Journal of Economic Behavior & Organization 106 (2014) 428–441

Contents lists available at ScienceDirect

Journal of Economic Behavior & Organization

journal homepage: www.elsevier.com/locate/jebo

# What factors determine the number of trading partners?

Noriaki Matsushima [a,*], Ryusuke Shinohara [b]

[a] Institute of Social and Economic Research, Osaka University, Mihogaoka 6-1, Ibaraki, Osaka 567-0047, Japan
[b] Department of Economics, Hosei University, 4342 Aihara-machi, Machida, Tokyo 194-0298, Japan

ARTICLE INFO

*Article history:*
Received 27 September 2012
Received in revised form 14 July 2014
Accepted 27 July 2014
Available online 26 August 2014

*JEL codes:*
C78
M11
L14
C72
D21

*Keywords:*
Buyer
Supplier
Investment
Economies of scope

ABSTRACT

The purpose of this paper is to provide a simple model to explain buyer–supplier relationships and identify factors that determine the chosen number of trading partners. We show that the optimal number of partners for a supplier is small, if it has low bargaining power, moderate economies of scope in variable costs, and large sunk investment. We extend the model by incorporating the supplier's quality investment and show that the investment level can be higher when the number of trading partners is small. The results may be consistent with the formation of Japanese buyer–supplier relations.



## 1. Introduction

Manufacturers seek to determine the optimal number of buyers, which affects their revenues and fixed and variable costs, including those related to labor, materials, and investment. In the context of buyer–supplier relations, suppliers must consider whether strategies that include a broader customer scope lead to superior performance (Nobeoka et al., 2002). In reality, in the Toyota *keiretsu* group (recognized as among the tightest), 41.7% of affiliated firms (defined here as those that are more than 20%-owned by Toyota) sold 40–80% of their products to outsiders (Sato, 1988, p. 121; Nishiguchi, 1994, p. 115).[1] More broadly, in the Japanese automobile industry, suppliers are typically affiliated with at most one assembler. However, some of the largest suppliers do supply parts to several unaffiliated assemblers (Ahmadjian and Oxley, 2013, p. 496).[2] For instance, the mean sales of Toyota's affiliated suppliers are 175 billion yen, whereas those of Toyota's nonaffiliated

* Corresponding author. Tel.: +81 6 68798571; fax: +81 6 68798583.
*E-mail addresses:* nmatsush@iser.osaka-u.ac.jp (N. Matsushima), ryusukes@hosei.ac.jp (R. Shinohara).

[1] Note that in Japanese buyer–supplier relations, the emphasis on cooperative assembler–supplier relationships and the notion of the *keiretsu* group sometimes lead to the misconception that there are exclusive relationships between assemblers and suppliers in the Japanese automobile industry (Nobeoka et al., 2002). Nishiguchi, 1994, p. 115 also mentions that it is a fallacy (especially outside Japan) that Japanese *keiretsu* firms do business only with those in the same *keiretsu* group.

[2] Ahmadjian and Oxley (2013) also indicate that the profitability of Japanese auto suppliers is not lower than that of Japanese auto assemblers in terms of return on assets (ROA) (Table 2 in their paper). This implies that auto suppliers are not always weak, relative to their trading assemblers. With regard to the customer scope of suppliers, see Ahmadjian and Lincoln (2001). See also Konishi et al. (1996), Sako and Helper (1998), and Okamuro (2001) for discussions on the Japanese automotive industry.

http://dx.doi.org/10.1016/j.jebo.2014.07.014
0167-2681/

suppliers are 318 billion yen (Ahmadjian and Oxley, 2013, p. 497).[3] In terms of return on assets (ROA), however, the average profitability of affiliated suppliers is not lower than that of nonaffiliated suppliers (Ahmadjian and Oxley, 2013, p. 497). These facts imply that expansion in customer scope does not always benefit suppliers. Therefore, when suppliers choose their optimal number of customers, they should take into account their technological environments, including product values, production efficiencies, and investment capabilities. In this study, we investigate which factors determine the number of trading partners (the customer scope).

We provide a simple model to explain suppliers' strategies. The setting is as follows. There is one supplier and two buyers. The supplier can provide a good that is used by the two buyers, but the latter cannot produce the good on their own. In this situation, the supplier first decides with whom to negotiate and incurs sunk costs that depend on the number of buyers. The (additional) sunk investment cost for the second buyer (the second unit of the good) is smaller than that for the first buyer. In the second stage, there are negotiations between the supplier and the designated buyer(s), for which we apply a simple Nash bargaining approach used by Chipty and Snyder (1999) and Raskovich (2003).[4] The characteristic of this approach is that if the supplier has chosen to bargain with two buyers, the supplier and each buyer simultaneously and separately conduct Nash bargaining. When the supplier produces the good for the buyer(s), it incurs a variable cost. The (additional) variable cost for the second buyer is smaller than that for the first buyer. The supplier only provides and sells the good to the buyer(s) if its variable cost is covered as a result of the bargaining.

