A Tax Rebate in A Recession: Is It Safe and Effective?

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ABSTRACT

Is a tax rebate safe and effective? Simulations with an empirically-tested macro-econometric model are used to estimate the impact of the actual 2001 tax rebate in the U.S. and of a rebate twice as large repeated in three additional quarters, and the results of the simulations are interpreted in light of two important recent empirical studies of the spending of the 2001 rebate by households. Our simulations show that as long as a tax rebate is temporary and detriggered when the recession ends, its use during a recession does not pose a significant debt or inflation problem. We find that at the end of one year the larger repeated rebate would have reduced the unemployment rate from 5.9% to at least 5.2%. Thus, a triggered tax rebate is a safe and effective anti-recession policy.
In June 2001 President Bush signed into law a tax cut containing a tax rebate of $600 per married couple ($300 per single person). For the quarter 2001.3, the aggregate rebate was about $35 billion, 1.4% of that quarter’s GDP. The U.S. Treasury mailed these checks out in July, August, and September. The purpose of the rebate was to try to promptly stimulate consumer spending to counter the recession. The rebate was the one element of the tax cut that received bipartisan support. Should we use a tax rebate again in the next recession? Is a tax rebate safe and effective?

Will A Tax Rebate Cause a Debt Burden or Inflation?

Before examining whether a tax rebate is effective against a recession, we need to address the crucial question of whether it is safe: Will a tax rebate significantly increase government debt and impose a large burden on future taxpayers to service the debt? Will it generate accelerating inflation? No matter how well a tax rebate works in a recession, it would be unwise to use it if it resulted in a substantial increase in government debt or inflation.

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1 The U.S. Treasury reports (Friday issues of The Daily Treasury Statement Cash and Debt Operations of the U.S. Treasury from July 20th through December 28th) that rebate payments were $6.781 billion in July, $17.448 billion in August, and $10.937 billion in September, for a total of $35.166 billion (an additional $0.702 billion was paid out in the remainder of the year).
In our view, the key to a safe tax rebate is triggering it automatically with the onset of recession, and detriggering it automatically with the onset of recovery (as described further below). A safe tax rebate would add to our arsenal of effective automatic stabilizers.

It is true that a triggered tax rebate would increase the issue of government debt—the treasury must borrow by selling new bonds when it triggers transfers to counter a recession. But automatic detriggering when the unemployment rate comes back down below the trigger threshold reduces the risk of a long-term build up of debt.

Moreover, the burden on future taxpayers can be kept less than the debt issued by the treasury. Though the treasury is prohibited from selling bonds directly to the central bank, the central bank can simultaneously buy treasury securities from the public through open-market operations. The central bank can then exempt the treasury from paying interest or principal on the securities it purchases (Seidman, 2001, p22-23). Then debt held by the public (excluding the central bank) will increase less due to these open-market purchases. To make sure the public understands this fact, the government should present official data on government debt held by the public excluding the central bank.

Will triggered rebates complemented by central bank open-market bond purchases be inflationary? It is true that permanent continuous transfers plus open-market purchases would eventually generate excessive aggregate demand and cause accelerating inflation. But what is proposed is a temporary stimulus. The aim of the temporary transfers plus open-market purchases is to make aggregate demand normal, not excessive. Even if fiscal expansion were improperly continued after recovery, the institutional independence of the Federal Reserve is a check against accelerating inflation. Historically, large budget deficits have indeed often led to
inflation, even hyperinflation, when they have been money-financed for a sustained period. In these historical episodes, the treasury and central bank were usually consolidated into a single unit so that the government simply printed money to finance its deficits. But with an independent central bank and a prohibition against printing money by the treasury, budget deficits need not lead to an excessive rise in aggregate demand.

There is, of course, a risk that expansionary fiscal policy will improperly continue even after the economy has recovered. There are two complementary ways to minimize this risk.

First, we propose that the rebates be automatically *detriggered* by recovery according to a formula pre-enacted by Congress. According to the formula, the rebate (as a percent of GDP) would only be triggered if the unemployment rate were above a threshold—so it would be automatically detriggered as soon as the unemployment rate falls below the threshold.

For example, the formula might be $R/[GDP]_{-1} = 3[U_{-1} - 5.7\%]$ where $R$ is the aggregate rebate for this quarter, $GDP_{-1}$ is last quarter’s nominal GDP, $U_{-1}$ is last quarter’s unemployment rate, 5.7% is the trigger unemployment rate$^2$, and 3 indicates the stimulus Astrength@ Congress desires. Then if last quarter’s unemployment rate were 6.4%, $R/[GDP]_{-1}$ would be 2.1%, so this quarter’s aggregate rebate would be 2.1% of last quarter’s GDP. For comparison with the 2001 experience, recall that the aggregate rebate paid out in the third quarter of 2001 was 1.4% of that quarter’s GDP. If each household receives the same dollar rebate (as in 2001), then each household’s rebate for the quarter would be set equal to $R/N$ where $N$ is the number of eligible

$^2$ Recently the Congressional Budget Office estimated the NAIRU the non-accelerating-inflation rate of unemployment to be 5.2%, so a reasonable trigger might be 5.7%. 

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Second, the government must practice fiscal discipline whenever the economy is running normally, balancing its budget or even running surpluses, thereby achieving a low debt/GDP ratio. An advocate of aggressive fiscal policy in a recession, rather than being indifferent to the deficits and debt in a normal economy, should be especially determined to maintain fiscal discipline during prosperity.

To do this, Congress should be pressured to adhere to a balanced budget rule called NUBAR--a normal unemployment balanced budget rule (a more complete description of NUBAR is given in Seidman, 2003). NUBAR prescribes that Congress enact a planned budget for the coming fiscal year that technicians estimate will be balanced if the unemployment rate is normal (the average of the preceding decade). If Congress adheres to NUBAR, and the technicians are accurate, then if the economy has a normal unemployment rate, the budget will be balanced; if the economy has a boom with a below-normal unemployment rate, the budget will run a surplus; and if the economy has a recession and an above-normal unemployment rate, the budget will be in deficit. Part of the deficit will be due to the automatic stabilizers—the automatic fall in tax revenue and increase in transfers for unemployment insurance benefits; and part will be due to the new automatic tax rebate.

