

**CAR Research Memorandum**  
**The Economic and Fiscal Contributions  
of the “Cash for Clunkers” Program—  
National and State Effects**

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## Executive Summary

The Consumer Assistance to Recycle and Save (C.A.R.S.) Program, commonly called “Cash for Clunkers” (C4C), was a \$3 billion government incentive to boost automotive industry sales that was in place July 24, 2009 through August 24, 2009. The program was widely hailed as a success since 677,081 individuals traded in their older and less fuel efficient vehicles for new vehicles. During this 32-day period, 2009 new vehicle sales peaked and, for the first time in a long time, the industry experienced the first signs of recovery. Aside from the potential environmental benefits associated with the program, the major purpose was to create jobs in the devastated automotive sector of the U.S. economy.

The Center for Automotive Research (CAR) estimated net new vehicle sales and employment induced by the C4C Program using a combination of an econometric sales forecast model and an inter-industry multi-region simulation model. In total, CAR estimates:

- 395,000 units new vehicle sales,
- 40,200 full-time equivalent jobs in the United States,
- \$2.085 billion increase in gross personal income, and
- \$1.275 billion net revenue

Overall, motor vehicle output added 1.45 percentage points to the third-quarter 2.2 percent change in real Gross Domestic Product (GDP).<sup>1</sup> The C4C Program succeeded in improving fuel economy of new vehicles sold, and in providing much needed stimulus to the struggling U.S. automotive industry.

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<sup>1</sup> Bureau of Economic Analysis, News Release, December 22, 2009.  
<http://bea.gov/newsreleases/national/gdp/gdpnewsrelease.htm>

## Introduction

The Consumer Assistance to Recycle and Save (C.A.R.S) Program, commonly called “Cash for Clunkers (C4C) was first introduced May 12, 2009 as part of H.R. 2346, a supplemental appropriations bill for fiscal year 2009-2010. The Program became Public Law 111-32 on June 24, 2009.<sup>2</sup> Title XIII of the appropriations bill established the voluntary Program in the National Highway Traffic Safety Administration (NHTSA), authorizing the issuance of an electronic cash-value voucher to offset the purchase or lease price for a new fuel efficient automobile upon the surrender of an eligible trade-in vehicle to a participating dealer. The legislation details additional requirements for vehicle eligibility, disposal of trade-in vehicles, and the size of the vouchers at either \$3,500 or \$4,500, depending on the fuel economy improvement realized by the transaction. The C4C Program was funded by a \$1 billion appropriation. Due to the early success of the program, a \$2 billion supplemental appropriation to extend the program was provided in H.R. 3435, which was signed on August 7, 2009 as Public Law 111-47. The Program was aimed not only at improving the fuel economy of new vehicles sold, but also at revitalizing the struggling U.S. automotive industry.

## United States Automotive Sales: 2009 Recap

The year 2009 was a very difficult one for automobile manufacturers. The recession reduced monthly motor vehicle sales to levels not observed in more than 25 years. Automotive sales for 2009 represented a sharp decline from previous years (1999-2007), during which the industry routinely posted sales of over 16 million vehicles a year. Persistent lackluster sales in the first half of 2009 put annual vehicle sales on track to be under 10 million for the year, a possibility that was narrowly avoided—due largely in part to the C4C Program. Strong sales in July and August, (the only months with sales near or above one million units), lifted the industry out of the doldrums and provided the boost necessary to get over the 10-million unit annual sales hump.

The C4C Program was created, in part, to address the growing concerns that additional job losses in the larger manufacturing sector would deepen the recession, particularly in the already hard-hit industrial Midwest. United States Transportation Secretary Ray LaHood hailed the program as highly successful, serving as a “lifeline to the automobile industry, jump-starting a major sector of the economy and putting people back to work.”<sup>3</sup>

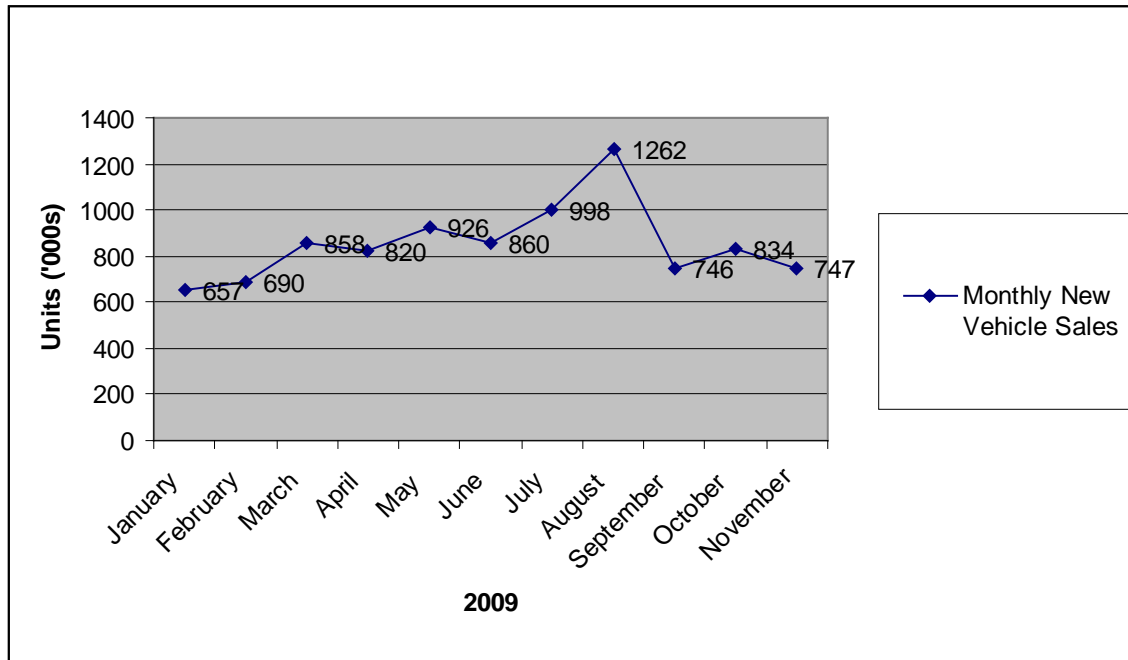
Indeed, consumers responded positively to the incentive by purchasing new vehicles at higher levels than they would have without C4C, and a large sales improvement was observed as the industry posted its second largest and largest monthly sales for 2009 in July (998,000 units) and August (1,262,000 units). See Figure 1.

