

SURVEY MEASUREMENT OF VEHICLE ASSETS: COMPARING KELLEY BLUE BOOK AND SELF-REPORTED VALUES

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I. INTRODUCTION

Reliable data on vehicle ownership and use are needed to test theories about wealth accumulation and consumption smoothing. These data are often used to construct measures of household assets or gross consumption flows. Household studies use various methods for collecting data on vehicle ownership, financing decisions, and resale values.¹

In this paper we describe the methodology for collecting and processing vehicle data from the 2011 Cognitive Economics (CogEcon) Study and present summary statistics about the raw data and estimated resale values. Respondents provided information about the make, model and vintage for each of their vehicles. This information was used to estimate resale values using Kelley Blue Book (KBB) and other online valuation tools.

We take as our starting point that we want to estimate the asset value of vehicles that respondents currently drive. Estimating consumption flows would be even more challenging. While resale values ostensibly reflect objective market valuation, consumption flows are supposed to capture an individual's gains from using the vehicle during the course of a specified time period. There are various proposed methods for measuring the value of services from consumer durables. Karz (1983) discusses various approaches, including measures based on present discounted value, opportunity costs, the market rental value, and in terms of the cost of substitute services.

There are two main lessons. First, resale values depend on market valuations and it's likely that estimated resale values are more accurate than self-assessed values. Second, the overall asset value must account for how vehicles are financed, whether they are purchased, loaned or leased. Ultimately, there is a trade-off between data quality and the time spent processing the data. For future studies, automating the vehicle valuation procedure seems both feasible and desirable.

Section II describes the CogEcon 2011 survey instrument, the coding of vehicle data and assumptions needed to estimate resale values using online valuation programs. Section III presents summary statistics about the estimated resale values, along with statistics on vehicle ownership, financing decisions and brand preferences. Survey data has recently been used to study brand preferences (e.g. Anderson et al., 2012), suggesting that detailed vehicle data could be useful even without estimating resale values. Then we analyze data quality in Section IV, comparing vehicle values from CogEcon 2011 with self-reported values collected in CogEcon 2008. We also analyze other studies which have used online valuation techniques. Section V

¹ As discussed in greater detail later, this includes the Survey of Consumer Finances (SCF), the Health and Retirement Study (HRS) and the Panel Study of Income Dynamics (PSID).

concludes the paper with recommendations for improving vehicle wealth measurement in future household surveys.

II. COGECON 2011

The 2011 wave of the Cognitive Economics Study (CogEcon) collected information about household vehicles and used this information to impute a resale value for each one. The questions started with the following:

E23: Does your household currently own or lease any automobiles or trucks? *Please only include vehicles that have been used in the past 12 months.*

Approximately 76 percent of respondents said “Yes” to E23 (564 of 742 answering the question). Respondents who answered “Yes” to E23 were then asked for the make, model and year of each vehicle:

E24: For each of your household’s vehicles, please enter the year, make, and model of that vehicle. Then, indicate whether you have a loan, lease, or if you own it outright.

Five web respondents did not provide any information about their vehicles.² We could not find values for six others because they were uncommon. All mail respondents who said they owned or leased a vehicle gave at least some information about the make, model or year. From the CogEcon survey, 559 respondents provided information about 1,121 vehicles, for an average of about two vehicles per respondent. Using self-reported make, model and year, we estimated values for 1,110 vehicles from 557 respondents. Table 1 shows the frequency of respondents who provided information about their vehicles. Respondents are classified in the table according to which data were missing from their reported vehicle information.

Table 1: Missing Information

Value in 2008 & 2011	Freq.	Percent
No missing information	970	86.53
Model	129	11.51
Make	7	0.62
Year	7	0.62
Make & Model	6	0.54
Model & Year	2	0.18
Total	1121	100

A. HOW VEHICLE DATA WERE CODED

The asset value of each vehicle was estimated using self-reported make, model and year. We used Kelley Blue Book (KBB) resale values whenever available. Kelley Blue Book defines

² There were slight differences on the mail and web survey. The web version first asked E23, then asked for the number of vehicles. Although 10 people said they have 5 or more vehicles, the next screen asked for information on the first four vehicles only.

resale value as the value of a vehicle at a given time. Most surveys were completed between October and December 2011, whereas the reflected car values were collected during March 2012.³ KBB did not list vehicles dated before 1992, “certain exotic or low volume vehicles,” or new vehicles (including 2012 and some 2011 car lines). In such cases we used the National Automobile Dealers Association (NADA) car value guide for used vehicles and the Manufacturer’s Suggested Retail Price (MSRP) for new vehicles.⁴

For older vehicles, we were forced to use alternative techniques for our valuations. First, for non-luxury⁵ vehicles, we divided them between pre-1985 vehicles and vehicles dated between 1985 and 1991. For those dated between ’85 and ’91, we discovered that their values had changed little from 1992 (the oldest listed value on KBB for a vehicle with the same make and model). For these models, the NADA prices were much higher than the KBB price of the newer model (NADA dates back farther than KBB but treats older vehicles as vintage). To decide which of the two we should use, we visited Edmunds.com to verify the price. We decided that KBB was a better option.

For those dated pre-1985, we opted to use NADA values. The greatest reason for doing so came from the many changes in car models in the early 1980s, which made using the 1992 KBB price less viable. For all luxury vehicles dated before 1992, we used the NADA value because we believed that a luxury vehicle of this age is not driven every day, but is likely owned as a vintage car for its owner. Only sixty vehicles were dated prior to 1992.

