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Abstract:

We estimate the impact of the 2009 financial rescue of two large American automobile companies (General Motors and Chrysler) on unemployment in Michigan. We conservatively estimate that the auto bailout saved about 7,700 workers from unemployment each month over a period of four-and-a-half years. This translates to a public savings of between \$1.3 and \$1.6 billion via lower transfer payments and higher tax revenues.

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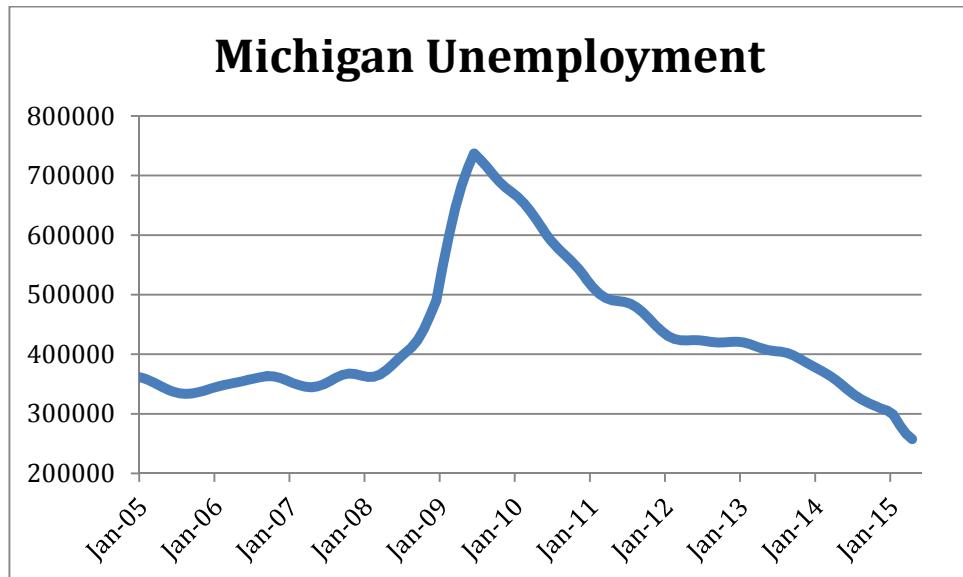
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Introduction

The federal government's decision in 2009 to rescue two large American automobile companies and a few affiliated financing companies was controversial. Prior to the auto bailout, the future of General Motors, Chrysler, and many of their suppliers was dim. Goolsbee and Krueger (2015) state that President Obama and his advisors believed that General Motors (GM) was headed for "an uncontrolled bankruptcy", a prospect that would also lead to a "failure of countless suppliers" (p. 4). Chrysler was also in dire financial condition, and was ultimately included in the auto bailout package. Further complicating matters was that the mere prospect of this catastrophic failure was already increasing unemployment, and there were no viable private finance options to keep the companies afloat. As Goolsbee and Krueger put it, the situation was "government money or bust" (p. 8).

Goolsbee and Krueger, the Center for Automotive Research, and numerous independent researchers believe that the rescue prevented a total collapse of the two firms.¹ Figure 1 illustrates the incredible climb of unemployment in Michigan leading up to the rescue, which approximately doubled in little more than a year between early 2008 and mid 2009. It is important to note the discussions to rescue GM and Chrysler occurred in late 2008 and early 2009. Had GM and Chrysler failed, which many believed would occur without government support, unemployment would have certainly climbed to even higher levels. By 2015, unemployment in Michigan returns to roughly pre-recession levels.

Figure 1



¹ McAlinden, Sean P., and Debra Maranger Menk. *The Effect on the U.S. Economy of the Successful Restructuring of General Motors*. Publication. Center for Automotive Research, 20 May 2014. Web. 22 July 2015.

However, the auto bailout comes at a significant cost. The full tally of all auto bailout activities is roughly \$80 billion. This is approximately ten percent of the estimated cost of the American Recovery and Reinvestment Act (ARRA) of 2009, which is a nationwide fiscal stimulus package whose payouts are distributed over ten years. In comparison, the auto bailout primarily focuses on two companies headquartered in Michigan. Fortunately GM and Chrysler rebounded to levels that surpassed most expectations, and ultimately all but \$9.3 billion² of the original public investment is repaid. By the end of 2013, the federal government formally ends the auto bailout by selling off all remaining assets in the companies.