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<sup>2</sup> The Library of Congress. <http://thomas.loc.gov/>

<sup>3</sup> U.S. Department of Transportation, August 20, 2009 Press Release. <http://www.cars.gov/files/Windown%20Release%2008.20.pdf>

Figure 1: U.S. Light Vehicle Sales by Month:  
January 2009 through November 2009



Source: Automotive News

## Program Achievements

According to data provided on the C.A.R.S. website and included in a program summary report issued on October 23, 2009, a total of 677,081 approved dealer transactions valued at roughly \$2.850 million were submitted.<sup>4</sup> Table 1 presents C4C Program data, and reveals that the vehicles traded in tended to have relatively low average fuel economy, with 71 percent of the owners eligible for the larger \$4,500 voucher for the highest net improvement in fuel economy.

Table 1: Summary Statistics of C4C Program

Voucher Amount	Total Vouchers	Voucher Percent	Total Dollars	New Vehicle Average m.p.g.
\$3,500	196,702	29%	\$688,457,000	22.1
\$4,500	480,379	71%	\$2,161,705,500	26.1
Total	677,081	100%	\$2,850,162,500	24.9

Source: C.A.R.S. Additional Program Statistics, NHTSA, October 23, 2009

As noted in the C4C Program data, 59 percent of new vehicle purchases were cars, while 85 percent of trade-ins were trucks. The report found the program successfully transferred consumers from trucks and SUVs to new, more fuel-efficient cars.

The C4C Program officially ran from July 24, 2009 through August 24, 2009, and it is within this period the majority of the vehicle transactions occurred. The short timeframe necessitated a high level of coordination between dealerships and the government to properly implement and manage the program. Even with some allowances for anxiety

<sup>4</sup> C.A.R.S. Summary Statistics Report. <http://www.cars.gov/files/reports/summary-statistics.pdf>

due to process delays, the program functioned more smoothly than many people thought possible.

## **Incentives: A Natural Economic and Social Experiment**

Our approach to the analysis is guided by our understanding that activity in the automotive industry, as in every other business, is influenced by both demand side and supply side stimuli. Incentives affect the quantity of vehicles demanded by lowering the product price. Measuring the effect of incentives is a difficult exercise, as all methods of measurement rely on a counter-factual framework in which researchers attempt to decouple the stimulating incentive effect from the activity that would have occurred in the absence of the incentive. The mechanics of this process involve creating a forecast value that serves to benchmark normal activity, adjusted for seasonal variations and economic conditions. This forecast value is subtracted from the observed sales level and the remainder is considered attributable to the incentive.

In the growing field of behavioral economics, incentives have become a key interest as they create rich natural experiments *for ex post facto* analysis. A brief literature review shows that incentives for high-ticket durable goods, to a large extent, effectively alter consumers' marginal propensity to consume not only a given product, but their level of consumption overall. Specific to the automotive industry, incentives are used by each automotive manufacturer to expand sales and increase profits in an industry that has a high fixed cost structure. It should be noted that some research has indicated incentives could backfire and effectively reduce, rather than increase, participation in certain programs. However, this effect is largely seen when incentives are tied to altruistic actions or are used as a penalty to encourage activities associated with moral and ethical behavior.<sup>5</sup>

The purchase of a new vehicle is utilitarian, rather than altruistic, and the potential for a backfire is not likely. Of course, inter-temporal tradeoffs and cross market segment shifts are factors that should be taken into account when considering how incentives for new vehicle purchases affect the quantity of consumer demand for vehicles. For the C4C Program, three inter-temporal tradeoffs and two cross market segment shifts are recognized, as defined below.

### **Inter-temporal Tradeoffs**

- *Pull Forward:* This effect is associated with an incentive-induced vehicle sale occurring in the 32-day program period that would otherwise have occurred in the near future. For instance, if a buyer had intended to purchase a vehicle in the fourth quarter of 2009, but the availability of the C4C incentive pulled his purchase activity into the July 24<sup>th</sup>-August 24<sup>th</sup> period, then that transaction is defined as a 'pull forward' sale.
- *Push Back (drop-off):* This effect is associated with a dealer not realizing a sale later in the year due to the pull forward effect. The net effect of the pull forward and push back effects on annual vehicle sales is zero. In fact, it is possible that for a brief interval in our forecast period, the combined effect of the pull forward

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<sup>5</sup> Bowles, Sam "When Economic Incentives Backfire" Harvard Business Review, March 2009  
<http://hbr.harvardbusiness.org/2009/03/when-economic-incentives-backfire/ar/1>

and push back effects was actually less than zero. Dealership inventories at the beginning of September were reported at 50 year lows. Since about 80 percent of new vehicle buyers in the United States typically select a vehicle off a dealer's lot, with very little choice or even inventory of any kind for dealers to offer consumers in September, sales plunged. It is presumed these additional lost sales were made up later in the fall of 2009 with the resumption of full-scale production by many of the North American automakers.

