



Do Tax Cuts Boost the Economy?

David Rosnick and Dean Baker

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Center for Economic and Policy Research
1611 Connecticut Avenue, NW, Suite 400
Washington, D.C. 20009
202-293-5380
www.cepr.net



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About the Authors

David Rosnick is an economist at the Center for Economic and Policy Research in Washington, D.C. Dean Baker is an economist and the Co-director of CEPR.

Introduction

There are many economists who argue that temporary tax cuts, like those in the 2009 stimulus and the ones proposed by President Obama last week, have no impact on the economy. They argue that people will save a temporary tax credit rather than spend it.

Stanford Economics Professor John Taylor, who served as Under Secretary of the Treasury for International Affairs under President Bush, is one of the economists making this argument.¹ He purports to show that there was no statistically significant increase in private consumption of goods and services as a result of certain types of government transfers made over the last decade. According to his analysis, it is unclear whether an additional dollar of government transfers led to any additional spending, or, alternatively, whether it raised personal savings by more than one dollar.

Taylor's Analysis

The \$300 tax rebate checks in 2001,² along with the lower withholdings in the third quarter of 2001, were the first of three stimulus areas Taylor considered. The second round of stimulus payments examined were the \$300 tax rebates in 2008.³ Finally, the third round of measures that Taylor considered were certain ARRA⁴ non-AMT tax cuts and social transfers (particularly the Making Work Pay Tax Credit and extension of unemployment benefits) starting in 2009.

The result of Taylor's regression is shown in **Table 1**. The dependent variable is personal consumption expenditures (PCE) from the first quarter of 2000 through the first quarter of 2011. The independent variables are disposable personal income (DPI) net of stimulus payments, the stimulus payments themselves, the price of oil (that of one barrel of West Texas Intermediate Crude, lagged two quarters) and the net worth of households and nonprofits (also lagged two quarters).

As can be seen in the first column of Table 1, an additional dollar of disposable income – if it comes not from stimulus payments – raises personal consumption by 82-88 cents. On the other hand, the effect of stimulus payments is not statistically significant in this regression.

If Taylor's analysis is correct, then such personal transfers are not clearly effective forms of stimulus. People do not necessarily spend such transfers, and with no additional demand for their products, businesses do not have any incentive to expand. It follows that it would be far more effective for the government to directly increase its own purchases of goods and services, rather than giving money to the private sector and hoping for the best.

1 http://www.stanford.edu/~johntayl/JEL_taylor%20revised.pdf

2 The Economic Growth and Tax Relief Reconciliation Act of 2001 created a new – and essentially retroactive – 10 percent tax bracket. This resulted in a tax cut of up to \$300 for those filing singly, and \$600 for joint filers. Thus, checks were sent out to those who paid taxes in 2000.

3 The Employment Stimulus Act of 2008 provided additional rebates against tax liability.

4 The American Recovery and Reinvestment Act of 2009 provided additional tax relief and other benefits. These included \$250 payments to recipients of Social Security, financial assistance to students, and relief from the Alternative Minimum Tax. This last was not counted as stimulus as it happens every year. Arguably, taxpayers treat AMT relief as a permanent policy.

TABLE 1
Taylor's Model and Related Regressions

	Reported
Constant	-27.1 (-0.25)
DPI without Stimulus	0.851 (60.4)**
Stimulus Payments	0.128 (0.81)
Oil Price ⁽¹⁾	-2.55 (-4.61)**
Net Worth ⁽¹⁾	0.018 (7.97)**
Standard error of regression	66.3

Levels of significance: # 10%, * 5%, ** 1%.
⁽¹⁾ Lagged two quarters.

A Closer Look

Some of the stimulus money surely went to people who were desperate for cash. It is unlikely that *none* of the money was spent, even if many individuals saved their entire share. Teasing out these effects is a tricky business. Obviously, economic stimulus payments are associated with bad economic times, and these times must somehow be accounted for in any analysis. The early \$300 Bush rebate checks were almost all sent in the third quarter of 2001. It should hardly require mentioning that determining the effect of this particular transfer of money might be confounded by the September 11th attacks in New York City and Washington, DC which took place in that very quarter.