This paper analyzes the unemployment effects of the auto bailouts in Michigan. Specifically, we use monthly unemployment data from Michigan to estimate the number of workers saved from unemployment as a result of the bailout. Next, we calculate the public savings of the bailout as a result of lower transfer payments and higher tax revenues. We find that the bailout decreased unemployment in Michigan by about 7,700 worker-months for each month over a period of four-and-a-half years. This decrease in unemployment saved the government between \$1.3 and \$1.6 billion in lower transfer payments and higher tax revenues.

While between \$1.3 and \$1.6 billion is small compared to the \$9.3 billion cost, these savings represent a conservative estimate on the public budget. First, we only measure the impact on Michigan. While Michigan employs the highest number of automobile employees, there are also significant numbers of automobile industry employees in Ohio, Indiana, and Kentucky. Furthermore, our estimation technique identifies unemployment effects by using an optimistic control group: the pre-recession unemployment picture in Michigan. It can be argued that Michigan without GM and Chrysler would be fundamentally different and the process of returning to pre-recession levels would be lengthy as capital and labor slowly adjust to the transition. Finally, the closing of GM and Chrysler would have likely put the burden of the companies' pension plans onto the Pension Benefit Guaranty Corporation (PBCG). Leading up to the bailout, the PBCG estimates this would cost \$20 billion.³

Even though the auto bailout was likely good for the short term public budget, this work is not an endorsement of all private business rescues. It is possible the automobile industry could find itself in another precarious financial position in the near future, which will make the auto bailout of 2009 appear as if it postponed the inevitable. Goolsbee and Krueger note that the success of the auto bailout benefitted from a "fairly unique" set of circumstances (p.4) and it is possible that if the bailout was tried in a different time it would not keep the companies afloat long

² "Auto Industry." *TARP Programs*. Department of the Treasury, 22 Dec. 2014. Web. 22 July 2015.

³ Elliott, Douglas J. *What Happens to the GM Pensions in Bankruptcy?* Rep. The Brookings Institution, 29 May 2009. Web. 26 June 2015.

term. Finally, the bailouts in the automobile and financial sectors may have created a dangerous incentive to all “too big to fail” firms who might try riskier strategies if they perceive the government will rescue them in bad times. This prospect is increasingly dangerous with the rise in American industry-level concentration that has created more large companies.⁴

Events Leading to Auto Bailout

During the years leading up to the bailout, the “Big 3” Automobile companies—General Motors, Ford, and Chrysler—posted some of the worst performances in the history of the industry. These losses can be attributed to a number of factors, including the rise of foreign competition as well as the economic recession.⁵ For example, increasing gas prices led to huge declines in purchases of fuel inefficient cars. This was particularly bad for American car companies that depended on these sales, as they faced the least amount of foreign competition for pickup trucks and large SUVs.⁶ By the end of 2008, the Big 3 companies testified in front of the House Financial Services Committee to request bailout funds. Ford didn’t need the funds as desperately as General Motors or Chrysler due to astute financial planning it made in anticipation of the financial crisis. However, Ford participated in the bailout hearings because the failure of the other companies would have incredibly harmful effects on their manufacturing parts suppliers, who also serviced Chrysler and GM.⁷

The initial bailout funds were announced at the end of President George W. Bush’s term. Ford declined the funds, but ultimately took out a loan from the Department of Energy for the purposes of designing more fuel-efficient cars. However, this loan has not been considered to be a part of the “auto bailout” by the Treasury Department, so it is not included in the calculations of government gains and losses. General Motors and Chrysler thus accepted the initial funds out of the \$700 billion Troubled Asset Relief Program under specific cost-cutting conditions laid out by the federal government. However, by mid-2009, both companies filed for bankruptcy and underwent a major restructuring as part of the government rescue. Over the next few years, both companies began paying off the loans until the Treasury completely exited out of General Motors in December of 2013.

⁴ Matthews, Christopher. "Mergers and Acquisitions Boom! Is This a Good Sign for the Economy?" *Time*. Time, Inc., 13 Feb. 2013. Web. 23 July 2015.