- *Push Forward:* This effect comes from realizing a sale from a buyer who was delaying an earlier purchase based on knowledge or anticipation of a future lower price.<sup>6</sup> We assume that buyers incorporate future price expectations when making a new vehicle purchase. Consumer price sensitivity is an accepted part of the economics literature, and the notion that consumers often wait for discounts is supported by empirical evidence. CAR does not believe this effect was significant in the case of the C4C stimulus because of the general difficulty the public, not to mention the industry, had in forecasting what Congress would do regarding initiating the C4C Program. The industry certainly wasn't prepared with sufficient inventory, and it is hard to believe the public delayed purchases because of the rumor of a C4C Program.

### **Cross Market Segment Shifts and Other Effects**

- *Pull Up:* This is the effect of an incentive inducing a consumer to buy a new vehicle rather than purchasing a used vehicle to replace an aging vehicle. Historically, 30 percent of all new vehicle purchases are made by individuals that had intended to buy a used vehicle. Data from CNW Research reveals that during the C4C incentive period, the rate of used car buyers who instead purchased a new vehicle increased to nearly 50 percent.<sup>7</sup> Consumers in this case, clearly raised their level of vehicle consumption to a higher level because of the incentive.
- *Pull In:* This is the effect of an incentive attracting consumers to consider a purchase which was not planned or considered previously. In the case of C4C, the 'pull in' effect is associated with increased foot traffic from people who may have gone to the dealership because of the C4C Program publicity, including those who did not qualify for the incentive, but made a purchase of a new vehicle anyway. The effect can also include the induced sales effect of the C4C Program in later months as the economy grows, improving consumer confidence. In addition, many households own a number of vehicles in different age categories. The average American household owns more than two motor vehicles. Numerous anecdotes related by dealership managers to the CAR chief economist as well as other auto economists describe many C4C buyers as individuals who "owned three or more vehicles, including an eligible clunker they were not intending to sell or trade-in, but due to the availability of the C4C program did trade-in for new vehicle. These individuals or households were often described by dealers as "special" or "well-to-do." Not many Americans, it was pointed out, can afford to maintain a clunker worth less than \$4,500 (and rarely used except for special purposes), and possess the ability to trade the

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<sup>6</sup> Consumer demand drops due to expectations of lower prices in future periods.

<sup>7</sup> CNW Research, Retail Automotive Summary, November 20, 2009.

vehicle in under the program and quickly qualify for an automotive loan during a period of severe credit availability in many decades. In a similar fashion to the Pull Up effect (buying new rather than used), it is likely that the Pull In effect increased consumer spending on motor vehicles to a degree larger than its negative effect on other types of consumption. In other words, saving and savings were reduced and produced a stimulus effect on the over-all economy.

Fully accounting for the inter-temporal and cross-market segment shifts allowed for proper attribution of incremental automotive sales to the program itself, during the C4C incentive period. Inter-temporal effects do not produce a stimulus to the economy. Cross market effects can produce stimulus. Estimation of the C4C Program impact has been considered, to varying degrees, by several economists and their approaches and conclusions have led to prickly public debates. From a review of the released statements and reports regarding the impact of the C4C Program, some analysts believe that the majority of vehicle purchases fall into the “pull forward” category, while others measure only the direct sales effect of C4C to produce estimates of government subsidization rates for vehicles purchased during the incentive period.<sup>8</sup> CAR’s efforts differ from previous efforts by providing a more comprehensive analysis of inter-temporal and cross-market effects, and delivering informative employment and income effects at the state and national level.

The purpose of C4C was to increase motor vehicle sales in order to kick start domestic motor vehicle production. The production of a motor vehicle is known to have a very large job multiplier effect, and this characteristic is very attractive to policy makers who wish to use fiscal policy to promote job growth during the recession. A critical metric in determining the success of the program is the calculation of the number of jobs that can be directly and indirectly associated with increased vehicle production.

### **A Model Forecasting Monthly Light Vehicle Sales**

Although the C4C stimulus program officially started on July 1, 2009, the program was not in effect until July 24 and it ended on August 24, 2009. During these 32 days of frenzied vehicle shopping, 677,081 vehicles were sold with vouchers issued under the stimulus program. The impact of the program on U.S. light vehicle sales was obvious, and it was perhaps one of the most successful economic stimulus programs the Federal government implemented during the 2009 economic recession.

The magnitude of impact of the C4C Program on U.S. light vehicle sales was estimated by various studies to range from 125,000<sup>9</sup> to 560,000<sup>10</sup> units. One of the major factors that caused the wildly different estimates was the discrepancy in projected monthly sales in the absence of the stimulus program. That is, what share of 677,081 units of vehicle sales was incremental and how many vehicles would have been sold without the stimulus program?

To reconstruct U.S. monthly sales between July and December, 2009, CAR created an econometric model including explanatory variables to represent the C4C stimulus

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<sup>8</sup> “Cash for Clunkers Results Finally In: Taxpayers Paid \$24,000 per Vehicle Sold, Reports Edmunds.com.” <http://www.edmunds.com/help/about/press/159446/article.html>

<sup>9</sup> *Ibid.*

<sup>10</sup> Executive Office of The President’s Council of Economic Advisers, “*Economic Analysis of The Car Allowance Rebate System*,” September 10, 2009.

program, lagged unemployment rates (UNEMP(-1)), gasoline prices (G\_PRICE), personal consumption expenditure on new vehicles (PCE\_NV), and seasonal effects (Q1-Q3).

Because PCE\_NV is an endogenous variable and is correlated with the error term, PCE\_NV is systematically estimated by two additional exogenous variables: lagged disposable personal income (DPI(-1)) and new vehicle price index (CAR\_PRICE). A two-stage least squares estimation with a one-month moving average term (MA(1)) was constructed to estimate monthly light vehicle sales (SALES).

The data used represents the period of January 2000 to October 2009. The explanatory variables are extended using trends to estimate November and December sales. Appendix I shows the model estimation output.