We provide several results that may be consistent with the formation of Japanese buyer–supplier relations. The supplier trades with one buyer if its bargaining power with its trading partners is weak and the variable cost is neither large nor small relative to the value of the good. In other words, there is nonmonotonicity in the relation between the optimal number of buyers and variable cost. Therefore, suppliers who employ broader customer scope strategies do not always achieve higher profits. This appears to be consistent with Ahmadjian and Oxley's (2013) finding.

Extending the basic model, we consider a situation in which the supplier endogenously determines the value of the good through its quality investment. We show that the equilibrium investment level can be higher when the supplier trades with one, rather than two buyers, if the efficiency of its quality investment is low, the supplier's bargaining power with its trading partners is weak, and the variable cost is high.[5] This may also be consistent with the finding that Japanese automakers and their suppliers are more specialized than their US counterparts and that there is a strong correlation between supplier specialization and automaker profitability (Dyer, 1996). Although this statement is based on the buyer (automaker) perspective, the correlation may occur because the narrower customer scope of suppliers leads to higher investment levels, and thereby, higher product quality and profitability for automakers.

This paper is closely related to Chipty and Snyder (1999), Raskovich (2003), and Adilov and Alexander (2006).[6] However, to analyze buyer–supplier relations with cooperative investments, we extend these works by incorporating two new elements. One is the supplier's decision regarding the number of buyers, and the other is the supplier's investment to improve the quality of the buyers' products. Inderst and Wey's (2003) study is also closely related to ours. They comprehensively discuss the determination of an equilibrium market structure in the context of bargaining, mergers, and technology choices in simple bilateral oligopolistic markets. However, they do not discuss the relation between bargaining power and equilibrium market structure (the number of trading partners), as in our paper.

This paper is also related to the literature on the sources of buyer power.[7] The structure of our model is related to Battigalli et al. (2007) and Inderst and Wey (2007, 2011). Those papers discuss situations in which a monopoly upstream supplier sells an input to downstream firms (buyers) and engages in quality-enhancing/cost-reducing investments. The number of buyers is exogenously fixed in those papers.

This paper is relevant to the literature on the hold-up problem because in our model, the supplier's investment is not fully compensated by the buyers (a classic form of "hold-up"). The literature mainly discusses ways to overcome the hold-up problem (e.g., Klein et al., 1978; Williamson, 1979) and examines a pair of buyers and sellers in isolation,[8] whereas this paper considers the hold-up problem in a situation including multiple buyers.

This study is also relevant to studies on buyer and seller networks. Although many papers discuss buyer–seller networks (e.g., Kranton and Minehart, 2000, 2001) and compare vertically integrated firms and networks of manufacturers and suppliers, the purpose of this study is different. Whereas product quality is exogenously given in most of these

[3] Ahmadjian and Oxley (2013) statistically show that in the Japanese automobile industry, the mean sales of nonaffiliated suppliers are significantly higher than those of affiliated firms (see Table 4 in Ahmadjian and Oxley (2013)).

[4] For theoretical discussions of bargaining solutions, see, for instance, Binmore et al. (1986), Chae and Yang (1994), Krishna and Serrano (1996), Okada (1996, 2010), and Stenbacka and Tombak (2012).

[5] The outcome in this paper (a narrower customer scope) may evoke the term "exclusive dealing," although the main concern here is quite different from that in the literature on exclusive dealing. Several papers discuss whether exclusive contracts foster relationship-specific investment by an incumbent supplier (e.g., Segal and Whinston, 2000; de Meza and Selvaggi, 2007).

[6] Stole and Zwiebel's (1996a,b) study is also relevant to the discussion in Chipty and Snyder (1999). Recently, as in Chipty and Snyder (1999), in the context of the CATV industry, Adilov et al. (2012) investigated the bargaining model in relation to product bundling.

[7] Inderst and Mazzarotto (2008) and Inderst and Shaffer (2007) provide surveys on discussions of buyer power. Rey and Tirole (2007) provide a comprehensive survey of vertical relations.

[8] See also Grossman and Hart (1986), Hart and Moore (1990, 1999), Chung (1991), Aghion and Bolton (1992), Aghion et al. (1994), Che and Hausch (1999), and Segal (1999).