Economics Bulletin

Volume 32, Issue 1

A first look at the 'Cash for Clunkers' program

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Abstract

This paper estimates the short run effect of the Car Allowance Rebate System (or "Cash for Clunkers" on light vehicle sales within the United States. Using a reduced form demand model of automobiles, I find that the program led to increased sales in July and August, 2009 of between 450,000 and 710,000 vehicles. Further, I find that the pre-announcement of the program did not reduce sales in June 2009. Further, I can reject a 'Cash for Clunkers' associated decline in automobile sales in the months immediately following the termination of the program.

Citation: Michael Hicks and Nalitra Thaiprasert, (2012) "A first look at the 'Cash for Clunkers' program", *Economics Bulletin*, Vol. 32 No. 1 pp. 567-573.
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Submitted: September 28, 2010. **Published:** February 08, 2012.

1. Introduction

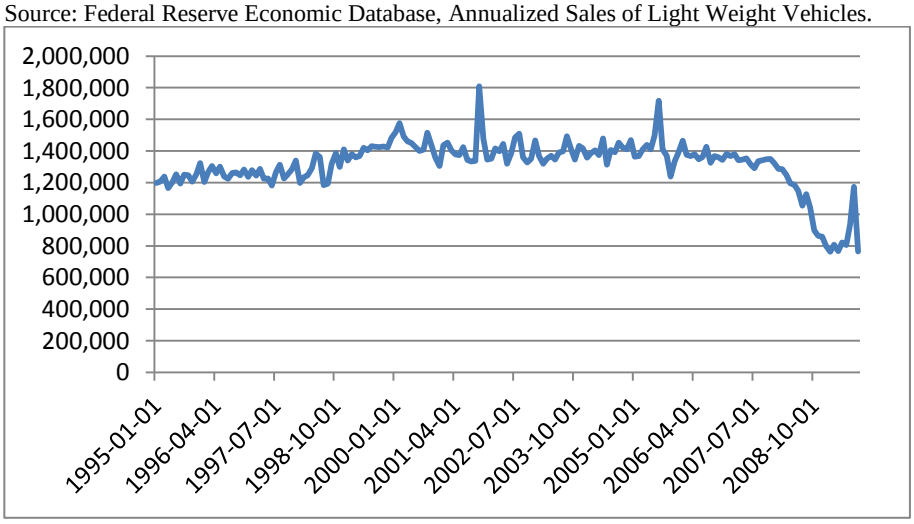
Cash for Clunkers (formally the Car Allowance Rebate System or CARS), was a U.S. Federal program designed to stimulate new car purchases from July 1, 2009 to November 1, 2009.[1] The program had the stated goals of stimulating the economy and reducing carbon emissions. This version of the plan was offered in an Op-Ed article which argued that the program would serve as a wealth equalization tool, as poorer Americans could upgrade their vehicle stock through the program (Blinder, 2008). The idea was not new, and had appeared in earlier research on environmental effects and fiscal policy. In the U.S., both Chicago Illinois and the State of Delaware had attempted a vehicle scrappage subsidy in the late 1980's and early 1990's (see Hahn, 1995). The new Cash for Clunkers program appears to have been enormously popular among automobile buyers, and despite additional resources added to the rebates, the program terminated almost six weeks earlier than planned. While it is far too early to evaluate the full welfare effects of the program, sufficient time has elapsed to assess the impact of the program on at least one of its goals.

2. Cash for Clunkers and Auto Sales

In July and August of 2009 a 677,974 vehicles were exchanged under the program with associated rebates of $2.877 billion.[2] The program period also saw a very visible increase in new car sales (See Figure 1).

Figure I, Monthly Light Vehicle Sales (Seasonally Adjusted)

Source: Federal Reserve Economic Database, Annualized Sales of Light Weight Vehicles.



[1] Initially, "Consumer Assistance to Recycle and Save Act", H.R. 2751

[2] "Cash for Clunkers Wraps up with Nearly 700,000 car sales and increased fuel efficiency, U.S. Transportation Secretary LaHood declares program "wildly successful"". U.S. Department of Transportation Press Release. August 26, 2009, retrieved October 29, 2009.