### **Impact on Sales**

Table 2 shows the estimated monthly sales in the absence of C4C stimulus, as well as the actual sales during those months. Estimated C4C impacts on sales are calculated by subtracting estimated sales from the actual sales figures. In July and August, estimated light vehicle sales (without C4C) were 887,406 and 1,070,544 units, respectively. Subtracting these estimates from actual sales during the same months, we found that 302,301 units, or 44 percent of light vehicles sold under the C4C Program, were incremental.

However, after the stimulus program ended on August 24, 2009, new vehicle sales plunged. September sales were 32,404 units lower than projected. This is partially due to a C4C 'push-back' sales effect materializing in September. In addition, many of the most popular models sold during the C4C period were not available due to depleted inventory levels.

The sales impact of C4C continued in October and resulted in 124,850 units of sales above the projection. In October, the C4C influence was noticeable on both demand and supply sides. On the supply side, U.S. light vehicle inventories were depleted during C4C months, leaving fewer models and less selection for purchases. Some of the incremental sales in October were, in fact, delayed purchases that would have occurred in September had there been sufficient inventories. On the demand side, the C4C Program jump-started the motor vehicle industry and allowed hibernating factories to resume production and bring workers back to work. After four consecutive quarters of negative growth, GDP finally grew by 2.2 percent in the third quarter of 2009—the largest quarterly growth since the third quarter of 2007. Consumer confidence was bolstered and demand for new vehicles showed signs of recovery.



Table 2: Monthly Sales and C4C Program Effects (thousands)

Month of 2009	Actual Sales	Sales Trend Without C4C	C4C Impact on Sales
July	998.1	887.4	110.7
August	1262.2	1070.5	191.6
September	746.2	778.6	-32.4
October	838.2	713.4	124.8
November	-	668.0	-
December	-	684.1	-
Total C4C Program Impacts on Sales thru October 2009			394.7

Source: Automotive News; CAR Research

Although the model projected monthly sales through December, the estimated impact of C4C on sales was constrained to October and the prior three months of July, August and September for two reasons. First, the forecast was completed before the actual numbers for November and December sales were available, and the difference between actual and projected sales cannot be calculated without knowing the actual sales numbers. Second, as economic recovery takes hold, it will have a much larger impact on light vehicle sales than any remnants of the C4C Program.

### Impact on Production

Since all the sales recovery is not due to the C4C Program, the total C4C impact on light vehicle sales in 2009 is conservatively estimated at 394,746 units. However, we estimate only 184,184 units, or 47 percent of the total, were produced in the United States. Of the remainder, 28 percent were non-North American imports and 25 percent were Canadian and Mexican imports. CAR identified the vehicles' assembly sources by determining the final assembly plant locations of the makes and models provided by the National Highway Traffic Safety Administration (NHTSA). The majority of models sold under the C4C Program were sourced to only one country; only a few models were sourced to two or more countries. For the models made in more than one country, CAR assumed the assembly source share of vehicles sold to be proportional to the production share of that model produced by each country.<sup>11</sup> The 184,184 domestically built units are further categorized at the state level based on vehicles' name plates and the locations of final assembly plants. In some cases where one model was made in two different states, the production shares were used to estimate the assembly source of vehicles sold. The state breakdowns are listed in Appendix II.

Since all North American-built vehicles contain U.S. content, the U.S. content values are also calculated for the vehicles assembled in Canada and Mexico. An estimated 61 percent of Canadian vehicles and 25 percent of Mexican vehicles<sup>12</sup> (models sold in the United States) are assembled with U.S.-sourced powertrains, drivetrains and components (engines and transmissions for the most part). In addition, based on previous CAR studies,<sup>13</sup> we estimated that the powertrain system accounts for more

<sup>11</sup> CAR estimated the U.S. and North American production shares of vehicles purchased under the C.A.R.S. Program. When compared to the Transaction Database published by NHTSA, CAR's estimates differed by only one and a half percentage points, and this difference had minimal impact on the overall conclusions reached in this memorandum.

<sup>12</sup> CAR research based on CSM Worldwide dataset, November 2009

<sup>13</sup> Sean P. McAlinden and David J. Andrea, *Estimating the New Automotive Value Chain*, November 2002.

than 35 percent of the cost of materials, constituting 75 percent of a vehicle's value.<sup>14</sup> Applying these factors to a total of 98,508 units of Canadian/Mexican vehicles, we estimated that an equivalent value of 11,123 units of vehicles are represented by U.S.-made powertrains installed in Canadian and Mexican vehicles and sold as a result of the C4C Program.

The U.S. content value of North American-assembled vehicles equaling 11,123 units of vehicles are further categorized at the state level based on the share of automotive parts manufacturing employment in each state. The state breakdowns are listed in Appendix III.

By following these computations, we were able to estimate the total net production value of finished automobiles and powertrains associated with the C4C Program and measure its contribution to growth in U.S. employment and personal income.

Using data collected from the National Automobile Dealers Association (NADA), Penske Automotive, AutoNation, and Group 1 press releases and C4C Program summary data, we subtracted the gross margin from the average selling price to estimate the invoice sticker for the new vehicles sold. The invoice sticker price is the dollar value of a motor vehicle before the dealership mark-up. By separating the dealer mark-up from the value of the fully-assembled automobile, we effectively captured the employment contributions at assembly and parts plants separate from value attributable to dealership operations.

Using a 2009 Regional Economic Models, Inc. (REMI) labor productivity conversion rate that measures the dollar value of production per motor vehicle assembly and parts employee, we estimated direct motor vehicle assembly and parts employment associated with the C4C Program on a state-by-state basis by dividing the total net production value by the labor productivity rates.

The final step in the analysis was to capture the net employment effects associated with direct increases in motor vehicle assembly employment and production in the United States by running a 50-state and District of Columbia forecast and simulation model, produced by REMI. In addition, we also captured the effect of U.S. powertrain manufacturers selling their products to Mexican and Canadian assemblers whose vehicles were then imported into the United States and registered with the C4C Program. It should be noted that our approach of capturing only the powertrain-related employment is a conservative estimate of all U.S. parts outflows to Mexico and Canada, which results in an understatement of the actual effect of C4C on the broader U.S. motor vehicle parts sector. Conversely, the fact that 28 percent of C4C new vehicle sales were non-North American-assembled vehicles certainly detracted from the overall macro-economic impact of the C4C Program.