NUBAR would achieve even more fiscal discipline if Social Security and Medicare were placed off-budget with respect to NUBAR, so that under NUBAR the planned budget excluding Social Security and Medicare would be balanced. By running surpluses in Social Security and Medicare, and by adhering to NUBAR for the rest of the budget, fiscal discipline would be maintained, and the ratio of national debt to GDP would be kept low despite deficits that occur.
during recession.

Is a Tax Rebate Effective?

With the precautions just outlined, a tax rebate can be made safe. But is it effective? An influential study conducted in 2001, published in the *American Economic Review* in 2003, seemed to imply that the answer is no.

In the summer of 2001, through a new module in the University of Michigan Survey Research Center’s monthly Survey of Consumers, University of Michigan economists Matthew Shapiro and Joel Slemrod asked a sample of consumers what they planned to do when they received the $600 rebate recently enacted by Congress. They asked consumers to look forward (p383):

> Thinking about your (family’s) financial situation this year, will the tax rebate lead you mostly to increase spending, mostly to increase saving, or mostly to pay off debt.

The Fall 2001 issue of the newsletter of the Office of Tax Policy Research (OTPR) at the University of Michigan Business School summarized the results of their survey. The article was entitled, *A Tax Rebates Go Largely Unspent.* Here are some excerpts from their summary (p1-2):

In a survey of 1,500 U.S. households conducted in August, September and October 2001, OTPR Director Joel Slemrod and University of Michigan economics professor Matthew Shapiro found that a surprisingly small percentage of households receiving the federal income tax rebate granted by this year’s tax legislation spent or expected to mostly spend the rebate...Shapiro and Slemrod found that only 22 percent of households receiving the rebate expected to or had spent the rebate...The results offer a cautionary conclusion for fiscal policy. Contrary to the desires of policymakers, the tax rebate likely will have little effect in stimulating the economy...Accordingly, another temporary tax cut, even one targeted at low-income households for which conventional wisdom would
have predicted a higher spending propensity, likely would provide little fiscal stimulus. Shapiro and Slemrod presented an analysis of their consumer surveys in an article in the *American Economic Review* (2003a). In their first paragraph they stated (2003a, p381):

> We find that only 21.8 percent of those receiving the rebate reported that it would lead them to mostly increase spending. This spending rate is remarkably low, both from a theoretical prospective and when compared to previous estimates.

Shapiro and Slemrod also did a follow-up survey in March and April 2002, asking consumers to look backward (2003a, p391):

> Did the tax rebate lead you mostly to increase spending, mostly to increase saving, or mostly to pay off debt?

They reported that in this survey, 24.9 percent of respondents reported spending the rebate. In their conclusion, they stated (2003a, p394):

> Our finding of a very low spending rate raises a cautionary note about the reliability of fiscal policy in general. It is possible that key parameters such as the propensity to consume are contingent on aggregate conditions in ways that are difficult to anticipate.

Shapiro and Slemrod suggested that the spending rates they find are low compared to what some theoretical models predict and compared to much existing empirical evidence, and that the aggregate marginal propensity to consume (MPC) might be unstable, so fiscal policy might have different effects at different times.

What do the Shapiro/Slemrod consumer surveys imply about the marginal propensity to consume (MPC) out of the rebate? Shapiro and Slemrod acknowledged that their consumer surveys do not provide direct information about the MPC out of the rebate because they did *not* ask what percent of the rebate the person intends to spend. Recall that they asked, *Did the tax*
rebate lead you mostly to increase spending, mostly to increase saving, or mostly to pay off
debt? For example, if everyone intends to spend 40% of the rebate and use 60% to pay off
debt, then 0% would answer mostly to increase spending, yet the marginal propensity to
consume is 40%, not 0%. In a subsequent paper (2003b) they wrote (2003b, p103):

A The aggregate marginal propensity to consume (MPC) from the rebate is an important
input for studying the aggregate impact of the tax rebate. Our survey does not provide
the MPC directly. Instead, it offers self-reported estimates of the fraction of people who
would either mostly spend the rebate or mostly save it, either by adding it to assets or
repaying debt.

They then used their survey results to estimate the MPC. They wrote (2003b, p103-04):

A With some assumptions about what range of individual MPCs correspond to mostly
spending or mostly saving and the distribution of those individual MPCs, our aggregate
answers can be converted to an aggregate MPC...By making some plausible assumptions
about the shape of the distribution, we can estimate the range of average, or aggregate,
MPCs that is consistent with what the survey reveals...In the appendix, we show that,
with these assumptions, only values of the average MPC between 0.340 and 0.372 are
consistent...

Shapiro and Slemrod (2003b) therefore estimated that between 34.0 and 37.2 percent of
the 2001 $600 tax rebate (checks from the U.S. Treasury mailed to households in July, August,
and September) was spent by March 2002. Hence their estimate for the MPC as of two-and-a-
half quarters (seven and a half months) was 36 percent.

Is this MPC large enough to make a tax rebate an effective anti-recession policy? A
casual reader of Shapiro and Slemrod=s newsletter article, ATax Rebates Go Largely Unspent@
would conclude that the answer is no. But is this pessimistic conclusion warranted?

Using an empirically tested and recently estimated macroeconometric model, we perform
simulations that estimate the macroeconomic impact of the actual 2001 rebate, and of a
hypothetical rebate twice as large and repeated in three additional quarters, and interpret the
simulations in light of the two important recent empirical studies of the spending of the 2001 rebate by households, one by Shapiro and Slemrod (2003a, 2003b), and the other by Johnson, Parker, and Souleles (2004).

