Demand Surges and Intermediary Profits

Mark Garmaise, Mark Jansen, and Jason Snyder*

May 2025

ABSTRACT

We show that demand surges can lead to disintermediation through an analysis of the effects of the 2011 Japanese tsunami on the U.S. used car market. The tsunami devastated Japanese new car production, which led to an increase in demand for used cars. Wholesale and retail prices for used Japanese cars rose, but dealer margins declined by 2.3 percentage points. The decline in dealer margins was most pronounced for popular cars trading in thick markets for which dealers are relatively more dispensable for trade and for younger used vehicles. Consistent with the adjustment costs literature, Japanese dealers, unlike their non-Japanese counterparts, were unable to exit markets for generally younger used Japanese models.

JEL Classification: G23, G51, G33, D83

Keywords: Intermediation, Search, Supply-Chain Shocks

*Garmaise: UCLA Anderson School of Management (mark.garmaise@anderson.ucla.edu); Jansen: University of Utah, Eccles School of Business (mark.jansen@eccles.utah.edu); Snyder: University of Utah, Eccles School of Business (jsnyder@eccles.utah.edu). We are grateful to the management team at the firm that provided the data for this research. For helpful comments, we also thank Colleen Cunningham, Bill Hesterly, William Mann, Gonzalo Maturana, and the seminar participants at the University of Utah.

1 Introduction

Intermediaries play a crucial role in decentralized markets, contributing significantly to both value creation and capture (Gans and Ryall, 2017; Mahoney and Qian, 2013). Their economic importance is substantial; estimates suggest that intermediaries account for a quarter (Spulber, 1996) to a third of U.S. Gross Domestic Product (Krakovsky, 2015). The presence of intermediaries in the economy, such as car dealers (Bennett, 2013; Israeli et al., 2022), real estate agents (Giustiziero, 2021; Gubler and Cooper, 2019), pharmaceutical benefit managers (Feng and Maini, 2023), staffing firms (Fernandez-Mateo, 2007) and concert ticket resellers (Bennett et al., 2015) has been a frequent subject of study in the strategy literature. Intermediaries create value by ensuring quality and reliability (certification) (Lizzeri, 1999), facilitating connections between economic agents (matchmaking) (Khurana, 2002; Fernandez-Mateo, 2007; Rider and Samila, 2019), and influencing consumer preferences (shaping demand) (Cialdini, 2007; Jansen et al., 2023).

Despite serving these important functions, however, intermediaries have increasingly faced the threat of being bypassed by buyers and sellers who deal directly with each other. This phenomenon of disintermediation has been linked to technological evolution (Waldfogel and Reimers, 2015; Gu, 2024), a desire by sellers to directly manage customer relationships (Hagiu and Yoffie, 2013; Malik et al., 2025; Zhu and Liu, 2018; Schauerte et al., 2024), and the emergence of digital platforms (Parker et al., 2016; Gu and Zhu, 2021). In this paper we study a new driver of disintermediation: demand surges for a specific good.

In periods marked by unexpected surges in demand, those possessing scarce resources are positioned to profit (Brandenburger and Stuart Jr, 1996; Gans and Ryall, 2017; Oberholzer-Gee, 2021). While it is unsurprising that demand surges are generally good for asset holders, it is unclear how demand surges affect intermediaries, as they serve as both buyers and sellers,

and it is challenging for intermediaries to adapt to a rapidly changing market environment (Teece et al., 1997; Argyres et al., 2019). One natural intuition is that intermediaries thrive during periods of increased demand, as they can exploit desperate consumers.[1]

To better understand the impact of increased demand on disintermediation and to provide theoretical guidance for our inquiry, we consider predictions arising from economic models of search (Rubinstein and Wolinsky, 1987; Osborne and Rubinstein, 1990). In these models, intermediaries facilitate trade between buyers and sellers. Under certain circumstances, buyers can exchange goods directly with sellers, but intermediaries in their enhanced ability to encounter potential buyers have a search advantage over sellers. We view a demand surge as an increase in the number of potential buyers of a good. A transaction between a seller and an intermediary takes place at a wholesale price, and a transaction between an intermediary and a buyer occurs at a retail price. The intermediary margin is the profit realized by the intermediary scaled by the retail price.

A demand surge leads to an increase in both wholesale and retail prices, but its impact on intermediary margins depends on how central intermediaries are for exchange. If intermediaries are indispensable to trade (i.e., if buyers and sellers can trade only through them), then an increase in the number of buyers per seller has no impact on intermediary margins. In such cases, the higher number of buyers raises retail prices, but the negotiating position of the intermediary is unaffected, and the intermediary continues to extract the same fixed fraction of the higher retail price. If the intermediary is dispensable for trade (i.e., buyers and sellers can meet directly), however, then intermediary margins decline when there is a demand surge. In these cases, the higher number of buyers (per available unit of the good) makes it easier for sellers to bypass intermediaries and sell directly to buyers, as buyers are

[1]For example, "'The Market Is Insane': Cars Are Sold Even Before They Hit the Lot", *New York Times*, July 15, 2021.

easier to find. Recognizing their improved bargaining position, sellers increase the prices they charge intermediaries, which reduces the intermediaries' margins. We refer to this as the *disintermediation mechanism*.

We assess these competing theoretical arguments by evaluating the impact of a demand surge on dealer margins in the U.S. used car market. The used car market is large and important. Dealers are active in this market, but sellers can also sell directly to buyers. About half of all used car transactions occur without the assistance of an intermediary.[2] The used car market therefore serves as a useful testing ground for the effects of heightened demand. We study these effects by examining the impact of the 2011 Japanese tsunami. The tsunami had a strong negative short-term impact on the production of new Japanese cars but little effect on non-Japanese manufacturers. This allows us to undertake a difference-in-differences analysis in which we contrast outcomes for Japanese and non-Japanese vehicles in the post-tsunami period.

We perform these tests on a data set that describes approximately 60,000 used car transactions across 39 states over the period 2009–2013. The data include retail and wholesale prices and financing details. The purchase transactions were funded by a large automotive indirect finance company.

We show that the tsunami generated a positive demand shock for used Japanese cars, as the shortage of new vehicles induced prospective buyers of Japanese cars to consider used autos instead. This led to higher wholesale prices for used Japanese cars for a period of roughly six months. We also find marginal evidence that retail prices for these cars increased.

Our central interest is in the impact of this demand surge on intermediary margins. We find that the dealer profit per used Japanese car decreased by 2.3 percentage points (6.6%)

[2]These data come from the National Automobile Dealers Association for the years 2010-2012.

in the post-tsunami period; so, while wholesale and retail prices increased, dealer margins fell. This evidence clearly favors the argument that a surge in the population of potential buyers reduces profits for search intermediaries (i.e., dealers) due to the disintermediation mechanism.

Counterintuitively, intermediary (dealer) performance suffered in transactions where demand for used cars surged due to the tsunami. From the perspective of the strategy literature, a central question is what drives the observed heterogeneity in performance responses to this surge in demand. We address this question by examining variation in performance at both the transaction level and the firm level. Understanding this variation is critical for developing strategic recommendations that firms can utilize during demand surges induced by shocks or policies in adjacent markets.

It is an implication of our model that the disintermediation mechanism is most important in markets where sellers can easily circumvent dealers. The ability of a seller to bypass dealers depends in part on the amount of goods available. We define "thick" markets as those in which a large volume of the good is potentially for sale; in "thin" markets, by contrast, the aggregate market size is small (Gavazza, 2011). For example, the popular Nissan Sentra sedan trades in a thick market, but the Nissan 350Z sports car, which is produced at a relatively low volume, trades in a thin one. Although a similar set of dealers might be interested in either of these vehicles, a private seller is more likely directly to find a buyer for a Sentra than for a 350Z. Under the disintermediation mechanism, we would expect the intermediary margins to decrease more, post-tsunami, for vehicles that trade in thick markets.

We propose three proxies for measuring the thickness of a market for a given auto make and model. The first proxy is the total new car sales of that make-model in the year preceding

the tsunami (i.e., 2010). The second proxy is the fraction of total used car sales in January-February 2011 that were generated by a given make-model. The third proxy is an indicator for vehicles that were not discontinued by their manufacturers; discontinued cars trade in less liquid markets. Each of these proxies identifies vehicles that sellers should find relatively easier to trade directly to buyers. A key implication of the disintermediation mechanism is that the post-tsunami demand surge for used Japanese vehicles should reduce dealer margins more substantially in thick markets.

We find for each of these proxies that wholesale and retail prices rose more after the tsunami for vehicles that traded in thicker markets. Further, we show that dealer margins declined in the post-tsunami period for cars in thick markets as measured by all three proxies. These findings present clear evidence that a demand surge leads to particularly low intermediary margins in thick markets in which dealers are dispensable. These results thus support the interpretation that it is the centrality to trade, and therefore the bargaining position, of dealers that determines the impact of a demand surge on their margins and the extent of disintermediation. These results suggest that during demand surges, the performance gap between transactions in which the intermediary is indispensable and those in which it is dispensable will widen.

The tsunami led to weakly higher retail prices and lower dealer percentage margins on used Japanese cars. One hypothesis is that dealers absorbed lower percentage margins in exchange for either higher dollar profits per unit or increased sales volumes. We find that neither of these potential mitigating events occurred. Dealer dollar profits per unit on Japanese vehicles declined after the tsunami. Furthermore, overall sales of Japanese used cars were flat in the post-tsunami period. Aggregate dealer dollar profits from Japanese makes declined after the tsunami.

As an additional piece of evidence, we document that private party sales directly between buyers and sellers constitute 47% of all used car transactions [3], which confirms that the disintermediation mechanism represents a viable and common method of exchange. We also present a suggestive finding that private party sales increased in the post-tsunami period, potentially reflecting the impact of the demand surge.

In the face of this demand surge, how did intermediaries (dealers) vary in their responses? We draw on the literature on adjustment costs (Argyres et al., 2015, 2019) to motivate our findings on firm-level heterogeneous responses to the tsunami-induced demand shock. As Argyres et al. (2019) observe, "the problem of repositioning in response to a shock puts adjustment costs into high relief, and is thus a useful laboratory in which to conceptualize them."

Specifically, we find that Japanese dealers suffered especially low profits in their used Japanese car business. It is an implication of our theoretical model that, in the face of a demand surge for some of their goods, intermediaries should shift to dealing in other unaffected goods within the span of their expertise. This finding in our model is consistent with the idea that Japanese dealerships face higher adjustment costs compared to competitors when adapting to the tsunami-induced demand shock. We do not find evidence, however, that Japanese dealers shifted to the non-Japanese used car market. This suggests that non-Japanese vehicles did not fall within the scope of the intermediation expertise. Put differently, Japanese dealers faced very high adjustment costs during this short-term shock.

Was there any respect in which Japanese dealers changed their strategies in the post-tsunami period? We analyze this question by considering which used Japanese vehicles were most affected by the tsunami. We show that after the tsunami young (i.e., three years old

[3]This comes from data provided for the year 2010-2012 by the National Automobile Dealers Association.

or less) vehicles experienced larger retail and wholesale price increases and greater dealer margin decreases than old vehicles; this is consistent with the argument that young used vehicles are the closest substitutes for missing new cars and were most impacted by the tsunami.

We assess the dealer responses to the demand surge by examining whether Japanese and non-Japanese dealers differed in the age profiles of the used Japanese cars that they sold after the tsunami. We find that within their own makes, post-tsunami the Japanese dealers tended to sell younger cars, suggesting that, unlike non-Japanese dealers, they were unable to transition away from selling models that were generally younger. Within a given model, however, Japanese and non-Japanese dealers sold cars of similar ages, indicating that Japanese dealers were able to shift into intermediating older vehicles within a fixed product. The demand shock thus illuminates the extent of the Japanese dealers' strategic flexibility; they were able to enact shifts within a given product range, but could not move into completely new markets or even new business lines.

A common intuition in the field of strategy is that when there is a positive demand shock, the holders of those goods will likely profit. Numerous strategy studies support this intuition (Lim et al., 2023; Wang et al., 2020; Albuquerque and Bronnenberg, 2012); the primary contribution of these studies is to understand how firm-level heterogeneity influences the performance responses to demand shocks.

In contrast, our paper does not study the asset holders (usually producers of the goods)[4] but rather the intermediaries who facilitate the exchange. For intermediaries, we show that the impact of a positive demand shock, perhaps precipitated by natural events or policy changes such as tariffs, can lead to lower margins. Our finding that a positive demand

[4]See for example, Bennett et al. (2015), which studies the thickness of the secondary market and its influence on producer behavior. Our study focuses on the performance of the intermediaries.

shock in the used car market reduced intermediary margins is likely to hold in other settings where sellers and buyers can transact privately. Critical to this intuition is the role of the disintermediation mechanism; during times of peak demand, it becomes easier to bypass the intermediary entirely.

