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An Economic Assessment of Trade-In Value Reduction Caused by Preventing Auto Dealers from Selling Passenger Vehicles with any Open Recall

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J.D. Power & Associates: A study commissioned by National Automobile Dealers Association

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Executive Summary

An Economic Assessment of Trade-In Value Reduction Caused by Preventing Auto Dealers from Selling Passenger Vehicles with any Open Recall

Project

The "Used Car Safety Recall Repair Act," proposed by Senator Richard Blumenthal (D – Conn.), would require auto dealers to fix outstanding safety recalls before selling or leasing a used passenger motor vehicle. The result of this legislation would be the removal of all vehicles subject to a safety recall from the commercial marketplace from the time dealerships receive notice of a safety recall until the recall is remedied.

This analysis will estimate a subset of impacts of this legislation: the impact to trade-in value if a consumer were to attempt to trade in a vehicle to a dealership under the hypothetical assumption that the dealer was restricted from reselling the vehicle, either at retail or at wholesale, until the recall is fixed. This is compared to the current situation where there is no resale restriction. This analysis does not attempt to quantify or describe other potential impacts, such as repair completion rates, customer experience, or overall vehicle safety.

Methodology

We estimate the reduction in trade-in value as follows. First, the NHTSA recall database is organized and filtered to gather all of the recalls available for analysis. These include recalls for light duty vehicles, where the vehicle involved is listed, and there is a reliable match between the model name and our list of standard vehicle descriptions. Summarized by the volume of vehicles affected by each recall, approximately 10% of recalls were omitted from the analysis. Secondly, the underlying costs franchised dealers face for holding vehicles in general are estimated, including the cost of financing the purchase (from the consumer) of the vehicle, the cost of storing the vehicle, the cost of insuring the vehicle, and the depreciation cost, each over a given month.

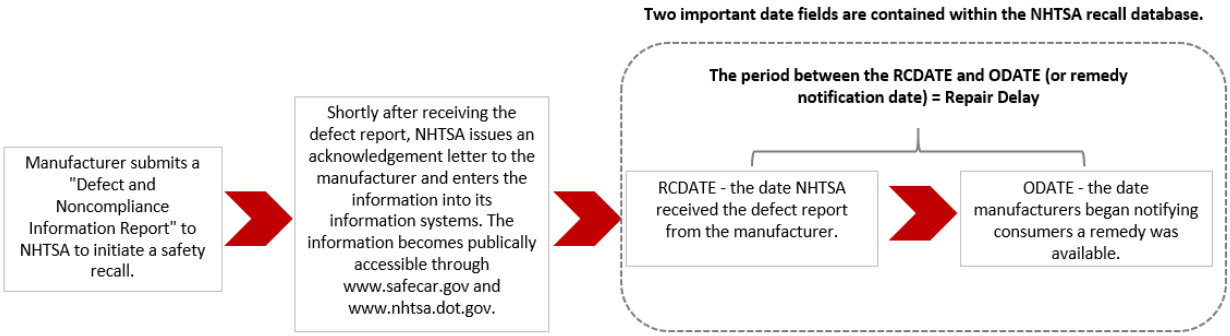
One key source for the cost estimates used in this analysis are franchised dealers and as such the overall estimates are generally tied to the costs this subset of dealers face. It should be noted that independent

dealers will likely face higher costs due to the fact that they are unable to perform recall repairs in-house. As such, consumers will likely face a larger reduction in trade-in value within the independent dealer market.

The dealer-sourced cost estimates were derived from a survey conducted among franchised dealers. Approximately 800 dealer representatives responded to the survey and gave information about the different costs incurred by purchasing a trade-in vehicle that is subject to a recall, under the hypothetical scenario that the vehicle must be held until the recall is addressed. These expected costs included shipping a vehicle to an authorized dealership in cases where it is bought by an out-of-brand dealer (e.g., a Ford trade-in to a Honda dealer) and storing and insuring the vehicle while it is waiting for the repair. These costs also included degradation to the quality of vehicles that were forced to sit on dealer lots waiting for repairs.

Two other significant cost estimates were estimated independent of the survey responses. Depreciation cost was estimated directly from auction sale transactions, holding mileage constant. Depreciation cost estimates pertain to the specific vehicles included in each recall. The cost of the capital used to purchase the trade-in from the consumer was estimated as the prime-rate average over the last ten years, or 4.51%. This type of financing is known as "floor planning" and varies significantly by dealer and over time and is also influenced by special manufacturer programs. Additionally, floor planning for used vehicles is typically more expensive than new car floor planning. These are the reasons for using the long term, more stable estimate of the cost of money based on the prime rate.

Thirdly, we calculate the timeframe of the repair delay for a given recall. Every qualifying recall (see above) in the NHTSA database with a received date starting in 2010 and ending with 2014 was used for this analysis, and for each of these the recall delay was defined as the difference between the RCDATE and the ODATE in the NHTSA database, which, as shown below, is the time difference between the date the recall was submitted to NHTSA by the manufacturer and the date when owners are notified that the remedy exists and parts are available at dealerships.



Lastly we apply the estimated costs to this timeframe. The equation behind the estimated trade-in value impact is as follows:

$$Trade - in\ Value\ Change = \left(\frac{RD(FR \times BegVal) + RD(DR \times BegVal) + RD(SI)}{2}\right) + SH$$

Where
RD = the repair delay period in days
FR = the daily interest rate to finance trade-in vehicle purchases
BegVal = the value of the given model at auction at the time the recall was received
DR = the daily depreciation rate
SI = the daily storage and insurance cost
SH = shipping costs (not applied to in-brand trade-ins)

Findings

For the vehicles studied in this analysis for recalls initiated in 2014,[1] the average trade-in value reduction was $1,210 resulting in an aggregated trade-in value reduction of $1.078 billion. This does not include trade-ins to independent dealers, and it does not include the impact of the approximately 11% of the 2014 recalled vehicles not included in the analysis.

The average trade-in value reduction was similar for the other years analyzed, ranging from $875 for recalls received in 2010 to $1,309 for recalls received in 2013. However, the number of vehicles impacted was significantly less for these years, ranging from a low of approximately 109,000 for recalls received in 2011 to a high of approximately 350,000 for recalls received in 2013.

The figures above represent the weighted average for both in-brand trade-ins (a Honda traded to a Honda dealer) and out-of-brand trade-ins (a Honda traded to a Ford dealer). However, the costs are higher for out-of-brand trade-ins because out-of-brand dealers incur additional costs when holding the vehicle during the repair delay and when transporting the vehicle to an in-brand dealer for repair. For recalls listed in 2010 (the low end of the range), the average in-brand cost was $596 while the out-of-brand cost was $992. For recalls listed in 2013 (the high end of the range), the average in-brand cost was $991 while the out-of-brand cost was $1,432.

The previous figures reflect averages; however the range of impacts on trade-in value for individual models is significant. For example, for recalls with repair delays longer than 90 days, the range of expected individual reductions in trade-in value as a result of these repair delays was $393 to $5,290 for in-brand dealers and $792 to $5,713 for out-of-brand dealers. Recalls with repair delays longer than 90 days represent approximately 69% of all recalled vehicles traded-in during a repair delay period.

[1] There were approximately 900,000 such vehicles. This number was derived as follows: This analysis included 197 recall campaigns initiated during 2014. (These 197 recall campaigns represent approximately 89% of the vehicles affected by all recall campaigns initiated in that year. And this percentage is similar for the other years covered in the analysis (2010-2013).) For the vehicles addressed in these 197 campaigns, approximately 900,000 were traded-in while subject to a repair delay.

These estimates cover a subset of the potential impacts of the proposed legislation. The primary factor that could lead to larger reductions in trade-in value is risk aversion on the part of dealers where dealers discount more based on the uncertainty of when a vehicle can be repaired. Specifically, the repair delays used in our estimates are known, but the repair delays in the future will not be known at the time the vehicle is brought to a dealership to trade in. Because of this, assuming a repair delay that is shorter than the actual repair delay is a risky proposition for a dealer, and thus they are more likely to act as if they believe the range of repair delays will be on the high end of the range of repair delays observed in the past for recalls of similar scale and complexity. In a hypothetical scenario, a lack of clear information could reduce the trade-in value offered to a consumer by hundreds of dollars if a trade-in manager were to overestimate a 30-day recall delay by an additional 30 days.

The primary factor that could lead to smaller reductions in trade-in value as a result of the proposed legislation is that, to an unknown extent, some dealers already voluntarily restrict the sale of vehicles under an open safety recall. To the extent that this is already happening, a portion of the aggregate trade-in value reduction we estimate is already occurring; however, the average financial impact would be unchanged.

Specific references are made in the main document to recalls under the scenarios listing above.