⁵ Cutcher-Gershenfeld, Joel, Dan Brooks, and Martin Mulloy. *The Decline and Resurgence of the U.S. Auto Industry*. Publication no. 399. Economic Policy Institute, 6 May 2015. Web. 22 July 2015.

⁶ “The Decline of the ‘Big Three’ U.S. Auto Makers.” Narr. Ed Gordon. News and Notes. NPR. Natl. Public Radio. Web. 4 May 2005.

⁷ Dornbach-Bender, Rhett, Bill Slade, and Joe Thorpe. *Strategic Report for Ford Motor Company*. Rep. Oasis Consulting, 20 Apr. 2009. Web. 22 July 2015.

Figure 2: Timeline of Events

January, 2007: Ford reports loss of \$12.7 billion in 2006, deepest in its 103 year history.
November, 2007: Chrysler announces 13,000 job cuts.
February, 2008: GM reports record loss of \$38.7 billion in 2007 and a \$722 million fourth-quarter loss.
November, 2008: Ford, GM, and Chrysler seek support from Congress for a \$25 billion loan package.
December, 2008: President Bush announces a \$17.4 billion emergency bailout for GM and Chrysler.
February, 2009: Ford announces it will not seek emergency funding from the United States government.
March, 2009: President Obama presents framework for General Motors to achieve viability.
April, 2009: The Obama Administration provides \$2 billion working capital loan to GM.
May, 2009: The Obama Administration provides additional \$4 billion working capital loan to GM.
June, 2009: GM files for bankruptcy. The Obama Administration accordingly provides a \$30.1 billion Debtor-in-Possession loan.
July, 2009: GM emerges from bankruptcy.
April, 2010: GM makes its final loan repayment.
December, 2010: GM repurchases all of the Treasury's preferred stock.
May, 2011: Chrysler makes its final loan repayment.
December, 2012: GM repurchases 200 million shares of common stock from the Treasury.
December, 2013: The Treasury sells final shares of GM.

Model and Estimates

In order to estimate the impact of the bailout on unemployment, we employ an autoregressive integrated moving average (ARIMA) model to track the path of monthly unemployment in Michigan. In addition, we account for national unemployment trends which would impact Michigan regardless of the bailout. Specifically, we model the number of unemployed workers in Michigan, or u_t , as

$$u_t = \alpha + \beta \text{bailout}_t + \delta \ln(natu_t) + \sum_{p=1}^P \phi_p u_{t-p} + \sum_{q=1}^Q \theta_q \varepsilon_{t-q} + \varepsilon_t, \quad (1)$$

where $\ln(natu_t)$ is the natural log of national unemployment (net of Michigan) and P and Q represent the number of AR and MA terms, respectively. We choose P and Q based on the best fit as determined by the Box-Jenkins method and also through inspection of the autocorrelation and partial autocorrelation functions. Effectively, our goal is to map the progress of Michigan unemployment and estimate any deviation from the path, or β , that occurs in the aftermath of the bailout. Put another way, this is a use of intervention analysis in Box and Tiao (1975). Seasonalized monthly unemployment data in Michigan and the rest of the country between January 1990 and April 2015 are from the Bureau of Labor Statistics.

Not surprisingly, both Michigan and national unemployment data net of Michigan over our sample frame fail all standard unit root tests: Dickey-Fuller (both augmented and generalized least squares versions), Phillips-Perron, and Kwiatkowski-Phillips-Schmidt-Shin. Fortunately a first difference of each variable eliminates unit roots according to these tests, leading us to first difference equation (1) which eliminates the constant term α .