The second column of **Table 2** represents our effort at reproducing Taylor's results. Clearly, there are no important differences between the two. However, the Bureau of Economic Analysis, which supplies most of this data, added numbers for the second quarter of 2011 and comprehensively revised the last several years. We fit Taylor's model to this revised data – the results of which are in column 3. Column 4 is identical to column 3, but the 2011 payroll tax cut is included as stimulus.⁵

⁵ The payroll tax cut replaced the Making Work Pay tax credit starting in 2011. There is no obvious economic reason for the distinction on Taylor's part, yet the payroll tax cut did increase disposable income. Taylor therefore overestimates disposable income net of stimulus in the first quarter of 2011, making stimulus appear less effective.

TABLE 2
Reproducing Taylor's Model and Related Regressions

	Reported	Reproduced	Updated	Including Payroll Tax Cut
Constant	-27.1 (-0.25)	-74.0 (-0.71)	-218.3 (-2.22)*	-237.7 (-2.32)*
DPI without Stimulus	0.851 (60.4)**	0.857 (53.42)**	0.917 (68.73)**	0.923 (57.98)**
Stimulus Payments	0.128 (0.81)	0.112 (0.72)	0.117 (0.88)	0.168 (1.21)
Oil Price ⁽¹⁾	-2.55 (-4.61)**	-2.65 (-4.18)**	-4.29 (-6.08)**	-4.28 (-5.65)**
Net Worth ⁽¹⁾	0.018 (7.97)**	0.018 (8.50)**	0.011 (5.19)**	0.011 (4.44)**
Standard error of regression	66.3	63.3	65.2	67.6

Levels of significance: # 10%, * 5%, ** 1%. ⁽¹⁾ Lagged two quarters.

These updates shift the results of Taylor's analysis considerably. Though the result still generally holds with revised and updated data, the coefficients are not necessarily close. The underlying rate of savings (1.0 minus the coefficient on personal income) is nearly halved, the effect of net worth on spending is shrunk considerably, and the effect of oil prices has grown immensely.

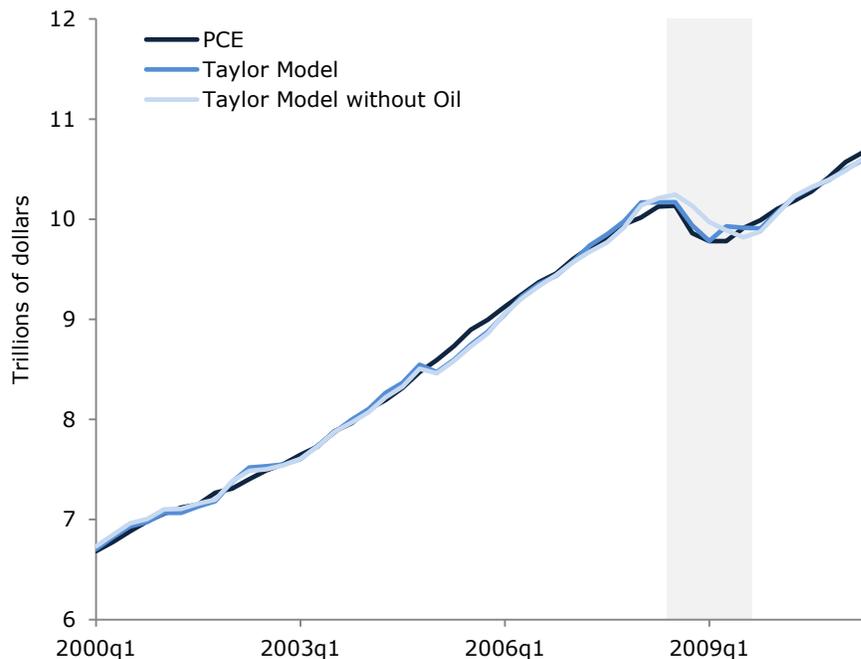
Even if we accept Taylor's model, the estimated effects are not all plausible. If we price PCE energy in terms of West Texas Intermediate crude oil, we get an energy consumption of about 15 million barrels daily. An extra \$10 per barrel would imply \$22 billion (annualized) in additional current spending on PCE energy.⁶ Yet Taylor's model does not allow any increase in overall PCE in the current quarter, implying an immediate reduction in non-energy PCE of \$22 billion. If the shock is temporary, then balance is restored the following quarter.