Introduction

The "Used Car Safety Recall Repair Act" proposed by Senator Richard Blumenthal (D – Conn.) (the "Legislation") would preclude auto dealers from selling or leasing at retail or wholesale all used passenger vehicles subject to a recall from the time of the formal issuance of the recall until the required repairs are completed. Currently, dealers can choose whether to sell a vehicle under an open recall and, if selling, decide whether to disclose the existence of the recall. Each potential buyer (dealer or consumer) currently has access to recall information but may or may not gather it and, if gathered, may or may not use it to exclude vehicles under open safety recall from their list of potential purchases and/or may or may not use it in the negotiating process. If enacted, the proposed Legislation would remove this decision from buyers and sellers and make all vehicles unsalable in the commercial market (wholesale and retail) until the recall repair is made. However, the Legislation would not prevent the sale of used vehicles with incomplete recalls in consumer-to-consumer sales. In this report, references to "sell" or "sale" include sales or leases in the retail and wholesale markets, unless specific references are made to private, consumer sales.

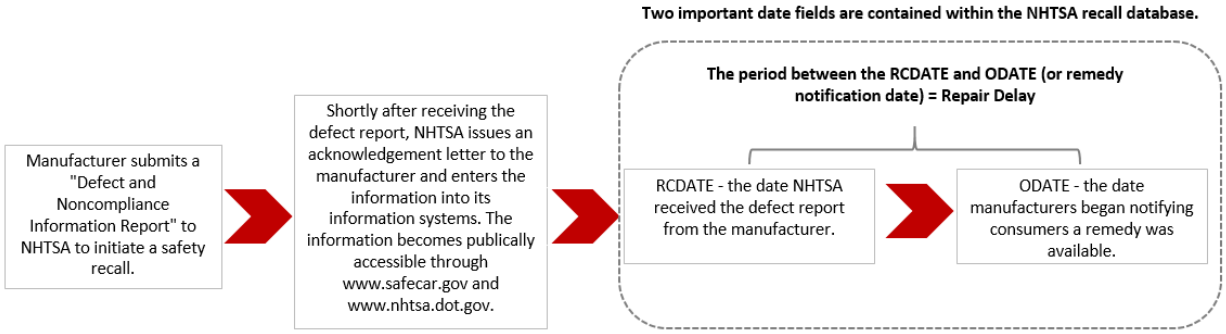
The exact timing required by the Legislation is unclear; this analysis assumes that the Legislation would restrict the sale of any vehicle where the dealer has notice of an un-repaired safety recall. In other words, once a VIN appears as having an open recall in the recall database maintained by the National Highway Traffic Safety Administration ("NHTSA"), the dealer would have constructive notice to ground the vehicle.

The theoretical impacts of the Legislation can be expressed in a few broad categories. Removing all vehicles under an open recall from the commercial marketplace would have an adverse impact on the value of these vehicles. Moreover, the removal of all recalled vehicles from the commercial marketplace would restrict the supply of vehicles in general and potentially increase prices for other vehicles. Lastly, the Legislation may increase or decrease recall completion rates and thus impact overall vehicle safety. It may increase this rate by forcing all dealers to repair vehicles prior to selling them. It may also decrease the rate by deterring dealers from acquiring certain vehicles, thereby incenting consumers to sell them to other private parties who are less likely to get them remedied. This analysis is concerned with the first of these potential impacts – the potential reduction in the value of these vehicles – and does not attempt to quantify or describe the other potential impacts, including the impact to repair completion rates, service revenue, customer experience, or overall vehicle safety.

When an automobile recall is announced, in most cases there is some delay before the repairs are available. There are many reasons for this delay, but nearly all are related to the design, production and distribution of the parts required. The franchised dealers who sell the brand of vehicle subject to the recall are authorized to, and routinely do, perform the repairs as soon as the manufacturer has provided the remedy. In some cases the delay is minor – a few days – but in other cases the delay is longer than 12 months. Frequently, neither the franchised dealers nor the vehicle owners themselves have a clear timeline of the length of the delay period. Throughout this document this delay will be called a "repair delay," and is defined as the time between the recall submission date (recorded as RCDATE in NHTSA's

database) and the date the owner is notified that the remedy and parts are available at a dealership (recorded as ODATE in NHTSA's database and referred to as the "remedy notification date" throughout this document). This timeline is graphically set out in Figure A.[2] Anecdotal information based on calls with several franchised dealers suggests repair delays may exceed the window analyzed in this study, especially with recalls involving a high volume of vehicles or complex replacement part requirements.

Figure A



This analysis will estimate the subset of impacts to a consumer's vehicle trade-in value if a consumer were to attempt to trade in a vehicle to a dealership under the hypothetical assumption that the Legislation were enacted and dealers were restricted from reselling the vehicle until the relevant repair is made. These impacts are then compared to the current situation where dealers are not restricted by law from reselling the vehicle. We are using as a proxy for these hypothetical future situations actual recalls from the 5 years of 2010-2014, with the repair delay (see above) recorded and the number of vehicles involved already known. As discussed later, the number of recalls is generally increasing over time and, as a result, this proxy is more likely to underestimate than overestimate the number of vehicles impacted by recalls in the future.

To these actual recalls we are applying estimated costs to account for the hypothetical no-sale restrictions throughout the known repair delays and using the result as the estimate of potential costs in the future under the proposed Legislation.

Additionally, we provide information from surveys of franchised and independent dealers as well as a review of relevant literature. This information helps the reader understand the market effects of the Legislation, specifically the adverse impact on trade-in values. In addition, this information gives a general understanding of some of the additional effects in the market, such as to what extent dealers are already restricting the sale of vehicles under an open recall and how dealers are likely to form expectations of unknown repair delay costs based on prior history of known repair delays.

[2] A third date, called DATEA, is also contained in NHTSA's recall database. This date denotes when NHTSA created the recall event in its database. The difference between RCDATE, or the date NHTSA received the defect report from the manufacturer, and DATEA is 1 day or less in 82% of recall campaigns and 1 week or less in 95% of recall campaigns. RCDATE was chosen because in some cases dealers are notified of the recall as early as the RCDATE.

Each year approximately 10 million vehicles are traded in to franchised dealers. In virtually all of these transactions, the trade-in manager at the dealership (using a combination of electronic analytic tools and physical inspections) must efficiently answer many of the following questions: What is the current wholesale and retail value of a similar used car of the same year, make and model? What is the market trend for this type of vehicle based on regional demand or other factors such as the trending price of gasoline? In general, does this brand or model typically hold or lose value due to perceived quality? What is the prior condition and use of the specific vehicle due to odometer reading, damage, etc.? Based on projected local demand, how long will this vehicle remain in inventory for retail sale? If necessary to mitigate losses associated with aged inventory by selling to a wholesale auction, what is the projected wholesale value in 60 or 90 days? What are the likely repair costs necessary to prepare this specific vehicle for retail sale? What is the likely wholesale value for disposing of the vehicle immediately to an auction?

After assessing the vehicle, the dealer decides how much of a "trade-in allowance" to offer the consumer. This trade-in allowance is usually an important part of overall transaction because, typically, the consumer uses the trade-in allowance to fund a down payment to finance a new car. The dealer's primary reference point in this bargaining process is the projected wholesale value of the vehicle at the time the dealer expects to resell the vehicle less the projected interim holding costs. The primary assumption in this analysis is that a dealer would reduce a trade-in allowance to reflect the costs associated with grounding a recalled vehicle pending repair. The existing procedure for valuing trade-ins at virtually every franchised and independent dealer in America is likely to be revised almost immediately to reflect the additional risks and costs mandated by the Legislation. Therefore, consumers are likely to feel the adverse consequences of the Legislation very soon after it takes effect.

Two important qualifications are needed. First, in the current marketplace some unknown percentage of dealers voluntarily restrict the resale of used inventory subject to an open safety recall. The aggregate trade-in value reduction discussed in this analysis is already occurring for this group of dealers and therefore an incremental value reduction would not be caused by the Legislation. This analysis does not attempt to estimate to what extent this process is already happening. Second, although the recall delay is defined as the time difference between the date the recall is recorded and the date when owners are notified that a fix is available, some portion of vehicles covered under the recall may have already been repaired because the dealership either had advance information of the recall or had performed other services that eliminated the issue before the recall campaign was even initiated. While we are not able to provide a specific estimate of the portion of vehicles repaired in this way, because it involves repairs made outside of the standard method of owner notification, it is unlikely to be a significant portion of the total.

Our analysis is presented as follows: First, we provide an overview of recalls. Second, the methodology used to estimate trade-in value reduction is described. Third we discuss our surveys of dealers and discuss the relevant literature. Fourth, we provide the specific trade-in value reduction estimates for three categories of recalls with examples for each category. These categories are those with repair

delays of more than 90 days, those with repair delays of 45 to 90 days, and those with repair delays of less than 45 days. We conclude with a summary of our findings.