**Simulating the Impact of Tax Rebates in the 2001 Recession**

We simulate the macroeconomic impact of the actual 2001 rebate, and of a hypothetical rebate twice as large and repeated in three additional quarters. Ideally, the impact of a rebate should be tested in a variety of macroeconometric models. In this study we use the model developed, empirically tested, and continuously updated by professor Ray Fair of Yale (2003, 2004). A interesting application of the model is given by Fair in AFed Policy and the Effects of the Stock Market on the Economy, *Business Economics* (April 2000).

We estimate and simulate the U.S. model using the Fair-Parke program downloaded from Fair=s website (Fair, 1996). The data and model files are provided by Fair on his website. As shown below, the model=s consumption equations imply a gradual, moderate consumption response to a change in disposable income. The model does not distinguish between a rebate and other disposable income in its consumption equations. However, we will also adjust the model to incorporate the possibility that consumers respond differently to a counter-cyclical rebate. In particular, we simulate the impact of a tax rebate using the estimates of two empirical studies of the spending of the 2001 rebate by households.

A full description of the model and its empirical testing is given in Fair (1994, 2003, 2004). The model assumes that the labor market does not clear continuously so that a fall in aggregate demand generates a rise in unemployment in the short run. The model consists of 30
stochastic equations estimated by two-stage least squares, 101 identities, 131 endogenous variables, slightly over 100 exogenous variables, and many lagged endogenous variables. It has six sectors: household, firm, financial, federal government, state and local government, and foreign. For monetary policy, the model estimates an interest rate reaction function (a Taylor rule) based on the historical behavior of the Federal Reserve. This estimated equation implies that the Federal Reserve generally engages in counter-cyclical monetary policy, lowering the interest rate (specifically, the three-month Treasury bill rate) in response to a rise in the unemployment rate, and raising the interest rate in response to a rise in the inflation rate. We use the July 31, 2003 version of model which is estimated on quarterly data from 1954.1 through 2003.2.

Because anti-recession tax rebates generate temporary, not permanent, deficits, rational financial market participants should not expect continuing future deficits from these policies. The reaction of financial market participants to the prospect of permanent deficits might well be very different. Fair (1994, 2004) provides a thorough discussion of the empirical tests to which he subjects the model, and the relationship of these empirical tests to the Lucas critique and Lucas=s rational expectations hypothesis.

We obtain the following MPC=s: one-quarter MPC = .20, two-quarter MPC = .36, three-quarter MPC = .47, and four-quarter MPC = .55.\(^3\) If consumers respond to a counter-cyclical

\(^3\) We obtain A\(J\)-quarter MPC=s\(\theta\) out of disposable income as follows. In the model, real per capita consumption this quarter \(C_t\) is a function of real per capita disposable income this quarter \(Y_t\) and real per capita consumption last quarter \(C_{t-1}\). Suppose an increment in real per capita disposable income occurs in quarter 1 only: Without the increment, \(Y\) would have been \(Y_{1'}\), with the increment \(Y\) is \(Y_1\), so the increment is \(\Delta Y_1 = Y_1 - Y_{1'}\). This increment will raise quarter 1 consumption directly through the \(Y_t\) term in the equation, and will also raise consumption in subsequent quarters through the \(C_{t-1}\) term. Let \(C_t\) be real per capita consumption
rebate the way they respond to other disposable income, then the model estimates that 20% of
the rebate would be spent by the end of the first quarter, 36% by the end of the second
quarter, 47% by the end of the third quarter, and 55% by the end of the fourth quarter (i.e. 55%
of the rebate is spent within a year).

The table presents model simulations of tax rebates in the 2001 recession. These simulations
are based on the assumption that consumers treat *counter-cyclical* transfers (rebates)
like other disposable income. Is this assumption plausible? Distinguish two situations. Under
the first, gross labor earnings are growing normally, but a transfer jumps disposable income abruptly above its normal path. Under the second, gross labor earnings grow more slowly than trend due to recession, but the transfer keeps the growth path of disposable income closer to normal. In the first case, the transfer bumps disposable income above its normal growth path; here it seems plausible that consumers might raise consumption less than if gross labor earnings had risen. But in the second case, the transfer helps keep disposable income nearer to its normal growth path; here it seems plausible that consumers might continue normal spending in response to the transfer. For example, suppose that due to a recession a $50,000 employee receives a 2.8% pay increase instead of a 4% pay increase; this 1.2% shortfall would reduce the employee=s pay $600 below normal growth. A transfer of $600 (as occurred in the 2001 recession) would restore this employee to normal salary growth. It seems plausible that consumers would respond to a $600 rebate that sustains normal growth in the same way they would have responded to $600 of normal growth if there been no recession.

In the simulations that follow, we adopt the standard procedure of first adding historical residuals to the constant term of each equation so that the model tracks history over the simulation period. We then use these adjusted equations for two simulations. First, we remove the rebate in 2001.3 and simulate the path the economy would have taken in the absence of the rebate; the difference between the historical path (with the rebate) and the path without the rebate measures the impact of the rebate. To remove the rebate in 2001.3, we reduce the aggregate transfer (from the federal government to households) by the amount of the aggregate rebate.
difference between the path with this larger repeated rebate and the path without the rebate measures the impact of the larger repeated rebate.