Several policy related research questions emerge from this program. The first is simply how many additional vehicle sales were spawned by the program? Second, what are the environmental benefits of reduced vehicle emissions? Finally what was the cost per vehicle of these effects?

Two studies have attempted to evaluate the environmental benefits, including the operation cost per vehicle. These are highly useful efforts, but since estimates of the cost of the primary greenhouse gas associated with vehicle use (Carbon Dioxide) ranges from zero to several hundred dollars per cubic ton, these estimates are unlikely to play an important role in the short term debate over the efficacy of the Cash for Clunkers program.[3] It is worth noting that among the DOT's database of turned-in vehicles the four most common makes are Ford Explorers, Chevrolet Blazer, Dodge Caravan, and Jeep Grand Cherokee, all from the 1990's and early 2000's.[4] Among the most popular new cars, only one US make entered the top ten (the Ford Focus). In fact, of the top ten new cars purchased, 90 percent or just over 156,000 were imported (or transplanted) autos.[5] Among the most popular new cars, four US makes entered the top ten (Ford, Chevrolet, Dodge, Pontiac). In fact, of the top ten new cars purchased, 62 percent or just over 360,000 vehicles were foreign makes (Japanese and Korean). [6] Of all new cars purchased (677,974), 48.5 percent were US makes, and 70 percents were made in the North America.[7] The average miles per gallon (mpg) of the turned-in vehicles are 15.71 mpg, while the average mpg of the new cars is 24.6 mpg.[8] From these data alone it is clear that more fuel efficient autos are being substituted for less efficient vehicles.

A commercial report estimated that only 170,000 vehicles sold in July and August of 2009 were attributable to the Cash for Clunkers program (see Edmunds.com). This study was strongly condemned by the Council of Economic Advisors, whose own study suggested more than 400,000 vehicles sales were attributable to the stimulus (CEA, 2010) If correct, the commercial report seriously challenges both the efficacy of the program for its stimulus effects and for its environmental effects (which would have otherwise been achieved through normal replacement). The commercial study (by Edmunds.com) performed this estimate by comparing the forecasted level of auto sales with the actual number of auto's sold over this period. From a method standpoint this is not an uncommon approach to modeling policy intervention. One drawback is that this approach requires a great deal of confidence in the underlying forecasting model during the period of policy intervention. This paper will address this question employing alternative models.

[3] "According t0 a study by Christopher Knittel at the Center for the Study of Energy Markets, this would reduce annual gas consumption in the United States by roughly 160 million gallons per year, lowering emissions of carbon dioxide, the most important element in the greenhouse gases that are implicated in global warming, by about 1.6 million tons a year." Murphey, Cait "Cash for Clunkers: Did it work?" CBS News, August 24, 2009.

[4] See Trade-in Vehicles.xls retrieved from http://www.cars.gov/carsreport, October, 2009.
[5] See Purchased Vehicles.xls retrived from http://www.cars.gov/carsreport, October, 2009.
[6] See Top 10s from http://www.cars.gov/carsreport/top-10/, December ,2009.
[7] See MFG origin from http://www.cars.gov/carsreport/mfg-origin/, December 2009.
[8] See MPG by state from http://www.cars.gov/carsreport/mpg-by-state/, December, 2009.

3. The Impact of Cash or Clunkers on Vehicle Sales

As Figure 1 illustrates, US automobile sales have languished in this business cycle. During the two months the Cash for Clunkers program operated, more than 677.794 households took advantage of the payment, which represents an apparently large effect on the automobile market. It is not clear how many sales could plausibly be linked to the Cash for Clunkers program. Clearly some owners would have exchanged their cars for new vehicles, with or without the program. Also, it is likely there has been some compression of vehicle sales from later months as consumers decided to expedite their purchase of automobiles. The task here is to decompose the effect of the Cash for Clunkers program. . In order to estimate the effect of Cash for Clunkers, I propose a reduced form model:

LVS = f(Gas Price, Prime Rate, Unemployment Rate, Clunker, Quarter)

where light vehicle sales is a function of a three month moving average of gasoline prices, monthly data for the Federal Reserve Prime Rate, the unemployment rate, three quarterly binary variables to account for seasonality in auto sales and a three month autoregressive and moving average term.[9] The Clunker variable takes three different forms. First, I combine both months, treating the entire active clunker period as a single dummy variable. Alternatively, I account for each month of the clunker program differently. There are benefits and drawbacks to both approaches that are largely to be resolved when making comparisons across the results. I also employ an alternative specification which includes a dummy for the month prior to, and the month following the program. The purpose of this is to test the actual effect of two serious concerns surrounding the policy. The first concern was that the announcement of the Cash for Clunkers program would stall car sales as clunker owners deferred purchases in the weeks prior to the implementation of the program. The post clunker dummy is a direct test of the concern that the clunker program would simply advance auto sales which would have happened in the near future to qualify for the program. In both instances, a negative coefficient would confirm these fears. Data are from the Federal Reserve Economic Database. These estimation results appear in Table 1.

[9] The variables employed are nominal (affecting gasoline prices) and are all stationary over the common period of January 1995 through September 2009. We treated the standard errors with White's heteroscedasticity invariant, variance covariance matrix.

Table 1, Estimation Results, dependent variable is light weight vehicle sales

	Base Model		With Pre/Post Effects	
	Model 1	Model 2	Model 1	Model 2
common intercept	26.72*** (11.58)	26.90*** (11.76)	28.872*** (10.85)	29.139*** (10.98)
Gasoline Price (3 month moving average)	-0.74** (-2.42)	-0.77** (-2.52)	-0.61* (-1.97)	-0.64** (-2.06)
Prime Rate	-0.251† (-1.53)	-0.258† (-1.59)	-0.37** (-2.13)	-0.39** (-2.21)
Unemployment Rate	-1.554*** (-6.75)	-1.569*** (-6.86)	-1.88*** (-5.51)	-1.91*** (-5.61)
Q2	0.159 (1.15)	0.164 (1.17)	0.11 (0.77)	0.11 (0.42)
Q3	0.347 (1.85)	0.356* (1.87)	0.29 (1.58)	0.30 (1.61)
Q4	0.193 (0.92)	0.197 (0.94)	0.22 (1.08)	0.23 (1.10)
Clunker (July & August)	4.119*** (3.68)	. . .	4.98*** (3.45)	. . .
Clunker (July)	. . .	2.686*** (6.56)	. . .	3.53*** (3.26)
Clunker (August)	. . .	5.563*** (13.24)	. . .	6.51*** (6.29)
Pre-Clunker (June, 2009)	. . .	. . .	1.36 (1.27)	1.38 (1.29)
Post-Clunker (September, 2009)	. . .	. . .	3.55** (2.41)	3.62** (2.59)
Autoregression (3)	0.914*** (19.46)	0.910*** (19.28)	0.90*** (16.97)	0.90*** (16.64)
Moving Average (3)	-0.581*** (-5.33)	-0.588*** (-5.44)	-0.57*** (-5.03)	-0.57*** (-4.90)
Adjusted R-squared	0.73	0.74	0.76	0.77
Log likelihood	-240.49	-238.35	-243.18	-240.60
F-statistic	52.29***	48.36***	46.76***	44.29***

Note: *** denotes statistical significance at the 0.01 level, ** denotes statistical significance at the 0.05 level, * denotes statistical significance at the 0.10 level and †denotes statistical significance at the 0.15 level. Traditional t-statistics are in parenthesis.

These results confirm what Figure 1 suggests. The Cash for Clunkers program significantly increased automobiles during July and August 2009 over what they would have otherwise been. Importantly, the model also confirms other information about auto markets, lower interest rates, lower gas prices and lower unemployment rates all boost auto sales, when all else is held constant. These are important both because they argue that this model provides an