For 2011 and 2012 vehicles that did not have KBB used car values we calculated a resale value by discounting the MSRP by an imputed depreciation rate. To do this we found the MSRP for the forty-nine 2011 vehicles that already had KBB resale values, and calculated the median depreciation factor $\hat{\delta} = \text{median} \left(\frac{KBB_i}{MSRP_i} \right) = 0.869$. For vehicles whose used price was not listed in the KBB database we then multiplied MSRP values by $\hat{\delta}$ to get a corresponding imputed KBB value ($\overline{KBB} = \hat{\delta} \times MSRP$).⁶

Table 2 shows the number of vehicles with imputed values from KBB, NADA and MSRP, broken down into the vehicle age categories described above. Almost 95% of vehicles were listed in Kelley Blue Book.

Table 2: Source of Valuation

³ A few questionnaires were not completed until January 2012.

⁴ Kelley Blue Book is considered the premier used-vehicle value guide according to an automotivedigest.com poll, receiving 66.2% of votes (Griffin, 2010). NADA received the second most (16.9%) votes in the same poll. The MSRP is an industry-standard retail price provided by a car’s manufacturer. This suggested price is usually higher than the final purchase price.

⁵ We classify luxury cars by luxury brands. Contact the authors for details about what was considered a luxury brand.

⁶ We used the same depreciation rate regardless of whether the new car was in 2011 or 2012. We cannot conclude anything about the age of the 2011 and 2012 vehicles (for the respondent) because both could be purchased at the time of the survey. By considering the depreciation, we captured the cost of depreciation from driving the car off the lot.

Source	Total	New (2011-2012)	Used (1992-2010)	Used (1985-1991)	Used (pre-1985)	Luxury (pre-1992)
KBB	1051	49	974	28	0	0
NADA	41	0	9	8	17	7
MSRP	18	18	0	0	0	0
Total	1110	67	983	36	17	7

B. ONLINE VEHICLE VALUATION TOOLS

KELLEY BLUE BOOK (KBB)

Kelley Blue Book valuations can be found at <http://www.kbb.com/>. Used cars, except for special cases, were valued by finding their blue book value. Kelley Blue Book requires a vehicle's make, model, year, style, trim, features, and zip code in order to estimate a car's private resale value. The following process was used to find vehicle valuations using KBB: (1) From the kbb.com home page, "What's my current car worth" was selected, followed by "I plan to sell it myself." (2) The car's year, make, model, and mileage were entered. (3) If necessary, the style of the car was chosen. (4) The trim of the car was selected and any unique equipment was noted. (5) We chose the price associated with a vehicle in good condition because, according to KBB, most consumer-owned vehicles fall into this category.

We found that there were a few other cases in which Kelley Blue Book was used in order to estimate vehicle valuations. Dixon and Garber (2001) used a similar method but alternated between the high end and low end equipment to find an average (engine size, number of drive wheels, etc). Their regression analysis showed that average trade-in prices decrease by 0.19% per year. Ackery et al. (2011) also used KBB for their valuations, but chose to use the high end model as default and assume excellent vehicle condition. They also ran into the issue of old vehicles (namely, 1990 and older). For vehicles between 1980-1990, the 1990 value was used. For vehicles older than 1980, a standard value of US\$1,000 was assigned. For alternative vehicles, a standard estimate was used (US\$30,000 for freight trucks and US\$3,000 for motorcycles).

NATIONAL AUTOMOBILE DEALERS ASSOCIATION (NADA)

To find valuations from the National Automobile Dealers Association, we used the following procedure: (1) From www.nadaguides.com, we selected "Autos: Car Prices". (2) The correct make of the vehicle was selected from the list. (3) We chose the appropriate year of the vehicle. If older than 1993, we chose classic/exotic and then the correct year from the list. (4) We selected model and trim. (5) Mileage was entered (this step is not necessary for classic cars⁷). (6) Any unique equipment was noted. (7) We selected the average trade-in price (the NADA guide offers low, average, and high retail prices for each vehicle).⁸ The valuations for older vehicles

⁷ Classic cars are defined by NADA as "a fine or unusual motorcar, which was built during the model years 1925-1948." However, when finding values for cars 1993 or older, NADA directs you to the classic car portion of their website.

⁸ NADA has the following guidelines for an "average retail value" vehicle: "This vehicle would be in good condition overall. It could be an older restoration or a well-maintained original vehicle. Completely operable. The exterior paint, trim, and mechanics are presentable and serviceable inside and out."

may be less precise due to lack of information about vehicle mileage and condition. Cars valued using NADA included luxury and classic cars, either pre-1985 or unlisted on KBB.

MANUFACTURER’S SUGGESTED RETAIL PRICE (MSRP)

We found the MSRP values of new vehicles at <http://autos.yahoo.com/>. MSRP values were found for vehicles manufactured within two years. For two cases, we were unable to find a Yahoo! MSRP value but found it on a manufacturer’s website.⁹ We chose Yahoo! because it offered MSRP values for both the 2012 and the 2011 lines.¹⁰ While KBB at the time listed new prices for 2012 editions, it often omitted the new price of 2011 models. We believe that consistency across new cars is more important than exclusively using KBB. From the autos.yahoo.com website, we selected “price a new car” and entered the make, model, and year of the vehicle. It then asked us to select the style of the vehicle.

C. VARIABLES USED IN ESTIMATION:

MAKE & MODEL

We used the vehicle make and model reported by CogEcon respondents. When car make was missing, Google search was used to find the make for the reported model.¹¹ Alternatively, if the model was missing, we found the most common model by looking at the other cars of a specific make in the other survey responses.¹² We calculated which model was most popular in our study and used this estimate when unable to identify a vehicle type. Of the 129 vehicles reported without a specific model, over 80% included the type of vehicle, whether it was a truck, van, SUV, etc. In several cases, this uniquely identified the model. For example, the Dodge Ram is the only pick-up in Chrysler Group LLC’s Dodge brand.