Overview of Automobile Recalls

In the mid-1960s, mounting pressure occurred to increase vehicle safety, leading to the creation of the Department of Transportation (DOT) in 1966. By March 1967, the first Federal Motor Vehicle Safety Standard (FMVSS) was promulgated and NHTSA has been enforcing these standards largely through recall campaigns since it was created as an agency of the DOT in 1970. It appears in the graphs below (Figures B and C) that the number and scope of recalls have slowly been growing over time. Importantly, there has been a marked increase in the number of recalls since 2013, both in terms of distinct number of recalls and overall number of vehicles impacted.

Figure B

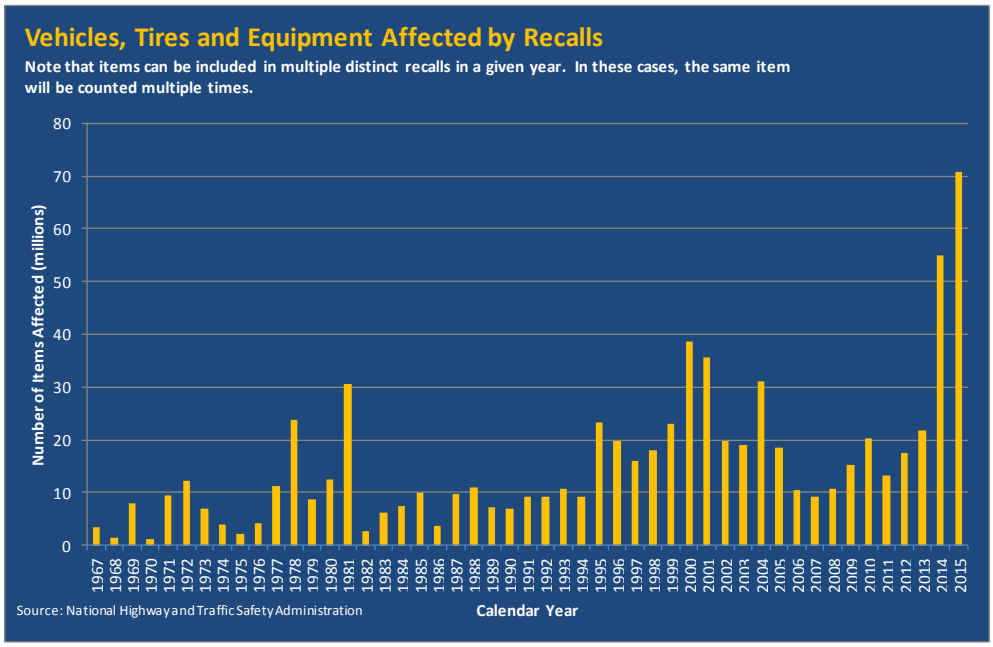
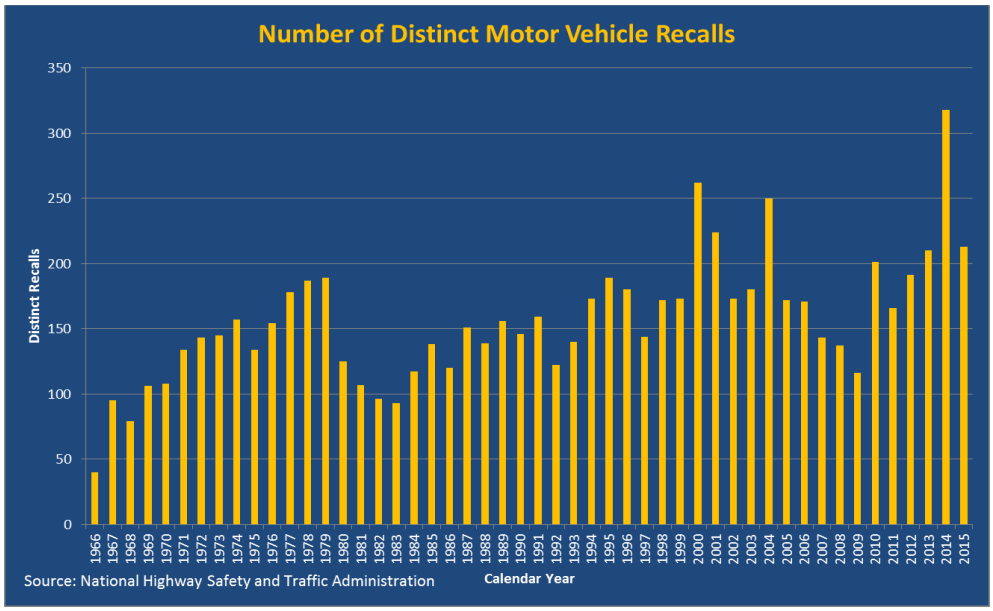


Figure C



During 2010-2014, the average number of days that recall remedy parts were delayed is about 60. However, this is not necessarily close to the typical amount of time that consumers would normally expect to wait on parts to get their vehicles repaired, as the recall campaigns facing repair delays of over six months skews the distribution. The median repair delay was about 42 days. The skewed distribution in repair delays notwithstanding, the repair delays are highly variable among different recall campaigns. The maximum observed number of days for a repair delay is 704, while seven recall campaigns had no repair delay. This variability allows for a suitable sample with which to conduct the analysis of the effect on costs.

There is also a wide variety in number of vehicles potentially impacted by the recalls in the sample. For example, almost 5.9 million vehicles were affected by the series of General Motors ignition switch recalls. On the other end of the volume spectrum, the smallest recall put under analysis involved just 256 vehicles.

The seriousness of potential safety consequences of the recalled vehicles also varies substantially. There are 171 distinct issues associated with the 652 recall campaigns analyzed, with highly varying levels of severity. These recalls range from defects with only minor consequences and a highly improbable likelihood of occurring, to serious missteps in which deaths directly resulted. The wide variety in types and consequences of recalls also results in an assortment of reasons for, and lengths of, part delays. These include the volume of parts needed, manufacturer preparedness, obsolescence, complexity and uniqueness of the part, supplier constraints, and the age of the vehicle affected and parts needed.

Historical Impact of Recalls on Used Vehicle Prices

Several characteristics predict whether there will be an impact on used vehicle prices. The first is the severity, because severe recalls typically receive greater media attention that could diminish consumer opinions of the vehicles mentioned. Existing brand reputation and the age of the recalled vehicles also play an important role. This is documented extensively in a paper titled "The Impact of Vehicle Recalls on the Automotive Market," which was written by the NADA Used Car Guide in June 2014.

Brands with reputations for reliable products have the most to lose when new information comes to light that creates consumer doubt. For example, the Toyota accelerator pedal recalls of 2009-2010 and the General Motors ignition switch recalls of 2014 were similar in terms of severity. However, because Toyota had built up more of a reputation for reliability, it saw its brand premium in the used wholesale market fall from 40% over those of direct competitors before the recalls to 20% by April 2010. This brand premium is determined from average wholesale prices relative to the competition. Because General Motors had not built as much of a reputation for reliability as Toyota and because the recalled vehicles were older in general, the impact on sales of GM vehicles was not as drastic.

Severe recalls that receive significant amounts of media attention also are more likely to adversely affect used vehicle prices for that brand.[3] The heavily covered Firestone tire recall on Ford SUVs and the previously mentioned 2009-2010 Toyota accelerator pedal recalls were associated with significant price declines for these brands in comparison to their competition. Under much less severe recalls, the grounding of vehicles may result in price declines that otherwise likely would not have been observed, possibly impacting trade-in decisions of both consumers and dealers. Furthermore, with the possibility of an increased perception of vehicle inferiority as a result of grounding, even vehicles that have already been repaired may exhibit diminished demand in some cases.

These examples illustrate that, although there are factors that are useful in predicting the likelihood of a significant market response to a recall, there is often still a good deal of uncertainty surrounding this topic. For example, although General Motors did not have the same reputation for reliability as Toyota, it is surprising that there was not as noticeable of a market response given the size, media attention, and severity of these recalls. However, the severity, media attention, age of the recalled vehicles, and brand reputation are likely to be very informative in most cases.