Finally, our work contributes to the growing strategy literature on adjustment costs (Argyres et al., 2015, 2019). Previous research has identified several organizational characteristics, such as vertical integration (Lim et al., 2023), diversification (Feldman and Sakhartov, 2022), market incumbency (Eklund and Kapoor, 2019), broader horizontal experience (Argyres et al., 2025), and legacy commitments (Dutta and Vasudeva, 2025) that influence adjustment costs as organizations respond to shocks. Our findings indicate that dealers with vertical affiliations, but not ownership relationships, are less likely to adjust their inventory of used vehicles when adverse shocks are connected to their affiliated upstream manufacturer. Our results are consistent with emerging insights from the literature on adjustment costs.

2 Data and Summary Statistics

To explore the role of demand surges on intermediary profits, we examine the retail and wholesale prices and financing of used vehicles that were purchased in 39 states in the period 2009–2013. Our data set consists of transaction-level information on pricing and financing. The loans to fund these purchases were made by a large automotive indirect finance company. In total, we observe the prices and vehicle characteristics of 58,745 loans that were originated at 1,485 dealerships located in 866 U.S. ZIP codes, as described in Table 2. We also observe the characteristics and terms of the borrower.[5]

[5]The raw data extend from the 1990s to 2021 and include approximately 343,000 sub-prime loans. We exclude subprime loans outside the five-year time window surrounding the tsunami. We also exclude a small number of loans for new cars (which comprise approximately 6% of the original sample), loans for

Table 2 presents summary statistics for prices, vehicle characteristics, buyer characteristics, and loan terms. The average vehicle has approximately 44,019 miles on it at the time of sale, a wholesale value (i.e., the price at which the dealership could sell a particular vehicle in the national wholesale market) of $13,424, and a retail price (selling price) of $17,265. The intermediary margin is measured as $\frac{\text{retail price}-\text{wholesale price}}{\text{retail price}}$ and averages about 36%. The 2010 new vehicle sales in the U.S. for each make and model are provided by *Automotive News* (a Crain Communications company). The difference between the retail and wholesale value gives rise to the per vehicle gross profit.

2.1 2011 Japanese Tsunami

A magnitude 9.0 earthquake, the largest tremor to hit Japan since 1850, struck on March 11, 2011 off the coast of the Tōhoku region of Honshu, Japan, generating a tsunami with waves exceeding 100 feet in height. The resulting wave damage destroyed nearly everything along a 350-mile coastline, including more than a dozen ports, and triggered a meltdown of the Fukushima nuclear reactor. Estimates of the economic damage wrought by the earthquake are on the order of US$360 billion (Ferris and Solís, March 11, 2013).

All Japanese automotive manufacturers (e.g., Honda, Toyota, and Nissan) had plants in or near the affected area, and they closed those facilities. Japanese plants that were less directly affected by the earthquake and tsunami were also forced to stop production, as earthquake-related damage to approximately 500 tier-1 and tier-2 suppliers resulted in logistic difficulties and parts shortages. Both Toyota's and Honda's Japanese-built vehicle output declined by over 60% in March; other manufacturers also experienced steep decreases. Output levels in April were even lower (Wheatley and Ramsay, July 1, 2011). Production

vehicle models with less than 10 observations, dealerships that originated only a single loan, and loans with incomplete origination data.

by Japanese automakers outside Japan was also severely affected.[6] As shown in Table 1, the production decrease for Japanese manufacturers was very substantial both in Japan and North America. In contrast, non-Japanese manufacturers essentially continued manufacturing without interruption. South Korean and American automakers met some of the demand that Japanese producers could not service (Edgerton, March 9, 2012).[7]

Table 1
Automotive Production by Month Post-tsunami automotive production decline relative to the Jan.–Feb. 2011 rate. Sources: International Organization of Motor Vehicle Manufacturers; Japan Automobile Manufacturers Association; VDA: German Association of the Automotive Industry; Automotive News, Crain Communications.

	Mar	Apr	May	Jun	Jul	Aug
Japan Output	-46%	-61%	-37%	-4%	3%	-7%
North America Output by Japan Mfrs	10%	-42%	-38%	-19%	-42%	3%
North America Output by non-Japan Mfrs	34%	7%	22%	22%	-12%	25%
Germany Output	27%	3%	23%	1%	1%	-14%

Lost production that was attributable to the tsunami amounted to almost 5% of global car production—approximately 2.8 million vehicles, of which 90% were from Japanese automakers (source: IHS Global Insight). The vehicle production losses of Japanese manufacturers peaked in the second quarter, and all Japanese automakers returned to profitability from September 2011 to March 2012.

[6]For example, Toyota's plants in China, Europe, and North America ceased production for up to three months. Toyota's North American production was impacted by a parts shortage, resulting a production loss of 500,000 vehicles. Honda's U.K. plant reduced its production capacity by 50% for almost two months, and Nissan's three U.S. plants were completely shuttered for a few months.

[7]Jesse Toprak, a vice president at TrueCar.com, observed that "part of the U.S. companies' ability to pick up sales resulted from being ready with small, high-MPG cars as gas prices were rising then as now. Sales shot up for models like the Chevrolet Cruze and Ford Fiesta, along with models from Korean maker Hyundai."

3 Theoretical Framework

Consider a model in which there is a seller, an intermediary, and B potential buyers. There is a single good owned by the seller. For simplicity, we assume that buyers place a value of one on the good and that the seller and intermediary do not value the good; the key point is that trade occurs because buyers value the good more highly than the sellers do. There are also search frictions that impede the meeting of the seller with buyers. The intermediary can help relieve those frictions by buying the good from the seller and then selling it to the buyer. Trade takes place sequentially in a multi-stage bargaining game in the following manner:

Stage 1. The seller and the intermediary meet. If the intermediary purchases the good from the seller, the price at which this transaction takes place is the wholesale price wp. Whoever possesses the good at the end of this stage is referred to as the stage-1 owner.

Stage 2. The stage-1 owner of the good meets with potential buyers. If the good is sold to one of these buyers, the price at which the transaction takes place is the retail price rp.

The intermediary may engage with any of the B potential buyers. The seller may engage with each potential buyer with independent probability $\lambda < 1$. The intermediary therefore has a search advantage over the seller in her ability to potentially encounter more buyers.

Within each stage, the parties engage in Nash bargaining and apply a common discount factor $\delta < 1$ to each period over which the bargaining is extended. In Stage 2, the stage-1 owner is randomly matched in each bargaining period to one of the potential buyers. The within-stage bargaining is thus as described in Osborne and Rubinstein (1990). The overall structure resembles the seller-intermediary-buyer model of Rubinstein and Wolinsky (1987) with the addition of multiple buyers.

From a formal standpoint, we will contrast the equilibrium outcomes for $B = 1$ and $B =$

2, referring to the second case as a demand surge. We describe the theoretical predictions in this section and detail the proofs in the appendix.

Given the Nash bargaining structure, retail prices can be calculated in Stage 2. if the stage-1 owner negotiates with one buyer, the retail price is $\frac{1}{2}$, while if she negotiates with two buyers, the retail price is $\frac{2-\delta}{4-3\delta} > \frac{1}{2}$.

In Stage 1, the intermediary and the seller calculate the expected payoff to the seller from retaining the good and bargain over the surplus generated by the intermediary's ability to encounter more buyers in Stage 2. This surplus is strictly positive, so the seller always sells the good to the intermediary. We show in the appendix that for B potential buyers the wholesale price $wp(B)$ is given by

$$wp(B) = \begin{cases} \frac{\lambda+1}{4} \text{ if } B = 1 \\ \frac{1}{2}\left(\frac{2-\delta}{4-3\delta} + \lambda - 2\lambda^2\left(\frac{1-\delta}{4-3\delta}\right)\right) \text{ if } B = 2 \end{cases}$$

We define the intermediary margin as $\frac{rp-wp}{rp}$. If $\lambda = 0$, the intermediary is said to be indispensable, as there can be no direct trade between the buyer and the seller. For $\lambda \in (0, 1)$, the intermediary is dispensable. We have the following implication.

Prediction 1: As the number of potential buyers increases

a. wholesale prices increase

b. retail prices increase.

As the number of buyers increases, the stage-1 owner of the good (in equilibrium, the intermediary) extracts a higher retail price from the buyers. Anticipating this, the seller negotiates a higher wholesale price from the intermediary. These effects hold whether the intermediary is dispensable or indispenable.

The dispensability of the intermediary does, however, have an impact on the intermediary's margin. If the intermediary is indispensable, then she captures a fixed fraction of the gains from sale, irrespective of the number of buyers. Demand surges in this setting have no impact on the intermediary margin.

By contrast, when the intermediary is dispensable, the seller has the opportunity to directly contract with potential buyers. Although the intermediary has an advantage relative to the seller in meeting potential buyers, this advantage matters less as the number of potential buyers increases. This is because the price negotiated by the stage-1 owner is concave in the number of potential buyers. When buyers and sellers can meet on their own (i.e., when the intermediary is dispensable), an increase in the number of potential buyers as a result of a demand surge therefore enhances the bargaining power of sellers and thereby alters the terms on which trade occurs. The intermediary margin decreases in the number of potential buyers as sellers can more easily circumvent the intermediary and trade directly with buyers. We refer to this strengthening of a seller's hand in negotiating with intermediaries as the disintermediation mechanism. It generates the following theoretical predictions.

Prediction 2:

a. *If buyers and sellers cannot meet directly (i.e., if the intermediary is indispensable to trade), then as the number of potential buyers increases the intermediary margin is constant.*
b. *If buyers and sellers can meet directly (i.e., if the intermediary is dispensable to trade), then as the number of potential buyers increases the intermediary margin decreases.*

In Figure 1, the wholesale and retail prices and the intermediary margin are depicted

for the case $\delta = 0.8$ and $\lambda = 0.6$ (i.e., the intermediary is dispensable). As described in the figure, as the number of potential buyers increases, wholesale and retail prices increase, and the intermediary margin declines, consistent with the intuitions underlying Predictions 1 and 2b.

3.1 Model Implications

Results 1 and 2 describe theoretical markets of one seller and one intermediary in which sellers find intermediaries to be either indispensable or dispensable for trade. In reality, there is heterogeneity across sellers in their ability to transact without an intermediary. In certain markets with a large number of both sellers and buyers, it will likely be the case that a greater fraction of sellers can transact directly without intermediation. We refer to such settings as thick markets. In thin markets with relatively fewer sellers and buyers, sellers will more likely find intermediaries to be indispensable for exchange. As a consequence, Prediction 2 has the following implication.

Model Implication A: An increase in the number of potential buyers will reduce intermediary margins in thick markets and leave intermediary margins unchanged in thin markets.

The model also has implications for how intermediaries will shift their activities in response to a demand surge. Specifically, suppose that intermediaries have a fixed amount of capital and that they exhibit heterogeneity in their ability to intermediate transactions across a variety of markets, business lines, or products. Prediction 2 implies that intermediaries will attempt to focus their attention on goods within the span of their expertise that are less affected by a given demand surge, as they pursue higher margins.

Model Implication B: If an intermediary deals in two goods, one that faces a demand surge

and another that does not, the intermediary will seek, at least partially, to reallocate operations from the first good to the second.

Model Implication B suggests that an analysis of an intermediary's response to a demand surge can help identify the span of its expertise and its ability to strategically shift its operations. Inflexible intermediaries or those with limited scopes of intermediation will display a muted response to a demand surge, while more agile intermediaries with broader ranges of expertise will quickly move away from dealing in affected markets or products. This is consistent with the adjustment costs emphasized in the strategy literature (Argyres et al., 2015). Adjustment costs in the strategy context refer to the frictions that organizations incur when trying to change existing patterns of business in the face of an external shock. Inflexible intermediaries are also those with the highest comparative adjustment costs (Argyres et al., 2019).

In our empirical analysis, we analyze the role of intermediaries in the U.S. used car market and assess the effect of demand surges on their per-unit and business line margins.

4 Empirical Methodology

We analyze prices and profits during demand surges using transaction-level data. We use the following regression specification for our analysis of a sale l that takes place during period t:

$$Outcome_{ltd} = \beta_1 Japan_l + \beta_2 Tsunami_t + \beta_3 Japan_l * Tsunami_t + \gamma Controls_l + \epsilon_{ltd}, \quad (1)$$

where the variable *Outcome* represents *Wholesale Price*, *Retail Price*, *Dealer Profit*, *Dealer Margin*, and *Loan-to-Value Ratio* across various tables. In Equation (1), *Japan* is a dummy

that equals 1 if the car is made by a Japanese manufacturer.[8] *Tsunami* is a dummy variable that equals 1 if the sale took place between March 15, 2011, and Sept 15, 2011. The coefficient of interest is β_3, which describes the impact of the tsunami on used Japanese vehicles[9].

Included in the controls are make-model fixed effects (e.g., a dummy variable if the vehicle is a Honda Civic), dealership fixed effects, and month of the year effects when predicting pricing and financing outcomes. The main effect on *Japan* is absorbed by the make-model fixed effects and is not reported in our tables. To control for time trends in the data, we use three different approaches. First, in many specifications we use year-month fixed effects (e.g. a fixed effect for May 2011). Second, we include make-month fixed effects to capture seasonal variation across makes. Third, we create a trend variable for the year starting in 2009. This variable *Year Trend* takes the value of 0 in 2009, 1 in 2010, etc. We include fixed effects for the interactions between *Year Trend* and make, to control for trends over time specific to each make. In some specifications, to control for local market effects, we include fixed effects at the two-digit zip code interacted with both an indicator for the post-tsunami period and the make of the vehicle.

