The Asymmetric Response of the Economy to Tax Changes Before and After 1980

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Abstract: This paper explores the asymmetry in the response of GDP to tax shocks before and after 1980 as first noted in Romer and Romer (2010). I find that there are two main reasons why output responds more strongly to tax shocks before 1980 than after. First, a greater sensitivity of the effect of tax shocks on output to the state of the economy before 1980 explains about half of the difference between periods. Second, before 1980 the effect of tax shocks on households is indirect and lowers total personal income and nondurable goods consumption. After 1980 tax shocks affect personal tax payments directly, causing disposable income and savings to change. This finding affirms Romer and Romer's hypothesis that households are more likely to consumption smooth. However, I find that households after 1980 consumption smooth in response to a change in their direct tax burden not, as Romer and Romer posit, because they have greater access to financial services.

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1 Introduction

In their seminal paper, Romer and Romer (RR 2010) find large differences in the response of output to narrative tax shocks during the postwar period before and after 1980. This intertemporal asymmetry has garnered little attention. Following Perotti (2012) I use an augmented vector autoregression (VAR) specification from RR and Mertens and Ravn (MR 2012) that also controls for idiosyncratic noise from non-narrative tax changes to examine differences in the response of the economy to tax shocks before and after 1980. I finds two basic reasons for the difference in the response of output between subperiods. First, for the period 1952Q1–1980Q1 the business cycle plays a role in explaining a large portion of the response of output to tax shocks. Second, for the period 1980Q1–2007Q4 household's tax burden changes directly in response to narrative tax shocks. In response to a tax increase, disposable income and household savings falls. This change in savings behavior mutes the effect of tax changes on household consumption, resulting in a smaller effect of tax shocks on overall GDP. My more detailed evidence supports the basic hypothesis of RR that savings behavior is changing across periods. However, the mechanism for this change in savings is not, as they suggest, a change in access to financial services but rather a change in the way taxes affect household disposable income across periods.

In this paper I divide up the full postwar period (1952Q1-2007Q4) into pre- and post-1980 periods, consistent with conventional understanding of a structural break in the economy, particularly with respect to monetary and fiscal policy, in 1980. I find two basic empirical differences in the response of output to tax shocks before and after 1980. By adding a recession dummy to the VAR models, I find a significant reduction in the effect of tax shocks before 1980 relative to the effect when not controlling for recessions. However, for the period 1980Q1-2007Q4, controlling for recessions does not change the response of output to tax shocks. This greater sensitivity to recessions before 1980 explains about half of the gap in the response between the two sub periods. This finding offers complementary evidence of a state-dependent response of tax policy to complement the findings of a state-dependent effect of government spending found by Auerbach and Gorodnichenko (AG 2012) and Fazzari, Morley, and Panovska (FMP 2014). Both of these papers find that government spending multipliers are also larger during recessions, but do not explore postwar subperiods. However, the finding here contradicts the theoretical findings of Sims and Wolff (SW 2018) that tax shocks are more effective during expansions.

Even with the diminished difference across subperiods when controlling for recessions, there remains significant heterogeneity in the response of output and income across subperiods. The second major difference between periods, then, stems from the household response to tax shocks. Before 1980 the decline in output in response to a tax increase is driven by a combination of a decline in nondurables goods consumption and a decline in nonresidential investment. This change is associated with a permanent decline in total personal income. The changes in nondurable goods consumption and personal income are permanent. After 1980, the dynamics are quite different. Statistically speaking, total personal income does not change. However, disposable income does decrease. This decrease in disposable income is driven by changes in personal tax payments, which increase in response to a positive tax shock. This temporary increase in tax payments is offset by a decrease in savings. Savings also decreases further because dividend income declines in response to an increase in taxes as well. This results in differences in the dynamics of aggregate demand. Household consumption of both durable and nondurable goods does not respond to an increase in taxes after 1980. Changes in investment behavior are also different after 1980 and are driven by changes in residential investments. I offer further evidence that household savings is more sensitive to tax changes after 1980 than before from the Flow of Funds to support this. In particular, household holdings of "semi-liquid" assets such as savings and time deposits, mutual fund deposits, and municipal bond holdings decline in response to a tax increase after 1980, but do not respond to tax changes before 1980. My findings support the RR hypothesis that savings behavior differs across subperiods. However, I argue that the mechanism for the change in savings is different from the RR proposed mechanism of better access to financial services for households. Rather, savings behavior responds to a combination of a change in household's tax burden and—assuming income from savings is also saved—a change in dividend income.

Striking in these results is that the smaller effect of tax shocks after 1980 is associated with a clear channel for tax changes to affect household behavior. An increase in tax payments leads to a change in savings behavior. However, before 1980 the effect of tax shocks on household behavior, even when controlling for recessions, is stronger but indirect. The indirect effect likely operates through the effect of tax shocks on nonresidential investment, but no clear evidence for a transmission mechanism of tax shocks to changes in economic activity emerges for tax shocks before 1980.