Methodology

The analysis first involves organizing and filtering the NHTSA recall database to gather a subset of recalls which qualify for the analysis, meaning that the record gives clear information as to the vehicles involved and these vehicles are also found in a J.D. Power database containing related information, such as the quantity of trade-ins. Specifically, to qualify a recall must involve a light duty vehicle. This excludes heavy duty trucks, trailers, construction equipment, and other non-passenger vehicles. Also,

[3] NADA Used Car Guide, *The Impact of Vehicle Recalls on the Automotive Market*, 3rd Quarter 2014

the recall must involve the vehicle itself, and not an aftermarket accessory, baby seat, or tire(s). The recall must have an owner remedy notification date listed (ODATE) and, lastly, the recall must be listed with a model name that can be matched to a vehicle in our vehicle list. Examples of recalls that are excluded because of this are recalls with an unknown model year, recalls with a model name referencing the part involved, and recalls with a model name that is ambiguous as it relates to the mapping. Key examples of this latter issue include cases of the F150, Sierra, Silverado, and Ram full-size trucks, which are often listed with model names that do not facilitate definitive matching to vehicles in our vehicle list. In cases where the matching is ambiguous, the recall record was excluded as omission was considered preferable to an incorrect match.

Figure D gives the counts of the recalls included in the analysis organized by the year in which the recall was received by NHTSA (RCDATE). For example, in 2014, there were 305 unique campaigns (see column A) listed after all campaigns for accessories, tires, construction equipment, trailers, etc. were removed. Of these, 263 were listed with specific light duty model names (see column B). Of these, 197 were listed with model names with a definitive match to a vehicle in our vehicle list (see column C), and this amounted to 65% of the unique campaigns (see column D). These 197 campaigns were included in the analysis.

Figure D

Summary of Light-Duty Vehicle Recalls Listed in the NHTSA Database - Number of Unique Campaigns				
Recall Received Year	(A) Number of Unique Campaigns	(B) Sub-Total: Number of Campaigns Listed with Specfic Vehicles	(C) Sub-Total: Number of Campaigns Analyzed	(D = C/A) Number Analyzed as a Percentage of the Total
2010	191	144	119	62%
2011	166	121	103	62%
2012	173	135	111	64%
2013	201	160	122	61%
2014	305	263	197	65%

Figure E gives the same information, but summarizes it in terms of the volume of vehicles involved (described as “potaff” in NHTSA’s recall database, or potentially affected units). For example, the 305 unique campaigns references above involved slightly more than 54 million units (see column A) and, of these, 52.3 million were specific vehicles (see column B) and, of these, 48.2 million or 89% (see columns C and D) were listed with model names with a definitive match and were included in the analysis. These figures are based on the sum of the potentially affected units totals for each campaign and include many cases where the same vehicle is part of two or more campaigns in a given year. For example, based on the percentage of the total trade-in vehicle population in 2014 that was subject to a recall, approximately 38 million vehicles were involved in campaigns initiated in 2014 (compared to the 48 million given below).

Figure E

Summary of Light-Duty Vehicle Recalls Listed in the NHTSA Database - Number of Unique Campaigns				
Recall Received Year	(A) Total Number of Potentially Affected Units	(B) Sub-Total: Number of Potentially Affected Units for Campaigns Listed with Specific Vehicles	(C) Sub-Total: Number of Potentially Affected Units for Campaigns Analyzed	(D = C/A) Potentially Affected Units for Analyzed Campaigns as a Percentage of the Total
2010	20,556,252	18,857,494	18,643,662	91%
2011	13,042,826	12,898,072	12,526,348	96%
2012	16,282,909	15,944,073	15,325,096	94%
2013	20,331,665	19,845,543	18,493,534	91%
2014	54,049,291	52,332,846	48,232,886	89%

The next analysis step is the estimation of the reduction in trade-in values that are expected to result from mandatory holding of trade-ins during a repair delay. We estimate the reduction in trade-in value as follows: First, the underlying costs franchised dealers face for holding vehicles in general are estimated, including the monthly costs of financing the purchase (from the consumer) of the vehicle, the cost of storing the vehicle, the cost of insuring the vehicle, and the depreciation cost. Second, we calculate the timeframe of the repair delay for a given recall, and lastly we apply the estimated costs to this timeframe.

Frequently the trade-in manager at a dealership cannot quantify these costs and/or the repair delay timeframe. Thus, due to the lack of clear information, dealers may be risk averse when determining the reduction in the trade-in offer for a vehicle subject to a recall, assuming that the vehicle is grounded pursuant to the Legislation. In a hypothetical scenario, a lack of clear information could reduce the trade-in value offered to a consumer by hundreds of dollars if a trade-in manager were to overestimate a 30-day recall delay by an additional 30 days.

The estimates contained in this analysis are the theoretical discounts a dealer should apply to a trade-in if the used car appraiser is perfectly rational, has full knowledge of internal costs, and has perfect information about the expected delay in remedying the recall. In reality, not all dealers will be willing or able to formally assess the discount necessary to account for all recall related costs. Further, a dealer may not have perfect information about the time needed to remedy the recall, and the extent to which dealers underestimate or overestimate these delays is unknown. However, it is reasonable to assume that shortly after the enactment of the Legislation, dealers would quickly become aware of the restrictions and begin to reduce trade-in offers. In addition, due to the widespread use of electronic pricing tools by dealership personnel, it is reasonable to expect that such tools will be upgraded to reflect the Legislation, providing the dealer an “automatic” assessment of the likely costs associated with unresolved recalls.

Cost Estimates

The primary sources for cost estimates used in this analysis are franchised dealers and, as such, the overall estimates are generally tied to the costs this subset of dealers face. It should be noted that independent dealers will likely face higher costs due to the fact that they are unable to perform recall

repairs in-house. As such, consumers will likely face a larger reduction in trade-in value within the independent dealer market.

Cost estimates were derived from the franchised dealer survey that is discussed in more detail later in this document. Approximately 800 dealer representatives responded to the survey and gave information about the different costs incurred by purchasing a trade-in vehicle that is subject to a recall, under the hypothetical scenario that the vehicle must be held until the recall is addressed. These expected costs included shipping a vehicle to an authorized dealership in cases where it is bought by an out-of-brand dealer (e.g., a Ford trade-in to a Honda dealer) and storing and insuring the vehicle while it is waiting for the repair. These costs also included degradation to the quality of vehicles that were forced to sit on dealer lots waiting for repairs. The survey responses were cleaned to remove invalid entries and averages were taken, amounting to average costs of $331 for shipping and $235 per unit per month for storage, vehicle quality deterioration, and insurance.

Two cost estimates were estimated independent of the survey responses. Depreciation cost was estimated directly from auction sale transactions, holding mileage constant. Depreciation cost estimates pertain to the specific vehicles included in each recall. The cost of the capital used to purchase the trade-in from the consumer was estimated as the prime-rate average over the last ten years, or 4.51%. This type of financing is known as "floor planning" and varies significantly by dealer and over time and is also influenced by special manufacturer programs. Additionally, floor planning for used vehicles is typically more expensive than new car floor planning. These are the reasons for using the long term, more stable estimate of the cost of money based on the prime rate.

Repair Delay Estimates

The NHTSA recall database was used extensively in this analysis, as it gives the most comprehensive and reliable account of each recall campaign. Some of the most useful information includes the number and specific types of vehicles potentially impacted in a recall campaign, the specific safety problems associated with each recall, the official date on which a recall began, and the date owners were notified a remedy was available. The database was restricted to all recalls referencing specific vehicles recorded in 2010 – 2015. The number of days between the recall date (RCDATE) and the official owner remedy notification date (ODATE) was then used to determine the number of days of the repair delay. This study focuses on the specific window of time defined by the RCDATE and ODATE, and does not include anecdotal estimates of repair delays caused by a shortage of parts, service scheduling inability, or other factors that may cause further delays. Conversations with dealers suggested that high volume recalls such as the GM ignition switch recall or the Takata airbag recall could cause an additional 30 to 60 day repair delay beyond the owner remedy notification date.

Cost and Trade-in Value Reduction Estimates

As discussed earlier, we use recalls with known repair delays as a proxy for future trade-in value reductions. The associated cost of holding vehicles through the repair delay is used as the estimate of the trade-in value reduction. As described in connection with Figures D and E, above, every qualifying

recall in the NHTSA database starting in 2010 and ending with 2014 was used for this analysis, and for each of these, the repair delay was estimated and when possible the recall was mapped to wholesale auction transactions to determine the value of the vehicle at the beginning of the recall and to retail transactions to determine the quantity of vehicles traded-in to franchised dealers during the repair delay time period.