5 Results

5.1 Prices and Dealer Percentage Margins

As described in Section 2.1, the March 2011 tsunami caused a dramatic short-term reduction in the supply of new Japanese cars. We propose that the tsunami therefore created a positive

[8]The Japanese makes in our data are Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Acura, Mazda, Mitsubishi, Isuzu, Suzuki, and Scion.

[9]The Tsunami period is defined as March 15–Sept 15, 2011, so it includes parts of March 2011 and Sept 2011 but not those entire months. In regressions with month-year fixed effects, the Tsunami indicator is therefore not completely subsumed by the controls, but it is not very meaningful.

demand shock for used Japanese cars. Given that new Japanese cars were very hard to find, we hypothesize that some of the consumers who had been considering buying a new Japanese car entered the market for a used Japanese car instead. These consumers probably remained loyal to Japanese makes, as household-level brand preferences exhibit pronounced persistence (Bronnenberg et al., 2012). The used cars in our sample are quite young (with a median age of three years) and therefore probably served as reasonable substitutes for new cars.

To assess whether the tsunami caused a positive demand shock and created a period of increased demand for used Japanese cars, we estimate equation (1) for vehicle wholesale prices: we regress the price paid by a dealer for a used car on an indicator for the post-tsunami period (March 15–Sept 15, 2011), an interaction between the post-tsunami indicator and a dummy for Japanese cars. Standard errors are double clustered by dealership and vehicle make. We find, in the first column of Table 3, a positive and significant effect of the post-tsunami–used Japanese car interaction (coefficient=353.5 and t-statistic=2.73): during the post-tsunami period, dealers purchased used Japanese cars at a premium of $353.5. This increase represents a meaningful effect compared to the $13,400 average vehicle wholesale price for used Japanese cars throughout the sample. This is clear evidence that the tsunami boosted the prices of the treated (i.e., used Japanese) cars. As the overall supply of used Japanese cars in the U.S. was likely unaffected by the tsunami, this price increase can be attributed to a positive demand shock generated by the reduced availability of new Japanese cars. The resulting increase in wholesale prices is consistent with Prediction 1a in Section 3.

Including fixed effects for the make-model of the car, the dealership, and the month of the sale yields a larger coefficient on the post-tsunami-used Japanese car interaction (coefficient=434.9 and t-statistic=3.07), as detailed in the second column of Table 3. In the

third column of Table 3, we present the results from including controls for the borrower credit score, an indicator for previous borrower bankruptcy, an indicator for borrower homeowner status, the log of borrower gross monthly income, car mileage, the month-year, month-make and the interaction between the make and the years since 2008 (i.e., a make-specific time trend). We find a coefficient of $360.8 and a t-statistic of 3.62. Decomposing the interaction into its month-by-month effects, we show, in the fourth column of Table 3, that vehicle wholesale prices were significantly higher for used Japanese cars in every month from April to August 2011.

In the fifth column of Table 3, we show that used Japanese cars did not sell at elevated wholesale prices in the period before the tsunami. A regression of vehicle wholesale price on an indicator for a sale in the six months before the tsunami and the interaction between this indicator and a Japanese vehicle dummy yields an insignificant result for the interaction (coefficient=-86.8 and t-statistic=-0.65). Thus, there is no apparent pre-trend in advance of the disaster.

To control for local market effects, we include fixed effects at the level of the two digit zip code interacted with both an indicator for the post-tsunami period and the make of the vehicle. These controls capture any changes in local markets during the tsunami period and any variation across local markets in prices of specific makes. As shown in the sixth column of Table 3, using the full augmented set of fixed effects yields an estimate of the post tsunami-used Japanese car effect on wholesale prices that is quite similar to that in our other specifications (coefficient=379.4 and t-statistic=4.01).

The results in Table 3 establish that the tsunami caused a demand-driven surge in interest in used Japanese cars. Prediction 1b suggests that retail prices (along with wholesale prices) should increase as a result of this elevated demand. We test this prediction by regressing

the retail price realized by the dealer on the post-tsunami–used Japanese car interaction and the standard controls. We find, in the first column of Table 4, that retail prices for used Japanese cars were not significantly higher (coefficient=220.8 and t-statistic=1.59) in the post-tsunami period. When we include make-model, month, dealership and borrower-level, vehicle-level and time trend controls, however, we find a marginally positive effect, as detailed in the second and third columns of Table 4. In the presence of all these controls, the coefficient estimate is 213.2 and the t-statistic is 2.00. This represents weak evidence in favor of the retail price predictions of Prediction 1b. We show, in the fourth column of Table 4, that retail prices for used Japanese cars were generally higher from April to August 2011, but the monthly effects are only significant during two months. We do not find a significant retail price shift for these vehicles in the six months preceding the tsunami, as we detail in the fifth column of Table 4.

In the specification that includes local market controls, the post-tsunami-used Japanese vehicle effect is again marginally significant (coefficient=203.2 and t-statistic=1.92), as detailed in the sixth column of Table 4.

The tsunami raised wholesale prices and had a marginally positive impact on retail prices, as shown in Tables 3 and 4, which is generally consistent with Predictions 1a and 1b. We next assess Prediction 2, which focuses on the effects of a demand surge on dealer profits and margins. If dealers are largely indispensable and cannot easily be circumvented, Prediction 2a predicts that dealer margins will be constant. If, however, buyers and sellers can meet directly and with ease, Prediction 2b predicts that dealer margins will decline when demand increases. We test these competing predictions by regressing dealer percentage margins on the post-tsunami–used Japanese car interaction, an indicator for Japanese car and a post-tsunami indicator. We find, in the first column of Table 5, that dealer margins declined by

1.9 percentage points (t-statistic=-2.66) for used Japanese cars after the tsunami. This is clear evidence in favor of Pred 2b. The decline in intermediary margins during the tsunami-induced demand surge is consistent with the disintermediation mechanism: sellers could negotiate directly with buyers, and an influx in potential buyers made it easier for sellers to avoid using intermediaries. The dealers' weakened bargaining position led to lower profits per vehicle for them.

Regression specifications including make-model, month, dealership, borrower- and vehicle-level characteristics, and time trend controls confirm this basic finding, as shown in the second and third columns of Table 5.

We show in the fourth column of Table 5 that dealer margins were lower for used Japanese cars in four of the five post-tsunami months. In the fifth column of Table 5, we show that there was no pre-trend in these margins prior to the tsunami; this finding is confirmed by the graphical evidence in Figure 2.[10]

In the specification with the full set of controls, including local market trends, which is described in the sixth column of Table 5, we show that the tsunami reduced dealer margins on used Japanese vehicles by 2.3 percentage points (t-statistic=-3.31). Relative to the average dealer margin of 35.1%, this represents a drop of 6.6%.

In Figure 3 we show the impact of the tsunami on dealer margins for both Japanese and non-Japanese used vehicles. As the figure indicates, margins decreased for all used vehicles in the aftermath of the tsunami, which is consistent with a heightened demand for used cars, in general, due to the disruption in new Japanese car production. The figure makes clear, however, that the impact on used Japanese vehicles was stronger, which is the result described statistically in Table 5. For a customer seeking a substitute for a new Japanese car,

[10]Controls in all of the figures follow the second column of Table 5.

a used Japanese vehicle is more likely to be suitable than a used non-Japanese vehicle. As a consequence, one would expect to see the greater impact on used Japanese vehicles depicted in Figure 3. From an empirical standpoint, we concentrate our analysis on used Japanese cars, rather than all used cars, in order to be able to incorporate market-level controls for various potential unobserved macro factors that may have influenced the overall used vehicle market.

We note that although dealer margins on used Japanese cars were lower in the post-tsunami period, dealers did not lose money, on average, on these transactions. The average dealer margin on all used cars during the entire sample period was 36 percentage points and dealer margins on used Japanese cars declined by 2.3 percentage points after the tsunami. So, the average margin clearly remained positive.

5.2 Thin and Thick Markets

Table 5 shows that the post-tsunami margins were lower for used Japanese vehicles. This result is consistent with the disintermediation of dispensable dealers outlined in Section 3, but may potentially arise due to other causes. In order to clarify the role played by disintermediation, we consider cross-market heterogeneity in the dispensability of intermediaries, and we analyze the link between dispensability and changing margins during the post-tsunami period. Specifically, we examine whether post-tsunami margins fell more in markets where dealers are less essential.

In what types of markets are intermediaries dispensable? In general, search frictions for individual agents are less severe in thick markets, where a relatively large number of assets are available for trade (Gavazza, 2011). In these markets, it is feasible for buyers and sellers to find each other, and intermediaries are not central to facilitating trade. Intermediaries

are more important in thin markets, where the number of assets is relatively small. Model Implication A therefore suggests that a demand surge will lead to reduced intermediary margins in thick markets, but will not affect margins in thin markets.

We propose three proxies for measuring the thickness of a market for a given auto make and model. The first proxy is the total new car sales of that make-model in the year preceding the tsunami (i.e., 2010).[11] Vehicles with greater previous year new car sales trade in thicker markets. The second proxy is the fraction of total used car sales in January-February 2011 that were generated by a given make-model.[12] This is a direct measure of the pre-tsunami used car market thickness of each vehicle. The third proxy is an indicator for vehicles that were discontinued by their manufacturers. Discontinued vehicles are less desirable (Garmaise et al., 2024) and trade in less liquid markets. More information on these data can be found in (Garmaise et al., 2024). A key implication of the disintermediation mechanism is that the post-tsunami demand surge for used Japanese vehicles should reduce dealer margins more substantially in thick markets.

We assess the relative impact of the tsunami on thick versus thin markets by regressing the wholesale price on the triple interaction between the post-tsunami indicator, the used Japanese car dummy, and the 2010 new car sales of the make-model, along with all the relevant double interactions and the full set of controls. We find, in the first column of Table 6, that the effect of the triple interaction is positive (coefficient=379.8 and t-statistic=3.76). The tsunami led to higher wholesale prices, especially for Japanese cars that traded in thick markets with a large number of new vehicles. We further show in the second column of Table 6, that post-tsunami wholesale prices rose more for used Japanese models for which the pre-existing used car market was larger (coefficient=62449.5 and t-statistic=4.78). In

[11]Data comes from the website https://www.goodcarbadcar.net which aggregates make-model sales data.
[12]These data were supplied by IHS Markit.

the third column of Table 6, we display the result that post-tsunami wholesale prices were relatively lower for used Japanese cars that were discontinued (coefficient=-3068.0 and t-statistic=-11.28).

Our three proxies for market thickness all generate the same finding: in the post-tsunami period, wholesale prices rose more for vehicles that trade in large, liquid markets in which dealers serve a less critical function in enabling trade.

In Table 7, we evaluate the impact of our three market thickness proxies on retail prices for used Japanese cars during the post-tsunami period. We find consistent results: Retail prices were higher for models with greater 2010 new car sales, for models representing a larger fraction of Jan-Feb 2011 used car sales, and for models that were not discontinued. For each measure, we find higher prices after the tsunami for Japanese used cars that trade in more liquid markets.

Our central tests of the impact of market thickness in explaining the post-tsunami price responses focus on dealer margins. In the first column of Table 8 we show that dealer margins on used cars were especially low after the tsunami for Japanese models that had large 2010 new car sales (coefficient=-0.013 and t-statistic=-3.18). The test in the first column of Table 7 uses a continuous measure of sales. In Figure 4a and Figure 4b we employ a 100,000-unit threshold to denote thick markets; those with sales below that threshold represent thin markets. Consistent with the results in the first column of Table 7, Figure 4a shows that the tsunami had no measurable impact on dealer margins for used Japanese cars in thin markets, while Figure 4b illustrates the large negative impact of the tsunami on dealer margins for used Japanese cars in thick markets.

Margins were also lower for models with a larger fraction of Jan-Feb 2011 used car sales (coefficient=-2.43 and t-statistic=-3.47), as detailed in the second column of Table 8.

This result is illustrated graphically in Figures 5a and 5b, in which vehicles with concentrations above the median are labeled as high-concentration and the others are described as low-concentration. The figures make clear that dealer margins dropped only for high-concentration cars. These findings establish that dealer margins fell the most for vehicles trading in thick markets.

In the third column of Table 8, we show that discontinued used Japanese vehicles yielded dealers relatively higher margins (coefficient=0.10 and t-statistic=3.52) after the tsunami. These results are illustrated graphically in Figures 6a and 6a. Discontinued vehicles are less liquid and are difficult for potential buyers to locate and therefore trade in thin markets. Our empirical findings thus present clear and consistent evidence in favor of Model Implication A: A positive demand shock results in particularly low intermediary margins in thick markets in which dealers are dispensable, just as outlined in Section 3.

