Market Structure and Entry:
Evidence from the intermediate goods market

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Abstract

The question of whether incumbent firms could deter new entrants in a more concentrated market has been a major concern by both antitrust authorities and industrial economists. This study is the first attempt to analyze the relationship between the market structure and entry in the intermediate goods market, utilizing unique data on auto parts transactions between automakers and auto parts suppliers in Japan during the period 1990-2010. The results suggest that there exists a U-shaped relationship between market concentration and entry, which sees entry decreasing and then increasing as markets concentrate. This result could emanate from a significant role of multi-product and multi-customer firms.

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1. Introduction

The question of whether incumbent firms could deter new entrants in a more concentrated market has been a major concern by both antitrust authority and industrial economists. From an antitrust point of views it is crucial to maintain just and competitive market mechanism by exercising strict control over entry deterrent behaviors by incumbent firms. The antitrust authority is keeping watch over whether an established seller with market power colludes with other incumbents or buyers to deter new entrants.[2] In industrial organization literature the market concentration is recognized as a part of behavioral barriers to entry that incumbents threaten to or actually engage in conduct disadvantageous to prospective entrants (Siegfried and Evans 1994, Geroski 1995). The significance of analyzing the relationship between market concentration and entry has resulted in a large number of studies (Table 1).

==Table 1==

The objective of the present paper is to broaden the understanding of the relationship between market concentration and entry by analyzing the intermediate good market. The analysis makes use of a unique dataset that tracks auto part transactions between automakers and auto part suppliers in Japan during the period from 1990 to 2010. The use of the dataset allows for observing virtually the vast amount of information about firms' entry decision that is lost if researchers have access only to datasets compiled by governments. This emanates from two distinctive features. One is its disaggregated product categories. The dataset provides transaction information on 200 auto parts, whereas Japan's Census of Manufacturers (the Census, hereafter) that are often employed for market entry analyses, contain only 9 products in auto part industry. The other is to include information about "selling to whom", enabling for identifying entry at seller-buyer-product-level. The Census limits to the identification at seller-product-level.

The other contribution of introducing this dataset is to make it possible to define "market" at buyer-product-level. This setting is crucial, particularly in analyzing the Japanese auto part

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industry where an automaker typically keeps the relationship with two potentially competitive suppliers for each auto part (Konishi *et al*. 1996). Taking into account this, all variables relating to market structure are measured at buyer-product-level. The market concentration is measured by the Herfindahl index. Entry is measured in gross term at seller-buyer-product-level.

I find that the market is duopolistic and concentrated: mean incumbents is 2.3, and Herfindahl index is 0.7 on average. Entry accounts for nearly one third of total transactions.[3] The main form of entry is diversification of incumbent firms, rather than a new business start. An important finding is the U-shaped relationships between market concentration and entry, which see entry decreases and then increases as market concentrates. The empirical evidence suggests that the upward slope could be partly explained by two factors. First, potential entrants in concentrated markets aims for a niche product. In a highly concentrated market, incumbent firms have less incentives to deter new entrants as long as potential competitors do not threaten their established transactions with buyer. The other is that impediments to new entrants are low, because of the dominant role of the multiple-product firms and multiple-buyer firms.

The present paper adds to the literature on the relationship between market concentration and entry. As far as I am aware, this is the first attempt to analyze the intermediate good market (Table 1). It has been well recognized that separating final good and intermediate good markets matters, given the different nature of the market (Katz 1989).[4] Particularly, the important role of a vertical contract between buyer and seller in intermediate good markets could strengthen the relationship between market concentration and entry. Studies such as Aghion and Bolton (1987) and Yong (1999) show that in oligopolistic settings a monopolistic seller can deter entry through signing exclusive dealing contracts with buyers. However, previous research has ignored this point, mainly due to data limitation. The other innovation is to define the "market"

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[3] Entry is defined as a transaction that did not exist in the past period (e.g. 2002) but emerge in the current period (2008).

[4] Katz (1989) points out the following distinctive features of intermediate good markets. First, intermediate good markets often involve large transactions made by sophisticated buyers. Second, the products being sold may possess very complex bundles of attributes, making problems of moral hazard more severe, or at least more complicated. Third, the buyers' demands for an intermediate good are interdependent when the buyers are product-market competitors with one another. Fourth, the buyers of an intermediate good typically are involved in a game in the downstream product market, and the sales contract for the upstream product may affect the equilibrium of this downstream game. Lastly, buyers of intermediate goods often can credibly threaten to integrate backward into supply of the intermediate good.

at most disaggregated level (*i.e.* buyer-product-level) for the accuracy of the analyses. Many authors have simply used the market boundaries provided by the compliers of official data. However, it is often difficult to choose among market definitions, and the official definitions are often inappropriate (Schmalensee 1989).

This paper also relates to the fledging literature on firm dynamics (Bernard *et al*. 2010, Kawakami and Miyagawa 2010, Bernard and Okubo 2013). The improving access to fine disaggregated database enables for a better understandings of firm dynamics by shedding light on the extensive margin of firm adjustments called "product switching".[5] This study informs the possibility that the prevalence of product switching is undercounted with firm- (or plant-) product-level data, as transactions within a product are aggregated.[6] Particularly, such aggregation bias becomes serious in a situation where the incumbents are multiple-buyer, and seller-buyer relationships are flexible over time.

The rest of the paper is structured as follows: Section 2 describes the dataset employed in this study, followed by the stylized facts drawn from the dataset. Section 3 presents the empirical model and estimation methods to examine the U-shaped relationship between market concentration and entry. Section 4 reports the results and additional analyses are undertaken in Section 5. Section 6 concludes.

2. Market Structure and Entry in the Japanese Auto Part Industry

2.1. Data

An important contribution of this paper is to introduce a unique transaction data to examine the relationship between market structure and entry in the intermediate good market. Since the data has not been utilized broadly in other studies, it is worth describing its features.[7] This study uses "*Jidosha Buhin 200 Hinmoku Seisan-Ryutsu Chosa* [Report on Production and

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[5] For example, Bernard *et al* (2010) utilize the U.S. Manufacturing Censuses from 1987 to 1997 and document that 54 percent of surviving firms in US manufacturing sectors altered their product mix every five years. Employing the Census of Manufacturers in Japan, Kawakami and Miyagawa (2010) present evidence that 33 percent of surviving firms undertook product switching from 1998 to 2003. Bernard and Okubo (2013) provide plant-level evidence, analyzing the Census of Manufacturers in Japan from 1992 to 2006. It is suggested that 20 percent of surviving plants altered their product mix annually.

[6] The dataset employed in this study shows that the prevalence of product switching by auto part suppliers are double higher than in the case where firm-product-level data is applied.

[7] The limited prior studies employing the same dataset include Nagaoka *et al* (2008).

Transactions of 200 Auto Components]" published by Industrial Research and Consulting (the IRC, hereafter), a Japanese market research company. The IRC was published every three years from 1984.[8] The IRC provides information on which auto part suppliers sold how much (in volume) of each product to which automakers for 200 types of products.[9] Around 600 sellers, mainly tier-1 suppliers, are covered. Buyers are 12 automakers manufacturing automobiles including both passenger and commercial vehicles (*e.g.* taxi and truck) in Japan. The data is collected by hearing surveys with firms involved. As far as I am aware, the coverage of the IRC is the most comprehensive in terms of auto part transactions compared with any other databases.

The IRC is ideal for more accurately analyzing the relationship between market structure and entry for the auto part market in Japan for a number of reasons. First, instead of relying on aggregated product categories, I observe virtually the much more disaggregated product categories. The IRC provides transaction information on 200 auto parts, whereas Japan's Census of Manufacturers (the Census, hereafter) that are often employed for a market entry analyses, contain only 9 products in auto part industry.[10] For example, engine components are aggregated into one product in the Census, but the IRC is able to identify 74 products.[11] The use of the IRC allows for exploring the vast amount of information about market entry decisions by firms that is lost if researchers have access only to government-supply aggregated data.

A second distinctive feature of the IRC is the inclusion of information about "selling to whom" that the Census does not provide. This means that the IRC enables for identifying the transactions at seller-buyer-product-level whereas the Census limits to the identification at seller-product-level. This feature has an important implications in defining "market". It is well studied that an automaker typically keeps the relationship with two potentially competitive suppliers for each part of a model to address the hold-up problem of relation-specific investments under incomplete contracts (Konishi *et al*.1996). Therefore, it is crucial to define the market at buyer-product-level for the purpose of the analysis. The use of the IRC makes this possible. A third important feature of the IRC is to enable for measuring market concentration

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[8] The publication has occurred every two years since 2008.

[9] Appendix 1 shows an example for a product "Crankshaft".

[10] "Industry" is defined as four-digit category, and "product" is defined as six-digit category based on Japan Standard Industry Classification (JSIC).

[11] The IRC is more disaggregated compared even to trade statistics based on the Harmonized System (HS) that classifies products at nine-digit level, enabling for the identification of 108 auto parts.

and entry accurately. Market concentration is measured by the Herfindahl index, which is an ideal measurement for market concentration but difficult to obtain by the Census. The use of the IRC also allows for measuring "gross" entry, which is more appropriate than "net" entry.