We find that the actual 2001 rebate, given its modest size and lack of repetition, had only a small effect on the economy. In the table and in the text that follows we report quarterly numbers (to obtain the corresponding numbers at annual rates, multiply by four). Recall (from footnote 1) that the 2001 rebate was $35.166 billion paid out in the third quarter ($140.664 billion at an annual rate), July-September, 1.4% of that quarter=s GDP.\(^5\) The top block of the table shows the impact of the actual 2001.3 rebate over the four quarters, 2001.3 through 2002.2. In the first quarter (2001.3), GDP was only $8.3 billion greater ($33.2 billion at an annual rate); and the unemployment rate, only 0.1% lower (4.8\% vs 4.9\%). Disposable income was $37.5 billion greater than it would have been without the $35.166 billion rebate (the discrepancy between $37.5 billion and $35.166 billion is due to a small multiplier effect in the first quarter); but consumption, only $6.4 billion greater. By the fourth quarter after the rebate (2002.2), GDP was only $5.0 billion greater ($20 billion at an annual rate); and the unemployment rate, only 0.1\% lower (5.8\% vs 5.9\%).\(^6\)

\(^5\) $0.702 billion was paid out in the remainder of the yearC we exclude this.

\(^6\) The one-time rebate generated a deficit only in the first quarter-- $33.7 billion, or 1.3\% of GDP (slightly lower than the rebate amount, $35.166 billion, due to a small multiplier effect in the first quarter); in the fourth quarter, government debt held by the public (excluding the Federal Reserve) was only $30.1 billion higher than it would have been without the rebate.
We also simulate the macroeconomic impact of a hypothetical rebate twice as large and repeated in three additional quarters. The bottom block of the table shows the impact if the rebate in 2001.3 had been twice as large-- 2.8% of GDP--- $70.332 billion instead of $35.166 billion-- and had been repeated for three additional quarters. With the $70.332 billion rebate repeated quarterly, in the fourth quarter (2002.2), GDP would have been $55.2 billion greater ($220.8 billion at an annual rate); and the unemployment rate, substantially lower: 0.8 percentage points lower than if there had been no rebate (5.1% instead of 5.9%). Because the rebate is repeated quarterly, the impact on the economy strengthens over the entire year. In the fourth quarter, multiplier effects would cause disposable income to be $92.7 billion greater than it would have been without the $70.332 billion rebate; and consumption, $41.2 billion greater.

But what about the impact of this larger repeated tax rebate on the deficit? This quarterly rebate generates a deficit in each quarter-- $67.4 billion (2.7% of GDP) in the first quarter (slightly lower than the rebate amount, $70.332 billion, due to a small multiplier effect in the first quarter). Because of the strengthening of the economy, the quarterly deficit declines to $60.2 billion (2.3% of GDP) in the fourth quarter. In the fourth quarter, government debt held by the public (excluding the Federal Reserve) is $252.9 billion higher than it would have been without the rebate; the ratio of government debt to annual GDP (not shown in the table) is only 2.4 percentage points higher (34.5% instead of 32.1%).

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7 The Fed can absorb more government debt, instead of the public, if its behavior diverges from its historical interest rate rule. If the Fed buys just enough debt to drive the interest rate to zero, then in the fourth quarter, government debt held by the public (excluding the Federal Reserve) would be $228.6 (instead of $252.9) billion higher than it would have been without the rebate; the ratio of government debt to annual GDP (not shown in the table) would be only 2.2 percentage points higher (34.3% instead of 32.1%) than it would have been without the rebate.
ratio is striking. As long as a tax rebate is temporary and detriggered when the recession ends, its use during a recession does *not* pose a significant debt problem.

But now suppose consumers treat a rebate differently from other disposable income. We modify the model to allow for the possibility that a counter-cyclical rebate is treated differently from other disposable income. Specifically, suppose consumers respond to a rebate $R$ the same way they would respond to $\alpha R$ of other disposable income, where $\alpha$ is the *relative effectiveness* of a rebate— that is, the effectiveness of a rebate *relative* to the effectiveness of other disposable income in the model’s consumption equations. The unadjusted model assumes that $\alpha = 1$.

**Interpreting the Simulations Using The Study With the Lower Spending Estimate**

What value of $\alpha$ would be implied by the Shapiro/Slemrod estimate (2003b) that the two-and-a-half quarter MPC out of the 2001 rebate was 0.36? In the Appendix, we show that their estimate implies an $\alpha$ of 0.87, so that consumers responded to $\$100$ of rebate the way they would have responded to an $\$87$ increase in other disposable income in the model’s consumption equations—the rebate’s *relative* effectiveness was 87%. Thus, based on the Shapiro/Slemrod MPC implied by their survey results, consumption out of the 2001 rebate was only a bit smaller than consumption out of disposable income as estimated by the model. It is easy to see why the $\alpha$ implied by Shapiro and Slemrod is close to 1.00. As reported above, the model estimates a two-quarter MPC of 0.36 and a three-quarter MPC of 0.47, so its two-and-a-half quarter MPC out of disposable income is approximately 0.41, only a bit larger than Shapiro and Slemrod’s
The Shapiro/Slemrod consumer survey results imply that each MPC out of a rebate would be 87% of the MPC out of other disposable income.

What would the bottom block of the table look like if \( \alpha \) were 0.87 instead of 1.00? We re-ran the simulations with \( \alpha = 0.87 \) (as described in the Appendix). In the fourth quarter (2002.2), GDP would have been $48.4 billion greater (compared with $55.2 billion in the table); and the unemployment rate, 0.7 percentage points lower (compared with the 0.8 percentage points in the table) than if there had been no rebate, so the rebate would have brought down the unemployment rate from 5.9% to 5.2% (instead of to 5.1% as in the table); government debt held by the public would have been $257.7 billion (slightly greater than the $252.9 billion in the table).