As an additional point, we consider whether the composition of used car buyers changed in the post-tsunami period. In Table IA.2 in the Appendix, we show that the income, credit score, probability of having experienced a previous bankruptcy, homeowner status, vehicle miles, and the likelihood of buying a discontinued model did not change during the tsunami for used Japanese car buyers. The reduction in dealer margins did not, therefore, arise from a shift in characteristics along any of these dimensions. The results in Table 8 instead support the interpretation that dealer margins fell the most for vehicles that traded in thick markets in which dealers could most easily be bypassed by sellers.

5.3 Dealer Dollar Profits

The tsunami had a weakly positive effect on retail prices of used Japanese cars, as shown in Table 4, and significantly reduced dealer percentage margins, as described in Table 5. In

Table 9 we examine the net impact of these two effects on the dollar profits earned by dealers on used Japanese autos. In the first column of Table 9, we show, in a specification without controls, that dollar dealer profits on used Japanese autos were marginally lower in the post-tsunami period (coefficient=-151.3 and t-statistic=-1.88). Including model, dealership, and month controls leads to an estimate that is somewhat larger in magnitude, as displayed in the second column of Table 9, and including additional controls for month-year, make-trend and make-month yields an estimated tsunami effect of -172.8 (t-statistic=-2.40), as depicted in the third column of Table 9.

Dealer profits on used Japanese autos were generally lower in each post-tsunami month, though the effect is significant in only one month, and there is no evidence of a pre-trend, as displayed in columns four and five of Table 9. Including the full set of controls, we find that dealer profits on used Japanese vehicles were reduced by \$204.6 (t-statistic=-2.94) in the post-tsunami period, as shown in the sixth column of Table 9. The negative effect of the tsunami on dealer margins was strong enough to generate a negative impact on dealer dollar profits despite the increase in retail prices.

One hypothesis is that dealers may have absorbed lower profits per used Japanese auto in the post-tsunami period in exchange for a higher volume of sales. We investigate this claim by analyzing the total sales of used cars in the United States using data obtained by IHS Markit on all used automobile registrations in the United States for the year 2011. As illustrated in Figure 7, registrations of Japanese used cars remained flat in 2011, indicating no significant increase in sales after the tsunami. This is consistent with the argument that the total supply of used Japanese cars in the U.S. likely did not change to any meaningful degree in the immediate post-tsunami period.

5.4 Private Party Sales

The results in Tables 3– 9 are all broadly consistent with Predictions 1 and 2. Our findings can thus be explained in the context of a disintermediation mechanism of private sales between buyers and sellers that bypasses dealers. Does this form of disintermediation actually occur in the used car market?

The National Automobile Dealers Association (NADA) supplies monthly data on the fraction of private party used car sales[13]. This monthly time-series data contain 36 observations from 2010-2012. From these data, we can construct the ratio of private market used vehicle sales compared to dealer sold used cars. First, party party sales constitute 47% of all used car transactions during this period. Disintermediated sales therefore constitute a viable alternative to dealer-facilitated transactions.

Second, we regress the ratio of private party to dealer used car sales on month dummies and an indicator for the post-tsunami period. As displayed in Table 10, there is an increase in the ratio of private transactions to dealer transactions in the post-tsunami period (coefficient=0.032 and t-statistic=3.39). This is a regression on a small data set of 36 observations, so we regard this evidence as purely suggestive, but it is consistent with the argument that private party sales increased during the positive demand shock that followed the tsunami.

[13]https://www.nada.org

5.5 Overall Dealership Profits, Dealer Heterogeneity and Responses to the Tsunami

5.5.1 Overall Dealership Profits

The analysis to this point has focused on per-vehicle profits and margins earned by dealers. We now turn our attention to the overall profits earned by each dealer and to the question of how different dealers responded to the tsunami.

We begin by calculating the aggregate profits earned each month by every dealer, accounting separately for Japanese and non-Japanese used car sales. We then regress this aggregate profit measure on dealership and month controls. We find, as displayed in the first column of Table 11, that aggregate profits from Japanese used car sales were lower (coefficient=-4283.1 and t-statistic=-4.51) in the tsunami period. There is clear evidence that lower per vehicle profits were also associated with lower aggregate profits. After the tsunami, which led to a demand surge and higher retail prices, volumes were relatively stable and dealer profits from used Japanese car transactions declined.

5.5.2 Dealer Heterogeneity

Dealers are heterogeneous: in particular, some dealers specialize in selling Japanese cars. In this subsection, we consider the impact of the tsunami specifically on Japanese dealers. In the second column of Table 11, we show that aggregate profits were lower for Japanese dealers during the six months following the tsunami (coefficient=-3091.3 and t-statistic=-2.11). As described in the third column of Table 11, Japanese dealers suffered especially low profits in their used Japanese car business after the tsunami. This is evident from the coefficient of -4083.2 (and t-statistic of -2.29) on the triple interaction between indicators for

Japanese cars, Japanese dealers and the tsunami period.

Model Implication B suggests that dealers experiencing a demand surge in one good should seek to reallocate their operations to a different good not subject to the same shock. Did Japanese dealers shift their activities to the non-Japanese used car market in the post-tsunami period? To examine this question, we analyze the coefficient on the double interaction between indicators for Japanese dealers and the tsunami in the third column of Table 11. Given the presence in this regression of the triple interaction with Japanese cars described above, the double interaction captures Japanese dealers' profits in non-Japanese cars after the tsunami. The estimated coefficient on the double interaction is insignificant (coefficient= 105.4 and t-statistic=0.06): we find no evidence of an increase for Japanese dealers after the tsunami in non-Japanese used car profits, as would be expected if they had shifted their sales to these vehicles.

5.5.3 Dealer Responses to the Tsunami

The results in Table 11, interpreted through the lens of Model Implication B, make clear that in the post-tsunami period Japanese dealers were unable to reallocate their intermediation expertise to the non-Japanese used car market. This finding is consistent with the adjustment costs literature Argyres et al. (2015, 2019). The finding suggests that the commitments that Japanese dealers make to their affiliated manufacturers limit the ability of the organization to reallocate toward more easily obtainable inventory. This raises the question of whether there were any respects in which Japanese dealers were able to respond to the shifting sales conditions after the tsunami.

The tsunami is unlikely to have a uniform impact on the Japanese used car market. Younger used cars, in particular, would likely serve as better substitutes for the missing new

cars. In Figure 8 we explore this hypothesis. As shown in the figure, young used cars (i.e., those of age less than or equal to three years) experienced increases in retail and wholesale prices after the tsunami relative to their older counterparts. This is consistent with the hypothesis that young used cars were more affected by the post-tsunami demand surge. Figure 8 also shows, consistent with Prediction 2, that dealer margins declined relatively more for young used cars after the tsunami.

Given this evidence on the disproportionate post-tsunami demand surge for younger used cars, Model Implication B suggests that dealers may have sought to intermediate older used cars for which they maintained higher margins. A dealer's ability to shift to intermediating different types of vehicles depends on the span of its expertise. Dealers that specialize in a specific make of auto are likely to have an expertise in that type of car. What is less clear, however, is whether a given dealer has expertise in selling other types of vehicles.

From an empirical perspective, we define a variable *Dealer-Make Match* to be equal to one if the dealer is selling a used vehicle of its own make and zero otherwise. For example, Dealer-Make Match = 1 if Karl Malone Toyota is selling a used Toyota. We contrast dealers selling their own makes with dealers that are not and consider the extent to which these different classes of dealers are able to shift to selling the older cars that were less affected by the tsunami.

We undertake this analysis by regressing the age of the vehicle that is sold on the triple interaction between indicators for the tsunami, a dealer-make match and a Japanese dealer, including all relevant double interactions and single variables. The coefficient on the triple interaction describes the impact of the tsunami on the age of same-make vehicles sold by Japanese dealers. In the first column of Table 12, we show that this coefficient is negative and significant (coefficient=-0.36 and t-statistic=-3.29). This indicates that after the tsunami,

Japanese dealers sold younger same-make used cars. This suggests that other dealers exited the market for young Japanese used cars, but that same-make dealers were unable to do, perhaps because their span of expertise was largely limited to their own make of vehicle. This finding is consistent with the result in Table 11 that Japanese dealers did not shift to the non-Japanese used car market after the tsunami.

We display in the second column of Table 12 the results from augmenting this regression with fixed effects for make, dealership and month-year. The estimated effect on the triple interaction is quite similar in this specification (coefficient=-0.28 and t-statistic=-3.32). Within a given make, the Japanese dealers that specialized in that make sold younger used cars after the tsunami.

In our final specification, we include an additional control for vehicle model. As detailed in the third column of Table 12, in this regression the triple interaction is insignificant (coefficient=-0.04 and t-statistic=-0.58). Within a given model, same-make dealers were no more likely to sell younger Japanese cars after the tsunami.

The results in the three columns of Table 12, interpreted in the context of Model Implication B, thus provide evidence on the ability of Japanese dealers to shift their operations to different segments of the used car market. The result in the first column shows that same-make Japanese dealers were unable to shift away from the young used Japanese car market in the way that other dealers did. The result in the second column shows that within a given make, Japanese matched-make dealers were also unable to shift out of the young used car market; for example, if a given model within the make generally had younger used cars, Japanese same-make dealers were apparently unable to shift demand from that model to a different model with older used cars. The regression described in the third column, however, demonstrates that within a given model, Japanese same-make dealers were not confined to

young used cars. Japanese dealers were able to intermediate old and young used Japanese cars of that model in the same manner as non-Japanese dealers. Taken together, these findings suggest that non-Japanese dealers shifted operations out of the young used Japanese car market, while Japanese dealers continued to trade in these cars. Japanese dealers were not able to move out of the markets for generally younger models, but within a given model they were able to sell vehicles with a similar age profile to those sold by non-Japanese dealers.

These results illustrate the point that in the face of a demand shock, intermediaries may not be able to shift to completely new markets or even new business lines, but they are more likely to be able to make adjustments within a given product range.

6 Conclusion

Disintermediation has become an important feature of the changing strategic landscape for firms. In this paper we explore a new driver of disintermediation: demand surges for a particular good. We analyze a formal model in which increased demand causes buyers and sellers to bypass a potentially dispensable intermediary, and we empirically study this mechanism in an analysis of the profits of dealers in the U.S. used auto market.

We show that after the 2011 tsunami, the disruption of new Japanese auto manufacturing led to heightened demand for used Japanese vehicles, resulting in higher wholesale and retail prices. We find that during the post-tsunami period, dealers acting as sales intermediaries for used Japanese cars experienced a 2.3 percentage point (6.6%) drop in profit margins. The effects were particularly strong in thick markets in which there were a large quantity of vehicles available. Dollar profits per vehicle and aggregate dealer profits for Japanese makes both also decreased. These findings are consistent with the search theory argument that,

during periods of elevated demand, intermediary profits decrease due to a disintermediation mechanism in which the introduction of new potential buyers makes it easier for sellers to circumvent dealers.

Dealers might be expected to attempt to exit markets that are affected by demand surges, but their ability to do so depends on their agility and the breadth of their intermediation expertise. We show that young used Japanese cars were most affected by the demand surge, likely because they served as the closest substitutes for the missing new cars. We find that Japanese dealers sold generally younger used Japanese vehicles and models after the tsunami, indicating that they were unable to exit this market to the same degree as non-Japanese dealers. Within a given model, however, Japanese dealers sold cars with a similar age profile to non-Japanese dealers. These findings suggest that Japanese dealers were not able to move out of the markets for typically younger used Japanese models, but they made adjustments within a given product range.

Dealers possess superior industry knowledge, a degree of market power, and relatively stable access to financing. In all these respects, they seem well-suited to thrive during an episode of elevated demand. We show instead that when dealers are not indispensable, a demand surge causes their market power to deteriorate, resulting in lower margins. This suggests that supply chain disruptions and policy interventions such as tariffs will generate disparate profit outcomes for intermediaries, depending on the feasibility of private party sales. In the used auto market, in particular, the emergence of very large used car specialist firms may limit the negative impact of higher demand on dealer profits, relative to the 2011 post-tsunami experience.

One limitation of this paper is that we do not specifically detail the precise manner in which disintermediation occurs. Instead, the variation we use to test the disintermediation

mechanism occurs at both the model and transaction levels. A single dealership may engage in transactions where it is either dispensable or indispensable. Nevertheless, the logic of indispensability likely plays a crucial role in intermediaries' strategic choices across various contexts.

For example, in a recent FTC case against Ticketmaster[14], the FTC accused Ticketmaster of engaging in anti-competitive behavior by attempting to secure exclusive ticket vending contracts with venues. In the framing of our paper, one could imagine that if these allegations are true, then Ticketmaster was using long-term contracts to prevent a disintermediation mechanism from emerging.

Future research examining the costs and benefits to intermediaries of occupying a dispensable versus indispensable position in a market would be illuminating. While, as our study demonstrates, indispensability can offer protection to intermediaries during demand surges, it may also entail costs, such as trading at lower volumes or operating in less profitable market segments.

Finally, in a world potentially trending toward increased protectionism, this paper provides important insights for international trade in durable goods and strategies to manage these shifts. Specifically, if tariffs on foreign durables rise, our analysis suggests that demand for used durable goods may surge. Intermediaries operating in such an environment are likely to struggle unless they either possess relatively low adjustment costs to shift across transactions or remain indispensable partners in trade.