## **Impact on Dealerships**

Prior to the C4C Program, dealerships faced one of the toughest years in recent history. The anemic sales pace in the first half of 2009 was insufficient to support the dealership network that had grown accustomed to annual sales of roughly 16 million vehicles. Dealer owners responded with layoffs as a stop-gap measure in the face of looming closures. The announcement of the C4C Program and subsequent boost in automotive

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<sup>14</sup> 2007 Economic Census, U.S. Census Bureau

sales required a change of course in personnel planning, and each dealership had to determine whether the upswing in sales would be temporary or permanent. The hours of current employees were likely expanded to handle some of the additional business activity, and several dealerships may have brought laid-off employees back to work. Given data limitations, the program effects on direct dealership employment, unfortunately, were not captured in this analysis. However, the additional income from extra hours and the increase in part-time or full-time employment would be an additional benefit to the economy and an aspect of the program that should be accounted for when considering more comprehensive program benefits.

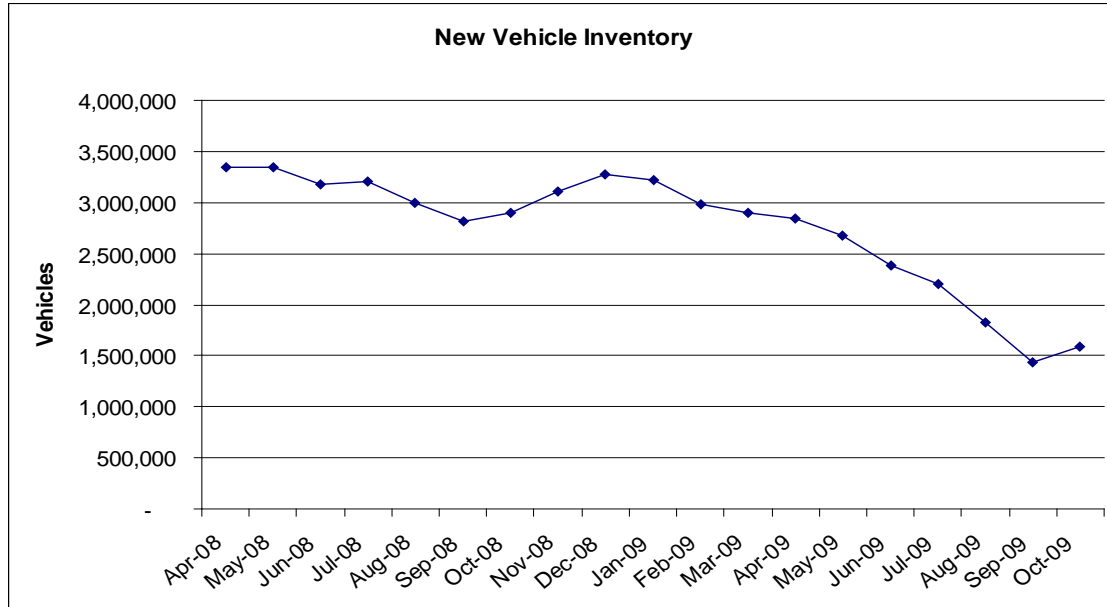
In places where data were insufficient, we either did not incorporate them or developed a lower-bound estimate, resulting in more conservative estimates. Employment and income results developed in this analysis are methodologically sound, and should be used to assess the true impact of the C4C Program on the U.S. economy during the last half of 2009.

### **Impact on Inventory**

To a great extent, the U.S. automotive industry was not prepared for the sudden surge of demand for new vehicles brought on by the C4C Program. In addition to ongoing restructuring activities by General Motors, Ford, and Chrysler, bankruptcy proceedings effectively closed down all production at GM and Chrysler facilities during the early summer months of 2009. Figure 2 shows that at the end of 2008, inventories, measured in vehicle units, were roughly 3.278 million. A slowdown in vehicle sales at that same time created an inventory surplus, and led to large reductions in production schedules at several assembly plants, including transplants. By all accounts, the industry was preparing for a very weak sales year and OEMs were cutting production to avoid exposure to inventory build-ups. Yet, a well-stocked inventory would have been an asset during the C4C Program period, as many dealerships scrambled to meet orders for high fuel-economy vehicles.

Rapid inventory depletion is a concern for dealerships as choice and variety in vehicle color, engine size, optional equipment packaging, and other consumer options allow for a better match between buyer and product, resulting in a more immediate realization of sales. OEMs are acutely aware of consumer demands, and to avoid lost sales due to reduced choice and variety, vehicle manufacturers schedule production to replenish inventory stocks and maintain target levels.

Figure 2: New Vehicle Inventory (measured in vehicle units), April 2008-October 2009



Source: Automotive News Data Center

At the end of the C4C Program period, inventories of several popular vehicles were depleted far beyond the target levels associated with the planned slowdown of production. Limited vehicle choice not only affected the options for eligible C4C buyers, but created a barrier to sales for all interested parties. It should be noted that target inventory counts vary by company, and are highly dependent upon consumer demand for popular vehicles.

### Direct Effects

CAR's analysis indicates that roughly 395,000 vehicle sales occurred in the last half of 2009 due to the stimulating effect of the C4C Program. Of this total, roughly 184,000 vehicles are sourced to U.S. production.

Table 3: Net New C4C-Induced Production, Sourced to Region, July-December 2009

Source of New Vehicle Production	New Vehicles (units)	Share of Total
United States	184,184	46.7%
Canada	49,293	12.5%
Mexico	49,215	12.5%
Other Imports	112,054	28.4%
<b>Total</b>	<b>394,746</b>	<b>100%</b>

Source: CAR Research.