Interpreting the Simulations Using the Study With the Higher Spending Estimate

Johnson, Parker, and Souleles (2004) summarize their study as follows:

\[ \text{AUnder the Economic Growth and Tax Relief Reconciliation Act of 2001, most U.S. taxpayers received a tax rebate between July and September, 2001. The week in which the rebate was mailed was based on the second-to-last digit of the taxpayer's Social Security number, a digit that is effectively randomly assigned. Using special questions about the rebates added to the Consumer Expenditure Survey, we exploit this historically unique experiment to measure the change in consumption expenditures caused by receipt of the rebate and to test the Permanent Income Hypothesis and related models. We find} \]

\[ \text{Combining the model with the Shapiro/Slemrod estimate gives the following MPCs out of the rebate: one-quarter MPC = 0.17, two-quarter MPC = .31, three-quarter MPC = .41, and four-quarter MPC = .48.} \]
that households spent about 20-40 percent of their rebates on non-durable goods during the three-month period in which their rebates were received, and roughly another third of their rebates during the subsequent three-month period. The implied effects on aggregate consumption demand are significant. The estimated responses are largest for households with relatively low liquid wealth and low income, consistent with liquidity constraint.

Crucial for their study is the fact that the timing of the mailing of each rebate was based on the second-to-last digit of the Social Security number of the tax filer who received it, a digit that is effectively randomly assigned. The main reason for the weekly payment schedule is that it was hard to print and mail the rebate checks all at once. Social Security numbers were an easy and fair way to determine when each household got its check.

They use a special module of the Consumer Expenditure (CE) Survey. The authors state that of all the U.S. household surveys, the CE has the most comprehensive measures of households’ expenditures. The regular CE data, however, would not have been adequate to study the 2001 rebate because the regular CE survey does not record the timing of taxes and transfers, nor the Social Security numbers of households’ tax filers. However, shortly after the passage of the 2001 Tax Act, the authors worked with the staff of the Bureau of Labor Statistics (BLS) and other government agencies to add a special module of questions about the tax rebates to the Survey. The module asked households about the timing and amount of each rebate check they received, and was included in the survey from shortly after the rebate mailing began until the end of 2001. Because households received the same rebate check at different times, and because the time of receipt was randomly assigned, the authors are able to estimate how receipt of the rebate affected a household’s expenditure.9

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9 The CE survey obtains reports of expenditures by a large, stratified random sample of U.S. households. In an interview, a household reports its expenditures over the preceding three months. Each household is interviewed every three months until it has given four reports. The
They regressed the change in a household’s consumption from one quarter to the next against a set of variables including the amount of the rebate the household had received in the preceding quarter—an amount which might be zero. In this way, they could estimate the impact of the actual receipt of a rebate of a given amount on a household’s consumption spending. They find that during the three-month period in which a rebate was received, relative to the previous three-month period, a household on average increased its expenditures on food by 11 percent of the rebate, its expenditures on non-durable goods strictly defined by 24 percent of the rebate, and its expenditures on non-durable goods (broadly defined) by 37 percent of the rebate.

A special module was used beginning the second week of August through the end of December. It asked households whether they received a rebate, how many rebate checks they received, and the amount and month of each check received. Because new households were added to the survey every month, their data is monthly in frequency. Thus, in their sample they have some households interviewed with the special module in August, and some in September, who are asked whether they had received a rebate (and if so, the rebate amount) and what they spent in the three months preceding the interview. Rebates checks were mailed out according to a staggered weekly schedule from July through September. Hence, in August and September some interviewed households had received a rebate, and others had not, solely because of differences in their social security number.
They also examined spending in the subsequent quarter, and discerned continued substantial spending due to the rebate. They found that over the two quarters households spent about two thirds of their rebate on nondurable consumption goods.\(^{10}\)

The Johnson/ Parker/Souleles study implies a magnitude of spending out of rebates that is roughly twice as great as Shapiro/Slemrod, and therefore an \(\alpha\) well over 1 (recall that the Shapiro/Slemrod study implied an \(\alpha\) of 0.87). It follows that, according to the Johnson/Parker/ Souleles estimate, if the actual 2001 rebate had been repeated for four quarters, this would have been sufficient to reduce the unemployment rate from 5.9\% to 5.2\% by the end of the fourth quarter.

**Conclusion**

Is a tax rebate safe and effective? Simulations with an empirically-tested macroeconometric model are used to estimate the macroeconomic impact of the actual 2001 tax rebate in the U.S. (the total actual rebate expenditure of $35 billion in the third quarter of 2001 was 1.4\% of that quarter=s GDP), and of a hypothetical rebate twice as large and repeated in

\(^{10}\) They studied the impact of the rebate among households that differed in income and in liquidity constraints. Low income households spent a much larger fraction of their rebate during the three-month period of receipt than middle-income households. In the three months in which the rebate arrived, low income households spent about 75 percent of their rebate. Also, households with few liquid assets spent a significantly greater share of their rebates.
three additional quarters, and the results of the simulations are interpreted in light of two important recent empirical studies of the spending of the 2001 rebate by households. Based on the study with the lower spending estimate, we find that at the end of one year the actual rebate reduced the unemployment rate from 5.9% to 5.8% and the hypothetical rebate would have reduced the unemployment rate from 5.9% to 5.2%. Based on the study with the higher spending estimate, the same result would have been achieved even without doubling, but simply by repeating the rebate in three additional quarters. Our simulations show that as long as a tax rebate is temporary and detriggered when the recession ends, its use during a recession does not pose a significant debt or inflation problem. Thus, a triggered tax rebate is a safe and effective anti-recession policy.
## Table: Rebate Simulations Begin in 2001.3

<table>
<thead>
<tr>
<th>Quarter</th>
<th>REB as % GDP</th>
<th>∆ GDP B$ per Quarter</th>
<th>∆ UR</th>
<th>∆ YD B$ per Quarter</th>
<th>∆ CON B$ per Quarter</th>
<th>∆ DEF B$ per Quarter</th>
<th>∆ DEF as % GDP</th>
<th>∆ DEBT B$</th>
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<td>8.3</td>
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<td>6.4</td>
<td>33.7</td>
<td>1.3%</td>
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<td>-0.1%</td>
<td>3.1</td>
<td>5.6</td>
<td>-1.6</td>
<td>0.1%</td>
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<td>-0.1%</td>
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<td>-1.3</td>
<td>0.1%</td>
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<tr>
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<td>-0.1%</td>
<td>2.9</td>
<td>4.2</td>
<td>-0.7</td>
<td>0.0%</td>
<td>30.1</td>
</tr>
</tbody>
</table>