It is fair to clarify the limitations of using the IRC. The IRC does not fully record all auto part transactions between automakers and auto part suppliers in Japan, because strictly speaking, products are differentiated by models. Given the unobserved conducts sellers presumably make at the level of models, the use of the IRC likely underestimates the true importance of entry by sellers. More importantly, the IRC does not provide any information about individual firms such as labors and capitals for outputs, making it difficult to undertake further investigations like firm attributes determining entry decisions. Such individual firms' information is available in the Census. Lastly, the IRC limits to only auto part industry, resulting in the difficulty in generalizing the findings obtained from this study. The Census covers all manufacturing sectors. Despite several shortcomings, the use of the IRC could contribute to a better understanding of the relationship between market concentration and entry by complementing previous research that employed the Census and other government-supply datasets.

To avoid an unnecessary confusion, it is crucial to keep track of the levels of aggregation. It is easiest to understand these levels of aggregation by extracting an example from the IRC (Appendix 1). At the lowest level a transaction is identified at seller-buyer-product-level. For example, Toyota internally produces 78.5 thousands of crankshafts and procures 117.7 thousands from Aichi Steel at the same time. Both of them are regarded as a transaction (*i.e.* Toyota-Toyota-Crankshaft, Aichi Steel-Toyota-Crankshaft). In this case, 36 transactions are identified in total. Each transaction, in turn, belongs to a "narrow market" at buyer-product-level. As can be seen, there exists 12 narrow markets (*e.g.* Toyota-Crankshaft, Nissan-Crankshaft and so on). The number of transactions, which is equivalent to the number of sellers, varies among each narrow market. We observe 3 transactions in Toyota's narrow market and 5 transactions in Suzuki's narrow market. The narrow market is, in turn, within a "broad market", which is the highest level of aggregation. Note that the number of transactions is not equivalent to that of

sellers, due to the multiple-customer nature of the auto part suppliers in Japan.[12] In the case of Crankshaft market, 19 sellers involve 36 transactions.

==Appendix 1==

Table 2 presents descriptive statistics of the number of transactions and sellers at the different levels of aggregation just defined. The table shows that there are roughly 4,200 transactions in each year in around 1,800 different narrow markets which can be aggregated into 200 broad markets. The mean transaction in broad markets is 21, and the mean transaction in narrow market is 2.3. The table also shows that the total number of sellers is around 570 in each year, and the average number of sellers is 9 in each broad market. As noted above, the number of sellers in narrow market is equivalent to the number of transactions.

==Table 2==

2.2. Stylized facts

Stylized Fact 1: Auto Part Markets in Japan are Duopolistic

The first fact concerns the market structure in the Japanese auto part industry. As shown in Table 2, the auto part market defined as a narrow market in Japan has 2.3 sellers on average. Despite the certain ranges from 1 to 9, the variation coefficient is around 0.5, implying the number of sellers in the sample is concentrated around 2.[13] The duopolistic nature can be observed when the sample is divided by types of product (Table 3). The average number of sellers at narrow markets in 2010 are around 2.3 for all product types except for Wheel/Tyre (3.4). Note that the duopolistic nature of auto part market is not observable for broad markets.

==Table 3==

Stylized Fact 2: Market is Highly Concentrated

The degree of market concentration is measured by Herfindahl index for each narrow market

$$Concentration_{b,p} = \sum_{s=1}^{N} m_{s,b,p}^2 \qquad (s: \text{seller}, b: \text{buyer}, p: \text{product})$$

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[12] For example, Aichi Steel sells a crankshaft to 6 automakers (Toyota, Mitsubishi, Suzuki, Daihatsu, Isuzu, and Hino).

[13] The duopolistic nature of the auto part market in Japan is observed even when the sample is restricted to products existing from 1990 to 2010 consistently (Appendix 2).

where $m_{s,b,p}$ is the market share of seller s in a narrow market b, p, and N is the number of incumbent firms. The index ranges from 0 to 1, and the large value indicates a high concentration with a dominant player.

Table 4 highlights the high degree of concentration at narrow market in the Japanese auto part industry. The mean Herfindahl index is around 0.7 for each year. The high degree of market concentration is also common among different types of products.[14] The high degree of market concentration is driven partly by the important role of monopolistic transactions in the Japanese auto part industry (*i.e.* one buyer procures a specific auto part from a single seller). Figure 1 presents the distribution of narrow markets by the Herfindahl index in 2010. As can be seen, the number of monopolistic market is top among others, accounting for one fourth of the total. The second top is the market where Herfindahl index ranges from 0.5 to 0.6.[15]

==Table 4==

==Figure 1==

The understanding of market structure just explained is completely different when the Herfindahl index is calculated for a broad market. The mean Herfindahl index is around 0.14 (Table 4). The low market concentration is also common among different types of products. There is no market where a single seller has a monopolistic power. The distribution of broad markets by the Herfindahl index is much more contrasting against the case of narrow market (Figure 2).

==Figure 2==

Stylized Fact 3: Entry Accounts for a Large Part of Transactions
Entry is comprised of diversification by incumbent firms and new business starts. The diversification occurs if an incumbent sells an existing product to a new buyer, or a new product to an existing buyer. The new business start is realized if an incumbent or outside firm begins

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[14] The high degree of market concentration is observed even when the sample is restricted to products existing from 1990 to 2010 consistently (Appendix 3).

[15] Although this structure has not changed over the past decades, the share of monopolistic transactions has declined. In 1990 the number of monopolistic market was top among others, and it accounted for nearly one third of the total (See Appendix 4).

producing a product that it has not produced in the past. Following Broda and Weinstein (2010), two measurements are introduced to examine the extent of entry. One is the entry rate defined as the number of new transactions in period t relative to period s as a share of total number of transactions in period t. t is current year and s is previous year (*e.g.* $t = 2008$, $s = 2002$). The other is creation rate defined as the volume of new transactions in period t relative to period s as a share of total volume of transaction in t. The creation rate is the weighting analogues of the entry rate.

To prevent the undercounts of entry the interval of the two periods takes 6 years. In the Japanese auto industry, models are changed every four years. It is unlikely that entry occurs during that period, because of the fixed-term contract between automakers and auto part suppliers, making it difficult to switch the business partners for a certain product. For the purpose of the comparison, I also present the extent of exit measured in a similar way to the entry.[16]

Table 5 summarizes the extent of entry and exit at different periods. The first column shows the entry rate. The low entry rate during the period between 2008 and 2010 is partly due to the undercount resulting from the short interval as discussed above. The entry rate during the period between 2002 and 2008 is 0.3, suggesting that roughly one third of total transactions in 2008 is made of new transactions that did not exist in 2002. The period between 1996 and 2002 sees a similar entry rate (0.33), and the entry rate is much higher during the period between 1990 and 1996 (0.42). That the creation rates are relatively smaller than entry rate is presented in second column. This implies that the volume of a new transaction is relatively small.

==Table 5==

Columns 3 and 4 of Table 5 presents the extent of exit. The exit rate during the period between 2002 and 2008 is 0.3, suggesting that roughly one third of total transactions in 2002 disappear in 2008. The exit rates are almost equivalent to the entry rates for the period between 2008 and 2010 and the period between 2002 and 2008. However, the exit rates during the period between 1996 and 2002 and the period between 1990 and 1996 are much smaller than the entry rates.

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[16] The exit rate is defined as the number of transactions that existed in period s but disappear in period t as a share of total volume of transactions in period s. (*e.g.* $t = 2008$, $s = 2002$). The destruction rate is defined as the volume of transactions that existed in period s but disappear in period t as a share of total volume of transactions in period s.

Destruction rates are consistently smaller than creation rates except for the period during 2008 and 2010.

Table 6 presents the extent of entry and exit by automakers during the period between 2002 and 2008. Mazda experienced more entry than any other automakers during that period: the entry rate was 0.37 and the creation rate was 0.43. The lowest entry rate was 0.25 (Isuzu) and the lowest creation rate was 0.13 (Mitsubishi). The interesting point is that the entry rate varies among automakers. While Toyota and Honda have a relatively high entry rate, the entry rates of Nissan and Mitsubishi are low. For exit, Isuzu saw the highest exit and destruction rates.

==Table 6==

Table 7 presents the extent of entry and exit by product types during the period between 2002 and 2008. The mean entry rate is highest for Steering (0.44), and the lowest is Wheel/Tyre (0.18). Electrical (0.66) has the highest mean of creation rate, and Wheel/Tyre has the lowest mean (0.06). For exit, Steering (0.44) has the highest mean of exit rate, and the Electrical (0.14) has the lowest mean. The mean destruction rate is highest for Steering, and the lowest for Electrical.[17]

==Table 7==

Table 8 demonstrates that diversification of incumbent firms accounts for a large part of entry. The share of incumbent firms of new entrants, on average, is about 0.8. In particular, the share is quite large in the period from 2002 to 2008 (0.94). The interesting finding is that the shares of incumbent firms of new entrants are consistently larger than in the case of exit.