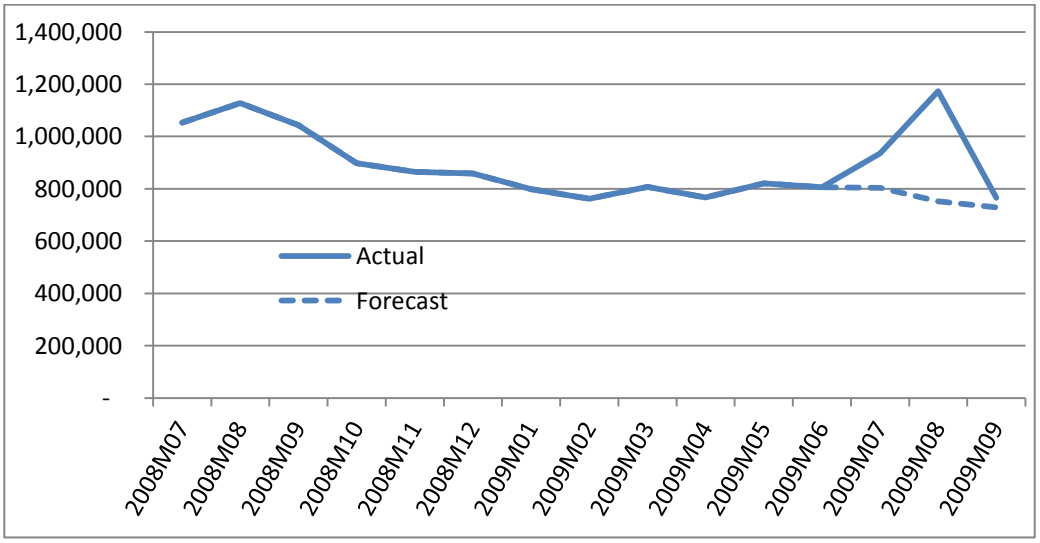
adequate basis for controlling for other variables that might influence the sales of automobiles. For the purposes of this paper, the effect of the Clunkers program is the variable of interest.

The reported sales above are normalized annual sales, as are the most common way these data are reported. Monthly sales are simply 1/12 of this amount. This requires adjusting the coefficients in Table 1 from the models to provide estimates of the Cash for Clunkers program on total automobile sales. In Model 1 (which treats July and August as one common period) I estimate the incremental change in light vehicle sales attributable to the cash for clunker program as roughly 685,000. In Model 2 (which treats July and August as separate periods) the estimate is roughly 687,000 vehicles. These estimates are unusually close to the 677,974 vehicles sold under the program and reported to the Department of Transportation.

The second set of models yield estimates that are not statistically different from the first two models. Importantly though, neither immediately prior or after the July and August Cash for Clunkers period do sales drop significantly. Quite the contrary, while the pre-Clunker period is positive, but not statistically meaningful, the post clunker period shows a positive and statistically meaningful increase in auto sales. Even with a year of data it is too early, and the data insufficiently complete to conclude the later sales represent secondary effects of this short run stimulus. It does clearly reject the notion that the Cash for Clunkers program merely compressed auto investment from the immediate short run into July and August. It is worth noting that both estimates are far higher than the Edmunds.com and that the standard errors for both estimates represent 185,000 to135,000 vehicles.

Replicating the Edmunds.com method by comparing forecasted to actual sales for July and August provides another point estimate of impacts that is within the standard error of both models reported here. Using this method I estimate the Cash for Clunkers program generated an additional 552,000 automobile purchases in July and August of 2009. This involves the use of the short run automobile demand model outlined here, not the model employed by Edmunds.com. For a visual comparison, see Figure II.

Figure II, Actual and Forecasted Light Vehicle Sales July 2008 - October 2009



4. Further Discussion

Other analysis has challenged the efficacy of the Cash for Clunkers program. In particular, the deadweight loss of the vehicle destruction provision has been estimated to be in the $1.4 billion range (Abrams and Parson, 2009). The total paid amount for new cars is just over $2.8 billion.[10] Further, some analysts have expressed concern that the automobiles purchased under the program (which were not primarily Ford, GM and Chrysler) will ultimately lead American consumers away from domestic producers. This might generate an unintended effect of lowering market share for the very firms the program was apparently designed to benefit. Nonetheless, one criticism of the program – that Cash for Clunkers actually did not generate increased automobile sales – does not survive the scrutiny of empirics. By my estimates, most to virtually all the automobiles sold under the Cash for Clunkers program can be attributed to the effects of this policy.

5. References

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[10] http://www.cars.gov/carsreport/invoices-by-state/index.html