Rebate of $35.166 Billion (at Quarterly rates) for One Quarter

<table>
<thead>
<tr>
<th>Quarter</th>
<th>REB as % GDP</th>
<th>∆ GDP B$ per Quarter</th>
<th>∆ UR</th>
<th>∆ YD B$ per Quarter</th>
<th>∆ CON B$ per Quarter</th>
<th>∆ DEF B$ per Quarter</th>
<th>∆ DEF as % GDP</th>
<th>∆ DEBT B$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001.3</td>
<td>2.8%</td>
<td>16.5</td>
<td>-0.2%</td>
<td>75.0</td>
<td>12.7</td>
<td>67.4</td>
<td>2.7%</td>
<td>67.1</td>
</tr>
<tr>
<td>2001.4</td>
<td>2.8%</td>
<td>33.5</td>
<td>-0.4%</td>
<td>81.1</td>
<td>23.8</td>
<td>64.2</td>
<td>2.5%</td>
<td>131.3</td>
</tr>
<tr>
<td>2002.1</td>
<td>2.7%</td>
<td>47.2</td>
<td>-0.7%</td>
<td>87.6</td>
<td>33.1</td>
<td>61.2</td>
<td>2.4%</td>
<td>192.6</td>
</tr>
<tr>
<td>2002.2</td>
<td>2.7%</td>
<td>55.2</td>
<td>-0.8%</td>
<td>92.7</td>
<td>41.2</td>
<td>60.2</td>
<td>2.3%</td>
<td>252.9</td>
</tr>
</tbody>
</table>

Rebate of $70.332 Billion (at Quarterly rates) for Four Quarters

Notes: REB is the rebate, B$ at quarterly rates. GDP is Gross Domestic Product, B$ at quarterly rates. YD is household disposable income, B$ at quarterly rates. UR is the civilian unemployment rate. CON is the sum of consumer expenditures for services, nondurable goods, and durable goods, all B$ at quarterly rates. DEF is federal government deficit (+), B$ at quarterly rates. DEBT is the amount of federal government securities outstanding outside of the Federal Reserve and Treasury), B$.
APPENDIX

Let \( Y \) be real per capita disposable income, and \( C \) be real per capita consumption.

The MPC=s Out of Disposable Income In the Model

Let \( \Delta Y_1 \) be an increment in \( Y \) in quarter 1.

Suppose the estimated equation is \( C = aY + \lambda C_{-1} \) (the model fits an equation of this form for consumer durables). Then it follows\(^{11} \) that

\[
(1) \quad C = aY + \lambda aY_{-1} + \lambda^2 aY_{-2} + \lambda^3 aY_{-3} + ...
\]

It can be shown\(^{12} \) that the cumulative increase in consumption in the first four quarters (the increment in consumption above what it otherwise would have been) is

\[
(2) \quad \Sigma C = \Sigma_{i=1}^{4} \Delta C_i = a(1 + \lambda + \lambda^2 + \lambda^3) \Delta Y_1,
\]

so the four-quarter MPC out of disposable income, \( \Sigma C/\Delta Y_1 \), equals \( a(1 + \lambda + \lambda^2 + \lambda^3) \).

Now suppose the estimated equation is \( \ln C = a \ln Y + \lambda \ln C_{-1} + \gamma \ln C_{-2} \) (the model fits an equation of this form for consumption of non-durables, and for consumption of services, \( \gamma \) for services, Fair sets \( \gamma = 0 \)). Then it follows\(^{13} \) that

\[^{11} \text{Since } C = aY + \lambda C_{-1}, \text{ and } C_{-1} = aY_{-1} + \lambda C_{-2}, \text{ then } C = aY + \lambda (aY_{-1} + \lambda C_{-2}) = aY + \lambda aY_{-1} + \lambda^2 C_{-2}; \text{ and since } C_{-2} = aY_{-2} + \lambda C_{-3}, \text{ then } C = aY + \lambda aY_{-1} + \lambda^2 (aY_{-2} + \lambda C_{-3}) = aY + \lambda aY_{-1} + \lambda^2 aY_{-2} + \lambda^3 C_{-3}. \text{ Continuing this way yields (1).}\]

\[^{12} \text{Suppose in quarter 1 only there is an increment } \Delta Y_1. \text{ In quarter 1, } C_1 = aY_1 + \lambda aY_0 + \ldots \text{ Had there been no } \Delta Y_1, \text{ } C'_1 = a(Y_1 - \Delta Y_1) + \lambda aY_0 + \ldots \text{ Hence, the increase in quarter 1 real per capita consumption due to } \Delta Y_1 \text{ is } \Delta C_1 = C_1 - C'_1 = a\Delta Y_1. \text{ In quarter 2, } C_2 = aY_2 + \lambda C_1 = aY_2 + \lambda aY_1 + \lambda^2 aY_0 + \ldots \text{ Had there been no } \Delta Y_1, \text{ } C'_2 = aY_2 + \lambda C'_1 = aY_2 + \lambda a(Y_1 - \Delta Y_1) + \lambda^2 aY_0 + \ldots \text{ Hence, the increase in quarter 2 consumption due to } \Delta Y_1 \text{ is } \Delta C_2 = C_2 - C'_2 = \lambda a\Delta Y_1. \text{ Similarly, } \Delta C_3 \text{ is } \lambda^2 a\Delta Y_1, \text{ and } \Delta C_4 \text{ is } \lambda^3 a\Delta Y_1.\]

\[^{13} \text{If we are only interested in the impact on consumption in the first four quarters, we only need to keep track of } C \text{ terms back to } C_3. \text{ Since } \ln C_{-1} = a \ln Y_{-1} + \lambda \ln C_{-2} + \gamma \ln C_{-3}, \text{ and } \ln C_{-2} \]