==Table 8==

Stylized Fact 4: The U-Shaped Relationship between Market Concentration and Entry
It has been shown so far that the market structure in the Japanese auto part industry is characterized by duopoly and high concentration, and entry accounts for a large part of transactions. What is the relationship between the market structure and entry? It is expected that

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[17] The other evidence of showing the importance of entry is that a transaction that has continued from 1990 to 2010 accounts for only one third of total transactions in 2010 (Appendix 5). In other word, most transactions emerged and disappeared after 1990.

the market concentration and entry are negatively correlated, as in a more concentrated market a seller with market power is likely to collude with other competitors or buyers to deter new entrants. Also, market concentration is recognized as a behavioral barrier to entry that incumbents threaten to or actually engage in conduct disadvantageous to prospective entrants.

That the U-shape relationship between market concentration and entry exists is implied in Figure 3. X-axis is categorized according to the degree of market concentration measured by the Herfindahl index. Y-axis shows the relative entry index (*REI*) measured by the ratio of the number of new transactions occurred during the period between 2002 and 2008 to the number of markets in 2002 for each concentration degree. Note that new transaction is measured at seller-buyer-product-level, and market is defined as narrow market at buyer-product-level. For example, the REI in the market with the degree of concentration $0.2 \geq HI > 0.3$ is calculated as follows:

$$REI_{0.2 \geq HI > 0.3} = \frac{Number\ of\ entry_{0.2 \geq HI > 0.3}}{Number\ of\ market_{0.2 \geq HI > 0.3}} = \frac{42}{44} = 0.95$$

The expectation is met in the markets with the relatively low degree of concentrations ranging from 0.2 to 0.6. However, it seems that the relationship turns to be positive for the range of the HI from 0.6 to 1.

==Figure 3==

Stylized Fact 5: The Significant Role of Multiple-Product Firms and Multiple-Buyer Firms
Table 9 shows that multiple-product firms play a significant role in the Japanese auto part industry. Around 57% of sellers are multiple-product firms, and 87% of transactions are associated with multiple-product firms. On average, multiple-product firms are dealing with almost 5 products. The middle part of Table 9 shows that multiple-buyer firms also play an important role among sellers. Around 53% of sellers have multiple-customer, and 85% of transactions are conducted by multiple-buyer firms. On average, multiple-buyer firms are transacting with 5 customers. That multiple-product firms are specializing in limited types of products (2.5) rather than diversifying their product lines is presented in the bottom part of Table 9.

11

==Table 9==

3. Estimation Strategy

This section undertakes econometric analyses to investigate the existence of the U-shaped relationship between market concentration and entry. I will explain the model, followed by the discussion of estimation methods and endogeneity issues.

3.1. The Model

The linear probability model (LPM) is estimated as a baseline;

$$Entry_{s,b,p} = \alpha + \beta_1 Concentration_{b,p} + \beta_2 (Concentration_{b,p})^2 + \beta_3 Incumbent_{b,p}$$
$$+ \beta_4 Growth_{b,p} + \beta_5 Size_{b,p} + \varepsilon_{s,b,p} \qquad (1)$$

where subscripts *s,b,p* denote seller (*i.e.* auto part supplier), buyer (*i.e.* automaker), and products, respectively. *Entry* stands for an entry decision made by a seller. *Concentration* stands for the degree of market concentration that captures the likelihood of predatory behaviors conducted by established firms (Siegfried and Evans 1994).[18] The main interest of this analysis is the U-shaped relationship between market concentration and entry: $\beta_1 < 0$ and $\beta_2 > 0$ support the hypothesis. *Incumbent* stands for the number of incumbent sellers, which is another variable to capture the market structure. *Growth* stands for expected demand growth, and *Size* stands for the demand size.

All variables are constructed from the IRC for 1990, 1996, 2002, 2008, and 2010. The period from 2002 to 2008 is examined as a baseline. *Entry* is measured at seller-buyer-product-level by a binary variable whether a transaction that does not exist in the past period (*i.e.* 2002) emerges in the current period (*i.e.* 2008). I also introduce Entry rate as an alternative measurement of entry often introduced by previous studies (Table 1). Entry rate is measured for narrow markets defined at buyer-product-level by the number of new entrants in the current (*i.e.* 2008) relative to the number of incumbent sellers in the past (*i.e.* 2002). For robustness checks, I examine

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[18] On the other hand, the expected profits are higher in concentrated market, encouraging entry. Previous research has shown that high concentration could lead to less entrants, indicating that the deterrent effect outweighs expected profit (Table 1).

different periods including 1996-2002, 1990-1996 and the pooled of three periods (1990-2008) and different intervals including 1996-2008, 1990-2008, and 2008-2010.

All explanatory variables are measured for the narrow market. *Concentration* is measured by the Herfindahl index in the past period. In the case of the period from 2002 to 2008, for example, the influence of market concentration in 2002 on seller's entry decision made in 2008 is examined. This treatment is to avoid a reverse causality problem. *Size* is measured by the total transaction volume in the past. *Growth* is measured by the change in transaction volume during the past period. In the case of the period from 2002 to 2008, for example, the change in transaction volume during the period from 1996 to 2002 is used.

The LPM has two shortcomings. One is that the predicted probability might take either less than zero or greater than one, and the other is that the partial effect of any explanatory variable is constant. To overcome these drawbacks the Logit model and Probit model are introduced.[19] The use of these models ensures that the estimated response probabilities are strictly zero and one. The LPM is estimated by the ordinary least squares (OLS). The Logit and Probit models are estimated by the maximum likelihood estimation (MLE).

3.2. Endogeneity

The fundamental assumption for consistency of the OLS estimator is that the error term in Eq. (1) is not correlated with the explanatory variables. If this assumptions fails, the OLS estimator is not consistent and no longer allows for a causal interpretation. The endogeneity problem may arise due to the fact that the error term may include other difficult-to-control-for variables which are correlated with market concentration. One such variable may be product-specific characteristics including asset specificity and capital costs, which could influence market concentration and seller's entry decision simultaneously.[20] An incumbent may have an absolute cost advantage over potential entrants for the product that requires relation-specific investments and exclusive knowledge about the product (*e.g.* engine components) and the product protected

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[19] The main difference between these two models is that the Logit model is based on the cumulative distribution function for a standard logistic random variable, whereas the Probit model is based on the standard normal cumulative distribution function with the standard normal density.

[20] Nishitateno (2013, 2015) discuss endogeneity problems relating to product-specific characteristics, when the relationship between exports and foreign direct investments is analyzed using product-level data.

by the property right.[21] Potential entrants may find it difficult to enter such product markets. Concurrently, such product market may be concentrated, because incumbent sellers closely collaborate with buyers. This seems to be reflected in that the Herfindahl index for engine components (0.73) that require close cooperation between seller and buyer is relatively higher, whereas that for Wheel/Tyre (0.52), which needs less collaborations, is relatively low (Table 4).

Buyer-specific characteristics could also affect market concentration and seller's entry decision. Attitude toward the transaction with sellers differs among buyers. It is well recognized that Toyota has valued a long-lasting relationship with sellers, whereas Nissan and Mazda have shifted to open outsourcings from any competitive suppliers, influenced by the alliances with foreign automakers (*i.e.* Renault and Ford). Buyer's preference over stable transactions with incumbent sellers might become structural barriers over potential entrants. In fact, entry rate for Toyota (0.26) is relatively low, however that for Nissan (0.38) and Mazda (0.38) are relatively high (Table 6). Simultaneously, buyer's preference over stable transactions could lead to a concentrated market, because sunk costs are too large to switch business partners.

One way to overcome the endogeneity problem is to employ an estimation method such as instrumental variable (IV) estimation (Schmalensee 1992). However, IV approaches are not appropriate because of the difficulties in finding an instrument that is correlated with market concentration, does not determine sellers' entry decision, and is excludable from Eq. (1). Alternative method is to use a least squares dummy variables (LSDVs) approach, allowing controls for time-invariant unobservable factors among products and buyers. Therefore, in order to mitigate the probability of endogeneity bias, I include product-and buyer-dummy variables into model (1).

4. Results

Table 10 reports the estimates during the period between 2002 and 2008. The first column shows the specification based on the linear probability model (LPM). The coefficient of Herfindahl index is negative and that of squared Herfindahl index is positive at statistically significant at the 1% level, implying a non-linearity of the effect of market concentration on

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[21] Recent technological changes such as modularization and standardization of auto parts might lower an absolute cost advantage over potential entrants.

entry. The result suggests that the probability of entry initially decreases and then increases as the market concentrates. The second column, which controls buyer- and product-fixed effects, shows the robustness of this finding. That the non-linear relationship between market concentration and entry is consistent even when the seller-fixed effects are controlled (Column 3). The fourth and fifth columns present the estimates of the Logit and Probit models. The results support the U-shaped relationship between market concentration and entry. The sixth column shows the estimates of the LPM where the entry rate is employed as a dependent variable instead of binary entry variable. The key result is still consistent: the entry rate decreases first and then increases as the market concentrates. This finding is robust when buyer- and product-fixed effects are controlled (Column 7).[22]

==Table 10==

The coefficient of number of incumbent firms has expected sign with significant levels. The negative coefficient suggests that a seller is reluctant to enter a more competitive market, because of its low profitability. There is no evidence that market size is a determinant of entry. The market growth is statistically significant but economically insignificant.