Table 3 presents the share of vehicles by manufacturer, pooled across all vehicles. The percentage shares in CogEcon 2011 are a good representation of the market shares of 2011 new car purchases (WSJ Market Data Center, 2012). We found that 14.03% of vehicles in our study were Toyotas (market share of 12.3 in 2011), 13.94% Ford (market share of 17.0 in 2011), and 22.08% General Motors (market share 20.3 in 2011).¹³ The market shares include both compact cars and trucks, which could explain the higher fraction of Fords in the overall market than among CogEcon respondents. We should expect differences because we compare vehicles of all vintages while the current market share statistics measure new vehicles.

Table 3: Distribution of car makes:

Make	Percent	Make	Percent
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⁹ For a 2011 Cadillac, we went to <http://www.cadillacdealer.com/> and for a 2011 Chevrolet we used <http://www.chevrolet.com/>. The MSRP prices were taken from this site so that they were comparable to the valuations taken from Yahoo! Autos.

¹⁰ Based on the timing of when we gathered new car valuations (3/2012), we were able to find 2011 editions. At the time we began this paper (7/2012), we were only able to view new pricing for the 2012 and 2013 models on many vehicles.

¹¹ For example, by searching “2009 F-150,” Google came up with “2009 *Ford* F-150”

¹² If there was not a clear model that was the most common, we used Google search to find a popular model. For example, searching “2009 Ford” resulted in the first three results being “Ford F-150”

¹³ General Motors includes Buick (3.78), Chevrolet (13.40), GMC (3.51), and Cadillac (1.35).

Toyota	14.03	Subaru	2.25
Ford	13.94	Saturn	1.98
Chevrolet	13.40	Mercury	1.89
Honda	7.01	Pontiac	1.71
Dodge	6.29	Mercedes-Benz	1.44
Buick	3.78	BMW	1.35
GMC	3.51	Cadillac	1.35
Hyundai	3.42	Acura	1.17
Chrysler	3.06	Oldsmobile	1.17
Jeep	2.79	Kia	1.08
Lexus	2.61	OTHER ¹⁴	7.83
Nissan	2.52	MISSING	0.45
		Total	100

STYLE & TRIM

We used the default style and trim unless respondents explicitly gave more detail. For cars, we chose the Sedan style (4 door) rather than Coupe (2 door), Hatchback, Wagon, or other style options. The default trim typically includes automatic windows, air conditioning, and cruise control, but lacks heated or leather seats and Bluetooth capabilities. By ignoring luxury features we might have underestimated the value for certain cars. Unless noted by the respondent, we used rules to account for the following major features: engine size (what comes on standard trim), transmission (automatic), number of doors (four for cars and two for trucks), and truck bed size (the smaller size, or middle if more than two options were given).¹⁵

YEAR

We used self-reported year in order to find the correct line of the listed car. If year was missing, we used the year 2002 as an average estimate.¹⁶ In four cases, the respondent provided a partial date, such as “7”. In these cases, we treated the date as missing unless we were confident about which year was being specified, such as would be the case by assuming 1998 if the respondent had answered “98”.

MILEAGE

Both KBB and NADA required an approximate mileage to estimate used car values. The CogEcon survey questionnaire did not ask about vehicle mileage, so we imputed mileage using a calculation of the average miles driven per year and the age of the vehicle. According to the United States Department of Transportation (2011), drivers aged 55 to 64 travel on average 11,972 miles per year. Therefore, we used the simple rule of thumb that each vehicle had been driven 12,000 miles per year over its lifetime, where number of years was calculated as 2011-

¹⁴ This includes all makes that compose less than 1% of the share of vehicles in the CogEcon sample.

¹⁵ There were usually two truck bed sizes. A 2006 Ford F-150 Regular Cab, for example, hosts a 6 ½ ft. bed and an 8 ft. bed. For the purposes of this study, we chose to find valuations using the 6 ½ ft. bed.

¹⁶ 2002 was selected as the average estimate because the mean age of the cars in our study was 9.07 years. Using 2011 as our base year, the average car is from 2002.

year of vehicle. For example, we calculated that a 2004 car has been driven for 7 years as of 2011 and thus has accumulated 84,000 miles. To estimate KBB values for 2011 vehicles we used mileage of 6,000 to represent a half-year of use.

ZIP CODE

We used 48109 (Ann Arbor, Michigan) as the zip code in KBB and NADA. We were concerned that vehicle prices may vary across locations to account for shipping costs, cost-of-living, and relative demand. By taking a variety of cities ranging from the coasts to the Midwest and varying in size, we found that location matters little, as evident in Table 4. Between all of the cities, it was unusual to find a common car that varied by more than 1% from the value in Ann Arbor, MI. The vehicles compared were a 2009 Honda Accord, 2005 Toyota Camry, 2006 Dodge Caravan, 2001 Ford F-150, and 2010 Volkswagen Jetta. Prices from Ann Arbor (48109), Charlotte (28202), Chicago (60601), Des Moines (50301), Philadelphia (19115), Phoenix (85001), and Sacramento (95834) were examined.