[14] apnews.com/article/justice-department-live-nation-ticketmaster-antitrust-lawsuit-df9b552d127e1494db13e3cd625787a8

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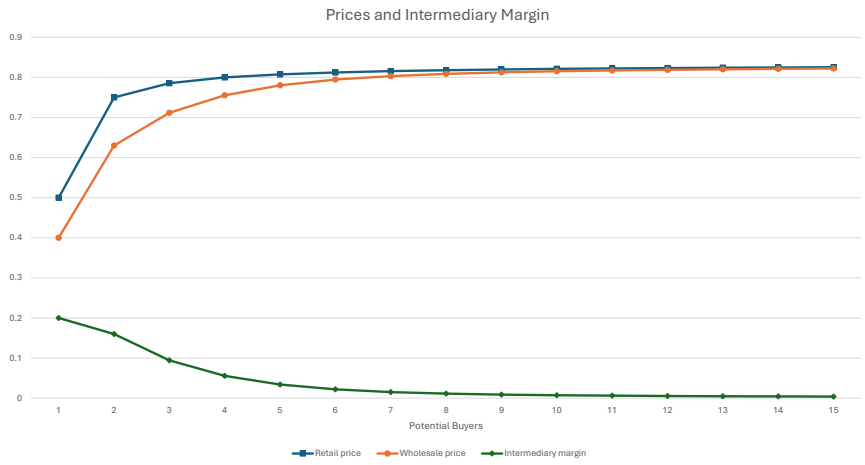


Figure 1. This figure describes the wholesale price, retail price and intermediary margin in the model described in Section 3 for the case $\delta = 0.8$ and $\lambda = 0.6$.

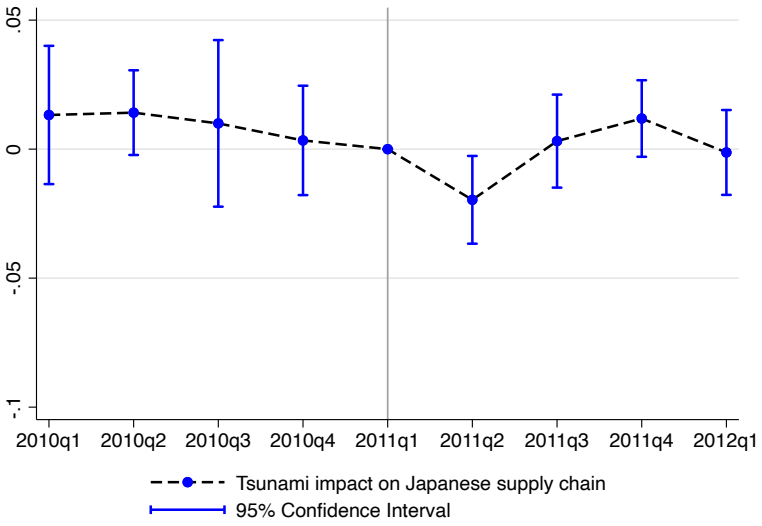
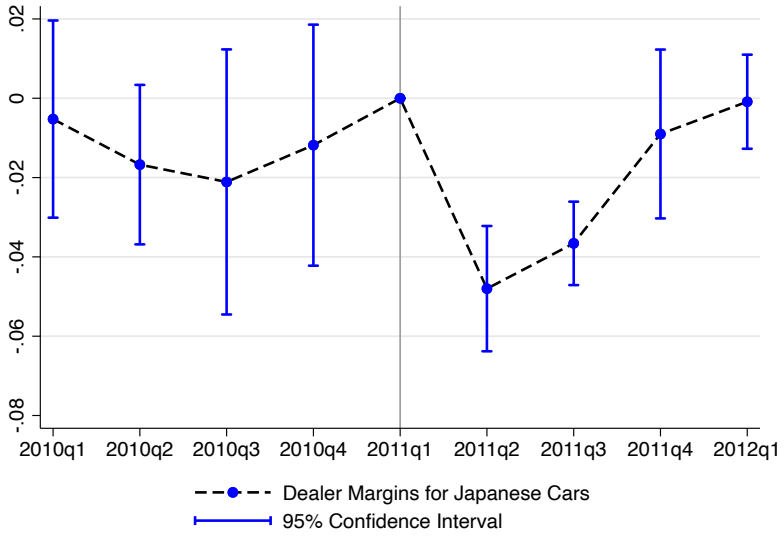


Figure 2. This figure reports differences in the dealership profit margins for the sale of used cars between Japanese makes and non-Japanese makes. The figure shows a discontinuity in the first quarter of 2011, the quarter in which the tsunami occurred (March 15, 2011). Controls include year trends, month fixed effects, dealership effects, and vehicle model fixed effects. Standard errors are double clustered by dealership and vehicle make.

(a) Dealer Margin for Japanese Vehicles



(b) Dealer Margin for non-Japanese Vehicles

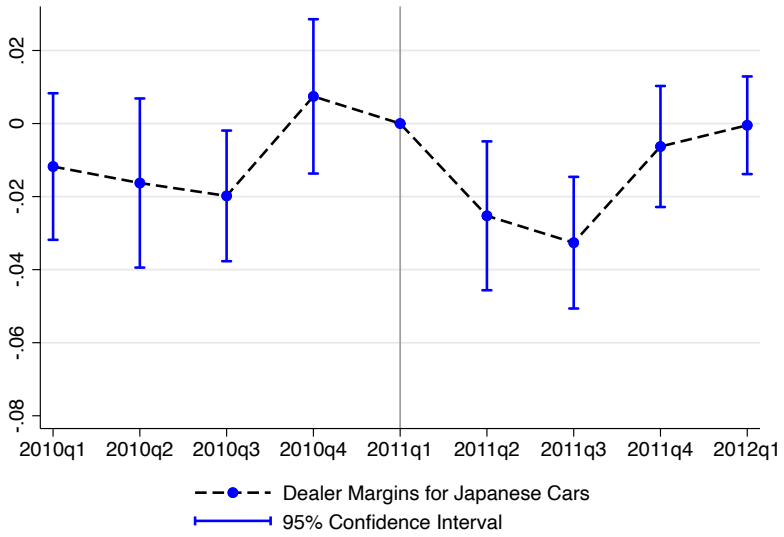
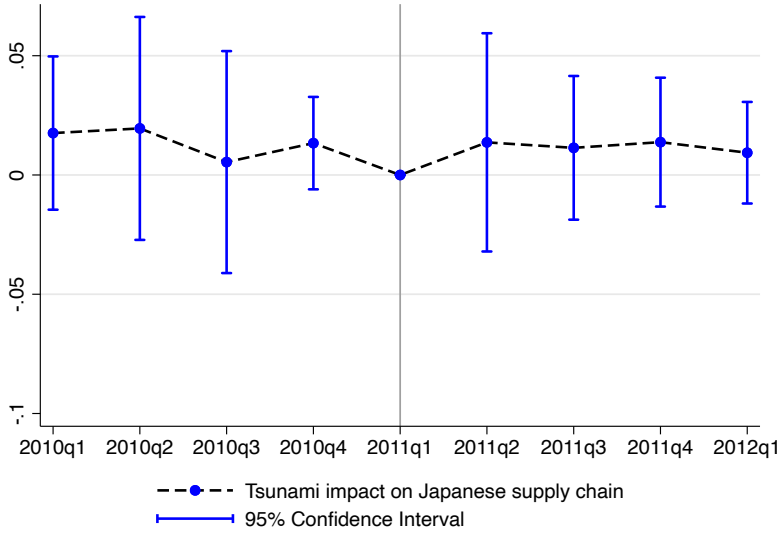


Figure 3. This figure reports dealer profit margins for the sale of used cars for Japanese makes (Panel a) and non-Japanese makes (Panel b). The figure shows a discontinuity in the first quarter of 2011, the quarter in which the tsunami occurred (March 15, 2011). Standard errors are double clustered by dealership and vehicle make.

(a) Dealer Margin for Low Sales Volume Vehicles



(b) Dealer Margin for Large Sales Volume Vehicles

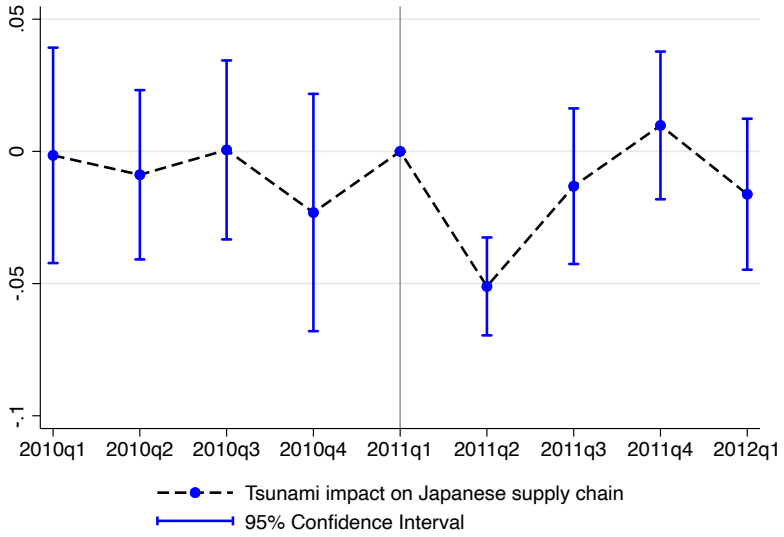
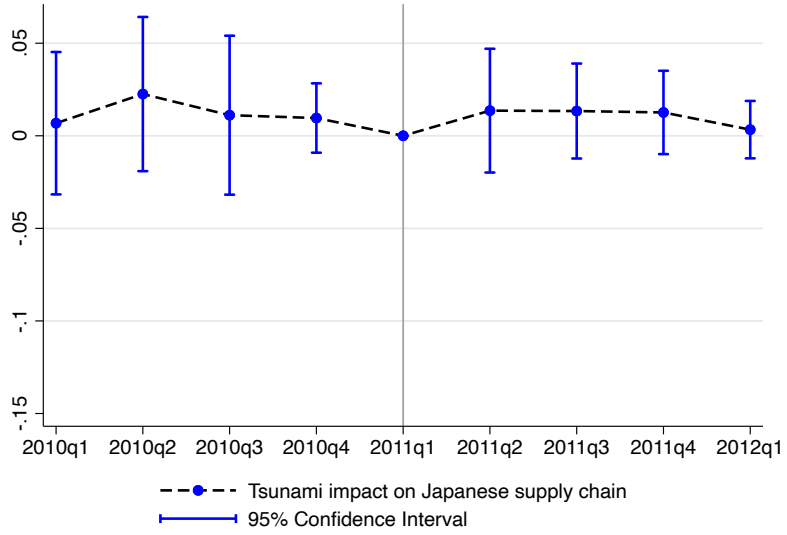


Figure 4. This figure reports differences in the dealership profit margins for the sale of used cars between Japanese makes and non-Japanese makes. The figure shows a discontinuity in the first quarter of 2011, the quarter in which the tsunami occurred (March 15, 2011). Panel a shows the results for sales of thinly traded vehicles (i.e., vehicles with annual sales volume less than 100,000 vehicles in 2010). Panel b shows the results for sales of thickly traded vehicles (i.e., vehicles with annual sales volume in excess of 100,000). Controls include year trends, month fixed effects, dealership effects and vehicle model fixed effects. Standard errors are double clustered by dealership and vehicle make.