Table 11 reports the OLS estimates of the LPM by examining the different periods and different intervals. The first column shows the benchmark estimates just transferred from the third column in Table 10. The second and third columns report the estimates employing the data for the period between 1996 and 2002 and the period between 1990 and 1996. The results support the existence of the U-shaped relationship between market concentration and entry even during the different periods. The fourth column reports the estimates with the pooled data for the three different periods (*i.e.* 1990-1996, 1996-2002, and 2002-2008). The key finding is consistent. The existence of the U-shaped relationship between market concentration and entry is robust even when different intervals are introduced (Columns 5, 6, and 7).[23]

==Table 11==

5. Discussions

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[22] The estimates of the Logit and Probit models show the similar results.
[23] The estimates of the Logit and Probit models lead to the same conclusion.

Previous research finds that entry is negatively correlated with market concentration. The empirical analyses in this study has revealed the U-shaped relationship between market concentration and entry in the Japanese auto part industry. In order to explore this finding further, this section addresses the following two questions.

5.1. Why Does Entry Increase as Market Concentrates?

One hypothesis is that potential entrants in concentrated markets aim for a niche product. In a highly concentrated market, incumbent firms have less incentives to deter new entrants as long as potential competitors do not threaten their established transactions with buyer. Probably, the models produced in small volume are outsourced to such new entrant firms. To examine this argument, I undertake additional analyses by examining the relationship between the size of new entry and market concentration. The size of entry is measured by the volume of transaction that does not exist in 2002 and emerges in 2008 for each narrow market. Note that the sample is limited only to a narrow market that entry occurs during the period from 2002 to 2008. Table 12 shows the negative correlation between the size of new entry and market concentration: the coefficient of Herfindahl index is -0.64 (Column 1), suggesting that the size of entry becomes small as the market concentrates. The second column suggests that there is no evidence of non-linear relationship between the size of entry and market concentration.

==Table 12==

Another hypothesis is that impediments to new entrants are low, because of the dominant role of the multiple-product firms and multiple-buyer firms. As already demonstrated in Table 9, around 87% of sellers are multiple-product firms, and 85% of sellers are multiple-buyer firms. In addition, diversification of incumbent firms, rather than new business starts, accounts for a large part of entry (Table 8). These facts imply that a potential entrant has already sold the same product to other buyers, or a potential entrant has already sold several products to a buyer. Thus incumbents' cost advantages over potential entrants become small. To examine this argument, I estimate Eq. (1) by types of firms and the results is presented in Table 13. It is suggested that the U-shaped relationship between market concentration and entry does not exist for single-product firms (Column 1), whereas it exists for multiple-product firms (Column 2). Likewise, the results suggest that there is no statistical evidence of the U-shaped relationship

16

between market concentration and entry for single-customer firms (Column 3), but such relationship exists for multiple-customer firms (Column 4)

==Table 13==

5.2. Is the U-shaped relationship between market concentration and entry found even for broad markets?

The degree of market concentration measured by the Herfindahl index depends on the definition of market. The mean concentration is high in a narrow market defined at buyer-product-level, whereas the concentration is low when the market is broadly defined at product-level (Table 4). The distribution of markets by the Herfindahl index also substantially differs between narrow market and broad market (Figure 1, 2). The empirical analyses in this study have introduced the narrow market. Does the use of broad market lead to the same results found in this study? To address this question, the following model is estimated;

$$Entry_{s,p} = \alpha + \beta_1 Concentration_p + \beta_2 (Concentration_p)^2 + \beta_3 Incumbent_p + \beta_4 Growth_p + \beta_5 Size_p + \varepsilon_{s,p} \qquad (2)$$

where subscripts s denotes seller, and p denotes product. Entry is measured at seller-product-level by a binary variable whether a transaction that does not exist in 2002 emerges in 2008. All explanatory variables are measured at product-level. Table 14 shows that the U-shaped relationship between market concentration and entry disappears when broad market is analyzed.

==Table 14==

The results highlight the significance of defining the "market", probably due to the different extent of modularity among industries. The "market" defined at buyer-product-level is appropriate in analyzing the industry with the low level of the modularity such as auto part industry. In such industries, the product is differentiated among buyers, resulting in more fragmented markets. On the other hand, it might be appropriate to define the market at product-level in analyzing for, for example, electronic industries where the extent of modularity is high. In such industries, the product is more standardized and the market is well integrated.

17

6. Conclusion

The purpose of this study was to analyze the relationship between market concentration and entry, utilizing a unique dataset on auto part transaction between automaker and auto part suppliers in Japan during the periods from 1990 to 2010. The key finding of this study was the U-shaped relationship between market concentration and entry, which see entry increases and then decreases as market concentrates. The positive relationship between the two variables could be partly explained by two factors. One is that potential entrants in concentrated markets aims for a niche product and the other is the dominant role of the multiple-product firms and multiple-buyer firms, which are less disadvantageous to incumbent firms.

The results obtained in this study have implications in operating antitrust law particularly concerning transactions with exclusive conditionality. The antitrust authority in Japan employs market concentration to examine the illegality, and it is recognized that the higher the market concentration is, the incident is more likely to against the law. However, the empirical results in this study showed that the relationship between market concentration and entry is non-linear, probably resulting from the multiple-product and multiple-customer nature of firms. This could make aware of careful attention to firm attributes in investigating market structure. This study also highlighted the significance of defining a market. The empirical results were quite different, depending on whether a market is defined broadly or narrowly. This could alarm antitrust authority of careful attention to drawing a market scope in investigating the incident.

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Table 1: Summary of Previous Research

Author (s)	Period	Dependent Variable	Measurement	Market Concentration	Results	Data	Control Variables	Methods
Orr (1974)	1963-1967	Net entry, industry-level, Canada	An average increase in number of firms	Dummy indicating equal to 1 if industry is classified as highest concentration.	Less entrants in high concentrated industry	Cross-section (71 three-digit industries)	Profit rate, growth rate of industry output, capital requirements, advertising intensity, R&D intensity, risk and etc.	OLS
Duetsch (1975)	1958-1963, 1963-1967	Net entry, industry-level, U.S.	Percentage change in number of firms	Top four-firm concentration	More entrants in high concentrated industry	Cross-section (134 four-digit industries)	Demand growth, industry diversification, intensity of product promotion and etc.	OLS
Chappell *et al* (1990)	1972-1977	Net entry, industry-level, U.S.	Change in number of firms	Top four-firm concentration	Less entrants in high concentrated industry	Cross-section (330 four-digit industries)	Profit index, growth rate, value, capital requirements, advertising ratio and etc.	Poisson
Duetsch (1984)	1963-1972	Net entry, industry-level, U.S.	Increase in number of firms	Dummy indicating 1 if four-firm concentration > 0.6	No significant effects	Cross-section (95 industries)	Profitability, growth rate of industry output, industry size, capital requirements, scale economies and etc.	OLS
Richard and Smiley (1987)	1976-1981	Gross entry, industry-level, U.S.	Number of entrants divided by number of incumbents	Top-four-firm concentration	No significant effects	Cross-section (40 four-digit industries)	Growth rate of industry , R&D intensity, advertising intensity, capital costs, risks and etc.	OLS
Acs and Audretsch (1989)	1978-1980	Net entry, industry-level, U.S.	Change in number of firms divided by average number of incumbents	Top four-firm concentration	Less entrants in high concentrated industry	Cross-section (247 industries)	Industry growth, price-cost margin, capita-labor ratio, advertising intensity, R&D intensity, unionization and etc.	OLS
Jeong and Masson (1990)	1976-1981	Net entry, industry-level, South Korea	Percentage change in number of firms	Top-three-firm concentration	More entrants in high concentrated industry	Cross-section (62 industries)	Industry growth rate, industry profit rate, minimum efficient scale, absolute capital costs, advertising intensity and etc.	OLS
Chappell *et al* (1992)	1972-1977	Gross entry, industry-level, US	Number of entrants divided by number of incumbents	Top four-firm concentration	Less entrants in high concentrated industry	Cross-section (323 four-digit industries)	Price-cost margin, capital-intensity, growth rate of industry output, advertising-intensity, unionization and etc.	OLS
Morch von der Fehr (1991)	1981-1985	Gross entry, industry-level, Norway	The number of entrants+1	Hefindahl index	Less entrants in high concentrated industry	Cross-section (97 four-digit industries)	Profits, market size, market growth, real capital, minimum efficient size, capital requirements, import share and etc.	Pooled OLS
Jeong and Masson (1991)	1977-1981	Gross entry, industry-level, South Korea	Number of new entrants divided by number of incumbents	Top three-firm concentration	No significant effects	Cross-section (48 four-digit industries)	Profits, minimum efficient scale, advertising intensity, capital costs, government loans ant etc.	OLS
Mayer and Chappell (1992)	1972-1977	Net entry, industry-level, US	Change in number of firms	Top four-firm concentration	Less entrants in high concentrated industry	Cross-section (330 four-digit industries)	Profit, industry growth, capital intensity, advertising intensity, scale economies, multi-plant production and etc.	Quasi-Maximum Likelihood