Table 4: Kelley Blue Book used car values across locations

	Resale value in dollars					Percent difference from Ann Arbor				
	Accord	Camry	Caravan	F-150	Jetta	Accord	Camry	Caravan	F-150	Jetta
Sacramento, CA	14017	9237	7000	3794	12305	-0.8	-0.7	-1.0	-0.1	-1.3
Philadelphia, PA	14017	9237	7029	3784	12337	-0.8	-0.7	-0.6	-0.3	-1.0
Charlotte, NC	14100	9285	7010	3820	12380	-0.2	-0.1	-0.8	0.6	-0.7
Phoenix, AZ	14112	9292	6956	3792	12369	-0.1	-0.1	-1.6	-0.1	-0.8
Ann Arbor, MI	14124	9298	7068	3797	12465	n/a	n/a	n/a	n/a	n/a
Des Moines, IA	14148	9312	7064	3828	12551	0.2	0.2	-0.1	0.8	0.7
Chicago, IL	14184	9332	7103	3805	12519	0.4	0.4	0.5	0.2	0.4

III. SUMMARY STATISTICS

This section presents summary statistics on the variables used in the estimation procedure and the estimated vehicle values. Table 9 (see Appendix) shows the number of vehicles, information about the vehicles, and the financing of vehicles broken down by household status, age, income and financial asset categories.

A. NUMBER & AGE OF VEHICLES

Over fifty percent of respondents reported having two or more vehicles. The number of vehicles varied by relationship status, age, income and financial assets, all as expected. While respondents younger than 60 have over 2 cars in their household, on average, those over 80 have an average of less than 1. This is consistent with the expected number of drivers in these households. Younger respondents might have driving age children, some of whom have their own car. At the other end, respondents over 80 are more likely widowed and some are not driving anymore. People without financial assets are also less likely to have vehicles, and households at higher asset levels are more likely to have multiple cars.

Average age of cars does not significantly change across age categories but vehicles gradually become newer across income groups. As expected, more wealthy households seem to buy newer

vehicles. Younger households have newer cars. The average age of a household’s newest car increases from approximately 6 years old for people younger than 65, to 7 years for those in their 70s, and more than 9 years old for respondents over 80. This is consistent with older households driving cars they already own or being less likely to purchase new vehicles.

D. ESTIMATED RESALE VALUES

Table 9 also includes summary statistics about the average vehicle values (column “Val per vehicle), broken down by demographic groups. This variable was constructed by creating respondent level average vehicle value and then averaging across respondents. This average is taken across respondents with positive vehicle values. The estimated resale values vary across demographic groups. This is as expected; households with higher incomes and financial assets have more valuable vehicles. By examining the longitudinal CogEcon 2008 data, we are able to observe the changes in household vehicle worth from before and after the 2009 Great Recession.

CogEcon 2008 respondents were asked whether they owned vehicles:

Do you (or your spouse/partner) own any cars, trucks, boats, trailers, motor homes, airplanes, or other vehicles?

If Yes, they were prompted to provide a value:

If so, what is the total market value or range letter for these vehicles? That is, what would these vehicles be worth if sold today?

Table 10 (appendix) compares the reported value of household vehicles in CogEcon 2008 and the estimated values for 2011. The self-reported values in 2008 are larger than estimated values in 2011. Self-reported data from 2008 also has larger standard deviation than the estimated resale values from 2011. This holds across demographic categories.

Table 5 compares 2008 and 2011 vehicle responses. It summarizes vehicle ownership, the frequency of missing vehicle values, and the estimated values across the two waves. Almost half of respondents reported values in 2008 that were higher than the estimated values in 2011. There were also 15 percent of respondents who said they had vehicles in 2008 but did not in 2011.

Table 5: Comparison of information in 2008 and 2011

Value in 2008 & 2011	Freq.	Percent
2008 > 2011 (both > 0)	296	45.82
2008 =< 2011 (both > 0)	152	23.53
0 in both years	35	5.42
2008=0, 2011>0	21	3.25
2008>0, 2011=0	102	15.79
2008 missing val, 2011 > 0	21	3.25
2008 missing val, 2011 = 0	12	1.86
2011 missing val, 2008 > 0	5	0.77
2011 missing val, 2008=0	2	0.31
Total	646	100

There are a few reasons we might expect this relationship between 2008 and 2011 vehicle asset values. First, the questions are conceptually different. The 2008 question specifically mentions boats and airplanes, which were not asked about in 2011. In 2008, there was no qualification that vehicles needed to have been used in the previous year, suggesting that there are vehicles respondents might have included in their 2008 self-reported valuation that were not specified in 2011. Both of these factors could partly explain the fifteen percent of respondents who switched from having vehicles to not having vehicles between waves.

Additionally, many households lost financial and housing wealth during the financial crisis, and the respondents are aging. The former might have prevented households from buying new vehicles or replacing vehicles with less expensive (and, hence, less valuable) vehicles. We would also expect this same trend if households held onto the same vehicles and saw depreciation in value. This makes sense since older respondents have fewer vehicles that are older vintages.

In Table 10, we see a noticeable difference between 2008 and 2011 car values. Because the majority of cars in the study are included in both, we believe the most significant reason for this is respondent overestimation of their vehicles. While we do not know whether respondents simply do not know their vehicle's blue book value or if they have a false optimism for what their car is worth, it is clear that there is significant error in their estimation. Respondents might consider the price they paid for the vehicle, while conceptually we are asking for the current resale price. Alternatively, people might consider what they would ask for if trying to sell the vehicle. Because used car prices are often bartered down, we would expect the distribution of initial posted prices to be higher than the distribution of resale prices. We believe that by comparing the two values, it may be possible to find a distinction between the value of the vehicle and its worth to its owner.

E. OTHER ANALYSES

VEHICLE FINANCING DECISIONS

We collected data about vehicle financing because it affects how we treat vehicles when estimating wealth. Vehicles should only be considered net assets if owned by the household. Vehicles that are fully paid for should be distinguished from vehicles on lease or with outstanding loans.¹⁷ Prior studies have found that an increasing fraction of new vehicles are financed through leasing contracts. Our results are consistent with the general trends but raise concerns about some conclusions drawn from earlier studies.