The following equation was used to calculate the trade-in value change for each individual model included in the recall. Note the total is divided by two. This is because we assume that between the start and end of the repair delay period, a steady flow of trade-in units will come to the dealership and face a trade-in value reduction based on a delay from that point to the end of the delay. On average, the delay faced by each vehicle will be half of the total delay. Totals were then calculated as the auction volume weighted averages of the values for all of the models included in the recall.

$$Trade\text{–}in\ Value\ Change = \left(\frac{RD(FR \times BegVal) + RD(DR \times BegVal) + RD(SI)}{2}\right) + SH$$

Where

RD = the repair delay period in days
FR = the daily interest rate to finance trade-in vehicle purchases
BegVal = the value of the given model at auction at the time the recall was received
DR = the daily depreciation rate
SI = the daily storage and insurance cost
SH = shipping costs (not applied to in-brand trade-ins)

Franchised and Independent Dealer Survey Results

Franchised Dealer Survey

Franchised automobile dealers were surveyed to assess current recall repair processes and costs associated with vehicle storage and insurance, as well as logistical expenses associated with moving a vehicle with an open recall to an authorized dealer for repairs. Nearly 800 franchised dealers from 47 states participated in the franchised dealer survey.

Specific to the franchised dealer survey, results provided the estimated costs and time delays included in this analysis and resulted in an estimated cost for logistical expenses — transportation, arranging service, etc. — to be $235 and the additional time delay, beyond the repair delay, to be approximately 12.3 days. This was confirmed in a conversation with a high volume dealer in a metropolitan area who stated that transportation requires hiring two personnel for 4-6 business hours. Time delays for out-of-brand recall repairs were also a concern based on conversations with dealers, since most dealers agree that servicing a competitor's dealer trade-in recall repairs would likely have to wait until after the dealer's primary customers are serviced.

Independent Dealer Survey

A separate survey of independent auto dealers containing similar questions was also conducted. A total of 200 dealers participated in the independent dealer survey. While independent dealer expenses were not included in the scope of this analysis, answers provide insight into how the non-franchised dealer community would respond to the Legislation, particularly since only franchised dealers are authorized to handle recalls. The survey showed expenses and risk aversion are likely higher than the estimates and conclusions for franchised dealers.

Overview of Related Literature and Economic Topics

The costs of the Legislation can be analyzed directly by using the framework presented. However, delving a bit into economic literature and theory can help provide context and additional channels through which both the new and used vehicle markets can be impacted.

Although recalls have the potential to significantly impact commerce, the volume of academic literature devoted to the subject is relatively small. However, existing research suggests that the impact of automotive recalls on consumer decisions is not negligible. Several suggestions are made in the empirical research conducted by George Hoffer and Robert Reilly of Virginia Commonwealth University and Stephen Pruitt of Memphis State University.[4] One assertion is that severe safety-related recalls negatively impact post-remedy new car sales growth of the previously recalled vehicles.

The main focus of their paper centers on the determinants of owner compliance with a recall. Their econometric models provide evidence that compliance rates are relatively low for owners of older model cars, foreign makes, and vehicles with safety problems that are perceived as less severe. It is natural to believe that the Legislation is likely to cause substantial issues for dealers and consumers as they seek to buy these vehicles, as the owners of these types of vehicles are more likely to neglect the recall notice.

The purchase of a vehicle under recall would impose financial risks on dealers if the Legislation were to be enacted, especially if they are uncertain as to how long it will take for parts to become available. This information asymmetry between the dealership and the supplier or manufacturer can cause apprehension for the dealer. As a result, a used car manager at a dealership is more likely to discount a trade-in under an open recall. This discount is likely to be steeper the more uncertainty there is surrounding the length of the repair delay. Because of the costs imposed on dealers, a risk-averse dealer will likely tend to overestimate repair delay and by extension the costs associated, leading to further reductions in trade-in values. As the trade-in allowance is often a key consideration for many consumers, these lower allowances can result in failed, rather than mutually-beneficial, transactions.

[4] Hoffer, G., Pruitt, S., & Reilly, R. (1994). When Recalls Matter: Factors Affecting Owner Response to Automotive Recalls. *The Journal of Consumer Affairs, 28*(1), 96-106.

As discussed earlier in the paper, the survey conducted with franchised dealers provides additional evidence of a risk-averse reaction.

Opportunity cost is another factor, particularly lost profits for franchised dealers. This analysis estimates through a set of costs associated with holding additional inventory for a given amount of time. The impact of some of these costs, namely storage and insurance, could be alternately estimated by treating the held vehicles as regular inventory which is not available for sale and thus removes the space in inventory for units which would otherwise sell. In an example scenario, a dealer with a daily sales rate of two and a days-to-turn of 30 days for its used inventory would expect to sell 60 used vehicles in a single month. If 20% of the inventory is grounded due to safety recalls, 12 sales could potentially be foregone. If we assume, for example, that typical profits for these foregone sales are $2,000 / unit, the foregone profit due to holding some vehicles rather than selling others is $24,000. This expected reduction in profit levels could be expected to translate to a reduction in trade-in value for the associated vehicles.

Profile of Recall Repair Delays

The following sections give the estimated trade-in value reductions associated with recalls from 2010-2014 under the hypothetical scenario that dealers are required to hold these vehicles until the repair is completed. Figure F gives an overall summary by the year in which each recall was received. For example, we analyzed 103 campaigns that were recorded in 2011 (see column A; see also the methodology section detailing the selection of campaigns). Based on the specific repair delays for each of these campaigns, as measured by the time difference between the date the recall was received and the owner remedy notification date, the average (weighted by volume) trade-in value reduction was $1,132 (see column D). This applied to 108,848 vehicles (see column G). It does not include trade-ins to independent dealers. The total value of this reduction was $123 million (see column H).

The number of recalls increased significantly in 2014, where the average value reduction was $1,210 (see column D), applying to nearly 900,000 vehicles (see column G), giving a total value reduction of $1.078 billion (see column H). Again, this does not include trade-ins to independent dealers. To give some context, in 2014 there were approximately 11 million trade-ins to franchised dealers, and these amounted to a total value of approximately $100 billion. The total value of all new and used automobile retail sales transactions amongst franchised dealers for 2014 was approximately $400 billion.

Figure F

Estimated Trade-in Value Reduction								
Recall Received Year	(A) Number of Campaigns Analyzed	Average Value Reduction Due to Repair Delay			Quantity of Trade-Ins During the Delay Period*			(H) Total Value Reduction - in Millions
		(B) In-Brand Trade-Ins	(C) Out-of-Brand Trade-Ins	(D) All	(E) In-Brand Trade-Ins	(F) Out-of-Brand Trade-Ins	(G) All	
2010	119	$596	$992	$875	56,421	134,248	190,669	$167
2011	103	$831	$1,245	$1,132	29,717	79,131	108,848	$123
2012	111	$1,091	$1,328	$1,263	48,841	131,579	180,420	$228
2013	122	$991	$1,432	$1,309	96,177	247,384	343,561	$450
2014	197	$932	$1,315	$1,210	245,188	645,630	890,818	$1,078

*excludes trade-ins to independent dealers, excludes trade-ins for campaigns not analyzed.

The trade-in value reduction described above is necessarily a sub-total of the overall trade-in value reduction that would be expected, because not all recall campaigns were analyzed. Note that most but not all of the campaigns involving light-duty vehicles were included and the characteristics (the average reduction in trade-in value and the quantity of trade-ins during the delay period) of the omitted campaigns are not estimated in this analysis. However, we are able to estimate that approximately 90% of all relevant recalls are included (again see the methodology section for more information). Figures G, H, and I below are organized by the year of the trade-in, rather than the year in which the recall was received (as above), and this allows for a comparison of the trade-in volume represented in the above and the total. Note the reason for any difference in the volumes between Figure F and Figures G, H, and I are due to the timing of the repair delay – Figure F is organized by the year when the recall is recorded, and Figures G, H, and I are organized by the trade-in year. For example, Figure F will show volumes in the 2013 row for recalls that were received in 2013, but still had a repair delay in 2014.