The specification of the dichotomous variable bailout_t is vital since it defines the length of the auto bailout benefits. While the start of federal monies to GM and Chrysler is December 2008, we use July 2009 as the beginning of the bailout period for two reasons. First, the bankruptcy and restructuring of GM in June 2009 led to the largest government payout (a little more than \$30 billion) in the auto bailout period. The initial payments distributed at the end of 2008 functioned as more of a temporary fix and bought time for the development of an alternative to traditional bankruptcy. Second, July 2009 marks the beginning of the federal government's control of the companies following their emergence from bankruptcy. At this point, most of the restructuring within both companies occurred and the U.S. government owned 60 percent of GM and 10 percent of Chrysler.⁸

We use December 2013 as the end date of bailout_t for several reasons. First, the Treasury sells off its final GM shares during this month and thus ends direct government control of the company. Second, the literature on fiscal stimulus length suggests that our bailout period – July 2009 to December 2013, which is four-and-a-half years or 18 quarters – is a conservative estimate of the length of fiscal policy stimulus. Several authors employ impulse response functions (IRFs) to investigate the reactions of macroeconomic indicators to fiscal policy changes. For example, Blanchard and Perotti (2002) find positive effects on gross domestic product (GDP) from a spending shock for at least 18 quarters. Auerbach and Gorodnichenko (2012) find positive GDP impulse responses lasting at least 20 quarters in a recessionary period. Fatás and Mihov (2001) may be the most appropriate guide for this study

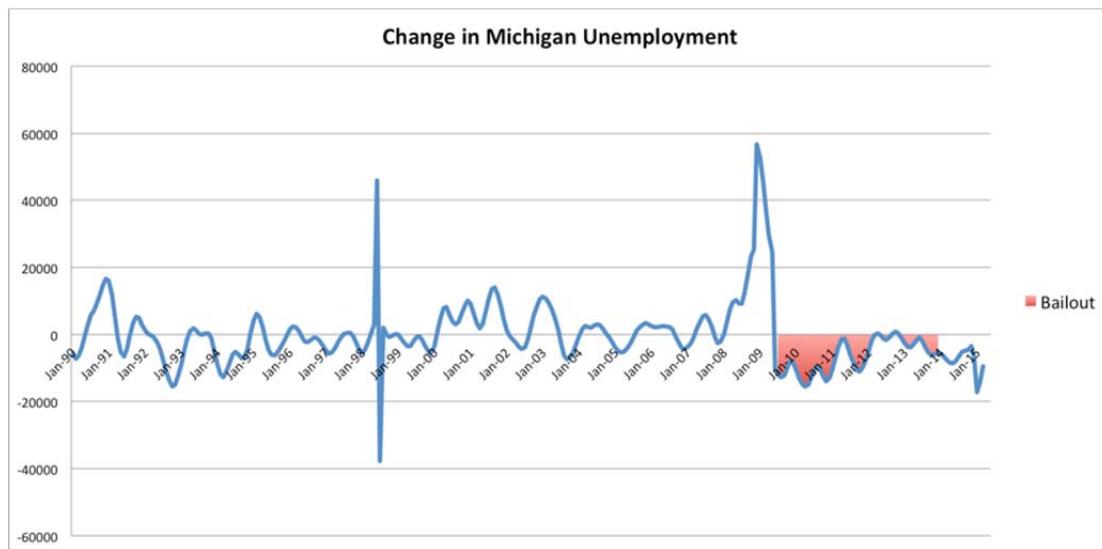
⁸ Ikenson, Daniel J. "Policy Report: Hard Lessons from the Auto Bailouts." *Cato Institute*. Cato Institute, 16 Feb. 2012. Web. 23 July 2015.

since it estimates the response of employment (rather than GDP) to government spending shocks. This paper finds “persistent” increases in employment after a government spending shock, and its impulse response graphs suggest positive employment effects that last at least 24 quarters.

However, our auto bailout end date is constrained by the American Recovery and Reinvestment Act (ARRA) of 2009. By the end of our bailout period, Michigan receives about \$7.9 billion⁹ in fiscal stimulus from the ARRA, or roughly ten percent of the government’s auto bailout investment. Since our model uses aggregate unemployment data in Michigan, we cannot separate the effects of the auto bailout and the ARRA. However, the auto bailout’s size and timing relative to the ARRA makes us confident that we are primarily identifying auto bailout effects. Nevertheless, Michigan’s share of the ARRA fiscal stimulus can be considered an additional cost to the public budget during our auto bailout period.