¹⁷ Although respondents were not asked for the amount of debt remaining, they were asked earlier in the questionnaire about debt values that can be used to calculate net worth. They were asked the following:

D33: Aside from mortgages, other home equity lines of credit, and credit card balances, do you (or your spouse/partner) have other debts, including vehicle loans, student loans, overdue taxes, other personal loans, or debt for medical expenses? (YES or NO)

D34: What is the total outstanding balance on all of these loans or debts?

Presumably we could impute vehicle loans by subtracting an imputed value of non-vehicle loans from the value given in D34. Given the small number of observations with loans we decide to focus on who leases versus owns outright.

In particular, we find that less wealthy households are leasing more. Leasing is generally believed to be more common among wealthier households, but we find the opposite trend. Households with lower income and financial assets are more likely to lease rather than loan or own outright. We believe this finding could stem from a couple of reasons. First, lower income households may find leasing to be an attractive option to push the limit. By leasing, someone may be able to drive a luxury or quality car outside of their price range for purchasing. An alternative could be that households are not being informed. Reed (2011) explains, “Few consumers fully understand leasing, however, and they can be misled by finance managers and car salesmen who hide the true expenses.” Many leases have additional costs for mileage and repairs, contracts that lock a driver in for a number of years, and higher insurance costs. According to O’Donnell (2009), leasing, especially in the long run, tends to be more expensive than buying used and can even be more costly than purchasing a new vehicle.

Table 13 (appendix) summarizes the financing of vehicles among CogEcon respondents. Approximately 79 percent of the vehicles are owned outright, whereas 18 percent are leased and 3 percent have loans. When vehicles from all years are pooled, vehicles that are financed with a loan are worth the most, followed by leased and then vehicles owned out-right. Vehicles with leases and loans are mostly newer.

The rate of leasing is consistent with other accounts of the vehicle market. Aizcorbe and Starr-McCluer (1997) document that vehicle leasing increased during the 1990s and the early 2000s. Vehicle guides have noticed the uptick in leasing among baby boomers. Reed (2011) explains the recent growth in leasing.

VEHICLE PREFERENCES: FOREIGN VS. DOMESTIC

Having detailed information about car brands allowed us to check whether people have preferences for domestic versus foreign vehicles. There was substantial variation across households. Of households with two cars, only 18.6% had a mix of one domestic and one foreign car.

Table 6: Ownership of Domestic versus Foreign Cars:

	Any car	1 car	2 cars	3+ cars
Domestic	233 (41.9%)	89 (51.15%)	96 (38.7%)	48 (35.8%)
Foreign	218 (39.2%)	85 (48.9%)	106 (42.7%)	27 (20.2%)
Both	105 (18.9%)	NA	46 (18.6%)	59 (44.0%)

Table 7: Foreign vs. Domestic: frequency & value

Vintage		Domestic	Foreign
before 1990 (N=41)	Percent	48.8%	51.2%
	Mean	\$7,553	\$8,580
	Median	\$5,450	\$5,450
1990-1994 (N=82)	Percent	70.7%	29.3%
	Mean	\$5,373	\$5,176
	Median	\$1,907	\$1,705
1995-1999 (N=163)	Percent	63.8%	36.2%
	Mean	\$5,783	\$5,163

	Median	\$2,762	\$2,880
2000-2004 (N=310)	Percent	65.1%	34.9%
	Mean	\$6,400	\$7,493
	Median	\$4,371	\$7,176
2005-2009 (N=366)	Percent	52.7%	47.3%
	Mean	\$9,796	\$13,119
	Median	\$9,122	\$12,247
2010-2012 (N=138)	Percent	39.7%	60.4%
	Mean	\$16,306	\$18,245
	Median	\$16,310	\$16,849

Older households are less likely to have foreign vehicles. This could reflect different preferences for vehicles or the increasing market penetration of foreign vehicles. In Table 7, we break up the sample of vehicles based on vintage and we observe a larger fraction of foreign vehicles among the newer ones. This is consistent with Train and Winston's (2007) finding of the changing market share of foreign versus domestic production. We find the same trend in the CogEcon sample. At the same time, within vintage foreign vehicles are more valuable.

BRAND LOYALTY

We look for evidence of brand loyalty by comparing the brand of each household's newest vehicle with the second newest vehicle. Following Train and Winston (2007) we use the following categories of manufacturers: GM, Ford, Chrysler, Toyota, Honda, Japanese, European.²⁰

Table 8 displays summary statistics explaining brand loyalty. The sample used to construct this table includes respondents who provided the make of their two most recent vehicles (or only had one vehicle). The first section of the table displays the market share of the newest vehicles purchased in a household. The middle section shows the percentage of households who own only one car versus those who own multiple cars. For example, of the 131 respondents whose newest car is a GM, 35.9% have only this vehicle. The final section displays the loyalty shown when purchasing the newest car by displaying how many purchased the same brand as they had purchased when they bought their second-newest vehicle.

²⁰ The category for Japanese includes vehicles made in Korea.