Table 2: Descriptive Statistics

		Number of transactions									
	Total	By broad market					By narrow market				
Year		Sample	Mean	S.D.	Min	Max	Sample	Mean	S.D.	Min	Max
1990	3,474	180	19.30	7.80	2	52	1,628	2.13	1.07	1	7
1996	4,296	200	21.48	8.09	2	55	1,840	2.33	1.16	1	7
2002	4,523	200	22.62	8.05	3	55	1,875	2.41	1.19	1	9
2008	4,310	200	21.55	7.57	3	46	1,843	2.34	1.11	1	8
2010	4,247	200	21.24	7.50	3	49	1,849	2.30	1.10	1	7
		Number of sellers									
	Total	By broad market					By narrow market				
Year		Sample	Mean	S.D.	Min	Max	Sample	Mean	S.D.	Min	Max
1990	513	180	8.55	5.18	1	26	1,628	2.13	1.07	1	7
1996	629	200	9.97	5.74	2	32	1,840	2.33	1.16	1	7
2002	628	200	9.75	5.65	1	28	1,875	2.41	1.18	1	9
2008	554	200	8.92	5.03	2	27	1,843	2.33	1.11	1	8
2010	539	200	8.75	4.83	1	27	1,849	2.30	1.1	1	7

Notes: "Broad market" is defined at product-level. "Narrow market" is defined at buyer-product-level. Buyer is automaker and seller is auto part supplier. S.D. is standard deviation. Sellers at broad market are not double counted.

Table 3: Descriptive Statistics by Product Types, 2010

		Number of transactions								
	Total	By broad market					By narrow market			
Sectors		Sample	Mean	S.D.	Min	Max	Sample	Mean	S.D.	Min	Max
Engine	1,482	74	20.03	7.30	5	49	681	2.18	1.08	1	7
Powertrain	520	24	21.67	8.08	3	36	223	2.33	1.11	1	5
Steering	265	12	22.08	2.39	19	26	116	2.28	0.82	1	5
Suspension	108	5	21.60	7.77	15	34	47	2.30	1.04	1	5
Brake	386	16	24.13	7.68	6	38	151	2.56	1.10	1	6
Wheel/Tyre	131	4	32.75	13.00	21	44	38	3.45	1.43	1	7
Exterior	406	21	19.33	6.80	7	31	190	2.14	0.97	1	5
Interior	592	26	22.77	7.20	7	36	239	2.48	1.21	1	7
Electrical	269	14	19.21	7.73	7	32	127	2.12	0.94	1	5
Supply	88	4	22.00	6.38	16	31	37	2.38	1.26	1	6
Total	4,247	200	21.24	7.50	3	49	1,849	2.30	1.10	1	7

		Number of suppliers								
	Total	By broad market					By narrow market			
Sectors		Sample	Mean	S.D.	Min	Max	Sample	Mean	S.D.	Min	Max
Engine	279	74	8.97	5.37	2	27	681	2.18	1.08	1	7
Powertrain	114	24	9.67	4.54	1	19	223	2.33	1.11	1	5
Steering	73	12	8.83	5.18	4	21	116	2.28	0.82	1	5
Suspension	19	5	5.40	2.30	3	9	47	2.30	1.04	1	5
Brake	55	16	7.56	2.83	3	14	151	2.56	1.10	1	6
Wheel/Tyre	24	4	6.75	3.50	3	11	38	3.45	1.43	1	7
Exterior	96	21	8.05	4.48	2	18	190	2.14	0.97	1	5
Interior	114	26	10.58	5.79	4	21	239	2.48	1.21	1	7
Electrical	51	14	6.86	2.18	3	12	127	2.12	0.94	1	5
Supply	20	4	8.25	2.63	6	12	37	2.38	1.26	1	6
Total	539	200	8.75	4.83	1	27	1,849	2.30	1.10	1	7

Notes: "Broad market" is defined at product-level. "Narrow market" is defined at
buyer-product-level. Buyer is automaker and seller is auto part supplier. S.D. is standard deviation.
Sellers at broad market are not double counted.

Table 4: Market Concentrations

| | Market concentration measured by Herfindahl Index | | | | | | | | | |
| | By broad market | | | | | By narrow market | | | | |
	Sample	Mean	S.D.	Min	Max	Sample	Mean	S.D.	Min	Max
By year										
1990	180	0.15	0.09	0.05	0.66	1,628	0.72	0.24	0.22	1
1996	200	0.14	0.09	0.04	0.82	1,840	0.70	0.24	0.19	1
2002	200	0.13	0.06	0.05	0.49	1,875	0.69	0.24	0.17	1
2008	200	0.15	0.11	0.05	0.78	1,843	0.70	0.23	0.20	1
2010	200	0.15	0.10	0.05	0.64	1,849	0.71	0.23	0.17	1
By sector (2010)										
Engine	74	0.15	0.10	0.07	0.63	681	0.73	0.23	0.17	1
Powertrain	24	0.14	0.12	0.06	0.64	223	0.71	0.24	0.29	1
Steering	12	0.13	0.04	0.08	0.19	116	0.72	0.19	0.33	1
Suspension	5	0.12	0.02	0.11	0.15	47	0.72	0.22	0.34	1
Brake	16	0.16	0.11	0.10	0.54	151	0.68	0.22	0.29	1
Wheel/Tyre	4	0.09	0.02	0.05	0.11	38	0.52	0.23	0.25	1
Exterior	21	0.18	0.11	0.08	0.58	190	0.74	0.23	0.31	1
Interior	26	0.16	0.10	0.07	0.50	239	0.67	0.24	0.26	1
Electrical	14	0.18	0.10	0.09	0.44	127	0.71	0.23	0.26	1
Supply	4	0.15	0.05	0.08	0.18	37	0.69	0.25	0.26	1

Notes: "Broad market" is defined at product-level. "Narrow market" is defined at buyer-product-level. Buyer is automaker and seller is auto part supplier. S.D. is standard deviation.

Table 5: Entry and Exit in the Japanese Auto Part Industry

Periods	Entry		Exit	
	Entry rate	Creation rate	Exit rate	Destruction rate
2008-2010	0.09	0.06	0.10	0.11
2002-2008	0.30	0.29	0.30	0.15
1996-2002	0.33	0.20	0.22	0.11
1990-1996	0.42	0.39	0.16	0.07

Notes: "Entry rate" is defined as the number of new transactions in current period t (*e.g.* 2008) relative to previous period s (*e.g.* 2002) as a share of total number of transactions in period t. "Creation rate" is defined as the volume of new transactions in current period t relative to previous period s as a share of total volume of transaction in t. "Exit rate" is defined as the number of transactions that existed in previous period s but disappear in current period t as a share of total volume of transactions in period s. "Destruction rate" is defined as the volume of transactions that existed in previous period s but disappear in current period t as a share of total volume of transactions in period s.

Table 6: Entry and Exit by Automakers, 2002-2008

Automakers	Entry			Exit		
	Number of entry	Entry rate	Creation rate	Number of exit	Exit rate	Destruction rate
Toyota	135	0.26	0.33	122	0.24	0.12
Nissan	191	0.38	0.21	148	0.33	0.21
Honda	126	0.27	0.43	88	0.21	0.08
Mazda	166	0.38	0.43	182	0.4	0.26
Mitsubishi	133	0.27	0.13	183	0.34	0.19
Suzuki	123	0.27	0.17	92	0.22	0.13
Daihatsu	116	0.29	0.18	116	0.29	0.14
Subaru	123	0.31	0.3	100	0.27	0.19
Isuzu	72	0.25	0.19	165	0.43	0.35
Hino	82	0.28	0.25	63	0.23	0.07
Average	127	0.3	0.26	126	0.29	0.17

Notes: "Entry rate" is defined as the number of new transactions in 2008 relative to 2002 as a share of total number of transactions in 2008. "Creation rate" is defined as the volume of new transactions in 2008 relative to 2002 as a share of total volume of transaction in 2008. "Exit rate" is defined as the number of transactions that existed in 2002 but disappear in 2008 as a share of total volume of transactions in 2002. "Destruction rate" is defined as the volume of transactions that existed in 2002 but disappear in 2008 as a share of total volume of transactions in 2002.

Table 7: Entry and Exit by Product Types, 2002-2008

Types	Entry			Exit		
	Number of entry	Entry rate	Creation rate	Number of exit	Exit rate	Destruction rate
Engine	340	0.23	0.15	414	0.27	0.13
Powertrain	228	0.42	0.25	183	0.37	0.17
Steering	117	0.44	0.36	118	0.44	0.32
Suspension	29	0.25	0.13	26	0.23	0.10
Brake	153	0.39	0.17	138	0.37	0.25
Wheel/tyre	24	0.18	0.06	34	0.24	0.10
Exterior	129	0.31	0.22	86	0.23	0.09
Interior	150	0.26	0.50	183	0.30	0.16
Electrical	66	0.24	0.66	35	0.14	0.05
Supply	31	0.34	0.29	42	0.42	0.13
Average	127	0.31	0.28	126	0.30	0.15

Notes: "Entry rate" is defined as the number of new transactions in 2008 relative to 2002 as a share of total number of transactions in 2008. "Creation rate" is defined as the volume of new transactions in 2008 relative to 2002 as a share of total volume of transaction in 2008. "Exit rate" is defined as the number of transactions that existed in 2002 but disappear in 2008 as a share of total volume of transactions in 2002. "Destruction rate" is defined as the volume of transactions that existed in 2002 but disappear in 2008 as a share of total volume of transactions in 2002.