NHTSA's C.A.R.S. Transaction Dataset, which included each new purchased Vehicle's Identification Number (VIN), was obtained after the analysis of the vehicle's production sourcing was completed. The comparison of CAR's estimate of North America production share and the share calculated based on NHTSA's October 2009 Transaction

Dataset is shown in Table 4. CAR's North American estimate differed by only one and a half percentage points, and this difference had minimal impact on the overall conclusions reached in this memorandum.

Table 4: Production Shares of C4C New Vehicles

	NHTSA	CAR Estimates
U.S.	48.5%	46.7%
Canada	9.6%	12.5%
Mexico	12.0%	12.5%
Rest of World	29.8%	28.4%

Source: CAR Research based on C.A.R.S. Transaction Database, NHTSA. <http://www.cars.gov/carsreport>

## Simulation Results

### *Employment*

CAR's analysis of C4C identifies employment increases totaling roughly 40,200 for the nation, with the largest gains seen in Michigan, Ohio, and Indiana. These jobs are measured as full-time equivalents in job-years units. With a continued economic recovery and improvements in the 2010 auto market, we can assume that these jobs will remain and contribute positively to U.S. employment levels. However, if the economy sags or the auto market fails to exceed 2009 sales levels, policy makers should consider what another \$3 billion investment in a second round of C4C could yield. Table 5 provides information on total employment associated with the C4C Program. The values below include:

- employment at automotive assembly and parts factories in the United States.
- employment at U.S. parts makers selling powertrain components to Mexican and Canadian assembly plants supplying the U.S. market
- employment associated with the development of intermediate goods and services for U.S. assemblers and parts makers
- employment associated with household purchases

In effect, our simulation captures the direct, indirect, and induced effects of the C4C Program on the U.S. economy, with regional details available at the state level.

Table 5: Total Employment Effect, Top 10 States

Rank	State	Employment*
1	Michigan	5,800
2	Ohio	5,000
3	Indiana	3,000
4	Illinois	2,700
5	California	2,100
6	Missouri	1,900
7	Tennessee	1,700
8	Kentucky	1,700
9	Texas	1,600
10	Alabama	1,400
<b>United States</b>		<b>40,200</b>

Source: CAR Research. \*Rounded to nearest hundred

These employment findings strongly suggest the C4C Program was highly efficient at creating employment opportunities, with a government subsidization rate of \$71,000 per new job. As a comparison to another government-funded job creation stimulus program, the Council of Economic Advisers assumed a government subsidization rate of \$92,000 per new job for the American Recovery and Reinvestment Act (ARRA).<sup>15</sup> Our results indicate that an investment in the automotive sector, on an equivalent dollar basis, carries with it a far greater employment stimulating effect than what was benchmarked for ARRA. This finding should be referenced by policy makers in search of highly stimulating investment programs. The difference in the cost-per-job figures can largely be ascribed to the motor vehicle industry's historically higher than average employment multiplier. That is, a dollar invested to stimulate the production of a motor vehicle has far greater reach into other industries than a dollar invested in nearly any other industry.

### **Income**

The net income-generating effect of motor vehicle employment is considerable, due to the extensive interconnections between automotive and other well-paying jobs in non-motor vehicle manufacturing, professional service firms, transportation, and wholesale trade sectors. As a result of the C4C Program, unemployed autoworkers were called back to work on the assembly line. During a time of great losses and threats to the livelihood of thousands of families, the household income generated by the C4C Program was a welcome relief. Incremental income gains associated with the C4C Program totaled \$2.085 billion, not an insignificant gain during a recession.

<sup>15</sup> Council of Economic Advisers, Estimates of Job Creation from the American Recovery and Reinvestment Act of 2009. <http://www.whitehouse.gov/administration/eop/cea/Estimate-of-Job-Creation/>

### ***Changes to Revenues and Expenditures: Federal and State***

A large stimulating effect of the C4C Program on state budgets came as a result of increased sales tax collection due to new vehicle purchases. Excluding sales made in Guam, Puerto Rico, and the Virgin Islands, as well as the tax exemption of a \$3,500-4,500 voucher in certain states, and accounting for no sales taxes in Alaska, Montana, New Hampshire, and Oregon, CAR found that revenue attributed to increased state sales taxes amounted to roughly \$440 million in 2009.<sup>16</sup> For states in fiscal crisis, this boost was extremely timely and should be considered when evaluating the effects of the C4C Program.<sup>17</sup>

In addition to sales tax collections, state and federal revenues also increased due to increased income taxes collected from people earning paychecks. The federal budget was positively affected, as fewer people required outlay assistance from the government, and employees and employers contributed to the payroll tax. Due to increases in income and payroll tax collections, and reductions in government outlays, the gross revenue effect was \$835 million. In total, C4C had a net positive impact of \$1.275 billion on the bottom line of state and federal government revenues and outlays.

### ***C4C Program Regulations: Did Import Allowances Cost the United States?***

During the recession, a number of nations instituted or proposed legislation to stimulate consumption of automobiles through trade-in programs similar to the United States C4C Program or through direct tax incentives or subsidies. A major difference between the program carried out in the United States and the programs initiated in a number of other nations is in the treatment of import vehicles. Under United States rules and regulations, imports were eligible without any penalty or restriction. However, other nations developed regulations that severely restricted the program eligibility of imported vehicles as trade-ins for higher fuel economy vehicles, or excluded imports from receiving tax advantages or subsidies for the purchase of higher fuel economy vehicles.

When comparing program rules and regulations across the globe, an interesting counterfactual question surfaces: “What if the United States had restricted the \$3,500-\$4,500 program voucher to vehicles produced in the North American Free Trade Agreement (NAFTA) region?” According to calculations presented earlier, of the 394,746 C4C-induced vehicles sales, 112,504 were non-NAFTA imports. As it turns out, a considerable amount of economic activity could have been generated for the United States if the program excluded non-NAFTA imports.