Worse, Taylor's results imply an annualized \$43 billion drop in PCE in the second quarter following the shock – knocking approximately 2 percentage points off the annualized rate of consumption growth in that quarter and adding 2 percentage points to PCE growth in the third quarter following the shock. These are implausibly large effects. If true, the fall in oil prices from the third quarter (\$118 per barrel) to fourth quarter of 2008 (\$58 per barrel) added about \$255 billion to consumption in the second quarter of 2009. This implies an additional 10.2 percentage points of annualized growth in PCE. Real PCE growth from the first to second quarter was -1.9 percent, so real PCE would have fallen at a 12.1 percent annualized rate but for the fall in oil prices.

If the oil effect is implausibly large, what is it contributing to the model? In **Figure 1** we see that the oil variable is really only important for estimates over 2008Q3-2009Q3.

⁶ A 1 percent increase in oil prices is roughly associated with a 0.3-0.5 percent increase in PCE energy spending, and \$10 times 15 million barrels per day comes to \$55 billion per year. 40 percent of this amount is \$22 billion.

FIGURE 1
The Importance of Oil



Pretty much anything with a sharp peak in 2008Q4-2009Q1 would help explain the fall in spending. We may test this by substituting as a variable Google’s trend for worldwide traffic of “Obama.”⁷ Without making too much of it, this provides a vastly improved fit.⁸ The point is that there is evidence that a correctly specified model would not necessarily include oil prices lagged two quarters.

A Structural Break in Taylor’s Model

There is reason to believe that the economy simply functioned differently after 2008 than it had previously. The second round of tax rebates in particular took place as the economy collapsed and large financial institutions were found insolvent. Importantly, the collapse of the housing bubble meant homeowners that had been able to borrow freely against their homes in prior years were suddenly credit risks and unable to extract equity. Even if they could, a homeowner might save more in response to falling wealth amidst a housing bust than the same homeowner might spend in response to rising wealth during a housing boom.

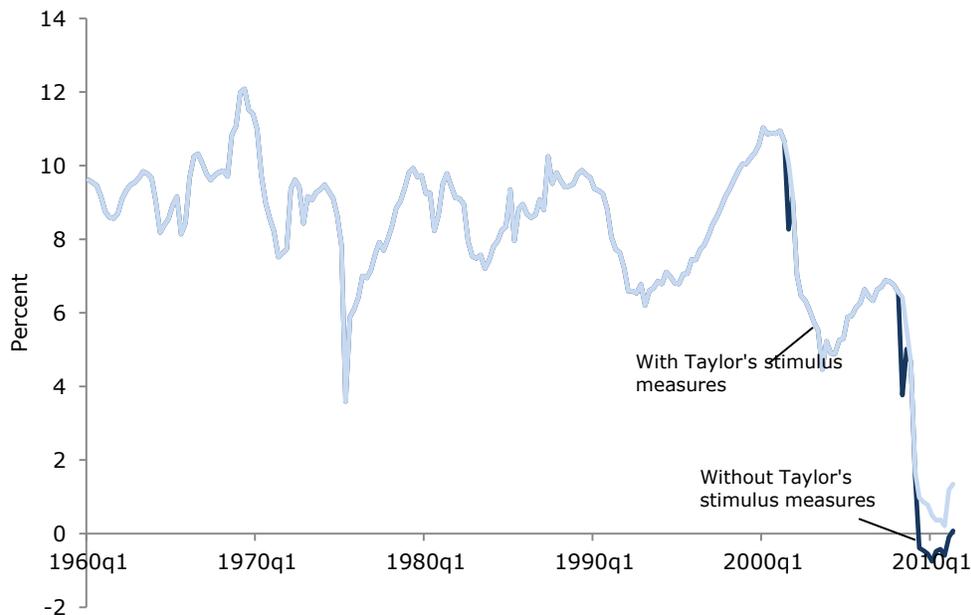
Net taxes, for example, have fallen precipitously in recent years. **Figure 2** shows personal taxes net of government transfers (with and without Taylor’s stimulus measures) as a share of pre-tax