Figure G

In-Brand and Out-of-Brand Trade-in Volume Summary (Franchised Dealers Only)					
Trade-in Year	(A) Total	(B) Sub-Total - Those Involved in a Recall Campaign	(B / A)	(C) Sub-Total - Those Involved in a Recall Campaign and Traded-in During the Repair Delay	(C / B)
2010	10,248,305	1,205,723	12%	276,652	23%
2011	10,160,539	1,395,430	14%	138,554	10%
2012	11,387,413	1,437,826	13%	159,188	11%
2013	12,451,767	1,576,221	13%	419,263	27%
2014	10,955,519	1,679,167	15%	744,057	44%

Figure H

In-Brand Trade-in Volume Summary (Franchised Dealers Only)					
Trade-in Year	(A) Total	(B) Sub-Total - Those Involved in a Recall Campaign	(B / A)	(C) Sub-Total - Those Involved in a Recall Campaign and Traded-in During the Repair Delay	(C / B)
2010	3,032,583	356,786	12%	81,864	23%
2011	2,773,967	380,972	14%	37,827	10%
2012	3,082,655	389,230	13%	43,093	11%
2013	3,485,767	441,250	13%	117,369	27%
2014	3,015,388	462,172	15%	204,793	44%

Figure I

Out-of-Brand Trade-in Volume Summary (Franchised Dealers Only)					
Trade-in Year	(A) Total	(B) Sub-Total - Those Involved in a Recall Campaign	(B / A)	(C) Sub-Total - Those Involved in a Recall Campaign and Traded-in During the Repair Delay	(C / B)
2010	7,215,722	848,937	12%	194,788	23%
2011	7,386,572	1,014,458	14%	100,727	10%
2012	8,304,758	1,048,596	13%	116,094	11%
2013	8,966,000	1,134,971	13%	301,894	27%
2014	7,940,131	1,216,994	15%	539,263	44%

For example, in 2014, we estimate there were approximately 11 million trade-ins to franchised dealers (see Figure G, column A). Note that this is limited to model years 1996 and up, but very few trade-ins outside of this range occur. Of the 11 million total, approximately 1.7 million were involved in a recall campaign at some point, regardless of whether or not there was a repair delay (see Figure G, column B). This amounts to 15% of all trade-ins, but excludes the unknown total of trade-ins for the campaigns which were not analyzed. Of these 1.7 million involved in a recall campaign, approximately 750,000 were traded-in during a recall repair delay (see Figure G, column C), and this amounts to 44% of those involved in a campaign in general (see Figure G, column "C / B"). Figures H and I give the same totals, but separated out by in-brand and by out-of-brand trade-ins.

Further summaries and examples are given below. They are grouped into three categories based on the length of the repair delay: more than 90 days, 45 to 90 days, and less than 45 days. Each section includes a summary of the recalls within that category and examples within the category, chosen based on relevancy rather than strict selection criteria.

Recalls with Repair Delays Longer than 90 Days

Approximately 17% of recalls have a repair delay of longer than 90 days, based on all recalls for the five years from 2010 through 2014. Based on the number of vehicles potentially affected by the recall, this category makes up 36% of the total, and based on trade-in volume of recalled vehicles during the delay period it is 69% of the total. This excludes a small subset of recalls that are not associated with specific vehicles within the NHTSA recall database and those for very old vehicles that do not map to our vehicle data. In total, our sample of evaluated recalls for this category is 102 unique campaigns.

Typically, recalls within this category are associated with a significant level of uncertainty regarding the timeframe of the delay prior to notification that repairs are available. The estimates given below are necessarily based on the assumption that the delay timeframe is known by the dealer, but as discussed earlier, it is likely that on average dealers will assume, because it is unknown, that the delay will be towards the high end of the range of delays observed for similar recalls where the final repair delay is already learned. As such, these estimates of the reduction in trade-in value are more likely to be underestimates than overestimates.

Within this category, the repair delay ranges up to 500 days (excluding 1 example of a longer delay) and the average delay is 163 days. The range of expected reduction in trade-in value as a result of these repair delays, with a hypothetical mandatory holding of the vehicle until the associated repair was available, was $393 to $5,290 for in-brand dealers and $792 to $5,713 for out-of-brand dealers. This is considering the recall campaign as a whole, based on a volume weighted average of all of the vehicles included in the campaign.

Overall weighted averages estimated trade-in value reduction for this category are as follows. The average for in-brand dealers was $1,287 and the average for out-of-brand dealers was $1,586. We estimated the number of trade-in units brought to dealers during the timeframe of the repair delay. The average campaign in this category applied to 3,614 trade-in units brought to the in-brand dealer, while the average campaign applied to 9,531 brought to the out-of-brand dealer. Overall, this category of recall campaigns represents a yearly population of approximately 94,000 trade-in units brought to an in-brand dealer and approximately 248,000 units brought to an out-of-brand dealer.

Example Recalls within this Category

1. Takata Airbag Recalls

   The widely publicized series of safety recalls of defective airbags produced by Japanese parts supplier Takata are collectively among the largest and most complex conducted to date. Initiated on a wide-scale in the U.S. in 2014, the recalls address faulty inflators in driver and front passenger airbags. In the event of a crash necessitating deployment of either airbag, the inflator could rupture with metal fragments striking and potentially seriously injuring occupants.

As of September 1, 2015, NHTSA estimated the number of U.S. vehicles equipped with defective Takata inflators to be 23 million.[5] The recalls span 11 different manufacturers and 89 specific nameplates covering 2000 to 2014 model year vehicles. NHTSA reported that roughly 4.4 million inflators, or 19 % of the estimated 23 million potentially defective, have been replaced thus far.[6] A certain number of these will be likely need to be replaced again in the future, as they were addressed through an "interim remedy" in which a brand new inflator carrying the defective design was installed.

The size and scope of the Takata recalls makes it difficult to ascertain when a sufficient supply of replacement parts will be available. Currently, there are thirty-four active Takata-related recall campaigns in NHTSA's recall database. Of those, twenty-five have remedy notification dates (ODATE or the date manufacturers actually began issuing notices to consumers stating that replacement parts were available). The number of days between the NHTSA recordation date and the remedy notification date ranges from 0 days for Mazda (NHTSA Campaign No. 15V346000) to 215 days for Honda (NHTSA Campaign No. 14V349000).

The remaining nine Takata-related campaigns in NHTSA's database have no remedy notification date populated. As of mid-September 2015, a total of 112 days had passed since the earliest of these recalls was recorded in NHTSA's database (NHTSA Campaign No. 15V312000).

NHTSA 14V349000 is one example of the Takata-related campaigns with a recorded remedy notification date, and so it can be analyzed with the historic recall sample:

Description: (Excerpt) American Honda Motor Company (Honda) is recalling certain model year 2002-2003 Civic, CR-V and Odyssey vehicles, and model year 2003 Accord, Element, Pilot, and Acura MDX vehicles to address a safety defect in the passenger side frontal air bag which may produce excessive internal pressure causing the inflator to rupture upon deployment of the air bag.

Units involved: 988,440
Trade-in volume during the delay period (In-Brand): 6,354
Trade-in volume during the delay period (Out-of-Brand): 21,764
Repair delay: 206 days
Average Trade-in Value Reduction, In-Brand (per unit): $982
Average Trade-in Value Reduction, Out-of-Brand (per unit): $1,369
High End of the Trade Value Reduction Range: $2,507

[5] This figure is approximately 25% lower than NHTSA's original estimate of more than 30 million.
[6] http://www.wsj.com/articles/u-s-regulators-cut-number-of-vehicles-deemed-to-have-faulty-takata-air-bags-1441142449

2. GM Body Control Module Recall

NHTSA 14V252000: (Excerpt) General Motors LLC (GM) is recalling certain model year 2004-2012 Chevrolet Malibu, 2004-2007 Malibu Maxx, 2005-2010 Pontiac G6 and 2007-2010 Saturn Aura vehicles. In the affected vehicles, increased resistance in the Body Control Module (BCM) connection may result in voltage fluctuations in the Brake Apply Sensor (BAS) circuit.

Units involved: 2,440,524
Trade-in volume during the delay period (In-Brand): 12,316
Trade-in volume during the delay period (Out-of-Brand): 34,884
Repair delay: 96 days
Average Trade Value Reduction, In-Brand (per unit): $520
Average Trade Value Reduction, Out-of-Brand (per unit): $917
High End of the Trade Value Reduction Range: $1,685

3. Chrysler Axle Pinion Recall

NHTSA 13V038000: (Excerpt) Chrysler is recalling certain model year 2009-2012 Ram 1500 trucks, model year 2009-2011 Dodge Dakota trucks, model year 2009 Chrysler Aspen trucks and Dodge Durango trucks manufactured from January 3, 2008, through December 18, 2008. The rear axle pinion nut may loosen due to an undersized pinion spline that can allow relative motion between the nut and companion flange.

Units involved: 278,229
Trade-in volume during the delay period (In-Brand): 12,024
Trade-in volume during the delay period (Out-of-Brand): 24,446
Repair delay: 274 days
Average Trade Value Reduction, In-Brand (per unit): $1,951
Average Trade Value Reduction, Out-of-Brand (per unit): $2,369
High End of the Trade Value Reduction Range: $4,324

4. Toyota Spare Tire Carrier Recall

NHTSA 14V273000: (Excerpt) Toyota Motor Engineering & Manufacturing (Toyota) is recalling certain model year 2004-2011 Sienna. The affected vehicles have a spare tire carrier assembly mounted under the vehicle whose attachment cable may corrode due to high concentrations of road salt splashing onto the spare tire carrier.