Figure 3 illustrates the bailout period of the first-differenced data on unemployment in Michigan. It is clear from the figure that the turning point in Michigan unemployment occurred after GM’s bankruptcy and the government’s debtor-in-possession loan. The large increase and subsequent decrease in Michigan unemployment in 1998 coincides with a union walkout in Flint, Michigan. The strike lasts almost two months, and the Bureau of Labor Statistics data reflects the drastic change in unemployment. We control for this by adding a dichotomous variable $strike_t$ to equation (1) which, when first-differenced with the rest of the equation, accounts for the beginning and end of the strike.

Figure 3



⁹ "Recipient and Agency Data." *The American Recovery and Reinvestment Act*. Recovery Accountability and Transparency Board, Web. 24 July 2015.

Table 1 presents the estimation of the first-difference of equation (1). We find the auto bailout decreases unemployment in Michigan by nearly 7,700 workers per month in each month during the four-and-a-half year auto bailout period. This estimate is statistically significant at any reasonable level. Given the bailout period lasts 54 months, we estimate the auto bailout saved $7,688 * 54 \approx 415,000$ worker-months from unemployment. Alternatively, the 95% confidence interval of the estimate puts the total number of worker-months saved from unemployment between 360,611 and 464,843. We also find a positive correlation between unemployment in Michigan and unemployment in the rest of the United States, but this estimate is not statistically significant.

Table 1: ARIMA Estimation Results

variable	estimate (standarized)	variable	estimate (standardized)
$\Delta bailout_t$	-7,688 ($z = -16.37$)	AR(1)	0.765 ($z = 16.47$)
$\Delta strike_t$	41,571 ($z = 11.94$)	MA(1)	0.420 ($z = 6.42$)
$\Delta ln(natu_t)$	2,062 ($z = 0.37$)	MA(2)	0.363 ($z = 5.39$)
log L	-2,849.213	MA(3)	0.374 ($z = 5.39$)
		MA(4)	0.239 ($z = 5.30$)

Note: The dependent variable is the first difference of Michigan unemployment, or Δu_t .

Based on numerous trial-and-error attempts, the best fit of the autoregressive and moving average structure is $P = 1$ and $Q = 4$, respectively, and our estimate of the impact of the bailout is largely unaffected by the choice of P and Q . Finally, the 1999 strike caused Michigan unemployment to substantially deviate from its path by temporarily increasing unemployment by over 41,500 workers. Fortunately this increase in unemployment was erased at the culmination of the strike.

Effect on Transfer Payments and Tax Revenue

Our next step is to transform the reduction in Michigan unemployment to changes in the public budget. Table 2 summarizes this calculation, which we perform using three different numbers for the auto bailout's marginal effect $\hat{\beta}$: the lower 95% confidence interval estimate, the point estimate from Table 1, and the upper 95% confidence interval estimate.

Table 2: Calculation of Transfer Payments and Tax Revenue Effects

	<i>lower 95% estimate ($\hat{\beta} = 6,677.983$)</i>	<i>point estimate ($\hat{\beta} = 7,687.595$)</i>	<i>upper 95% estimate ($\hat{\beta} = 8,608.207$)</i>
Worker months saved from unemp. over bailout period (54 mos.)	360,611	415,130	464,843
Private earnings gains	\$3,767,664,585	\$4,337,279,598	\$4,856,681,524
Amount saved in unemp. insurance (\$1,448 per mo.)	\$552,164,847	\$601,108,240	\$673,092,664
Increase in income tax revenue (\$545.92 per mo.)	\$196,864,757	\$226,627,770	\$253,767,091
Increase in Social Security and Medicare receipts ¹⁰	\$542,962,330	\$625,050,182	\$699,901,771
Public Budget Impact	\$1,291,991,934	\$1,452,786,192	\$1,626,761,526

We begin by finding the number of worker-months saved from unemployment by multiplying the monthly marginal effect of the bailout by the number of months of the bailout period (54 months). We also calculate the private income gains from remaining employed, which is the number of worker-months saved from unemployment multiplied by average quarterly earnings in Michigan. Quarterly earnings data are from the Industry Census of Employment & Wages published by the Bureau of Labor Statistics. Since quarterly earnings change over time, we multiply the number of saved worker-months by three (to make it quarterly), and then multiply this product by quarterly earnings in that period. Mathematically, this approach equates to $3\hat{\beta} \sum_q \bar{earnings}_q$ for all 18 quarters (q) in the bailout period.