A second simulation was developed to represent the potential effects of replacing imports with NAFTA-area production. We assumed 100 percent substitution of imports with NAFTA-produced vehicles, and assigned final assembly and powertrain sourcing proportional to the Appendix II and III findings. The simulation results indicated that roughly 15,900 additional jobs and \$825 million in personal income could have been realized in the United States if all of the C4C-induced sales had been produced in the NAFTA area. Accounting for increases in income and payroll tax collections, and

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<sup>16</sup> As explained on the C.A.R.S. website, the clunker credit is not counted as taxable income for federal taxes, but discretion about whether states can levy their sales tax rates on the value of the clunker credit is left to the states.

<sup>17</sup> 2009 Federal tax law allows eligible taxpayers to deduct state and local sales taxes paid on up to \$49,500 of the purchase price. This effect is not captured in our analysis.

reductions in government outlays, the net tax revenue effect would have been roughly \$330 million more. State sales tax collection on motor vehicles would have remained the same.

Table 6: Economic Impact of C4C Program

Result/Scenario	Factual	Counter-factual (100% NAFTA)	Difference
Employment	40,200	56,100	+15,900
Gross Personal Income (\$B)	2.085	2.910	+0.825
Net Tax Revenue (\$B)	1.275	1.605	+0.330

Source: CAR Research, REMI model

## Conclusion

The C.A.R.S Program provided critical support to the U.S. motor vehicle industry at a time when the industry and the U.S economy were in a desperate state. The employment, personal income, tax revenue and GDP gains associated with the program offer a large body of evidence for Congress to consider when assessing the stimulating effects of ongoing and future recovery and reinvestment programs. It is our belief that another round of C4C should be considered, as it could provide positive effects on a similar scale to that realized from the initial \$3 billion investment.

In considering another round of the C4C Program, CAR advises policy makers and program administrators to evaluate the equity attributes of the program. A survey of car dealerships and 2,200 consumers conducted by CNW Research found that the average income of new car buyers under the C4C Program was \$57,700. Relatively affluent individuals benefited far more than lower-income individuals, since more affluent buyers had both the clunker in hand and the good credit history necessary to qualify for a loan in what is still a very tight credit market. Given credit and income constraints, and considering the reduction in low-cost used vehicles available in the market (effectively shrinking supply and driving up the price of used vehicles), low-income individuals benefited the least from the program.



## Appendix I

### Estimation Output

Dependent Variable: SALES				
Method: Two-Stage Least Squares				
Sample (adjusted): 2000M04 2009M10				
Included observations: 115 after adjustments				
Convergence achieved after 2 iterations				
MA Backcast: 2000M03				
Instrument list: C DPI (-1) CAR_PRICE UNEMP(-1) C4C				
Lagged dependent variable & regressors added to instrument list				
	Coefficient	Std. Error	t-Statistic	Prob.
C	952.9025	80.16452	11.88684	0.0000
PCE_NV	3.563235	0.239029	14.90714	0.0000
UNEMP(-1)	-80.26355	5.768806	-13.91337	0.0000
G_PRICE	-0.662333	0.094692	-6.994603	0.0000
C4C	109.1724	65.26897	1.672654	0.0973
Q1	25.78485	30.06510	0.857634	0.3930
Q2	281.7263	22.28554	12.64167	0.0000
Q3	204.0211	29.71929	6.864938	0.0000
MA(1)	-0.417908	0.119926	-3.484721	0.0007
R-squared	0.802724	Mean dependent var		1319.935
Adjusted R-squared	0.787835	S.D. dependent var		236.5829
S.E. of regression	108.9733	Sum squared resid		1258770.
F-statistic	32.07562	Durbin-Watson stat		2.190691
Prob(F-statistic)	0.000000	Second-Stage SSR		3333515.
Inverted MA Roots	.42			

## Appendix II

### C4C Program Impacts of Motor Vehicle Manufacturing (Unit of Motor Vehicles)

State	Jul-Aug Units	Sep-Dec Units	2009 (Jul-Dec)
AL	10,255	3,991	14,246
CA	10,136	1,788	11,924
DE	74	81	155
GA	11	6	17
IL	7,928	1,371	9,299
IN	10,723	4,820	15,543
KS	3,443	1,299	4,742
KY	11,303	4,776	16,078
LA	3,085	312	3,398
MI	28,679	11,174	39,853
MN	3,147	350	3,497
MO	15,336	3,690	19,026
MS	3,899	1,487	5,385
OH	21,201	6,516	27,716
SC	0	369	370
TN	6,344	2,589	8,934
TX	867	3,135	4,002
CAN	36,351	12,942	49,293
MEX	40,464	8,751	49,215
IM	89,056	22,998	112,054
<b>Total</b>	<b>302,301</b>	<b>92,445</b>	<b>394,746</b>
<b>U.S. Total</b>	<b>136,430</b>	<b>47,754</b>	<b>184,184</b>

Source: CAR Research

### Appendix III

Canadian/Mexican Production impacts of U.S. Auto Parts Manufacturing  
(equivalent value in unit of vehicles)