(a) Dealer Margin for Low Concentration Vehicles



(b) Dealer Margin for High Concentration Vehicles

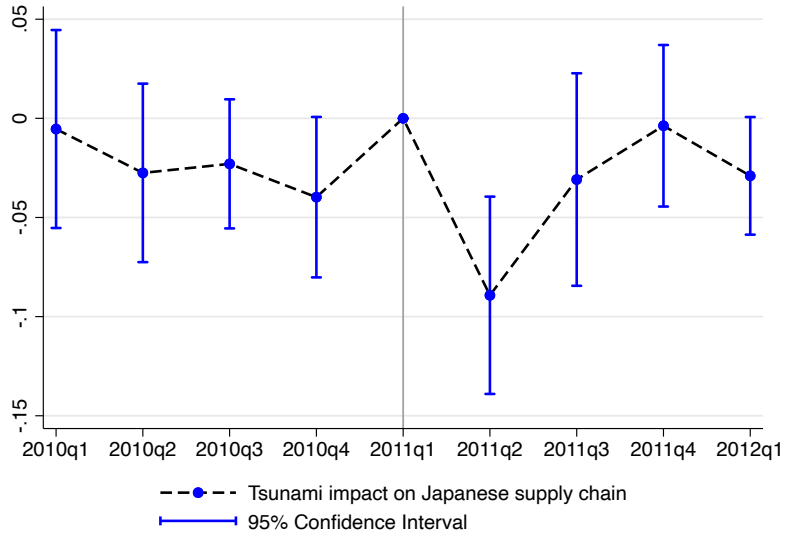
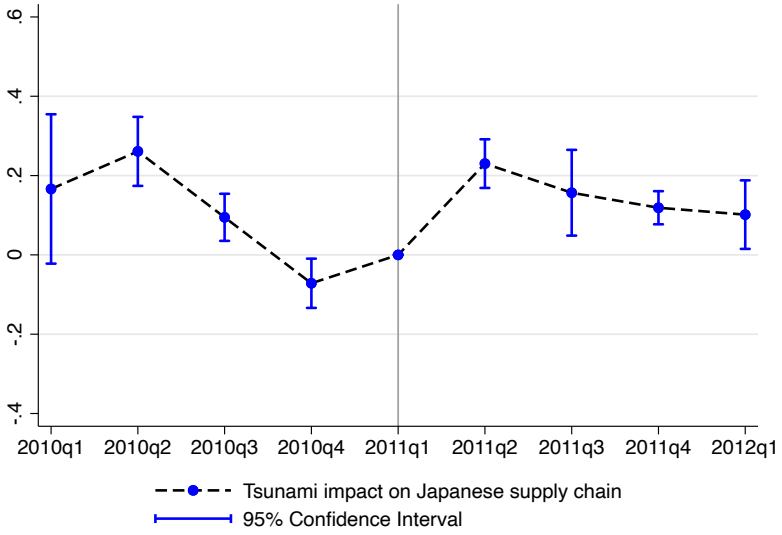


Figure 5. This figure reports differences in the dealership profit margins for the sale of used cars between Japanese makes and non-Japanese makes. The figure shows a discontinuity in the first quarter of 2011, the quarter in which the tsunami occurred (March 15, 2011). Panel a displays the results for high concentration (i.e., above median) models, and Panel b displays the results for low concentration (i.e., median or below) models. Controls include year trends, month fixed effects, dealership effects, and vehicle model fixed effects. Standard errors are double clustered by dealership and vehicle make.

(a) Dealer Margin for Discontinued Vehicles



(b) Dealer Margin for Not Discontinued Vehicles

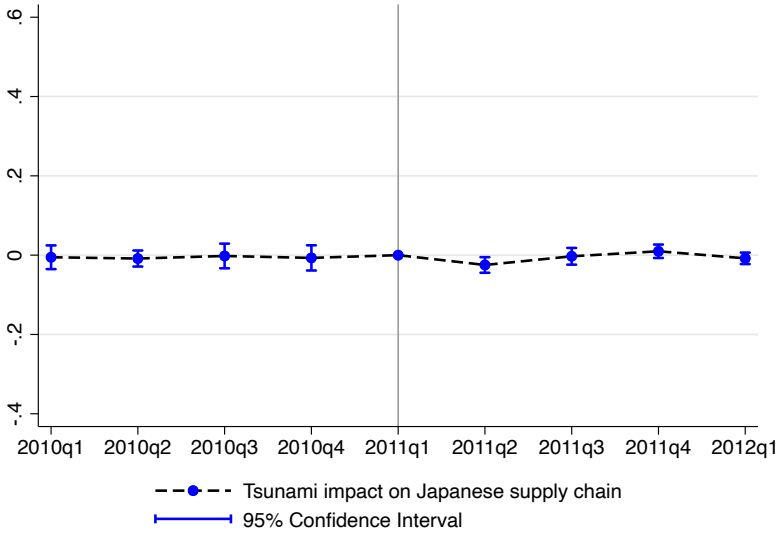


Figure 6. This figure reports differences in the dealership profit margins for the sale of used cars between Japanese makes and non-Japanese makes. The figure shows a discontinuity in the first quarter of 2011, the quarter in which the tsunami occurred (March 15, 2011). Panel a displays the results for discontinued vehicles, and Panel b displays the results for non-discontinued vehicles. Controls include year trends, month fixed effects, dealership effects, and vehicle model fixed effects. Standard errors are double clustered by dealership and vehicle make.

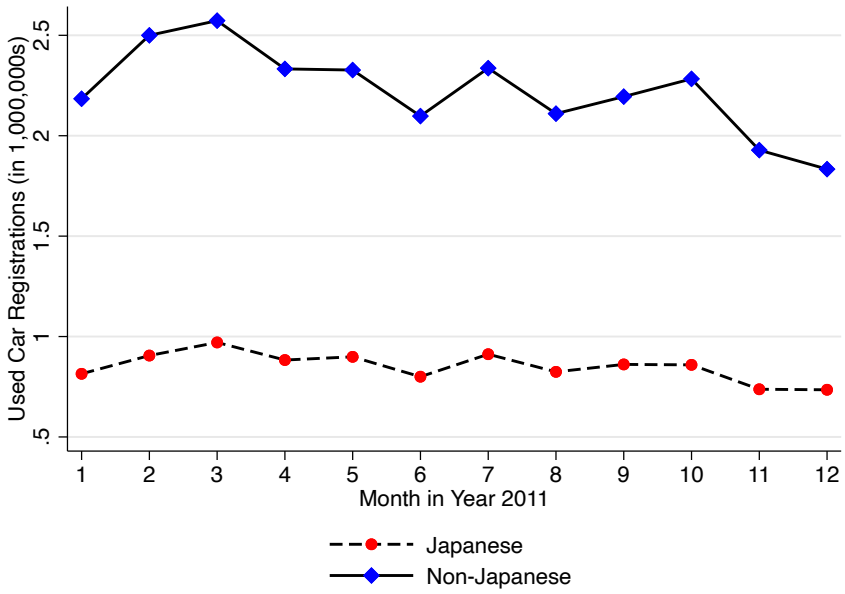
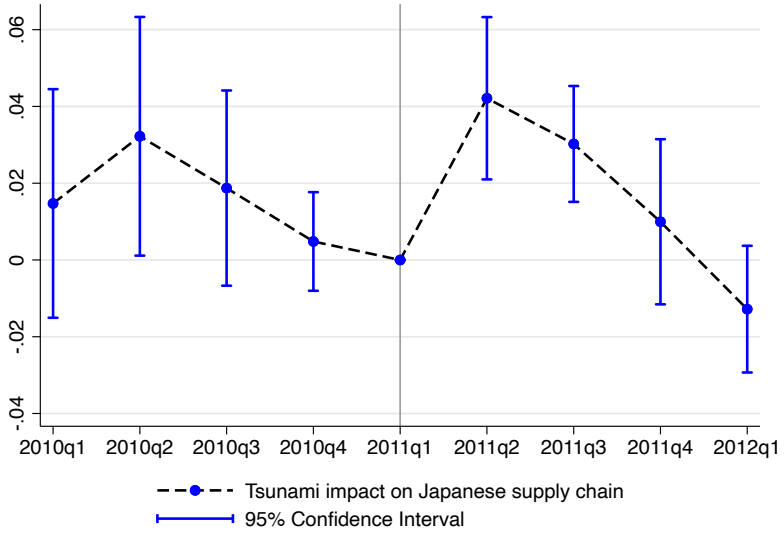


Figure 7. This figure reports the counts of used car registrations in the United States during the year 2011. Trends for Japanese makes and non-Japanese makes shown. Data comes from Information Handling Services.

(a) Dealer Margin for Old vs. Young Cars



(b) Retail Price for Old vs. Young Cars

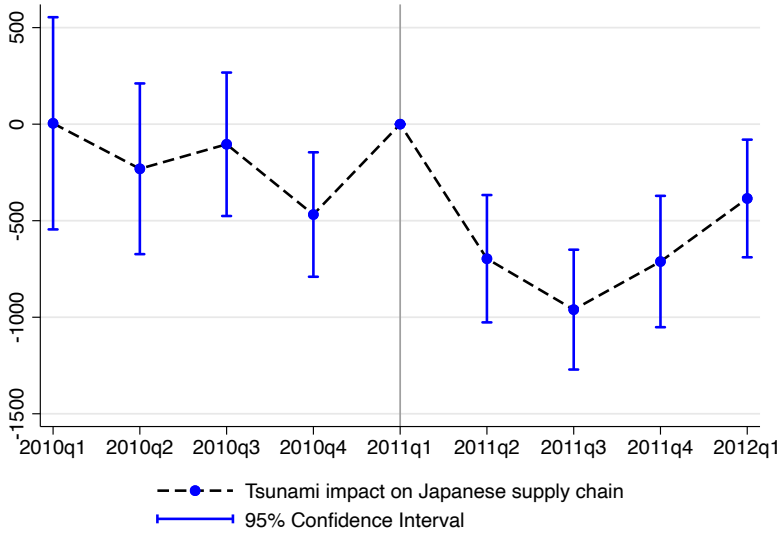


Figure 8. This figure reports differences in the dealership profits, retail price, and wholesale price for the sale of used cars between old (age greater than 3 years) vs young (less than or equal to 3 years) cars. Controls include year trends, month fixed effects, dealership effects, and vehicle model fixed effects. Standard errors are double clustered by dealership and vehicle make.

(c) Wholesale Price for Old vs. Young Cars

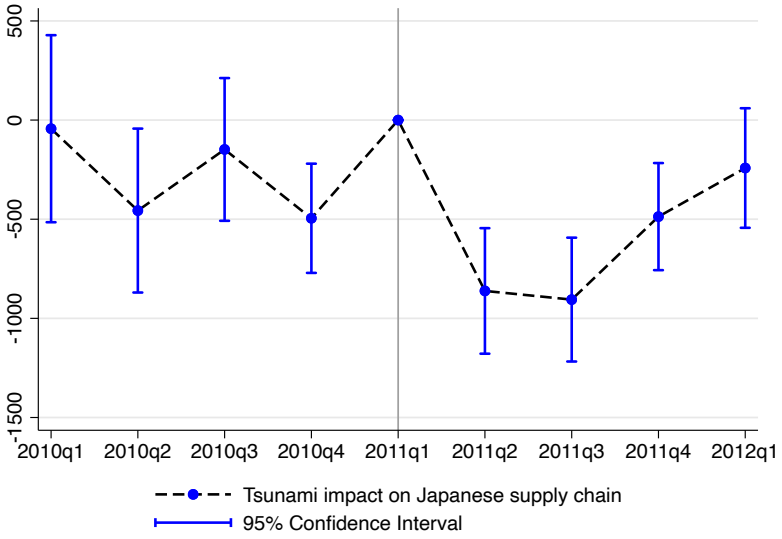


Figure 8. (continued)

Table 2

Summary Statistics This table reports summary statistics for the sample of 58,745 used auto sales transactions extended by 1,485 dealerships. Means and standard deviations are reported. The data summarizes vehicle, and dealership characteristics, and also borrower characteristics.

	Mean	SD	Count
Vehicle and Dealership Characteristics			
Japan	0.45	0.50	58,745
Vehicle Wholesale Price ($)	13,424.3	3,259.8	58,745
Vehicle Retail Price ($)	17,265.9	3,679.6	58,745
Vehicle Mileage (10,000s)	4.40	1.87	58,745
Vehicle Model 2010 Sales (100,000s)	1.34	1.11	58,745
Vehicle Concentration	0.008	.008	58,745
Model Discontinuation	.10	.30	58,745
Dealer Profit Margin	0.36	.19	58,745
Dealer Profit Margin ($)	4,616.3	2,226.9	58,745
Borrower Characteristics			
Credit Score	533.55	44.78	57,371
Ch. 7 Bankruptcy	0.30	0.46	58,745
Homeowner	0.09	0.29	58,745
Gross Monthly Income (ln)	8.32	0.37	58,745

Table 3

Difference in vehicle wholesale prices of Japanese- and non-Japanese-manufactured vehicles The dependent variable is the wholesale price of the vehicle at the time of sale. *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. The regressions control for borrower characteristics and vehicle characteristics. Tsunami is defined as one if the date of sale falls within March 15–Sept 15, 2011, and zero otherwise. Standard errors are double clustered by dealership and vehicle make. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var: Vehicle Wholesale Price	(1)	(2)	(3)	(4)	(5)	(6)
Japanese Car * Tsunami	353.5**	434.9***	360.8***			379.4***
	(2.73)	(3.07)	(3.62)			(4.01)
Japanese Car	173.6					
	(0.79)					
Tsunami	603.5***	554.1***	-86.0			
	(5.01)	(4.63)	(-0.74)			
Year Trend		216.7***				
		(5.45)				
Credit score			0.48	0.48	0.48	0.48*
			(1.66)	(1.67)	(1.66)	(1.70)
Ch. 7 Bankruptcy			91.2***	91.6***	91.5***	94.8***
			(2.93)	(2.94)	(2.95)	(3.06)
Homeowner			-28.3	-28.7	-28.6	-33.2
			(-1.12)	(-1.15)	(-1.14)	(-1.31)
Gross Monthly Income (ln)			1152.1***	1152.2***	1152.9***	1145.3***
			(15.79)	(15.81)	(15.84)	(15.66)
Vehicle Mileage			-938.3***	-938.3***	-938.2***	-937.9***
			(-25.43)	(-25.42)	(-25.44)	(-25.57)
Japanese Car * Apr				326.4***		
				(3.22)		
Japanese Car * May				426.2**		
				(2.24)		
Japanese Car * Jun				545.1***		
				(2.76)		
Japanese Car * Jul				559.5***		
				(2.99)		
Japanese Car * Aug				318.8**		
				(2.48)		
Japanese Car * 6 Month Post Tsunami					-86.8	
					(-0.65)	
6 Month Prior to Tsunami					9.29	
					(0.05)	
Adjusted R^2	0.005	0.400	0.672	0.672	0.672	0.676
Vehicle_Model	NO	YES	YES	YES	YES	YES
Month	NO	YES	YES	YES	YES	YES
Dealership	NO	YES	YES	YES	YES	YES
Year	NO	NO	YES	YES	YES	YES
MonthXYear	NO	NO	YES	YES	YES	YES
MakeXYearTrend	NO	NO	YES	YES	YES	YES
MonthXMake	NO	NO	YES	YES	YES	YES
TwoDigitZipXTsunami	NO	NO	NO	NO	NO	YES
TwoDigitZipXMake	NO	NO	NO	NO	NO	YES
Observations	58745	58745	57338	57338	57338	57021