Newest Car			Number of Cars		2nd Newest Brand	
Brand	Obs.	Percent	1 Car	2+ Cars	Same	Different
GM	131	24.7	35.9	64.1	60.7	39.3
Ford	81	14.8	30.9	69.1	39.3	60.7
Chrysler	72	13.0	23.6	76.4	30.9	69.1
Toyota	90	16.3	27.8	72.2	33.9	66.1
Honda	47	8.5	31.9	68.1	12.5	87.5
Japanese	95	17.1	39.0	61	25.9	74.1
European	31	5.6	25.8	74.2	43.5	56.5

Looking at the brand of the most recent vehicle, we find that many had the same brand for their second most recent vehicle. Among people who own a GM as their most recent vehicle, over 60% have a GM as the second most recent. This finding of brand loyalty within person is consistent with vehicle preference transmission from parents to children, which has been documented by Anderson et al. (2012). They find that “a child whose mother has recently purchased a given brand is 59% more likely to choose that brand (an 8.6 percentage-point increase on a base of 14.3%) than a demographically similar child whose mother did not choose that brand.” (p. 3)

IV. VEHICLE DATA COLLECTION IN OTHER SURVEYS

Household surveys estimate vehicle equity in various ways. These methods place different burden on respondents and data processing capabilities. The Health and Retirement Study (HRS) briefly ask about vehicles, whereas the Survey of Consumer Finances and the Panel Study of Income Dynamics (PSID) have more intensive modules on vehicle ownership and use.

HEALTH AND RETIREMENT STUDY

The Health and Retirement Study (HRS) asks for the value of what respondents own for transportation, minus what is owed on them. This lumps together the value of all vehicles, as was the case in CogEcon 2008. At the same time, there is no way to distinguish between the value of the vehicle and the money owed on it.

There are slight differences in the HRS vehicle questions from early waves, although roughly the same questions have been asked.²¹ Since 1996 respondents have been first asked a Yes/No question about whether they own any vehicles for transportation, and are then asked about the value, less what is owed. The most recent questions, from the 2010 HRS survey, are below:

Q370: Do you (or your [husband/wife/partner]) own anything for transportation, like cars, trucks, a trailer, a motor home, a boat, or an airplane?

Q371: What are they worth altogether, minus anything you still owe on them?

²¹ Since HRS 1996, the vehicle questions have been labeled Q370 & Q371.

Response rates for these questions are quite high compared to the response rates for other wealth questions. Juster and Smith (1999) find 86 percent of respondents have an exact data report, which is only surpassed by house value (96 percent) and first mortgage amount (92 percent).

PANEL STUDY OF INCOME DYNAMICS

Since 1999, the Panel Study of Income Dynamics (PSID) has collected detailed information on up to three vehicles in a household. They ask about vehicle make, model, vintage, date of purchase, purchase price, vehicle financing, and whether it is a gift. The make, model and vintage are not generally used to estimate vehicle values. In 1968-1972 this information was used to look up car values, but has not generally been used since then.²²

To calculate the value of household vehicles for yearly waves between 1968-1972, the PSID used the NADA Official Used Car Guide. Cars that did not run and other unowned vehicles (ex. Leased) were not included in the valuations. The survey chose to always take the middle price and to use the four-door sedan model of the vehicle. The good condition value was taken directly from the guide. When the respondent noted that his car was in fair or poor condition, the good condition price was discounted through a method of multiplying it by .8 or .6, respectively. Cars from before 1962 were valued at \$150, \$100 and \$50, depending on whether they were in good, fair or poor condition.

SURVEY OF CONSUMER FINANCES

The Survey of Consumer Finances (SCF) uses an imputation method similar to what we used in CogEcon 2011. The SCF assigns a blue book value for each vehicle using respondent-reported make, model and year. Similar to CogEcon, the SCF's average vehicle value is much lower than other surveys that use respondent value estimates. One major difference of the SCF is that vehicle values come from the Census Bureau, which only dates back seven years. Because of this, all vehicles older than seven years are assigned a standard value of the year. This could have a large effect on the sample quality, as approximately half of the vehicles in the sample are older than seven years.

Unlike many other surveys, the SCF has continued to use imputed values for vehicles. Czajka et al. (2003) believe that "the findings for vehicles suggest that the methodology used in the SIPP and the SCF is better than the PSID approach, which asks respondents to estimate the equity value of their vehicles. Respondents appear to overestimate what their vehicles are worth." These findings are consistent with our own, which find that values are nearly cut in half (from 2008 to 2011) when imputed compared to respondent provided.

The Survey of Consumer Finances (SCF) asks about leased vehicles besides those leased by a business. We do not distinguish between the sources of the lease and have no way of knowing whether respondents are including vehicles that are leased by a business. Since a leased vehicle should not be considered an asset, presumably the only difference is whether the household or the employer pays for the vehicle.

V. CONCLUSION

²² We are thankful to Tecla Loup for providing information about the vehicle data processing in the PSID.

The CogEcon survey collected information directly from respondents about their financial assets and debts. For many, vehicles are the largest non-financial asset in the household other than homes. The equity value of a vehicle depends on the resale price and how it is currently financed.

DATA COLLECTION

There are several reasons to believe KBB resale values are usually more accurate than self-reported valuations. Respondents know the quality of their own vehicle but do not know what others are willing to pay for it. On the other hand, KBB uses information from millions of vehicle purchases and, therefore, aggregates information from multiple sources to estimate resale values. This leads to a trade-off between the two sources of information. Self-reports can account for private information about vehicle quality, while KBB estimates make use of aggregated information about consumer demand. Asking for vehicle information allows us to objectively estimate resale values, but does require additional data cleaning efforts.

INTEGRATING DATA COLLECTION AND DATA CLEANING/PROCESSING

Asking for vehicle information reduces ownership bias and gives a fair market price for all vehicles, but it also takes more time and effort to clean and process the data. Part of this work includes imputing values for the vehicles, for which we entered vehicle information individually into online valuation tools, such as Kelley Blue Book. By automating this process, the imputation method would be greatly simplified. Multiple issues would need to be resolved before this would be possible. First, a different form of data collection would be necessary for vehicle make and model. We suggest a drop down menu, which would eliminate spelling error and mix-ups between make and model. For year, we suggest placing a limit on entered values or including a follow-up question if a respondent provides a number not in the specified range. For example, if “7” or “98” were provided, the correct year could be immediately confirmed. These drop-down menus would need to have correct combinations of vehicle year, make and model for this process to work properly. Ideally, future survey designers might collaborate directly with Kelley Blue Book to design questions easily compatible with the service.