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\begin{align*}
\ln C &= alnY + \lambda (alnY_{-1} + \lambda \ln C_{-2} + \gamma \ln C_{-3}) + \gamma (alnY_{-2} + \lambda \ln C_{-3} + \ldots), \text{ so} \\
\ln C &= alnY + \lambda alnY_{-1} + \gamma alnY_{-2} + \lambda^2 \ln C_{-2} + 2\lambda \gamma \ln C_{-3} + \ldots, \text{ so} \\
\ln C &= alnY + \lambda alnY_{-1} + \gamma alnY_{-2} + \lambda^2 (alnY_{-2} + \lambda \ln C_{-3} + \ldots) + 2\lambda \gamma \ln C_{-3} + \ldots, \text{ or} \\
\ln C &= alnY + \lambda alnY_{-1} + (\gamma + \lambda^2) alnY_{-2} + (\lambda^3 + 2\lambda \gamma) \ln C_{-3} + \ldots, \text{ and since } \ln C_{-3} = alnY_{-3} + \ldots, \text{ then continuing this way yields (3).}
\end{align*}
\[(3) \ln C = a \ln Y + \lambda a \ln Y_1 + (\lambda^2 + \gamma) a \ln Y_2 + (\lambda^3 + 2\lambda\gamma) a \ln Y_3 + \ldots\]

It can be shown\(^{14}\) that the cumulative increase in consumption in the first four quarters (the

\(^{14}\) Suppose in quarter 1 only there is an increment \(\Delta Y_1\). In quarter 1, \(\ln C_1 = a \ln Y_1 + \lambda a \ln Y_0 + \ldots\) Had there been no \(\Delta Y_1\), \(\ln C_1' = a \ln(Y_1 - \Delta Y_1) + \lambda a \ln Y_0 + \ldots\) Hence, the increase in the \(\ln\) of quarter 1 consumption due to the \(\Delta Y_1\) is

\[\Delta \ln C_1 = \ln C_1 - \ln C_1' = a[\ln Y_1 - \ln(Y_1 - \Delta Y_1)],\]

so

\[\ln(C_1/C_1') = a \ln y_1 = a \ln y_1,\]

where

\[y_1 = [Y_1/(Y_1 - \Delta Y_1)]\] (Note that \(y_1 > 1\)). Then

\[C_1/C_1' = y_1^a.\]

Since \(C_1' = C_1 - \Delta C_1\), then \(C_1/C_1' = C_1/(C_1 - \Delta C_1) = y_1^a\), so \(C_1 = (C_1 - \Delta C_1)y_1^a\), and \(\Delta C_1(y_1^a) = C_1(y_1^a) - C_1\), so the increase in quarter 1 real per capita consumption due to \(\Delta Y_1\) is

\[\Delta C_1 = C_1(y_1^a - 1)/y_1^a.\]

In quarter 2, \(\ln C_2 = a \ln Y_2 + \lambda a \ln Y_1 + (\lambda^2 + \gamma) a \ln Y_0 + \ldots\) Had there been no \(\Delta Y_1\), \(\ln C_2' = a \ln Y_2 + \lambda a \ln(Y_1 - \Delta Y_1) + (\lambda^2 + \gamma) a \ln Y_0 + \ldots\) Hence, the increase in the \(\ln\) of quarter 2 consumption due to \(\Delta Y_1\) is

\[\Delta \ln C_2 = \ln C_2 - \ln C_2' = \lambda a[\ln Y_1 - \ln(Y_1 - \Delta Y_1)],\]

so

\[\ln(C_2/C_2') = \lambda a \ln y_1 = \lambda a \ln y_1,\]

so

\[C_2/C_2' = y_1^\lambda.\]

By the same steps we find that the increase in quarter 2 real per capita consumption due to \(\Delta Y_1\) is
increment in consumption above what it otherwise would have been) is

$$\Sigma C = \Sigma_{i=1}^{4} \Delta C_i,$$

where

$$\Delta C_i = C_i \left(\frac{y_1^{\beta_i} - 1}{y_1^{\beta_i}}\right),$$

where $\beta_1 = a$, $\beta_2 = \lambda a$, $\beta_3 = (\lambda^2 + \gamma)a$, and $\beta_4 = (\lambda^3 + 2\lambda\gamma)a$, and $y_1$ is defined as $y_1 / [Y_1 / (Y_1 - \Delta Y_1)]$, where $Y_1$ is the real per capita disposable income with $\Delta Y_1$, and $C_i$ is the real per capita consumption (with $\Delta Y_1$) in quarter $i$.

Recall that the model has three components of consumption spending: consumer durables, consumption of services, and consumption of non-durables. For durables, $\Sigma C = \Sigma_{i=1}^{4} \Delta C_i$ is given by equation (2); for services, by equation (4) for $\gamma = 0$; and for non-durables, by equation (4). Let $\Sigma \Delta C$ be the sum of the increase in total consumption of the three components.

The MPC over the first $J$ quarters (the $J$-quarter MPC) is $(\Sigma_{i=1}^{J} \Delta C) / \Delta Y_1$. 

The MPC=5 Out of A Rebate In the Model

$$\Delta C_2 = C_2 \left(\frac{y_1^{\lambda a} - 1}{y_1^{\lambda a}}\right).$$

Similarly, $\Delta C_3$ is given by the same formula with the exponent $(\lambda^2 + \gamma)a$, and $\Delta C_4$, with the exponent $(\lambda^3 + 2\lambda\gamma)a$. 