Table 4

Difference in vehicle retail prices of Japanese- and non-Japanese-manufactured vehicles The dependent variable is the retail price of the vehicle at the time of sale. *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. The regressions control for borrower characteristics and vehicle characteristics. Tsunami is defined as one if the date of sale falls within March 15–Sept 15, 2011, and zero otherwise. Standard errors are double clustered by dealership and vehicle make. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var: Vehicle Retail Price	(1)	(2)	(3)	(4)	(5)	(6)
Japanese Car * Tsunami	220.8	278.4*	213.2*			203.2*
	(1.59)	(1.85)	(2.00)			(1.92)
Japanese Car	897.2***					
	(3.36)					
Tsunami	522.5***	591.6***	41.0			
	(3.75)	(4.92)	(0.38)			
Year Trend		378.7***				
		(8.22)				
Credit Score			1.19***	1.20***	1.19***	1.16***
			(3.00)	(3.00)	(2.99)	(2.97)
Ch. 7 Bankruptcy			100.9***	101.1***	101.0***	104.2***
			(3.64)	(3.64)	(3.64)	(3.97)
Homeowner			-45.8*	-46.4*	-46.2*	-50.0**
			(-1.96)	(-1.98)	(-1.97)	(-2.20)
Gross Monthly Income (ln)			1628.8***	1629.3***	1629.4***	1620.9***
			(22.99)	(23.02)	(23.04)	(22.88)
Vehicle Mileage			-971.4***	-971.2***	-971.3***	-968.9***
			(-27.07)	(-27.06)	(-27.09)	(-27.10)
Japanese Car * Apr				295.0**		
				(2.15)		
Japanese Car * May				296.0		
				(1.46)		
Japanese Car * Jun				140.7		
				(0.55)		
Japanese Car * Jul				500.7***		
				(2.82)		
Japanese Car * Aug				47.1		
				(0.41)		
Japanese Car * 6 Month Post Tsunami					-151.1	
					(-1.09)	
6 Month Prior to Tsunami					11.9	
					(0.07)	
Adjusted R^2	0.017	0.398	0.645	0.645	0.645	0.647
Vehicle_Model	NO	YES	YES	YES	YES	YES
Month	NO	YES	YES	YES	YES	YES
Dealership	NO	YES	YES	YES	YES	YES
Year	NO	NO	YES	YES	YES	YES
MonthXYear	NO	NO	YES	YES	YES	YES
MakeXYearTrend	NO	NO	YES	YES	YES	YES
MonthXMake	NO	NO	YES	YES	YES	YES
TwoDigitZipXTsunami	NO	NO	NO	NO	NO	YES
TwoDigitZipXMake	NO	NO	NO	NO	NO	YES
Observations	58745	58745	57338	57338	57338	57021

Table 5

Difference in dealer percent margin of Japanese- and non-Japanese-manufactured vehicles The dependent variable is the retail price of the vehicle at the time of sale. *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. The regressions control for borrower characteristics and vehicle characteristics. Tsunami is defined as one if the date of sale falls within March 15–Sept 15, 2011, and zero otherwise. Standard errors are double clustered by dealership and vehicle make. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var: Dealer Profit Margin	(1)	(2)	(3)	(4)	(5)	(6)
Japanese Car * Tsunami	-0.019**	-0.022***	-0.021***			-0.023***
	(-2.66)	(-2.78)	(-3.16)			(-3.31)
Japanese Car	0.036***					
	(3.75)					
Tsunami	-0.023***	-0.016**	0.0041			
	(-3.82)	(-2.68)	(0.47)			
Year Trend		0.012***				
		(6.81)				
Credit Score			0.00039***	0.00039***	0.00039***	0.00038***
			(17.92)	(17.91)	(17.83)	(17.94)
Ch. 7 Bankruptcy			0.0016	0.0015	0.0015	0.0010
			(0.57)	(0.56)	(0.57)	(0.37)
Homeowner			0.0025	0.0026	0.0026	0.0027
			(1.15)	(1.17)	(1.17)	(1.26)
Gross Monthly Income (ln)			0.061***	0.061***	0.061***	0.061***
			(12.64)	(12.65)	(12.66)	(12.34)
Vehicle Mileage			0.025***	0.025***	0.025***	0.025***
			(14.56)	(14.55)	(14.55)	(14.55)
Japanese Car * Apr				-0.017**		
				(-2.30)		
Japanese Car * May				-0.026*		
				(-1.78)		
Japanese Car * Jun				-0.034***		
				(-3.23)		
Japanese Car * Jul				-0.018		
				(-1.56)		
Japanese Car * Aug				-0.025**		
				(-2.10)		
Japanese Car * 6 Month Post Tsunami					-0.0027	
					(-0.55)	
6 Month Prior to Tsunami					0.0016	
					(0.16)	
Adjusted R^2	0.011	0.211	0.270	0.270	0.270	0.270
Vehicle_Model	NO	YES	YES	YES	YES	YES
Month	NO	YES	YES	YES	YES	YES
Dealership	NO	YES	YES	YES	YES	YES
Year	NO	NO	YES	YES	YES	YES
MonthXYear	NO	NO	YES	YES	YES	YES
MakeXYearTrend	NO	NO	YES	YES	YES	YES
MonthXMake	NO	NO	YES	YES	YES	YES
TwoDigitZipXTsunami	NO	NO	NO	NO	NO	YES
TwoDigitZipXMake	NO	NO	NO	NO	NO	YES
Observations	58745	58745	57338	57338	57338	57021

Table 6

Triple Interaction: Sales Volume, Concentration, & Discontinuations The dependent variable is the wholesale price of the vehicle at the time of sale. *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. The regressions control for borrower characteristics and vehicle characteristics. Tsunami is defined as one if the date of sale falls within March 15–Sept 15, 2011, and zero otherwise. Standard errors are double clustered by dealership and vehicle make. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var: Vehicle Wholesale Price	(1)	(2)	(3)
Tsunami	57.4	146.3	-143.9
	(0.39)	(0.96)	(-1.28)
Tsunami × Japanese Car	-185.7	-145.7	422.5***
	(-1.62)	(-1.21)	(4.32)
Tsunami × Sales 2010	-156.6*		
	(-1.84)		
Tsunami × Japanese Car × Sales 2010	379.8***		
	(3.76)		
Tsunami × Concentration IHS		-38174.9***	
		(-3.10)	
Tsunami × Japanese Car × Concentration IHS		62449.5***	
		(4.78)	
Model Discontinuation			-355.1**
			(-2.46)
Tsunami × Model Discontinuation			298.7**
			(2.12)
Japanese Car × Model Discontinuation			-414.4
			(-0.76)
Tsunami × Japanese Car × Model Discontinuation			-3068.0***
			(-11.28)
Credit Score	0.48	0.48	0.49
	(1.64)	(1.64)	(1.69)
Ch. 7 Bankruptcy	91.2***	90.6***	90.6***
	(2.92)	(2.91)	(2.90)
Homeowner	-28.2	-28.8	-26.0
	(-1.12)	(-1.14)	(-1.02)
Gross Monthly Income (ln)	1150.7***	1150.7***	1150.7***
	(15.72)	(15.77)	(15.74)
Vehicle Mileage	-938.6***	-938.4***	-937.3***
	(-25.58)	(-25.60)	(-25.57)
Adjusted R^2	0.672	0.672	0.673
Vehicle_Model	YES	YES	YES
Dealership	YES	YES	YES
Month	YES	YES	YES
Year	YES	YES	YES
MonthXYear	YES	YES	YES
MakeXYearTrend	YES	YES	YES
MonthXMake	YES	YES	YES
Observations	57338	57338	57338

Table 7

Triple Interaction: Sales Volume, Concentration, & Discontinuations The dependent variable is the retail price of the vehicle at the time of sale. *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. The regressions control for borrower characteristics and vehicle characteristics. Tsunami is defined as one if the date of sale falls within March 15–Sept 15, 2011, and zero otherwise. Standard errors are double clustered by dealership and vehicle make. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var: Retail Price	(1)	(2)	(3)
Tsunami	162.2	234.1	-22.6
	(1.16)	(1.64)	(-0.20)
Tsunami × Japanese Car	-142.9	-152.1	274.0**
	(-1.04)	(-1.00)	(2.47)
Tsunami × Sales 2010	-131.4*		
	(-1.86)		
Tsunami × Japanese Car × Sales 2010	262.0***		
	(3.10)		
Tsunami × Concentration IHS		-31662.9***	
		(-3.21)	
Tsunami × Japanese Car × Concentration IHS		46947.9***	
		(4.46)	
Model Discontinuation			-362.5**
			(-2.56)
Tsunami × Model Discontinuation			324.2**
			(2.05)
Japanese Car × Model Discontinuation			-479.2
			(-0.89)
Tsunami × Japanese Car × Model Discontinuation			-2078.9***
			(-6.93)
Credit Score	1.19***	1.19***	1.20***
	(2.98)	(2.98)	(3.01)
Ch. 7 Bankruptcy	100.8***	100.4***	100.3***
	(3.63)	(3.63)	(3.62)
Homeowner	-45.9*	-46.2*	-43.7*
	(-1.97)	(-1.98)	(-1.85)
Gross Monthly Income (ln)	1627.9***	1627.8***	1627.3***
	(22.95)	(22.98)	(22.88)
Vehicle Mileage	-971.5***	-971.3***	-970.3***
	(-27.21)	(-27.23)	(-27.23)
Adjusted R^2	0.645	0.645	0.645
Vehicle_Model	YES	YES	YES
Dealership	YES	YES	YES
Month	YES	YES	YES
Year	YES	YES	YES
MonthXYear	YES	YES	YES
MakeXYearTrend	YES	YES	YES
MonthXMake	YES	YES	YES
Observations	57338	57338	57338

Table 8

Triple Interaction: Sales Volume, Concentration, & Discontinuations The dependent variable is the dealer margin on the vehicle at the time of sale. *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. The regressions control for borrower characteristics and vehicle characteristics. Tsunami is defined as one if the date of sale falls within March 15–Sept 15, 2011, and zero otherwise. Standard errors are double clustered by dealership and vehicle make. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var: Dealer Profit Margin	(1)	(2)	(3)
Tsunami	0.0016	-0.0045	0.0032
	(0.17)	(-0.50)	(0.38)
Tsunami × Japanese Car	-0.00043	-0.0012	-0.021***
	(-0.06)	(-0.18)	(-3.35)
Tsunami × Sales 2010	0.0028		
	(0.71)		
Tsunami × Japanese Car × Sales 2010	-0.013***		
	(-3.18)		
Tsunami × Concentration IHS		1.42**	
		(2.13)	
Tsunami × Japanese Car × Concentration IHS		-2.43***	
		(-3.47)	
Model Discontinuation			0.0026
			(0.41)
Tsunami × Model Discontinuation			0.0033
			(0.52)
Japanese Car × Model Discontinuation			0.014
			(0.91)
Tsunami × Japanese Car × Model Discontinuation			0.10***
			(3.52)
Credit Score	0.00039***	0.00039***	0.00039***
	(18.03)	(18.01)	(17.90)
Ch. 7 Bankruptcy	0.0016	0.0016	0.0016
	(0.57)	(0.58)	(0.58)
Homeowner	0.0025	0.0025	0.0025
	(1.14)	(1.16)	(1.13)
Gross Monthly Income (ln)	0.061***	0.061***	0.061***
	(12.61)	(12.66)	(12.65)
Vehicle Mileage	0.025***	0.025***	0.025***
	(14.58)	(14.58)	(14.56)
Adjusted R^2	0.270	0.270	0.270
Vehicle_Model	YES	YES	YES
Dealership	YES	YES	YES
Month	YES	YES	YES
Year	YES	YES	YES
MonthXYear	YES	YES	YES
MakeXYearTrend	YES	YES	YES
MonthXMake	YES	YES	YES
Observations	57338	57338	57338