REFINING VALUATION AND/OR DATA COLLECTION

Additional information about vehicle condition is needed to more precisely estimate resale values. One idea is to directly ask about mileage. While our mileage estimate may coincide with the average miles driven per year by our target population, we believe that it fails for older vehicles that have greater variation in how they are used and how much they are driven. Other studies find that mileage declines with vehicle age (Pickrell and Schimek, 1999; Engers et al., 2009).

The drawback to this is that some respondents may not be comfortable providing such detailed information. However, we believe this can be countered by offering more information about the purpose of the question – to estimate vehicle resale values. Another idea is asking directly about each vehicle’s condition. The question could include the exact language of Kelley Blue Book, asking whether the car is in excellent, very good, good or fair condition. Both of these additions would increase the accuracy of KBB resale values.

VEHICLE FINANCING

The type of vehicle financing determines whether vehicles are assets or liabilities. The CogEcon survey separates vehicles into three categories: lease, loan or own. For vehicle loans, we do not explicitly ask for the amount of loans held; rather, debts for vehicle loans, college loans, overdue taxes, personal loans, and medical expenses are grouped into one response. Knowing the exact amount of vehicle debt would be important for finding the distinction between collateralized and uncollateralized debts, but we believe this isn't as important for vehicles as it is with homes. By using lease information, we can more accurately determine assets and debt values of our respondents.

Future data collection efforts should focus on improving data on vehicle wealth using self-reported information to objectively estimate resale values. At the same time our results highlight that it is critical to collect information about vehicle financing and, in particular, whether newer vehicles are leased.

ACCOUNTING FOR ALL VEHICLES, NOT JUST CARS AND TRUCKS

The main goal going forward in vehicle valuation is to make sure all assets are accounted for. This includes the “other” vehicles that were offered as assets in the survey. A few respondents provide information about RVs, mobile homes, or semi-trucks.²³ In the future it might be better to ask first about cars and trucks, and then ask whether the household has any other vehicles such as RVs, mobile homes, or airplanes. By clarifying the survey questions, we believe that vehicle asset valuation can be a key to finding the true value of all assets in a household.

²³ Eight vehicles are an RV, motorhome, semi or motorcycle.

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G. APPENDIX

Table 9: Summary statistics about vehicle ownership, resale values and financing											
	Obs	% of respondents			# of vehicles	Age newest	Avg age	Val per vehicle	% of vehicles		
		0 cars	1 car	2+ cars					lease	loan	own
All	742	24.0	23.2	52.8	1.3	6.6	9.1	9251	18.0	2.9	79.1
Single	221	38.0	46.2	15.8	0.8	8.0	9.1	8605	17.6	3.3	79.1
Couple	521	18.0	13.4	68.5	1.5	6.2	9.1	9457	18.1	2.9	79.1
AGE											
<60	171	12.9	10.5	76.6	1.6	6.1	9.2	9226	19.8	2.7	77.5
60-65	173	17.9	19.7	62.4	1.5	6.0	8.8	9991	21.7	4.1	74.2
65-70	125	27.2	20.8	52.0	1.3	6.3	9.0	9314	17.0	1.8	81.3
70-80	163	27.6	30.7	41.7	1.1	7.3	9.2	9261	15.9	2.9	81.3
80+	110	41.8	40.0	18.2	0.8	8.5	9.3	7556	4.8	2.4	92.9
INCOME											
<\$25k	117	45.3	39.3	15.4	0.7	9.1	10.0	6463	21.7	0	78.3
\$25k-\$50k	184	28.3	33.7	38.0	1.1	7.1	9.0	7877	21.1	2.3	76.6
\$50k-\$100k	256	22.7	16.4	60.9	1.4	6.4	9.2	8612	17.6	3.4	79.0
\$100k+	165	5.5	9.7	84.9	1.8	5.1	8.5	12377	16.9	3.6	79.5
FINANCIAL ASSETS											
<\$10k	153	36.0	33.3	30.7	1.0	8.5	9.9	7166	22.7	3.1	74.2
\$10k-\$100k	157	22.9	30.6	46.5	1.2	6.8	9.1	8162	28.5	1.8	69.7
\$100k-\$250k	117	22.2	23.1	54.7	1.3	6.1	9.6	9048	14.8	2.7	82.5
\$250k-\$500k	137	19.0	19.0	62.0	1.4	6.6	9.2	8494	13.5	3.4	83.1
\$500k+	157	19.1	9.6	71.3	1.5	5.1	8.0	13056	13.7	3.8	82.6

		2008 val				2011 val				2011 val - 2008 val		
	Obs	Car %	Mean	P50	SD	Car %	Mean	P50	SD	Mean	P50	SD
All	606	90.8	26163	17501	41635	77.4	15176	11405	16886	-10988	-4767	40444
Single	168	78.6	12594	7501	16377	64.3	7659	4070.5	10792	-4935	-2498	15227
Couple	438	95.4	31368	20000	46899	82.4	18059	15108	17894	-13309	-6061	46438
AGE												
<60	152	96.7	32999	25000	63330	88.8	19494	17848	16294	-13505	-5552	63535
60-65	140	93.6	30652	20000	39424	82.9	17541	14566	17371	-13111	-6393	37400
65-70	105	90.5	23413	17501	28871	73.3	14055	10076	15867	-9358	-5066	27456
70-80	132	90.2	24290	17501	26717	72.7	14138	8665.5	19466	-10152	-4536	25087
80+	77	75.3	11470	7501	15864	58.4	5658	3549	7060	-5811	-2746	16535
INCOME												
<\$25k	83	71.1	10291	5000	15998	57.8	5371	1705	7663	-4920	-1460	14461
\$25k-\$50k	141	88.7	17574	10000	20459	73.1	9747	6848	11090	-7827	-4691	18479
\$50k-\$100k	221	96.4	28820	17501	55237	76.0	13226	11385	12559	-15594	-7056	55565
\$100k+	151	96.7	39092	30000	38397	94.7	28151	24175	21686	-10941	-5894	37925