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Suppose a rebate $R$ has the same effect on consumers as $aR$ of other disposable income. Then in a quarter with a rebate, in each consumption function $Y$ is replaced by $Y - R + aR$. Let $R_1$ be the real per capita rebate in quarter 1.\textsuperscript{15} Then we replace $\Delta Y_1$ with $aR_1$. So (2) becomes\textsuperscript{16}

\[
(2R) \quad \Sigma C = \Sigma_{i=1}^{4} \Delta C_i = a(1 + \lambda + \lambda^2 + \lambda^3)aR_1,
\]

so the four-quarter MPC out of the rebate (the amount of the rebate spent in the first four quarters), $\Sigma C/R_1$, equals $aa(1 + \lambda + \lambda^2 + \lambda^3)$.

So (4) becomes\textsuperscript{17}

\[
(4R) \quad \Sigma C = \Sigma_{i=1}^{4} \Delta C_i,
\]

\textsuperscript{15}To obtain the real per capita rebate, we divide the nominal aggregate rebate by non-institutional population 16+ (POP) times the consumption price deflator (PH).

\textsuperscript{16}Suppose in quarter 1 only there is an $R_1$. In quarter 1, $C_1 = a(Y_1 - R_1 + aR_1) + \lambda aY_0 + ...$ Had there been no $R_1$, $C_1' = a(Y_1 - R_1) + \lambda aY_0 + ...$ Hence, the increase in quarter 1 real per capita consumption due to $R_1$ is $\Delta C_1 = C_1 - C_1' = a\alpha R_1$. Similarly, $\Delta C_2 = \lambda a\alpha R_1, \Delta C_3$ is $\lambda^2 a\alpha R_1,$ and $\Delta C_4$ is $\lambda^3 a\alpha R_1$.

\textsuperscript{17}Suppose in quarter 1 only there is an $R_1$. In quarter 1, $\ln C_1 = a\ln(Y_1 - R_1 + aR_1) + \lambda a\ln Y_0 + ...$ Had there been no $R_1$, $\ln C_1' = a\ln(Y_1 - R_1) + \lambda a\ln Y_0 + ...$ Hence, $\Delta \ln C_1 = \ln C_1 - \ln C_1' = a[\ln(Y_1 - R_1 + aR_1) - \ln(Y_1 - R_1)],$ so

$\ln(C_1/C_1') = \lambda a \ln y_1$, where $y_1 = [(Y_1 - R_1 + aR_1)/(Y_1 - R_1)]$. Then $\Delta C_1 = C_1 (y_1^a - 1)/y_1^a$. Similarly, $\Delta C_2 = C_2 (y_1^a - 1)/y_1^a$, $\Delta C_3$ has the exponent $(\lambda^2 + \gamma)a$, and $\Delta C_4$ has the exponent $(\lambda^3 + 2\lambda\gamma)a$. 

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where

$$\Delta C_i = C_i \left( y_1^{\beta_i} - 1 \right) / y_1^{\beta_i},$$

where $\beta_1 = a$, $\beta_2 = \lambda a$, $\beta_3 = (\lambda^2 + \gamma)a$, and $\beta_4 = (\lambda^3 + 2\lambda\gamma)a$, and $y_1$ is defined as $y_1 / [(Y_1 - R_1 + \alpha R_1)/(Y_1 - R_1)]$, where $Y_1$ is the real per capita disposable income with the rebate in quarter 1, and $C_i$ is the real per capita consumption (with $R_1$) in quarter $i$. The MPC over the first $J$ quarters (the J-quarter MPC) is $(\sum_{i=1}^{J} \Delta C) / R_1$.

What value of $\alpha$ is implied by Shapiro and Slemrod’s estimate that the MPC out of the rebate is 0.36? Recall that the time period for their MPC is two-and-a-half quarters (seven and a half months) because the rebate was paid out in July through September (almost half the rebate was paid in August) and their follow-up consumer survey occurred in March and April of 2002. If we assume that the time period was two quarters, then by iteration we can find the value of $\alpha$ that makes the two-quarter $\sum C / R_1 = 0.36$; that value turns out to be approximately 1.00. If instead we assume that the time interval was three quarters, then by iteration we can find the value of $\alpha$ that makes the three-quarter $\sum C / R_1 = 0.36$; that value turns out to be approximately 0.75. So two-and-a-half quarters implies an $\alpha$ of approximately 0.87. Thus, the Shapiro/Slemrod MPC estimate implies that consumers respond to a $100 rebate the way they would respond to $87 of other disposable income.

Simulating the Model With $\alpha$

In the simulations, we adopt the standard procedure of first adding historical residuals to the constant term of each equation so that the model tracks history over the simulation period. We use the model except that in any quarter with a rebate, we replace actual real per capita
disposable income $Y$ with $(Y-R+\alpha R)$ in the consumption functions. For 2001.3, we adjust the constant term of each consumption equation (as well as the constant terms for the equations for residential investment and household money demand, which also includes disposable income as an explanatory variable) so that each of these equation predicts (within an extremely small tolerance) the actual historical value.\textsuperscript{18} We then use these adjusted consumption equations and remove the rebate to simulate the path we predict the economy would have taken in the absence of the rebate. When we remove the rebate $R$, consumers respond as though disposable income were reduced by $\alpha R$.\textsuperscript{19} Then we double the rebate in 2001.3, repeat this larger rebate in the next three quarters, and simulate the path the economy would have taken with this larger repeated rebate; the difference between the path with this larger repeated rebate and the path without the rebate measures the impact of the larger repeated rebate. When we introduce the larger rebate, consumers respond as though disposable income were increased by $\alpha$ times the larger rebate.

\textsuperscript{18} For a few subsequent quarters for a few variables in the model, the simulated path deviates slightly from the historical path but not more than 0.006 percent.

\textsuperscript{19} To remove the rebate in 2001.3, we reduce the aggregate transfer (from the federal government to households) by the amount of the aggregate rebate. This in itself reduces aggregate disposable income by the amount of the aggregate rebate, but consumers respond as though disposable income were reduced by $\alpha$ times the aggregate rebate, so it is necessary to add $(1-\alpha)$ times the aggregate rebate back to disposable income in the consumption equations in order to accurately predict consumption.
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