Units involved: 419,520
Trade-in volume during the delay period (In-Brand): 6,491
Trade-in volume during the delay period (Out-of-Brand): 19,140
Repair delay: 411 days
Average Trade Value Reduction, In-Brand (per unit): $2,560
Average Trade Value Reduction, Out-of-Brand (per unit): $2,967
High End of the Trade Value Reduction Range: $6,631

5. Chrysler Ignition Switch Recall

   NHTSA 14V373000: (Excerpt) Chrysler Group LLC (Chrysler) is recalling certain model year 2009-2010 Dodge Journey vehicles and 2008-2010 Dodge Grand Caravan and Chrysler Town and Country vehicles. Road conditions or some other jarring event may cause the ignition switch to move out of the run position, turning off the engine.

   Units involved: 724,503
   Trade-in volume during the delay period (In-Brand): 19,560
   Trade-in volume during the delay period (Out-of-Brand): 59,121
   Repair delay: 334 days
   Average Trade Value Reduction, In-Brand (per unit): $1,867
   Average Trade Value Reduction, Out-of-Brand (per unit): $2,267
   High End of the Trade Value Reduction Range: $4,745

Recalls with Repair Delays between 45 and 90 Days

Approximately 28% of recalls have a repair delay of between 45 and 90 days, based on all recalls for the five years from 2010 through 2014. Based on the number of vehicles potentially affected by the recall, this category makes up 27% of the total, and based on trade-in volume of recalled vehicles during the delay period it is 21% of the total. This excludes a small subset of recalls that are not associated with specific vehicles within the NHTSA recall database and those for very old vehicles that do not map to our vehicle data. In total, our sample of evaluated recalls for this category is 186 unique campaigns.

As with recalls in the prior category, those within this category are associated with a significant level of uncertainty, prior to notification that repairs are available, of the timeframe of the delay. The estimates given below are necessarily based on the assumption that the delay timeframe is known by the dealer but, as discussed earlier, it is likely that on average dealers will assume, because it is unknown, that the delay will be towards the high end of the range of delays observed for similar recalls where the final repair delay is already learned. As such, these estimates of the reduction in trade-in value are more likely to be underestimates than overestimates.

The range of expected reduction in trade-in value as a result of these repair delays, with a hypothetical mandatory holding of the vehicle until the associated repair was available, was $194 to $1,442 for in-brand dealers and $576 to $2,031 for out-of-brand dealers. This is considering the recall campaign as a whole, based on a volume-weighted average of all of the vehicles included in the campaign.

Overall weighted averages estimated trade-in value reduction for this category are as follows. The average for in-brand dealers was $396 and the average for out-of-brand dealers was $787. The average campaign in this category applied to 660 trade-in units brought to the in-brand dealer, while the average campaign applied to 1,728 brought to the out-of-brand dealer. Overall, this category of recall campaigns represents a yearly population of approximately 28,500 trade-in units brought to an in-brand dealer and

approximately 74,500 units brought to an out-of-brand dealer. The trade-in volumes brought to independent dealers was not estimated in this analysis.

Example Recalls within this Category

1. General Motors Ignition Switch Recalls

   In total, about 14.75 million vehicles were potentially affected by the ignition switch recalls, which were spread out among ten distinct recall campaigns in 2014. The model years of vehicles impacted by the recall ranges from between 1997 and 2014.

   The first major recall in this series occurred in February 2014, as about 620,000 model year 2005-2007 vehicles were initially recalled, with about 750,000 vehicles being added several weeks later and another large number being added to this particular campaign in March, signaling that this campaign may turn into something larger. This first recall campaign in the series ended up affecting about 2.2 million vehicles, with many brands and models being represented.

   Several more recalls occurred in subsequent months, and owners of recalled vehicles were advised to remove all items from their key rings until parts became available. As reported extensively in the media, there was indeed a large amount of demand initially to meet a limited supply of parts at dealerships. This resulted in delays in parts availability after General Motors initially indicated that parts would be available quickly in sufficient quantities. While substantial in many cases, the length of the repair delays were rarely above 90 days.

   NHTSA Campaigns Analyzed: 14V400000, 14V047000, 14V394000, 14V346000, 14V490000, 14V171000, 14V827000, 14V355000, 14V540000

   Units involved: Approximately 12,600,000 (within these specific campaigns)
   Trade-in volume during the delay period (In-Brand): 32,146
   Trade-in volume during the delay period (Out-of-Brand): 92,859
   Repair delay: 73.8 days (volume weighted)
   Avg. Trade Reduction, In-Brand (per unit): $370
   Avg. Trade Reduction, Out-of-Brand (per unit): $762
   High End Trade Reduction: $2,438

2. Hyundai Transmission Recall

NHTSA 14V434000: (Excerpt) Hyundai Motor Company (Hyundai) is recalling certain model year 2011-2014 Sonata vehicles manufactured December 11, 2009, through May 29, 2014. In the affected vehicles, the transmission shift cable may detach from the shift lever pin.

Units involved: 883,000
Trade-in volume during the delay period (In-Brand): 3,400
Trade-in volume during the delay period (Out-of-Brand): 6,947
Repair delay: 56 days
Average Trade Value Reduction, In-Brand (per unit): $368
Average Trade Value Reduction, Out-of-Brand (per unit): $780
High End of the Trade Value Reduction Range: $1,261

3. Honda Air Bag Recall

NHTSA 13V016000: (Excerpt) American Honda Motor Co. (Honda) is recalling certain model year 2001-2005 Honda Civic, 2003-2004 Civic CNG and Element, 2002-2005 CR-V, 2002-2004 Odyssey, 2003-2005 Accord, Pilot, Civic Hybrid, and Acura MDX, 2005 Acura RL and 2006 Honda Ridgeline vehicles originally sold, or ever registered, in geographic locations associated with high absolute humidity.

Units involved: 748,481
Trade-in volume during the delay period (In-Brand): 1,849
Trade-in volume during the delay period (Out-of-Brand): 3,963
Repair delay: 55 days
Average Trade Value Reduction, In-Brand (per unit): $503
Average Trade Value Reduction, Out-of-Brand (per unit): $948
High End of the Trade Value Reduction Range: $2,168

4. Ford Steering Torque Sensor Recall

NHTSA 14V284000: (Excerpt) Ford Motor Company (Ford) is recalling certain model year 2008-2011 Ford Escape and Mercury Mariner vehicles manufactured August 18, 2006, through September 11, 2010. The affected vehicles have a steering torque sensor that may not be able to properly detect driver steering input. As a result, the system could remove the Electric Power Steering (EPS) assist.

Units involved: 740,878
Trade-in volume during the delay period (In-Brand): 2,472
Trade-in volume during the delay period (Out-of-Brand): 6,659
Repair delay: 50 days
Average Trade Value Reduction, In-Brand (per unit): $286
Average Trade Value Reduction, Out-of-Brand (per unit): $687
High End of the Trade Value Reduction Range: $1,092

5. Chrysler Brake Recall

   NHTSA 14V154000: Chrysler Group LLC (Chrysler) is recalling certain model year 2011-2014 Jeep Grand Cherokee and Dodge Durango vehicles manufactured from January 5, 2010, through September 8, 2013. The subject vehicles have a brake booster with a center shell that may corrode and allow water to get inside.

   Units involved: 644,354
   Trade-in volume during the delay period (In-Brand): 1,925
   Trade-in volume during the delay period (Out-of-Brand): 4,000
   Repair delay: 59 days
   Average Trade Value Reduction, In-Brand (per unit): $589
   Average Trade Value Reduction, Out-of-Brand (per unit): $1,043
   High End of the Trade Value Reduction Range: $2,059

Recalls with Repair Delays less than 45 Days

Approximately 54% of recalls have a repair delay of less than 45 days, based on all recalls for the five years from 2010 through 2014. Based on the number of vehicles potentially affected by the recall, this category makes up 37% of the total, and based on trade-in volume of recalled vehicles during the delay period it is 9% of the total. This excludes a small subset of recalls that are not associated with specific vehicles within the NHTSA recall database and those for very old vehicles that do not map to our vehicle data. In total, our sample of evaluated recalls for this category is 364 unique campaigns.

As with recalls in the prior categories, those within this category are associated with a significant level of uncertainty, prior to notification that repairs are available, of the timeframe of the delay. The estimates given below are necessarily based on the assumption that the delay timeframe is known by the dealer. However, as discussed earlier, it is likely that on average dealers will assume, because it is unknown, that the delay will be towards the high end of the range of delays observed for similar recalls where the final repair delay is already learned. As such, these estimates of the reduction in trade-in value are more likely to be underestimates than overestimates.

The range of expected reduction in trade-in value as a result of these repair delays, with a hypothetical mandatory holding of the vehicle until the associated repair was available, was $0 to $1,714 for in-brand dealers and $331 to $2,515 for out-of-brand dealers. This is considering the recall campaign as a whole, based on a volume-weighted average of all of the vehicles included in the campaign.