Table 8: Entry and Incumbent Firms

Periods	Share of incumbent firms	
	Entry	Exit
2008-2010	0.60	0.67
2002-2008	0.94	0.54
1996-2002	0.79	0.58
1990-1996	0.77	0.51

Table 9: Multiple-Product Firms and Multiple-Buyer Firms

	Multiple-product		
Year	Share of firms	Share of transactions	Mean products per firms
1990	0.55	0.84	4.65
1996	0.58	0.87	4.77
2002	0.56	0.86	4.73
2008	0.58	0.88	4.79
2010	0.59	0.88	4.78
	Multiple-buyer		
Year	Share of firms	Share of transactions	Mean customers per firms
1990	0.50	0.83	5.08
1996	0.49	0.83	4.89
2002	0.54	0.85	4.94
2008	0.55	0.87	5.16
2010	0.56	0.87	5.14
	Multiple-sector		
Year	Share of firms	Share of transactions	Mean sectors per firms
1990	0.32	0.61	2.19
1996	0.34	0.62	2.48
2002	0.33	0.62	2.63
2008	0.32	0.62	2.75
2010	0.32	0.62	2.78

Table 10: Baseline Specifications, 2002-2008

Dependent variable:	Binary entry variable					Entry rate	
Estimation models:	(1) LPM	(2) LPM	(3) LPM	(4) Logit	(5) Probit	(6) LPM	(7) LPM
Herfindahl index in 2002	-0.68	-0.39	-0.54	-4.93	-2.62	-0.66	-0.46
	(0.16)***	(0.18)**	(0.15)***	(1.71)***	(0.92)***	(0.19)***	(0.20)**
(Herfindahl index in 2002)^2	0.62	0.37	0.49	4.39	2.39	0.89	0.71
	(0.12)***	(0.13)***	(0.11)***	(1.21)***	(0.65)***	(0.14)***	(0.15)***
Number of incumbent firms in 2002	-0.03	-0.04	-0.03	-0.32	-0.17		
	(0.01)***	(0.01)***	(0.01)***	(0.08)***	(0.04)***		
Market size in 2002	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Growth rate during the period from 2002 and 2008	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)**	(0.00)***	(0.00)***	(0.00)*	(0.00)**
Buyer-fixed effects	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*No*	*Yes*
Product-fixed effects	*No*	*Yes*	*Yes*	*Yes*	*Yes*	*No*	*Yes*
Seller-fixed effects	*No*	*No*	*Yes*	*Yes*	*Yes*	*n.a.*	*n.a.*
Observations	5,189	5,189	5,189	3,138	3,138	1,681	1,681
R-squares	0.03	0.11	0.49	0.24	0.24	0.21	0.44

Notes: Entry stands for a binary variable whether a transaction that does not exist in 2002 emerges in 2008. Clustered heteroscedasticity-consistent standard errors are in parentheses. Coefficients on constants, seller-fixed effects, buyer-fixed effects, product-fixed effects are not reported. ***, ** and * indicate statistical significance at 1, 5 and 10%.

Table 11: Robustness of the OLS Estimates

Dependent variable:	Different periods			Pooled	Different intervals		
Binary entry variable	(1) 2002-20008	(2) 1996-2002	(3) 1990-1996	(4)1990-2008	(5)1996-2008	(6)1990-2008	(7) 2008-2010
Herfindahl Index	-0.54	-0.56	-0.39	-0.67	-0.66	-0.96	-0.20
	(0.15)***	(0.17)***	(0.22)*	(0.11)***	(0.19)***	(0.27)***	(0.11)*
(Herfindahl Index)^2	0.49	0.47	0.36	0.56	0.49	0.70	0.17
	(0.11)***	(0.12)***	(0.16)**	(0.08)***	(0.14)***	(0.20)***	(0.08)**
Number of incumbent firms	-0.03	-0.04	-0.04	-0.04	-0.09	-0.11	-0.02
	(0.01)***	(0.01)***	(0.01)***	(0.00)***	(0.01)***	(0.01)***	(0.01)***
Market size	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	0.00	(0.00)	(0.00)**	(0.00)
Market growth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)**	(0.00)***	(0.00)**	(0.00)**	(0.00)***	(0.00)***	(0.00)
Buyer-fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Product-fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Seller-fixed effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year-fixed effects	*n.a.*	*n.a.*	*n.a.*	*Yes*	*n.a.*	*n.a.*	*n.a.*
Observations	5,189	4,515	3,103	12,808	3,698	2,581	4,613
R-squares	0.49	0.45	0.50	0.53	0.29	0.28	0.51

Notes: All specifications are based on the linear probability model (LPM). Clustered heteroscedasticity-consistent standard errors are in parentheses. ***, ** and * indicate statistical significance at 1, 5 and 10%.

Table 12: Entry Size and Market Concentration, 2002-2008

Dependent variable: Size of Entry	(1) Without squared term	(2) With squared term
Herfindahl Index in 2008	-0.64	-2.18
	(0.35)*	(1.85)
(Herfindahl Index in 2008)^2		1.09
		(1.27)
Number of incumbent firms in 2008	-0.15	-0.16
	(0.07)**	(0.07)**
Market size in 2002	0.00	0.00
	(0.00)	(0.00)
Market growth during the period from 1996 to 2002	0.00	0.00
	(0.00)***	(0.00)***
Buyer-fixed effects	Yes	Yes
Product-fixed effects	Yes	Yes
Observations	756	756
R-squares	0.55	0.55

Notes: The size of entry is measured by the volume of transaction that does not exist in 2002 and emerges in 2008 for a narrow market during the period between 2002 and 2008. Note that the sample is limited only to a narrow market that entry occurs during the period from 2002 to 2008. Both specifications are based on the linear probability model (LPM). Clustered heteroscedasticity-consistent standard errors are in parentheses. ***, ** and * indicate statistical significance at 1, 5 and 10%.

Table 13: The OLS Estimates by Types of Firms, 2002-2008

| Dependent variable:	Sample selection by types of firms:			
Binary entry variable	(1) Single-product firms	(2) Multiple-product firms	(3) Single-customer firms	(4) Multiple-customer firms
Herfindahl Index in 2002	-0.43	-0.64	0.03	-0.63
	(0.48)	(0.17)***	(0.45)	(0.17)***
(Herfindahl Index in 2002)^2	0.57	0.55	0.09	0.56
	(0.36)	(0.12)***	(0.32)	(0.13)***
Number of incumbent firms in 2002	-0.02	-0.03	-0.01	-0.03
	(0.02)	(0.01)***	(0.02)	(0.01)***
Market size in 2002	0.00	0.00	0.00	0.00
	(0.00)*	0.00	0.00	0.00
Market growth during the period	0.00	0.00	0.00	0.00
from 1996 to 2002	0.00	(0.00)**	0.00	(0.00)**
Seller-fixed effects	Yes	Yes	Yes	Yes
Buyer-fixed effects	Yes	Yes	Yes	Yes
Product-fixed effects	Yes	Yes	Yes	Yes
Observations	731	4,184	769	4,146
R-squares	0.71	0.25	0.65	0.28

Notes: All specifications are based on the linear probability model (LPM). Clustered heteroscedasticity-consistent standard errors are in parentheses. ***, ** and * indicate statistical significance at 1, 5 and 10%

Table 14: The OLS Estimates for Broad Market

| Dependent variable: Binary entry variable	Different periods			Pooled
	(1) 2002-20008	(2) 1996-2002	(3) 1990-1996	(4)1990-2008
Herfindahl Index	0.19	0.30	-1.77	-0.17
	(0.25)	(0.48)	(1.18)	(1.75)
(Herfindahl Index)^2	0.02	-0.05	6.71	2.81
	(0.06)	(0.85)	(3.39)**	(4.36)
Number of incumbent firms	(0.00	0.00	0.00	-0.03
	(0.00)*	(0.00)	(0.00)	(0.01)***
Market size	0.00	0.00	0.00	0.00
	(0.00)*	(0.00)	(0.00)	(0.00)
Market growth	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Seller-fixed effects	Yes	Yes	Yes	No
Product-fixed effects	No	No	No	Yes
Year-fixed effects	n.a.	n.a.	n.a.	Yes
Observations	2,157	1,973	1,354	3,327
R-squares	0.64	0.58	0.67	0.09

Notes: All specifications are based on the linear probability model (LPM). Clustered heteroscedasticity-consistent standard errors are in parentheses. ***, ** and * indicate statistical significance at 1, 5 and 10%. The dependent variable is measured at seller-product-level, and all explanatory variables are measured at product-level.