State	Employment Ratio <sup>1</sup>	Canda <sup>2,3</sup>	Mexico <sup>2,3</sup>	Total
Alabama	2.9%	226	92	318
Alaska	0.0%	0	0	0
Arizona	0.5%	41	17	57
Arkansas	1.0%	80	33	112
California	3.0%	234	96	329
Colorado	0.2%	16	7	23
Connecticut	0.7%	54	22	77
Delaware	0.0%	0	0	0
District of Columbia	0.0%	0	0	0
Florida	0.8%	64	26	90
Georgia	1.6%	129	53	182
Hawaii	0.0%	0	0	0
Idaho	0.0%	0	0	0
Illinois	4.5%	355	145	500
Indiana	11.0%	871	356	1,227
Iowa	1.4%	112	46	158
Kansas	0.5%	41	17	58
Kentucky	5.6%	444	182	625
Louisiana	0.1%	11	4	15
Maine	0.0%	0	0	0
Maryland	0.3%	22	9	31
Massachusetts	0.2%	16	7	22
Michigan	21.7%	1,710	700	2,410
Minnesota	0.5%	37	15	52
Mississippi	1.0%	79	32	111
Missouri	2.2%	176	72	248
Montana	0.0%	0	0	0
Nebraska	0.7%	59	24	83
Nevada	0.1%	9	4	12
New Hampshire	0.0%	0	0	0
New Jersey	0.2%	17	7	25
New Mexico	0.0%	0	0	0
New York	3.4%	268	110	378
North Carolina	2.8%	223	91	314
North Dakota	0.2%	13	5	18
Ohio	13.6%	1,070	438	1,507
Oklahoma	0.7%	53	22	75
Oregon	0.4%	31	13	44

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## Appendix III continued

State	Employment Ratio <sup>1</sup>	Canda <sup>2,3</sup>	Mexico <sup>2,3</sup>	Total
Pennsylvania	1.4%	108	44	152
Rhode Island	0.0%	0	0	0
South Carolina	3.0%	233	95	329
South Dakota	0.1%	9	4	13
Tennessee	6.1%	485	198	683
Texas	3.0%	233	95	328
Utah	0.7%	57	24	81
Vermont	0.1%	10	4	14
Virginia	1.2%	93	38	132
Washington	0.4%	32	13	46
West Virginia	0.3%	23	9	32
Wisconsin	1.9%	150	61	211
Wyoming	0.0%	0	0	0
TOTAL	100.0%	7,893	3,230	11,123

1. States' auto parts employment breakdown was provided by Don Grimes.
2. Sixty-one percent of Canadian vehicles and 25% of Mexican vehicles (models sold in United States) source U.S. engines and transmissions. **Source: CAR research based on CSM Worldwide dataset, November 2009.**
3. Powertrain accounts for 35% of total vehicle value. **Source: Sean P. McAlinden and David J. Andrea, *Estimating the New Automotive Value Chain*, November 2002.**
4. Material cost accounts 75% of vehicle's value. **Source: 2007 Economic Census, U.S. Census Bureau.**

## Appendix IV

### State Employment and Income Effects

State	Employment	Personal Income (M)
Alabama	1,425	68.6
Alaska	24	1.0
Arizona	168	7.0
Arkansas	293	11.9
California	2,068	113.2
Colorado	204	10.8
Connecticut	247	17.9
Delaware	63	3.4
District of Columbia	65	2.3
Florida	939	37.5
Georgia	936	45.0
Hawaii	28	1.0
Idaho	41	1.3
Illinois	2,653	156.4
Indiana	3,034	159.2
Iowa	345	14.0
Kansas	597	26.6
Kentucky	1,688	80.2
Louisiana	566	21.5
Maine	63	2.2
Maryland	306	18.3
Massachusetts	349	21.5
Michigan	5,819	339.8
Minnesota	695	33.7
Mississippi	650	25.9
Missouri	1,869	86.2
Montana	41	1.2
Nebraska	178	7.3
Nevada	136	6.0
New Hampshire	76	3.9
New Jersey	492	35.4
New Mexico	54	1.9
New York	1,197	78.9
North Carolina	755	33.5
North Dakota	46	1.5
Ohio	4,963	256.6
Oklahoma	220	9.7
Oregon	102	4.1

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## Appendix IV continued

<b>State</b>	<b>Employment</b>	<b>Personal Income (M)</b>
Pennsylvania	981	49.5
Rhode Island	47	2.1
South Carolina	458	20.1
South Dakota	55	1.8
Tennessee	1,730	85.2
Texas	1,575	87.0
Utah	133	5.3
Vermont	40	1.4
Virginia	594	30.9
Washington	113	6.0
West Virginia	183	7.5
Wisconsin	860	41.5
Wyoming	31	1.3
TOTAL	40,197	2085.4

## Appendix V

### State Employment and Income Effects: 100% NAFTA area Production

State	Employment	Personal Income (M)
Alabama	1,988	95.6
Alaska	34	1.4
Arizona	233	9.8
Arkansas	410	16.6
California	2,883	157.3
Colorado	285	15.2
Connecticut	345	25.0
Delaware	86	4.6
District of Columbia	91	3.2
Florida	1,313	52.2
Georgia	1,308	62.9
Hawaii	39	1.4
Idaho	57	1.8
Illinois	3,702	218.1
Indiana	4,235	222.2
Iowa	481	19.5
Kansas	834	37.2
Kentucky	2,360	112.1
Louisiana	793	30.1
Maine	89	3.0
Maryland	430	25.7
Massachusetts	488	30.1
Michigan	8,123	474.2
Minnesota	975	47.1
Mississippi	909	36.3
Missouri	2,612	120.5
Montana	56	1.7
Nebraska	249	10.2
Nevada	189	8.3
New Hampshire	106	5.4
New Jersey	688	49.5
New Mexico	76	2.7
New York	1,670	110.3
North Carolina	1,056	46.8
North Dakota	62	2.1

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## Appendix V continued

State	Employment	Personal Income (M)
Ohio	6,929	358.2
Oklahoma	306	13.4
Oregon	144	5.7
Pennsylvania	1,371	69.2
Rhode Island	65	2.9
South Carolina	641	28.0
South Dakota	75	2.4
Tennessee	2,413	118.7
Texas	2,201	121.3
Utah	184	7.3
Vermont	55	1.9
Virginia	829	43.1
Washington	158	8.4
West Virginia	257	10.5
Wisconsin	1,200	57.9
Wyoming	43	1.8
TOTAL	56,123	2910.7