⁷ <http://www.google.com/trends?q=Obama&ctab=0&geo=all&date=all&sort=0> Quarterly averages of the weekly data are assumed to be zero prior to 2004.

⁸ Assuming normal errors, the log-likelihood using “Obama” instead of lagged oil prices is greater by 8.34. (-250.25 versus -258.59)

income.⁹ In essence, Figure 2 shows that direct effect of government programs on disposable income fell to zero by 2009. Clearly, Taylor's stimulus measures (even including the payroll tax cut) pale in comparison to other changes in disposable income.

FIGURE 2
Effective Net Personal/Social Tax Rate



Between 1960 and 2000, the government frequently took ten percent of non-transfer pre-tax income to fund other priorities. This share was a relatively low 6.6 percent in the first quarter of 2008 – \$764 billion of \$11,643 billion pre-government. By the second quarter of 2009, the government was on net transferring \$42 billion to persons rather than the other way around. *Excluding* stimulus measures, this amounts to \$658 billion *per year* in additional net transfers from the government. It is difficult to imagine that the elimination of net taxation would fail to change spending patterns in some way.

Let us suppose there is *something* missing from the model that distinguishes 2008-2011 from 2000-2007. We may test for such a structural break by creating an indicator for the post-2007 period and interacting it with the other variables in the model. If there is no structural break, it is not likely that these additional variables would have explanatory power. The results of fitting these models are shown in **Table 3**.

⁹ Net taxes are defined here as personal taxes, less net government social benefits. (NIPA Table 2.1, lines 25 and 26, minus line 17) Pre-tax income is defined as disposable personal income (line 27) plus net taxes.

TABLE 3
Tests for Structural Break in 2008Q1

	With Oil Prices		Without Oil Prices	
	Basic	With Full Break	Basic	With Full Break
Constant	-237.7 (-2.32)*	91.8 (0.89)	216.2 (1.73)#	-90.0 (-1.02)
DPI without Stimulus	0.923 (57.98)**	0.908 (44.37)**	0.870 (34.42)**	0.916 (43.74)**
Stimulus Payments	0.168 (1.21)	0.207 (2.37)*	0.173 (0.63)	0.275 (3.17)**
Oil Price ⁽¹⁾	-4.28 (-5.65)**	3.25 (1.59)		
Net Worth ⁽¹⁾	0.011 (4.44)**	0.000 (0.13)	0.007 (2.27)*	0.005 (2.18)*
Post-2007 Constant		-1268.2 (-1.74)#		-568.0 (-0.64)
Post-2007 DPI		0.139 (2.29)*		0.096 (1.25)
Post-2007 Stimulus		0.253 (2.07)*		0.472 (1.54)
Post-2007 Oil Price ⁽¹⁾		-6.37 (-3.02)**		
Post-2007 Net Worth ⁽¹⁾		0.000 (0.01)		-0.012 (-2.42)*
F ⁽²⁾	--	11.78**	--	6.25**
Standard error of regression	67.6	51.4	86.0	59.0

Levels of significance: # 10%, * 5%, ** 1%. ⁽¹⁾ Lagged two quarters. ⁽²⁾ Test for joint significance of all interactions.