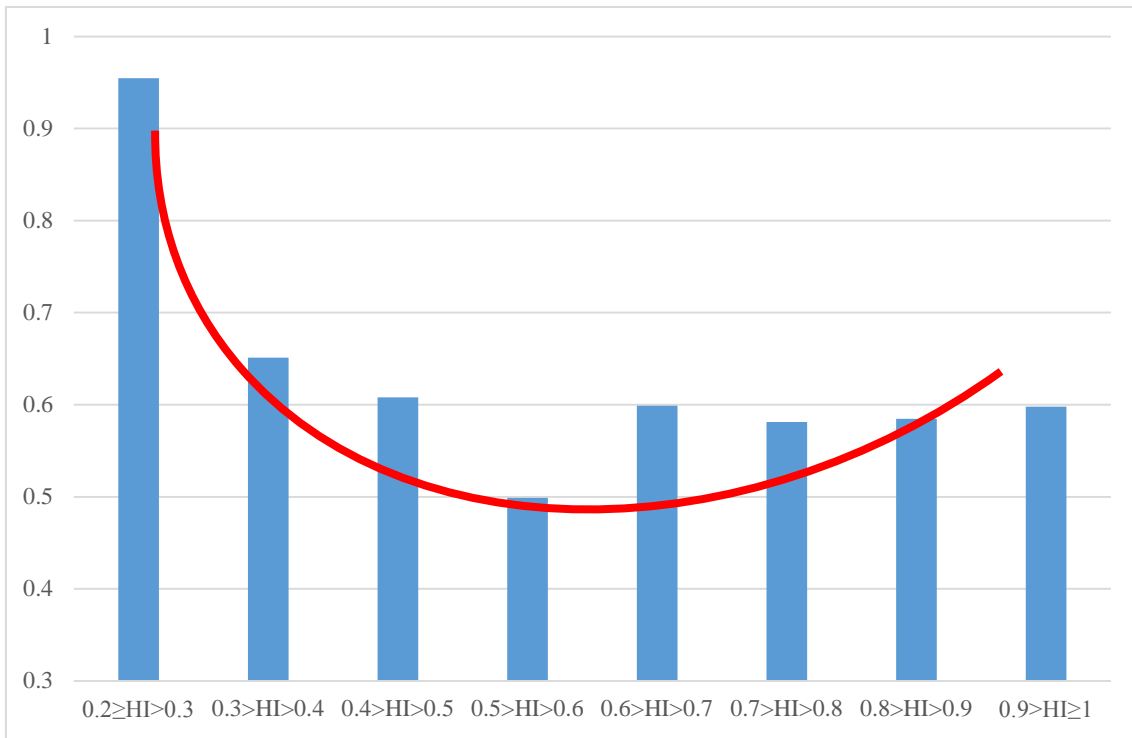**Figure 1: Distribution of Narrow Markets by the Herfindahl Index, 2010**
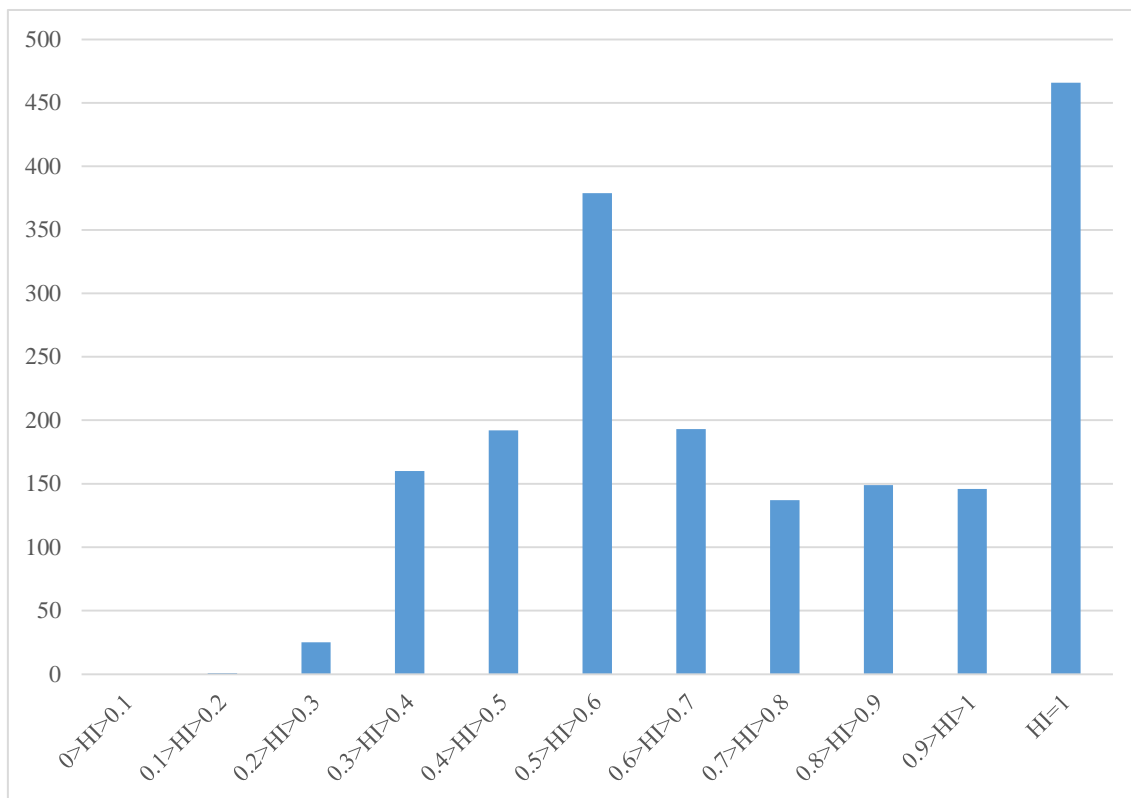
Notes: "Narrow market" is defined at buyer-product-level. HI=1 indicates that market is monopolistic.

Figure 2: Distribution of Broad Markets by the Herfindahl Index, 2010
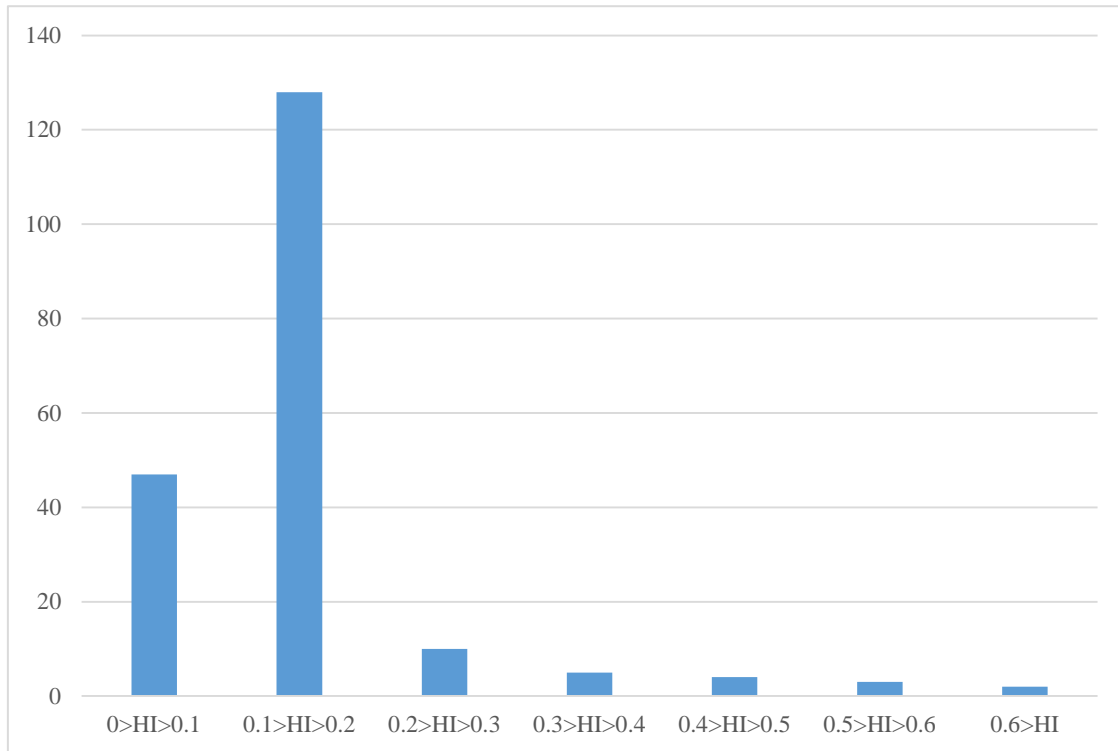
Notes: "Broad market" is defined at product-level.

Figure 3: Market Concentration and Entry, 2002-2008

Notes: X-axis is categorized according to the degree of market concentration measured by the Herfindahl index (*HI*). Y-axis shows the relative entry index (*REI*) measured by the ratio of the number of new transactions occurred during the period between 2002 and 2008 to the number of markets in 2002 in each concentration degree.