I also explore other possible explanations for the change in the response of output before and after 1980. RR also suggest the possibility that a more active monetary policy or a decline in confidence in the economy, particularly associated with concerns over rising federal government debt levels, could possibly explain the difference across subperiods. However, contrary to the findings of the original RR paper, using a model less likely to suffer from omitted variable bias, I find no evidence that the Federal Reserve responds strongly to tax shocks in either subperiod. Also, consumer confidence in the economy is actually higher on average after 1980, and tax shocks also do not have a direct effect on consumer confidence in either period. There is weak evidence to suggest that business confidence responds (on impact) to tax shocks, but the direction of the response contradicts the idea that confidence is driven by deficit concerns.

Also, other authors have decomposed the RR tax shocks into various subcomponents. Mertens and Ravn (MR 2013) look at the effect of personal and corporate income taxes on output. Jones, Olson, and Wohar (JOW 2015) show that negative narrative tax shocks have a stronger effect than positive shocks. Hussain and Malik (HM 2016) show that for the full postwar period the asymmetry of tax shocks operates similarly for personal tax decreases, which have a stronger effect on output than personal tax increases. Further, Mertens and Montiel Olea (MMO 2018) look at marginal tax shocks by income percentile. Exploring possible asymmetries of the decomposed shocks across subperiods produces some weak evidence that corroborates the main finding of this paper that changes in the personal income taxes have an effect on output after 1980 but not before.

This paper contributes to the literature by demonstrating the importance of considering intertemporal asymmetries in the response of output to tax shocks. The response of households differs in important ways before and after the structural break in 1980. I demonstrate that the response of tax shocks is more sensitive to the business cycle before 1980 than after. This is particularly striking given that no narrative tax shock happens during a recession before 1980, while four of the post-1980 shocks are during recessions. Second, as RR posit, savings behavior in response to tax shocks is different after 1980 than before, and I provide additional evidence for their supposition that households are more likely to consumption smooth,¹ after 1980, but with an important caveat. Household's savings response to tax shocks after 1980 is being driven by the fact that tax changes manifest themselves directly as changes in tax burdens for households whereas before 1980 tax changes affect household income indirectly.

2 Methodology

Researchers that study fiscal policy shocks are approaching a consensus that narrative identification—the establishment of exogenous shocks by a close examination of the historical record—is a key identification strategy. The seminal paper by RR (2010) establishes a series of narratively identified shocks culled from the historical record—that have become the baseline series for

¹An anonymous reviewer has pointed out that RR do not explicitly posit "consumption smoothing" as a possible explanation for the change across subperiods. To quote RR directly: "And third, the increasing depth and scope of financial markets may have caused the dependence of consumer spending on disposable income to decline over time" (RR 2010, p 795). I will, however, refer to this phenomenon as "consumption smoothing" for ease of exposition, though RR do not posit any specific behavioral mechanism for the disconnect between consumption and disposable income after 1980.

testing the impact of tax revenue shocks on output.

Perotti (2012) points out the problem of identifying the response of output to tax shocks when there is idiosyncratic noise in the tax revenue series that is distinct from the "discretionary" tax shocks of RR and the response of tax revenue to changes in output. Equation ?? breaks down the response of tax revenue changes into three components: exogenous shocks, the response of revenue to output, and the idiosyncratic "noise" that cannot be accounted for by the other two variables:

$$s_t = d_t + \eta y_t + \mu \tag{1}$$

Where s_t is the log change in tax revenues, y_t is the log change in output, d_t denotes discretionary tax changes,² and μ is a random error term, assumed to be i.i.d. with a zero mean and uncorrelated with d_t . The η term, is the elasticity of tax revenue to changes in output. RR propose a "narrative" procedure for identifying d_t . Their d_t series comes from an examination of the historical record to establish moments in which discretionary tax changes can be considered exogenous to changes in the overall economy. The empirical issue Perotti highlights is that empirical models that incorporate these RR revenue shocks have not done an adequate job of controlling for μ , which can bias results. He proposes a simple adjustment to the vector autoregressive model to control for these idiosyncratic shocks. With the combination of RR narratively identified shocks and the Perotti adjustment there is now a compelling procedure for identifying the effect of fiscal policy shocks on the economy. This paper employs this hybrid identification strategy in Perroti to identify exogenous revenue shocks. As Perotti explains, the identification problem can be articulated as follows.

Take a simple AR(1) regression of tax revenue on output:

$$y_t = \alpha y_{t-1} + \gamma_1 d_t + \gamma_1' (s_t - d_t) + \gamma_2 d_{t-1} + \gamma_2' (s_{t-1} - d_{t-1}) + \epsilon_t$$
(2)

²To be exact, d_t is an unexpected and exogenous discretionary tax changes at time t. I assume for this paper—following Perotti—that the discretionary tax changes (detailed below) are unanticipated.