These regressions provide strong empirical evidence of a structural break in Taylor's model. There is no particular reason to believe that adding the break properly specifies the model – note, for example, the shift in the estimated oil price effect. The original model shows a \$27-58 billion fall in PCE two quarters following a \$10 per barrel increase in oil prices. The expanded model shows that after 2007, the effect is much the same – a fall of between \$21 and \$41 billion. However, the expanded model also shows that in 2007 and before a \$10 increase in oil prices may have changed PCE anywhere from a \$9 billion decrease to a \$74 billion increase. This is not at all consistent with Taylor's result.

Furthermore, the expanded models provide evidence that the stimulus payments were in fact spent. Ignoring the confounding effects of 9/11, between 3 and 45 percent of the 2001 tax rebates was spent. Though the models show a great deal of uncertainty in the post-2007 stimulus, they suggest that between 15 and 134 percent of those payments were spent on personal consumption. Here, we reach a different conclusion than did Taylor.

With this evidence of a structural difference starting in 2008, we may also examine some simpler model changes – rather than a full break in the model. In **Table 4**, we consider a few variations.

TABLE 4
Regression Variations – 2000Q1-2011Q2

	(1)	(2)	(3)	(4)
Constant	-342.2 (-3.80)*	-332.3 (-3.58)	-236.3 (-2.95)**	-230.0 (-2.72)**
DPI without Stimulus	0.969 (53.38)**	0.965 (49.10)**	0.971 (46.44)**	0.970 (41.72)**
Stimulus Payments	0.539 (3.43)**	0.524 (3.46)**	0.701 (2.37)*	0.699 (2.35)*
Oil Price ⁽¹⁾	-2.29 (-2.92)**	-2.44 (-3.39)		
Net Worth ⁽¹⁾	0.003 (1.42)	0.004 (1.65)	-0.001 (-0.58)	-0.001 (-0.49)
Post-2007 Constant	-192.7 (-4.84)**	-791.4 (-0.93)	-276.0 (-4.46)**	-500.0 (-0.46)
Post-2007 DPI		0.056 (0.71)		0.021 (0.21)
F ⁽²⁾	23.45**	11.56**	19.91**	10.01**
Standard error of regression	59.6	59.2	63.7	63.7
95% Confidence Interval on Stimulus ⁽³⁾	22-86	22-83	10-130	10-130

Levels of significance: # 10%, * 5%, ** 1%. ⁽¹⁾ Lagged two quarters. ⁽²⁾ Test for joint significance of all interactions. F is equal to t^2 in columns 1 and 3. Note that in columns 2 and 3 the individual interactions are not significant though they are jointly significant. ⁽³⁾ Percent of stimulus transfers spent on PCE.

In column 1, we simply add to Taylor's model an indicator variable for the post-2007 period. (An indicator variable means that we allow for the possibility that the relationship between consumption and the other variables is different in the period after 2007 than before.) In column 2, we also interact this new variable with disposable income net of stimulus. This allows for a change in the rate at which ordinary income is spent. Columns 3 and 4 are identical to the first two, but the oil price variable is dropped. These regressions are consistent with a structural shift after 2007. They show that the way the shift is specified is not important – stimulus is a statistically significant indicator of increased PCE. The regressions show that \$1 of additional stimulus is associated with 52-70 cents of additional consumption.

Conclusion

We hesitate to suggest that unlike Taylor's regression, these structural-shift models are well specified and that the resulting estimates of spending rates are accurate. Indeed, though statistically significant, the lack of precision in the estimates does not make them terribly meaningful economically. However, these regressions do demonstrate that evidence regarding Taylor's conclusion is sensitive to the specification of the model.

The empirical uncertainty surrounding the personal transfers points to the importance of domestic government expenditures as stimulus. There, the direct impact on GDP is identically equal to 1.0, regardless of any subsequent multiplier effects. When and where crowding-out effects are unlikely given large amounts of unused capacity (both people *and* machines out of work) the impact may be very large. However, there is very little indication that – based on Taylor's work – personal transfers from the government fail to stimulate private spending.