Kim and Henderson, 2015; Kim, 2017).

Firm-level controls include the following variables for manufacturing suppliers calculated in 2015: (i) firm size (SIZE), measured as the natural log of total assets; (ii) market share (SHARE), defined as the ratio of each firm's sales to total sales of their respective industries (as identified by the 2-digit SIC code); (iii) firm's sales growth (SG), measured as the annual growth of sales; and (iv) financial leverage (LEV), calculated as the ratio of last year's total assets to last year's total equity (Kim and Henderson, 2015). Following previous research, we assume that these variables might influence firm performance. Finally, two firm-level control variables are introduced to proxy for the market power of service providers (Kim and Henderson, 2015): (i) service provider size (SP\_SIZE); and (ii) service provider market share (SP\_SHARE). Both variables are measured in 2015 and calculated analogously to manufacturers' SIZE and SHARE respectively.

#### Data collection

As already mentioned, the Compustat Customer Segment Files provided the service providers' purchases from the manufacturers. The remaining data were collected from the Compustat Annual Files. This involved matching each service provider's name to the unique identifier (i.e. *gvkey*) of a company listed in Compustat. Information was hand-collected from Capital IQ (accounting data) and Mergent Online (SIC codes) for the service providers that were not listed in Compustat. After eliminating 68 observations with

missing financial data for service providers, the final sample consisted of 193 unique servitized manufacturer-service provider relationships.

### *Analysis*

Because our data was nested, with servitized manufacturers grouped in specific manufacturing industries, we tested the appropriateness of a multilevel modelling approach. Likelihood-ratio tests comparing the multilevel model (with manufacturer-service provider dyads nested within manufacturers' 2-digit SIC codes) with a single-level model (i.e. linear regression) with no industry effects indicated that the single-level approach should be favoured over the multilevel approach ( $p$ -value  $> 0.05$  for each of ROA, ROS and ATO – results not reported) (Garson, 2014). Accordingly, we chose the linear regression approach and used industry dummies to control for industry-specific effects.

Prior to the regression analysis, our data was examined for influential outliers using the Cook's distance procedure (Cohen et al., 2003). We found evidence of three observations (manufacturer-service provider dyads) that were "influential" on the results of the regression equations (Cook's distance greater than one; Cook and Weisberg, 1982; Cohen et al., 2003). These were removed from the dataset. Potential multicollinearity problems were examined by calculating the variance inflation factor (VIF) for the independent variables in the models. The largest VIF was 5.37, which is well below the typical cut-off of 10. Therefore, it appears unlikely that multicollinearity among independent variables could distort model results (Tabachnick and Fidell, 2007).

Lastly, robust standard errors were adopted in the regression estimation to allow for heteroskedasticity and modest departures from other linear regression assumptions (Stock and Watson, 2003).

### **Results**

Two separate models were estimated for each performance metric. Model 1, Model 3 and Model 5 regress only the control variables on ROA, ROS and ATO, respectively. Model 2, Model 4 and Model 6 add the linear and the squared term of service provider's dependency to estimate their incremental effects on each financial performance variable. Table 2 presents the results of the regression analysis, along with statistics for the explanatory power of the models. Significant F-statistics ( $p < 0.05$  in Model 1 and Model 2;  $p < 0.01$  in Models 3 to 6) and reasonable amounts of variance explained ( $R^2$  values ranging from 18.43% to 54.77%) indicate a strong relationship between regressors and dependent variables, lending support for our model specification.

Table 2 also reports the change in  $R^2$ , along with F-statistics, associated with the linear and quadratic term of service provider's dependency. Significant  $R^2$  increases ( $p < 0.10$  - due to the small sample size, 10% statistical significance can be applied) suggest that these dependency effects significantly improve the prediction of all three performance measures.

*Table 2 – Regression results*

	ROA		ROS		ATO	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Firm-level Controls</i>						
SIZE	0.018**	0.010	0.028***	0.199**	-0.150***	-0.170***
SHARE	0.654	0.624	0.440	0.399	0.494	0.405
SG	0.012	0.014	-0.070	-0.068	-0.177*	-0.171
LEV	0.005	0.006	-0.004	-0.003	0.004	0.008
SP_SIZE	0.013	0.036	-0.010	0.012	-0.042	0.011
SP_SHARE	-0.033	-0.093	-0.070	0.012	0.492*	0.354
<i>Industry-level Controls</i>						
Omitted due to space limitations						
<i>Explanatory Variable(s)</i>						
SP_DEP		1.866**		2.181***		4.935***
SP_DEP <sup>2</sup>		-4.510**		-6.299***		-13.706***
<i>Intercept</i>	-0.271	-0.417	-0.066	-0.207	2.520	2.186
R <sup>2</sup>	25.47%	27.59%	18.43%	20.58%	53.03%	54.77%
Adjusted R <sup>2</sup>	17.62%	19.02%	9.83%	11.17%	48.08%	49.41%
F-statistic	1.77**	1.91**	2.19***	2.50***	30.81***	25.53***
Change in R <sup>2</sup> rel.to controls		2.12%		2.15%		1.74%
F-statistic for change		2.4*		3.66**		4.10**
Observations	190	190	190	190	190	190