Table 9

Difference in dealer profits of Japanese- and non-Japanese-manufactured vehicles The dependent variable is the dealer profits on the vehicle at the time of sale. *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. The regressions control for borrower characteristics and vehicle characteristics. Tsunami is defined as one if the date of sale falls within March 15–Sept 15, 2011, and zero otherwise. Standard errors are double clustered by dealership and vehicle make. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var: Dealer Profits	(1)	(2)	(3)	(4)	(5)	(6)
Japanese Car * Tsunami	-151.3*	-182.5**	-172.8**			-204.6***
	(-1.88)	(-2.18)	(-2.40)			(-2.94)
Japanese Car	634.1***					
	(6.03)					
Tsunami	-108.7	0.031	56.9			
	(-1.59)	(0.00)	(0.64)			
Year Trend		250.0***				
		(13.18)				
Credit score			4.82***	4.82***	4.82***	4.74***
			(21.83)	(21.80)	(21.73)	(21.58)
Ch. 7 Bankruptcy			55.2*	55.2*	55.1*	49.1
			(1.89)	(1.88)	(1.89)	(1.65)
Homeowner			13.4	13.6	13.7	13.0
			(0.64)	(0.65)	(0.65)	(0.61)
Gross Monthly Income (ln)			1140.0***	1140.2***	1139.6***	1135.2***
			(23.98)	(24.02)	(24.05)	(23.20)
Vehicle Mileage			-0.14	-0.086	-0.23	3.49
			(-0.01)	(-0.01)	(-0.02)	(0.24)
Japanese Car * Apr				-101.3		
				(-0.95)		
Japanese Car * May				-235.1		
				(-1.68)		
Japanese Car * Jun				-349.4**		
				(-2.62)		
Japanese Car * Jul				-51.0		
				(-0.45)		
Japanese Car * Aug				-209.2		
				(-1.54)		
Japanese Car * 6 Month Post Tsunami					-42.4	
					(-0.62)	
6 Month Prior to Tsunami					-29.1	
					(-0.22)	
Adjusted R^2	0.020	0.179	0.223	0.223	0.223	0.223
Vehicle_Model	NO	YES	YES	YES	YES	YES
Dealership	NO	YES	YES	YES	YES	YES
Month	NO	YES	YES	YES	YES	YES
Year	NO	NO	YES	YES	YES	YES
MonthXYear	NO	NO	YES	YES	YES	YES
MakeXYearTrend	NO	NO	YES	YES	YES	YES
MonthXMake	NO	NO	YES	YES	YES	YES
TwoDigitZipXTsunami	NO	NO	NO	NO	NO	YES
TwoDigitZipXMake	NO	NO	NO	NO	NO	YES
Observations	58745	58745	57338	57338	57338	57021

Table 10

Ratio of Private Market Used Car Sales to Dealer Used Cars Sales in 2011 The dependent variable is the ratio of private market used car sales to dealer sold used cars from 2010 to 2012. Tsunami is defined as one if the date of sale falls within April 1 – Sept 30, 2011, and zero otherwise. Standard errors are robustly calculated. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The average value for the dependent variable is equal to .891. Approximately 47% of used car transactions occur in the private market.

Dep Var: Ratio Private : Dealer	(1)
Tsunami	0.032***
	(3.39)
Adjusted R^2	0.628
Month	Yes
Observations	36

Table 11

Difference in Total Dealer Quarterly Profits for Japanese- and non-Japanese-manufactured vehicles The data has been collapsed to the quarter/year/dealership/Japanese make. Dealer profits are summed for the unit of observation. The dependent variable is Quarterly Dealer Profits. *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. Tsunami is defined as one if the date of sale falls within April 1–Sept 30, 2011, and zero otherwise. Standard errors are clustered by dealership. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var: Dealer Quarterly Profits	(1)	(2)	(3)
Japanese Cars	1082.58	645.01	-7180.69***
	(-.83)	(0.50)	(-5.85)
Japanese Cars * Tsunami	-4283.1***		-3242.25***
	(-4.51)		(-2.92)
Japanese Dealers * Tsunami		-3091.28**	105.35
		(-2.11)	(0.06)
Japanese Cars * Japanese Dealers			24552.03***
			(9.23)
Japanese Cars * Japanese Dealers * Tsunami			-4083.21***
			(-2.29)
Adjusted R^2	0.483	0.482	0.516
Dealership	YES	YES	YES
Quarter	YES	YES	YES
Year	YES	YES	YES
QuarterXYear	YES	YES	YES
Observations	11,721	11,721	11,721

Table 12

Triple Interaction: Vehicle Age The dependent variable is the age of the vehicle at the time of sale. *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. The regressions control for borrower characteristics and vehicle characteristics. Tsunami is defined as one if the date of sale falls within March 15–Sept 15, 2011, and zero otherwise. *Dealer-Make Match* is equal to 1 if the dealer is selling a used vehicle of its own make, zero otherwise. For example, *Dealer-Make Match* if Karl Malone Toyota is selling a used Toyota. Standard errors are double clustered by dealership and vehicle make. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var:	Vehicle Age	Vehicle Age	Vehicle Age
Tsunami	0.27***	0.17**	0.06
	(3.32)	(2.15)	(0.88)
Dealer-Make Match	-0.44***	-0.21***	-0.16***
	(-3.47)	(-3.88)	(-3.45)
Japanese Dealers	0.07	Absorbed	Absorbed
	(0.87)		
Tsunami * Dealer-Make Match	0.17**	0.08	-.01
	(2.09)	(1.05)	(-0.09)
Tsunami * Japanese Dealers	-0.13	-0.08	-0.56
	(-1.51)	(-1.30)	(-1.16)
Dealer-Make Match * Japanese Dealers	0.41*	0.10	0.02
	(1.93)	(1.35)	(0.27)
Tsunami * Dealer-Make Match * Japanese Dealers	-0.36***	-0.28***	-0.04
	(-3.29)	(-3.32)	(-0.58)
Adjusted R^2	0.008	0.20	0.30
Vehicle_Make	NO	YES	NO
Vehicle_Model	NO	NO	YES
Dealership	NO	YES	YES
Month	NO	YES	YES
Year	NO	YES	YES
MonthXYear	NO	YES	YES
Observations	58745	58745	58745

Internet Appendix to: "Demand Surges and Intermediary Profits"

For Online Publication

May 2025

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Proofs of Predictions.

The within-stage bargaining game described in the model precisely matches the bargaining structure outlined in Model B of Chapter 6 of Osborne and Rubinstein (1990). As shown in their Proposition 6.4, given that $\delta < 1$, there is a unique market equilibrium within each stage with one seller and b potential buyers, in which a good with value 1 is sold with price

$$p(b) = \frac{1 - \frac{\delta}{b}}{2 - \delta - \frac{\delta}{b}} \tag{2}$$

It follows immediately from (2) that in Stage 2 the stage-1 owner receives $\frac{1}{2}$ if there is one potential buyer and $\frac{2-\delta}{4-3\delta}$ if there are two potential buyers.

If $B = 1$, then the seller's expected Stage 2 payoff $s(1)$ is $\frac{\lambda}{2}$, as the seller receives nothing if she encounters no potential buyers. If $B = 2$, the seller's expected Stage 2 payoff $s(2)$ is $\lambda(1-\lambda) + \frac{\lambda^2(2-\delta)}{4-3\delta}$. The intermediary's Stage 2 payoff is given by $p(B)$. Given the Nash bargaining in Stage 1, the wholesale price $wp(B) = s(B) + \frac{(p(B)-s(B))}{2}$, and the seller will always sell to the intermediary. Given these findings, the wholesale price, retail price and intermediary margin are given by

$$wp(B) = \begin{cases} \frac{\lambda+1}{4} \text{ if } B = 1 \\ \frac{1}{2}\left(\frac{2-\delta}{4-3\delta} + \lambda - 2\lambda^2\left(\frac{1-\delta}{4-3\delta}\right)\right) \text{ if } B = 2 \end{cases}$$

$$rp(B) = \begin{cases} \frac{1}{2} \text{ if } B = 1 \\ \frac{2-\delta}{4-3\delta} \text{ if } B = 2 \end{cases}$$

$$margin(B) = \begin{cases} \frac{1-\lambda}{2} \text{ if } B = 1 \\ \frac{1}{2}\left(1 - \frac{\lambda(4-3\delta)}{2-\delta} + \frac{2\lambda^2(1-\delta)}{2-\delta}\right) \text{ if } B = 2 \end{cases}$$

The fact that $wp(2) > wp(1)$ follows from $\frac{1}{2} \in \left(\frac{(1-\delta)}{4-3\delta}, \frac{(2-\delta)}{4-3\delta}\right)$, and $rp(2) > rp(1)$ follows similarly, which demonstrates Prediction 1. If $\lambda = 0$, then $margin(1) = \frac{1}{2} = margin(2)$. If $\lambda \in (0,1)$, then $margin(2) < margin(1)$ follows from $\lambda > \lambda^2$ and $\frac{(1-\delta)}{(2-\delta)} > 0$. That demonstrates Prediction 2.

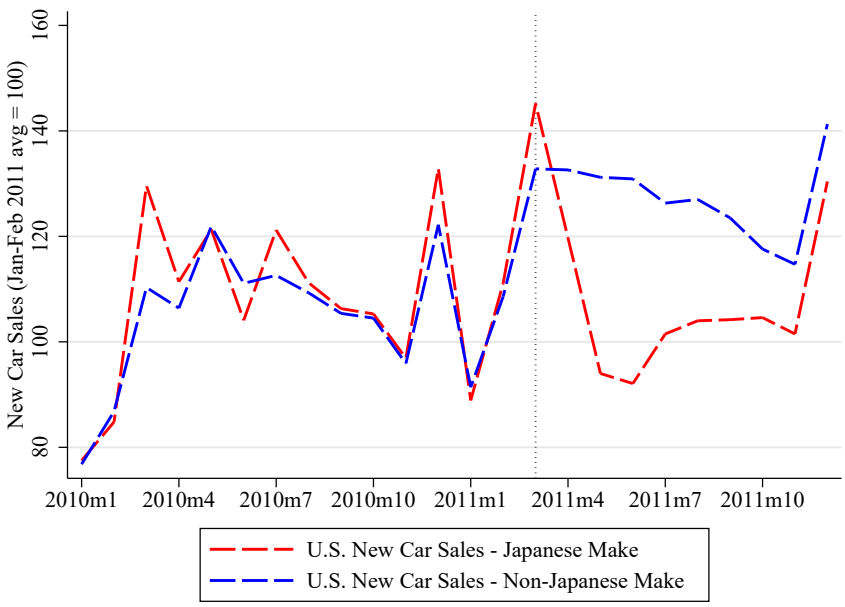

Figure IA.1

This figure reports monthly new car sales volume from January 2010 to December 2011, scaled so that January 2010 (=100). The red (blue) dashed line represents of new vehicle sales of Japanese (non-Japanese) manufacturers. The black dotted line represents the tsuanmi event in March 2011. Sources: Automotive News, Crain Communications

Table IA.1

Change in automotive production by country. Column 1 reports the change in production for 2011 relative to the 2010 rate. Column 2 reports the change in global market share of each country from 2010 to 2011. Source: Automotive News, Crain Communications

	(1)	(2)
China	4.2%	+1.3%
Japan	-13.9%	-16.2%
Germany	5.8%	+2.8%
South Korea	9.2%	+6.2%
India	7.4%	+4.4%
USA	9.0%	+6.0%
Rest of World	5.2%	+2.3%

Table IA.2

Difference in Customer Characteristics for Japanese- and non-Japanese-manufactured vehicles

The dependent variable are customer characteristics including log monthly gross income (col 1), credit score (col 2), prior chapter 7 bankruptcy (col 3), an indicator variable (=1) for homeownership (col 4), vehicle mileage (col 5), and an indicator variable(=1) for whether the vehicle had been discontinued at the time of sale (col 6). *Japan* is an indicator equal to one if the vehicle was manufactured by Toyota, Nissan, Lexus, Infiniti, Subaru, Honda, Scion, Mazda, Mitsubishi, Suzuki, Acura, or Isuzu. Tsunami is defined as one if the date of sale falls within March 15–Sept 15, 2011, and zero otherwise. Standard errors are clustered by vehicle make and dealership. T-statistics are shown in parentheses below the coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dep Var:	Income	Credit Score	Bankruptcy	Homeowner	Mileage	Discontinuation
Japanese Car * Tsunami	0.0094	0.31	0.0043	-0.0019	0.044	-0.037
	(1.08)	(0.25)	(0.42)	(-0.22)	(0.97)	(-1.06)
Tsunami	0.026**	-1.08	0.014	-0.019	0.049	0.0050
	(2.09)	(-0.38)	(0.71)	(-1.60)	(0.73)	(0.32)
Adjusted R^2	0.127	0.059	0.223	0.039	0.227	0.732
Vehicle_Model	YES	YES	YES	YES	YES	YES
Dealership	YES	YES	YES	YES	YES	YES
Month	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
MonthXYear	YES	YES	YES	YES	YES	YES
JapanTrend	YES	YES	YES	YES	YES	YES
MonthXJapan	YES	YES	YES	YES	YES	YES
Observations	58728	57338	58728	58728	58728	58728