Overall weighted averages estimated trade-in value reduction for this category are as follows. The average for in-brand dealers was $196 and the average for out-of-brand dealers was $602. The average campaign in this category applied to 155 trade-in units brought to the in-brand dealer, while the average campaign applied to 381 brought to the out-of-brand dealer. Overall, this category of recall campaigns represents a yearly population of approximately 12,700 trade-in units brought to an in-brand dealer and

approximately 31,415 units brought to an out-of-brand dealer. The trade-in volumes brought to independent dealers was not estimated in this analysis.

Example Recalls within this Category

1. Toyota Power Window Master Switch Recall

   NHTSA 12V491000: (Excerpt) Toyota is recalling certain model year 2007-2009 Camry, Camry Hybrid, RAV4, Corolla, Corolla Matrix, Tundra, Sequoia, Highlander, Highlander Hybrid, Yaris, Scion xB, Scion xD and Pontiac Vibe vehicles. The power window master switch assemblies in some of these vehicles were built using a less precise process for lubricating the internal components of the switch assemblies. Irregularities in this lubrication process may cause the power window master switch assemblies to malfunction and overheat.

   NHTSA Campaigns Analyzed:
   Units involved: 2,519,424
   Trade-in volume during the delay period (In-Brand): 3,316
   Trade-in volume during the delay period (Out-of-Brand): 9,005
   Repair delay: 26 days
   Avg. Trade Reduction, In-Network (per unit): $149
   Avg. Trade Reduction, Out of Network (per unit): $484
   High End Trade Reduction: $1044

2. Hyundai Brake Light Recall

   NHTSA 13V113000: (Excerpt) Hyundai Motor Company (Hyundai) is recalling certain model year 2006-2009 Accent, model year 2007-2011 Azera, Sonata and Sante Fe,2006-2011 Tucson, 2009-2011 Elantra Touring, 2007-2010 Elantra, 2008-2011 Veracruz, 2009-2011 Genesis, 2010-2011 Genesis Coupe, 2007-2008 Entourage, and 2006-2008 Tiburon vehicles. In the affected vehicles, the stop lamp switch may malfunction.

   Units involved: 1,712,336
   Trade-in volume during the delay period (In-Brand): 2,760
   Trade-in volume during the delay period (Out-of-Brand): 7,394
   Repair delay: 21 days
   Average Trade Value Reduction, In-Brand (per unit): $144
   Average Trade Value Reduction, Out-of-Brand (per unit): $560
   High End of the Trade Value Reduction Range: $992

3. Nissan Air Bag Recall

   NHTSA 14V138000: (Excerpt) Nissan North America, Inc. (Nissan) is recalling certain model year 2013-2014 Altima, LEAF, Pathfinder, and Sentra, model year 2013 NV200 (aka Taxi) and Infiniti JX35 and model year 2014 Infiniti Q50 and QX60 vehicles. In the affected vehicles, the occupant

classification system (OCS) software may incorrectly classify the passenger seat as empty, when it is occupied by an adult.

Units involved: 989,701
Trade-in volume during the delay period (In-Brand): 494
Trade-in volume during the delay period (Out-of-Brand): 821
Repair delay: 20 days
Average Trade Value Reduction, In-Brand (per unit): $126
Average Trade Value Reduction, Out-of-Brand (per unit): $535
High End of the Trade Value Reduction Range: $937

4. Toyota Air Bag Recall

NHTSA 13V029000: Toyota is recalling certain model year 2003-2004 Corolla and Corolla Matrix vehicles and 2003-2004 Pontiac Vibe vehicles. The supplemental restraint system (SRS) circuits are susceptible to internal shorting. The electrical short may create an abnormal current flow and increased heat which can damage the circuits.

Units involved: 887,709
Trade-in volume during the delay period (In-Brand): 662
Trade-in volume during the delay period (Out-of-Brand): 2267
Repair delay: 42 days
Average Trade Value Reduction, In-Brand (per unit): $191
Average Trade Value Reduction, Out-of-Brand (per unit): $393
High End of the Trade Value Reduction Range: $839

5. Ford Air Bag Recall

NHTSA 14V237000: Ford Motor Company (Ford) is recalling certain model year 2013-2014 C-MAX, and Escape vehicles. In the affected vehicles, the restraint control module (RCM) may have errors in the programming software which may result in a delayed deployment of the side-curtain rollover air bag.

Units involved: 594,785
Trade-in volume during the delay period (In-Brand): 477
Trade-in volume during the delay period (Out-of-Brand): 801
Repair delay: 23 days
Average Trade Value Reduction, In-Brand (per unit): $211
Average Trade Value Reduction, Out-of-Brand (per unit): $655
High End of the Trade Value Reduction Range: $1170

Findings

The Legislation would prevent auto dealers from leasing or selling at wholesale and retail any used passenger vehicles under an open recall until the relevant repair is made. One of the effects of enacting the Legislation would be an increased cost for dealers in holding these vehicles while waiting for parts or other causes of a repair delay, and it is expected that these costs would translate promptly to a roughly equivalent reduction in the value of trade-in vehicles with open, unremedied safety recalls.

Based on the known repair delays of recalls during the 5 years of 2010 through 2014, we estimate the costs that dealers would have incurred had they been subject to the mandates of the Legislation and use this as a proxy for expected costs associated with repair delays for future recalls and, by extension, as our estimate of future trade-in value reductions.

For recalls with a repair delay greater than 90 days, which make up 17% of unique recall campaigns but account for 69% of the total pool of recalled vehicles traded-in during the repair delay timeframes, the average estimated trade-in value reduction is $1,287 and $1,586 for in-brand and out-of-brand trade-ins, respectively. Each year, 62,070 vehicles subject to a recall were traded-in within the repair delay timeframe to in-brand franchised dealers and 162,890 such vehicles were traded-in to out-of-brand franchised dealers. Independent dealer volumes estimates were not given, but it should be noted that for these units the out-of-brand trade-in value reductions or potentially high trade-in value reductions would apply.

For recalls with a repair delay of 45 to 90 days, which make up 28% of unique recall campaigns but account for only 21% of the total pool of recalled vehicles traded-in during the repair delay timeframes, the average estimated trade-in value reduction is $396 and $787 for in-brand and out-of-brand trade-ins, respectively. 23,130 vehicles subject to a recall were traded-in within the repair delay timeframe to in-brand franchised dealers and 59,950 such vehicles were traded-in to out-of-brand franchised dealers each year; the same note about independent dealer volumes as above applies to this category.

For recalls with a repair delay of less than 45 days, which make up 54% of unique recall campaigns but account for only 9% of the total pool of recalled vehicles traded-in during the repair delay timeframes, the average estimated trade-in value reduction is $196 and $602 for in-brand and out-of-brand trade-ins respectively. 10,070 vehicles were traded-in to in-brand franchised dealers and 24,740 vehicles were traded-in to out-of-brand franchised dealers each year subject to a recall and within the repair delay timeframe; the same note about independent dealer volumes as above applies to this category.

These estimates cover a subset of the vehicles involved in recalls. The analysis covers approximately 90% of all relevant recalls as measured by the number of affected vehicles, but we do not know the characteristics of the omitted recalls, such as the number of vehicles traded-in during the repair delay or the average reduction in trade-in value.

These estimates cover a subset of the potential impacts of the Legislation. The primary factor that could lead to larger reductions in trade-in value is risk aversion and imperfect information available to dealers.

Specifically, the repair delays used in our estimates are known, but the repair delays in the future will not be known at the time the vehicle is brought to a dealership for a potential trade. As a result, the dealer risks assuming a repair delay that is shorter than the actual repair delay and is thus more likely to assume towards the high end of the range of repair delays observed in the past for recalls of similar scale and complexity.

The primary factor that could lead to smaller reductions in trade-in value as a result of the Legislation is that some unknown number of dealers already have instituted business practices that mirror the Legislation. To the extent that this is already happening, a portion of the aggregate trade-in value reduction we estimate is already occurring. As such, the total financial impact may be less than estimated; however, the average financial impact would go unchanged.

Our survey of automobile dealers gives some information regarding these two factors. Survey responses indicate significantly less willingness to purchase an out-of-brand trade-in compared to an in-brand trade-in when faced with a repair mandate and a repair delay of unknown length. Independent dealer responses suggested more risk aversion than franchised dealer responses. And, lastly, survey responses indicated that a significant portion of in-brand vehicles under a recall are already being repaired by the dealer as standard policy as long as the needed parts are available.

Two notable related topics were not covered in this analysis, though they are discussed briefly in the introduction. First, we do not address the potential for the proposed Legislation to increase the rate of recall repairs by assigning a significant economic cost to not repairing. Secondly, we do not address the potential for the proposed Legislation to do the opposite, by assigning this cost specifically to those consumers bringing a vehicle to a dealership, thereby incentivizing them to sell the vehicle to another private party where historically repairs are less likelihood to occur.