¹⁰ For most of the bailout period, the Social Security tax rate is 6.2% and the Medicare tax rate is 1.45%. These taxes are paid by both employers and employees, meaning the total tax rate on income for these two programs is 15.3%. However, in 2011 and 2012 the Social Security tax rate for employees was lowered to 4.2%, changing the total tax rate on income to 13.3%. Our calculations reflect this change. Unfortunately we cannot incorporate two other tax changes during the bailout period. First, employers did not have to pay Social Security tax for new hires from February 2009 until the end of the year. Second, high income workers pay an additional 0.9 percentage points on their Medicare tax beginning in 2013, which overlaps the bailout period by one year. See <http://www.ssa.gov/oact/progdata/taxRates.html>.

The estimates for worker-months saved from unemployment and the resulting private earnings gains are used to calculate the impact on the public budget. According to the State of Michigan Department of Licensing and Regulatory Affairs, unemployment benefits cost an estimated \$1,448 for each worker-month, which we multiply by the number of worker months saved from unemployed to calculate the amount saved in unemployment insurance. In addition, we refer to the tax tables published by the Internal Revenue Service for each year of the bailout period to calculate the average amount of income tax paid by a worker earning the average Michigan salary in that period. The average annual income tax payment is \$6,551, or \$545.92 per month. The increase in private earnings is used to calculate the increase in tax revenues for Social Security and Medicare. We calculate the increase in tax revenues for these programs by multiplying the increase in private earnings by the total tax rate.

The final row calculates the impact on the public budget, which sums the decrease in unemployment insurance payments, the increase in income tax revenue, and the increase in Social Security and Medicare tax revenues. We estimate the public budget improved by between about \$1.3 and \$1.6 billion.

The Pension Benefit Guaranty Corporation

Pensions were a key aspect of the debate to rescue GM and Chrysler. In fact, the financial situation of the government's Pension Benefit Guaranty Corporation (PBGC) created a situation where the government faced either a large bailout payment or, assuming GM failed, a large payment to the PBGC.

After the recession during the early 2000s, GM's pension fund was incredibly weak. Specifically, the fund contained over \$20 billion less than what the company needed to pay the approximate 400,000 retirees \$7 billion each year.¹¹ In order to address this, GM sold over \$14 billion of bonds the following year and injected the revenues into their pension fund. This combined with the proceeds from the sale of GM's Hughes Electronics subsidiary amounted in over \$18 billion.¹² As a result of contributing this much more than GM's minimum requirement, federal law did not require them to make any more contributions until 2013.

However, the pension fund's surplus was short-lived. Increasing health care costs for retired workers forced GM to spend billions of dollars that could have gone to company and product innovation. As GM's market share decreased at the benefit of foreign competitors, the company began major downsizing projects and an abnormally large number of employees retiring early. In 2007, the fund was worth

¹¹ Viceira, Luis M., and Helen Tung. "General Motors U.S. Pension Funds." Harvard Business School Case 206-001. July 2005. Web. 28 June 2015.

¹² Walsh, Mary Williams. "G.M.'s Pension Fund Stays Afloat, Against the Odds." *The New York Times*. The New York Times, 24 Nov. 2008. Web. 26 June 2015.

\$104 billion with only \$85 billion in obligations, but by 2008 it was underfunded by \$13 billion.¹³ By 2011, the fund was underfunded by \$25.4 billion.¹⁴

If GM failed, taxpayers likely would have had to pay for at least a vast portion of these pensions. Typically when a company files for Chapter 11 Bankruptcy, the pension plan gets handed over to the PBGC, which funds itself primarily by taking over what remains in the pension funds of failed companies. It guarantees pension promises, but only up to maximum defined limits. Thus, young retirees (such as many who left GM) are particularly at risk for losing benefits because they have longer pension plans. Around the time that GM first requested funds from the government, the PBGC was already underfunded by around \$11 billion. It estimated that if required to take on GM's pension obligations, their deficit would increase by around \$20 billion.¹⁵ The PBGC is not technically a wholly public organization, but it was created under the Employee Retirement Income Security Act in 1974 and the Secretaries of Labor, Commerce, and Treasury are on its board of directors. Thus, in cases of extreme fund shortages, it is likely that the US government would have to intervene.