Appendix 1: Example of the IRC, Crankshaft

Automakers	Suppliers	Transaction volume (thousands)
Toyota	Toyota	78.5
	Aichi Steel	117.7
	Sumitomo Metal Industries	10.3
Nissan	Nissan	56.5
	NNA	30
	Daido Steel	1.8
Mitsubishi	Mitsubishi	25.1
	Sumitomo Metal Industries	13.8
	Aichi Steel	2.5
	Techno Metal	0.4
Honda	Honda	12.4
	Kakuta Iron Works	38.7
	Riken	18.6
	TFO	7.7
Mazda	Mazda	53.3
	Sumitomo Metal Industries	17.8
Suzuki	Suzuki	3.8
	Sumitomo Metal Industries	34.5
	Hitachi Metals	29.1
	Aichi Steel	5.4
	Kakuta Iron Works	3.8
Daihatsu	Daihatsu	2.2
	Metal Art	80
	Aichi Steel	20
	Sumitomo Metal Industries	8.9
Subaru	Ichitan	38.3
	Kakuta Iron Works	1.6
	Sumitomo Metal Industries	0.4
Isuzu	Isuzu	5.2
	Sumitomo Metal Industries	4.3
	Aichi Steel	3.5
Hino	Aichi Steel	7.2
	Sumitomo Metal Industries	0.1
UD truck	Daido Steel	2.1
	Sumitomo Metal Industries	1.3
Fuso	Techno Metal	5.5

Appendix 2: Descriptive Statistics, Sample Restricted

		Number of transactions									
	Total	By broad market					By narrow market				
Year		Sample	Mean	S.D.	Min	Max	Sample	Mean	S.D.	Min	Max
1990	2,488	119	20.91	7.02	4	52	1,139	2.18	1.08	1	7
1996	2,737	119	23.00	7.45	6	55	1,149	2.38	1.18	1	7
2002	2,830	119	23.78	7.36	11	55	1,159	2.44	1.17	1	8
2008	2,702	119	22.71	6.68	9	46	1,147	2.36	1.08	1	8
2010	2,668	119	22.42	6.86	6	49	1,147	2.33	1.08	1	7

|		Number of sellers									
	Total	By broad market					By narrow market				
Year		Sample	Mean	S.D.	Min	Max	Sample	Mean	S.D.	Min	Max
1990	459	119	8.98	5.28	2	26	1,139	2.18	1.08	1	7
1996	518	119	9.93	5.89	2	32	1,149	2.38	1.18	1	7
2002	500	119	9.57	5.61	3	28	1,159	2.44	1.17	1	8
2008	453	119	8.87	5.08	2	27	1,147	2.36	1.08	1	8
2010	438	119	8.62	4.87	2	27	1,147	2.33	1.08	1	7

Notes: Sample is restricted to products existing from 1990 to 2010 consistently. Braod market is defined at product-level. Narrow market is defined at buyer-product-level. Buyer is automaker and seller is auto part supplier. S.D. is standard deviation. Sellers at broad market are not double counted.

Appendix 3: Market Concentrations, Sample Restricted

| | Market concentration measured by Herfindahl Index | | | | | | | | | |
| | By broad market | | | | | By narrow market | | | | |
	Sample	Mean	S.D.	Min	Max	Sample	Mean	S.D.	Min	Max
By year										
1990	119	0.13	0.06	0.05	0.39	1,139	0.71	0.24	0.22	1
1996	119	0.12	0.05	0.04	0.38	1,149	0.69	0.24	0.19	1
2002	119	0.12	0.04	0.05	0.26	1,159	0.68	0.24	0.17	1
2008	119	0.12	0.05	0.05	0.41	1,147	0.68	0.23	0.23	1
2010	119	0.13	0.05	0.05	0.37	1,147	0.70	0.23	0.17	1
By sector (2010)										
Engine	45	0.12	0.05	0.07	0.34	426	0.72	0.23	0.17	1
Powertrain	14	0.12	0.08	0.06	0.37	136	0.69	0.24	0.29	1
Steering	6	0.13	0.05	0.08	0.19	58	0.70	0.20	0.33	1
Suspension	5	0.12	0.02	0.11	0.15	47	0.72	0.22	0.34	1
Brake	7	0.12	0.01	0.10	0.14	70	0.67	0.21	0.37	1
Wheel/Tyre	3	0.09	0.03	0.05	0.11	30	0.51	0.23	0.25	1
Exterior	14	0.15	0.07	0.08	0.33	132	0.72	0.23	0.31	1
Interior	13	0.12	0.06	0.07	0.30	130	0.66	0.24	0.26	1
Electrical	9	0.13	0.03	0.09	0.18	88	0.65	0.22	0.26	1
Supply	3	0.14	0.06	0.08	0.18	30	0.69	0.24	0.26	1

Notes: "Broad market" is defined at product-level. "Narrow market" is defined at
buyer-product-level. Buyer is automaker and seller is auto part supplier. S.D. is standard deviation.
Sample is restricted to products existing from 1990 to 2010 consistently.

Appendix 4: Distribution of Markets by the Degree of Concentrations, 1990
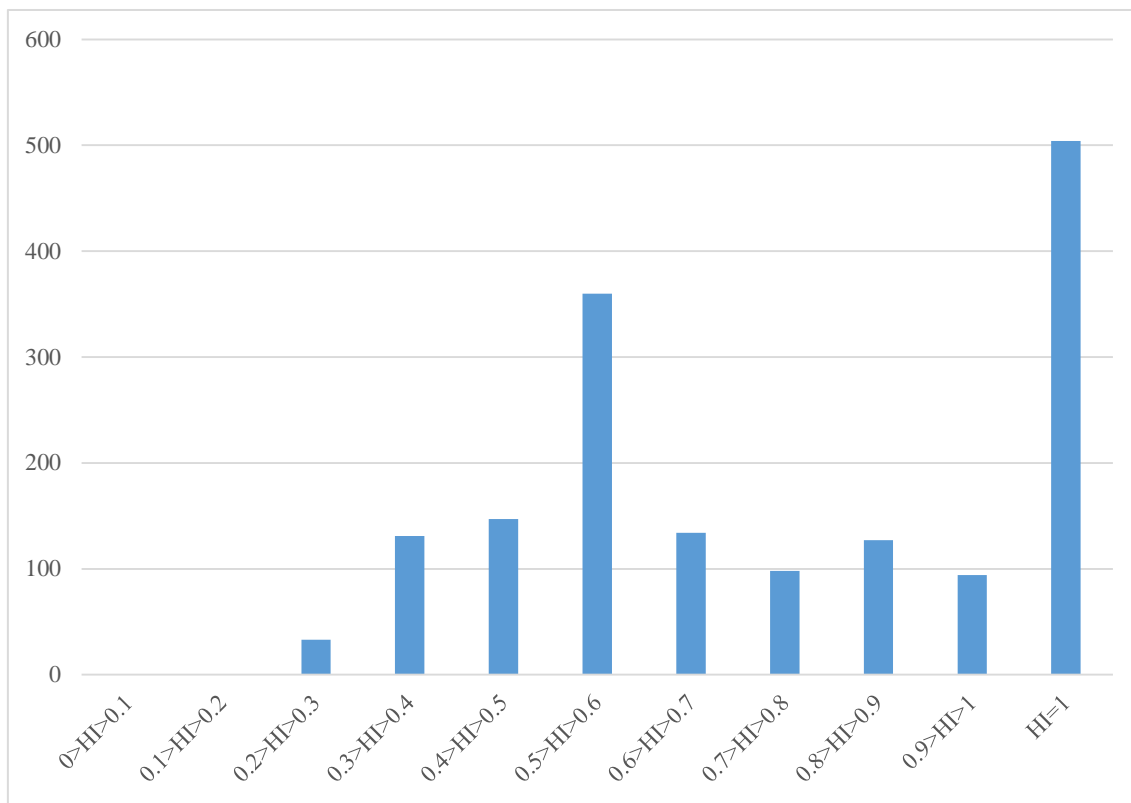
Appendix 5: Transaction Continuity

Durations	Share of continuing transactions in total transactions in 2010
1990-2010	0.32
1996-2010	0.15
2002-2010	0.18
2008-2010	0.25
2010	0.09

Notes: Each transaction are mutually exclusive.

Appendix 6: Firm Attributes of Multiple Customer and Multiple Product Firms

Firm Characteristics	Multiple customer	Multiple product	Multiple sector
Sales	0.97	1.24	1.49
Employment	0.89	1.00	1.34
Establishment Year	-7.38	-2.73	-2.84
Labor Productivity	0.14	0.27	0.17
TFP	0.12	0.12	0.07

Notes: Results are from OLS regressions of log characteristics on a dummy variable indicating the firms' status for the year 2008. Labor productivity and TFP are calculated following Aw et al (2001). The information on firm characteristics are from Ministry of Economy, Trade and Industry [Basic Survey of Japanese Business Structure and Activities]. Regressions are restricted to the 860-864 observations for which all firm characteristics are available. All differences are statistically significant at the 1 percent level.