SIZE = manufacturer's size; SHARE = manufacturer's market share; SG = manufacturer's sales growth; LEV = manufacturer's financial leverage; SP\_SIZE = service provider's size; SP\_SHARE = service provider's market share; SP\_DEP = service provider's dependency (mean-centred variable)

\* p < 0.1; \*\* p < 0.05; \*\*\* p < 0.01 (two-tailed tests)

The results of the full models (Model 2, Model 4 and Model 6) show significant, negative associations of the quadratic term of service provider's dependency (SP\_DEP<sup>2</sup>) with manufacturer's ROA (b = -4.510, p < 0.05), ROS (b = -6.299, p < 0.01) and ATO (b = -13.706, p < 0.01), denoting a non-linear, concave downward relationship between service provider's dependency and manufacturer's performance. The significant, positive association of the direct term (SP\_DEP) with performance, for all three performance measures, further indicates that, at low levels of dependency, the effect on performance is positive. Therefore, our hypothesis of an inverted U-shaped relationship between service provider's dependency and manufacturer's performance is supported.

The predicted ROA values are plotted against SP\_DEP in Figure 1. The graphs plot the predicted ROA for different values of SP\_DEP (and consequently SP\_DEP<sup>2</sup>) when other variables are kept at their mean levels. The graphs show the expected U-shaped curves. The inflection point (where contribution to performance of service provider dependency changes from positive to negative) is at approximately 0.2. While this value is in the meaningful range of the dependency measure, it should be noted that this was reached only by two observations in the sample.

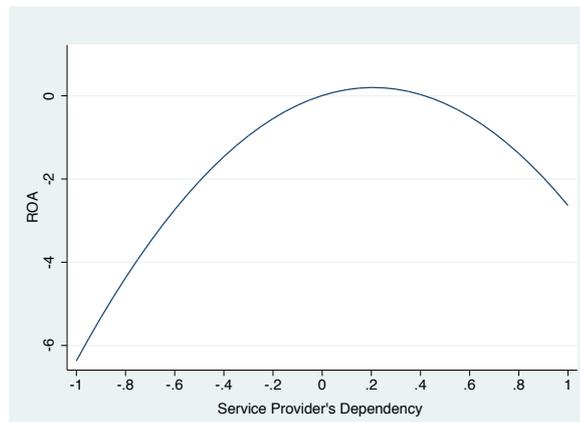


Figure 1 – ROA and service provider’s dependency

### Discussion and conclusions

Our study investigates the effects of the dependency of a third-party provider of services related to a servitized manufacturer’s product(s) on the manufacturer’s financial performance. We rely primarily on the theoretical lens of relational embeddedness and SCM research in predicting an inverted U-shaped relationship between service provider’s dependency and manufacturer’s financial performance. The study’s results substantiate the presumed diminishing returns of service provider’s dependency. Beyond a certain point at which drawbacks exceed benefits, the service provider’s dependency yields diminishing benefits for the manufacturer’s profitability as measured by ROA. Thus, we offer evidence for a “dark side” phenomenon (Anderson and Jap, 2005) in the economic effects of dependency.

Furthermore, our simultaneous investigation of ROA and its two factors – ROS (efficiency) and ATO (productivity) - sheds light on the mechanisms through which dependency affects profitability in the examined supplier-buyer relationships. Both ROS and ATO display an inverted U-shaped curve – i.e., service provider’s dependency is associated with manufacturer’s ROA via its association with both ROS and ATO. ROS measures the manufacturer’s ability to convert sales into profits. Therefore, its association with ROS demonstrates a significant, non-linear link between service provider’s dependency and such aspects as operational practices, information availability, resource utilisation, etc. at the manufacturer. Similarly, the association with ATO suggests that service provider’s dependency is important for a manufacturer’s ability to generate sales by developing market knowledge and acting on it to create innovative responses to customer emerging needs.

The study contributes by providing financial-statement-based empirical evidence on how dependency of a third-party provider of services related to a servitized manufacturer’s product(s) affects the manufacturers’ financial performance. Our results are consistent with theory and, to a large extent, with the results of prior research that has more broadly investigated the economic consequences of dependency among SC members (e.g. Lanier et al., 2010; Kim and Henderson, 2015). Moreover, the study responds to calls for more research on service-led growth in manufacturing that extends the unit of analysis beyond the individual firm (e.g. Kohtamäki et al., 2013). A final contribution from the study is to underscore that SCM research provides interesting theories to investigate how servitized

manufacturers can best design inter-firm relationships to support economic performance and growth.

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