Fortunately, GM was not required to defer their pension plans to the PBGC. Instead, the bailout efforts allowed GM to offer lump-sum payments to 42,000 of their retirees and transfer responsibility for 76,000 plans to Prudential Insurance. This reduced GM's pension obligations by an estimated \$26 billion.¹⁶ Chrysler stopped issuing public pension reports when it became private in 2007, but the bailout likely saved their funds from a similar fate. Thus, despite the widespread debate on exactly how much the U.S. government saved in other areas, it is clear that the \$9.3 billion loss was likely, at a minimum, offset by the funds saved on pension relief.

Conclusion

The auto bailout provides an interesting case study in fiscal policy stimulus. While the prospect of GM and Chrysler shutting down was bleak, the cost to save these companies was significant, particularly in light of an uncertain future heading into the recession. We conservatively estimate the auto bailout saved 7,700 worker-months in Michigan from unemployment for each month over a four-and-a-half year period, which translates to between \$1.3 and \$1.6 billion in public savings. In addition, the financial condition of the PBGC would have likely forced the government to provide an additional \$20 billion in support had the government not

¹³ "A Giant Falls." *The Economist*. The Economist Newspaper, 06 June 2009. Web. 26 June 2015.

¹⁴ Elliott, Douglas J. *What Happens to the GM Pensions in Bankruptcy?* Rep. The Brookings Institution, 29 May 2009. Web. 26 June 2015.

¹⁵ *Ibid*

¹⁶ Akerson, Dan. "The State of General Motors." Annual Meeting of Stockholders of General Motors Co. Detroit. 12 June 2012. *General Motors*. Web. 26 June 2015.

intervened. After an initial investment of \$80 billion, the net cost of the auto bailout turned out to be \$9.3 billion, or \$17.2 billion if the ARRA payouts are included.

We stress that our estimates of the auto bailout impacts are conservative. For example, we use a relatively short time frame for the auto bailout stimulus, four-and-a-half years or 18 quarters, compared to the empirical literature that employs impulse response functions to measure fiscal policy effects. If we extend the auto bailout period to the end of our sample frame, which makes the bailout period just under six years or 23 and two-thirds quarters, the estimate for worker-months saved from unemployment becomes roughly 16,400 per month with a *p*-value less than 0.001. The jump in the estimate stems from Michigan's improving unemployment picture even relative to the rest of the country (see Figure 3). Over the new bailout period, this translates to between \$3.35 and \$4 billion in public budget savings.

A second reason that our estimate is conservative is that our comparison group might be overly optimistic. The ARIMA setup that we employ estimates the impact of the auto bailout by comparing the first-difference of unemployment between bailout and non-bailout periods. Prior to the bailout, the first-difference of unemployment is stationary around zero. This means the auto bailout's effect is calculated based on a comparison group of monthly unemployment changes that hover around zero. But had the government not intervened and let GM and Chrysler close, monthly unemployment changes would likely remained positive for a significant time period as capital is transferred to other uses and labor migrates out.

Though beyond the scope of this paper, there were numerous sources of private gain as a result of the auto bailout. These include wage effects from lowering unemployment and gains in the financial sector to those holding stock. In addition, Goolsbee and Krueger argue the auto bailout benefits are not limited to Michigan, stating "in all likelihood the Great Recession would have been deeper and longer, and the recovery that began in mid-2009 would have been weaker" (p.4). However, in similar estimations for Ohio, Indiana, and Kentucky, which are three states that also have many auto industry employees, the auto bailout had an insignificant effect on unemployment. This is likely because these states, compared to Michigan, more closely follow national unemployment during the auto bailout period. Our belief is the auto bailout likely spilled into these states, and perhaps the rest of the country, but only after Michigan was saved from the closings of GM and Chrysler.

Even though the auto bailout produced positive short term effects, it remains to be seen whether keeping GM and Chrysler afloat is a wise long term strategy. American automobile companies face increasing pressure for foreign firms, several of whom have a reputation for high quality cars. Nevertheless, we hope our estimates can be used to predict the efficacy of fiscal policy stimulus in future decisions.

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