Note: Observations limited to respondents who provided valid vehicle data in both the 2008 (c1_q90_val) and the 2011 (carval2011 var created by combining imputed values of all vehicles) survey. Respondents who provided vehicle values in excess of \$1,000,000 were omitted from these statistics. Car % refers to the percentage of respondents that own one or more vehicles. The 2011val - 2008val statistics were created by finding the difference of each individual piece of data and then finding summary statistics of those values.

		2008 val				2010 val				2010 val - 2008 val		
	Obs	Car %	Mean	P50	SD	Car %	Mean	P50	SD	Mean	P50	SD
ALL	10093	78.0	12991	6000	22835	73.8	12149	5000	32400	-842	0	30853
Single	5871	67.3	7963	3000	15535	62.0	7719	2000	33436	-244	0	32864
Couple	4222	93.0	19983	12999	28759	90.1	18308	10750	29832	-1675	-1000	27799
AGE												
<60	1904	82.8	13958	8000	21138	79.0	12279	6000	19262	-1678	0	18822
60-65	1429	86.1	14608	10000	19474	83.8	15553	9000	42281	946	0	41580
65-70	1677	84.1	15781	8000	28329	82.4	15319	7000	38957	-462	0	29984
70-80	3054	78.3	13185	6000	24395	73.9	12549	5000	37083	-637	0	38137
80+	1572	57.6	6268	1000	10831	49.8	4875	0	12601	-1393	0	11714
INCOME												
<\$25k	4139	59.7	5783	1000	11507	53.8	5902	500	34614	119	0	34742
\$25k-\$50k	2456	88.3	13434	9000	17547	84.3	11900	7000	22400	-1534	-700	22174
\$50k-\$100k	1840	94.1	18829	12000	22249	92.2	17217	11000	24667	-1611	-1000	22510
\$100k+	1201	95.2	27029	19000	41821	94.0	26603	17000	46538	-426	0	42551

Note: Observations limited to respondents who provided vehicle information in both the 2008 (LQ371) and the 2010 (MQ371) survey. Respondents who provided vehicle values in excess of \$1,000,000 were omitted from these statistics. Only one survey participant per household was used for these data. This person was considered the financial respondent (LFINR=1). Car % refers to the percentage of respondents that own one or more vehicles. The 2010val - 2008val statistics were created by finding the difference of each individual piece of data and then finding summary statistics of those values.

		2008 val			2011 val			2011 val - 2008 val		
	Obs	Mean	P50	SD	Mean	P50	SD	Mean	P50	SD
ALL	448	30007	19000	46141	19840	16357	16917	-10167	-3644	44874
Single	98	16839	10000	17700	12273	9112	11818	-4566	-2865	16533
Couple	350	33693	22500	50768	21958	18420	17526	-11735	-4135	49918
AGE										
<60	132	35113	25000	67301	22101	18978	15722	-13012	-4013	67614
60-65	112	33895	20500	41820	21219	17253	17047	-12676	-4973	39523
65-70	73	27778	17501	31969	19055	15168	15592	-8723	-4335	29999
70-80	91	26853	17501	27670	20256	16332	20690	-6596	-3490	24735
80+	40	13510	9000	10614	9000	6962	6431	-4510	-2773	9611
INCOME										
<\$25k	44	13202	7750	14581	9525	6721	8236	-3677	-2790	11099
\$25k-\$50k	95	20278	17501	21927	13662	11372	11256	-6616	-3543	18857
\$50k-\$100k	163	30854	18000	62634	17186	16288	11471	-13668	-3207	62584
\$100k+	140	40406	30000	38844	29943	24918	21233	-10463	-6096	38204

Note: Observations limited to respondents who responded with vehicle data in both the 2008 (c1_q90_val) and the 2011 (carval2011 var created by combining imputed values of all vehicles) survey. All respondents in this table owned a vehicle in both waves of the survey. Respondents who provided vehicle values in excess of \$1,000,000 were omitted from these statistics. The 2011val - 2008val statistics were created by finding the difference of each individual piece of data and then finding summary statistics of those values.

	Lease				Loan				Own outright				# of vehicles
	% of vehicles	Value per vehicle			% of vehicles	Value per vehicle			% of vehicles	Value per vehicle			
		mean	p50	sd		mean	p50	sd		mean	p50	sd	
2010+	46.0	19058	17759	6555	17.3	25675	19859	14209	36.7	21628	17843	11814	139
2008-2009	34.7	13776	13043	4051	6.3	15429	11845	11638	59.1	19159	15651	8495	127
2006-2007	31.8	11385	11315	3583	0.0				68.2	11260	10490	3822	179
2004-2005	12.5	8718	8631	1811	0.0				87.5	8701	8030	3409	136
pre 2004	3.7	7338	3939	6960	0.2	4200	4200	.	96.1	3970	2950	4064	538
	18.1	13723	12982	6504	3.0	22540	17843	14327	79.0	7928	5425	7724	1119