Where I remind the reader that $s_t - d_t = \eta y + \mu$. If one assumes that $\gamma_i = \gamma'_i$ then

$$y_t = \alpha y_{t-1} + \gamma_1 s_t + \gamma_2 s_{t-1} + \epsilon_t \tag{3}$$

Here, changes in output only depend on changes in total revenues as all components of revenue affect output the same. Similarly if $\gamma'_1 = \gamma'_2 = 0$ then equation ?? reduces to

$$y_t = \alpha y_{t-1} + \gamma_1 d_t + \gamma_2 d_{t-1} + \epsilon_t \tag{4}$$

In equation ?? changes in output only depends on exogenous shocks as measured by the narrative series. However, for the more general case, in which $\gamma_i \neq \gamma'_i$ or $\gamma'_1 \neq \gamma'_2 \neq 0$ we get:

$$y_t = \Theta(\alpha + \gamma'_2 \eta) y_{t-1} + \Theta \gamma_1 d_t + \Theta \gamma_2 d_{t-1} + \Theta \gamma'_1 \mu_t + \Theta \gamma'_2 \mu_{t-1} + \Theta \epsilon$$
 (5)

Where $\Theta = \frac{1}{1 - \gamma'_1 \eta}$. Here, an empirical specification that does not account for μ will suffer from omitted variable bias.

Perotti's proposed solution is to simply correct the omitted variable bias by adding an estimate of the μ series, what he calls an "instrument" for μ . To do this he uses an IV estimation of the following equation, which includes more relevant variables and more lags than in the simple illustrative Equation ??:

$$s_t = \alpha_0 + \eta y_t + \alpha_1 d_t + \alpha_2 \Delta i_t + \alpha_3 g_t + \alpha_4 \Delta \pi_t + \nu_t \tag{6}$$

Where d_t is the RR narrative series. The RR shocks are as a percent of output. The log change of output per capita is denoted by y_t , Δi_t is the one period change in the interest rate (discussed below), g_t is the log change of government spending per capita, and $\Delta \pi$ is the one quarter change in the inflation rate. The instruments used are lags 0 to -4 of d_t and lags -1 to -4 of the other independent variables. Estimating Equation ?? produces a series we can use to control for changes in tax revenue not accounted for by the variables included in the VAR estimates below. A four lag (-1 to -4) moving average of μ is used to construct the μ variable.

The procedure for estimating the VAR model augmented to control for μ for testing the response of the menu of variables with the variable of interest is a simple one. Following Cristiano, Eichenbaum and Evans (CEE 1996), I simply add the variable of interest to the baseline specifications described below. For purposes of the Choleski decomposition necessary for extracting shocks from the VAR specification, I order the variable of interest last. The these variables of interest are all the log difference of constant dollar variables.

Peortti is agnostic on the appropriate VAR model to use, though he finds that estimates across specifications produce similar results with the inclusion of μ . There are four different VAR models used by Perotti. I employ two of these models including a control for NBER recessions.³

First is what he calls the "augmented" RR VAR.

$$X_t = A(L)d_t + B(L)X_{t-12} + r_t + \mu_{t-12} + e_t$$
(7)

Where A(L) is a lag operator of order 13 and B(L) is of order 4, d_t is the narrative tax shock, and r_t is a dummy variable that is equal to 1 for a quarters with an NBER-dated recession. As in all the model specifications, Xcontains all of the variables in equation ??. Elements of the flow of funds and the components of GDP and income are appended to X individually when estimating their impulse response functions.

The second comes from MR (2012):

$$X_t = A(L)d_t + B(L)X_{t-1} + r_t + \mu_t + e_t$$
(8)

³In an earlier version of this paper I made use of all four models in the original Perotti paper. For ease of exposition I used a simple model averaging technique following Buckland Burnham and Auhustin (1997) to produce a single estimate for each set of variables. However, as an anonymous reviewer pointed out, this averaging technique obscures points where the estimates from the different models diverged. As well, two of the specifications from the original paper did not fit the data very well (with very low weights in the model averaging scheme, which was a function of the Aikike information criteria). As such, I have chosen to focus on the two specifications that dominated the averaged estimates and to show these estimates separately for clarity.

Where A(L) here is of order 5 and B(L) is of order 4.

Perotti follows Favero and Giavazzi (FG 2009) in utilizing a measure of the cost of debt serving as the interest for Δi^4 . It is not obvious that this is the correct interest rate to use in this context, in particular because, as FG show, debt servicing does not seem to factor into the impulse responses of output to revenue shocks very strongly. As an alternative I use the Federal Funds rate. The use of the federal funds rate instead of a debt servicing interest rate is justified for a number of reasons. First, RR show a clear change in the relationship between monetary and fiscal policy across subperiods. Second, there is no clear reason to believe that policy makers consider the cost of debt servicing when making policy decisions. This certainly does not seem to be the case starting in the 1980s, when both deficits and the cost of debt service increased in parallel. Third, of no small interest is the relationship between monetary and fiscal policy. New Keynesian models take the policy rate to be the central factor in determining the ability of fiscal policy to influence output (Woodford, 2011). Finally, and relatedly, since the focus of this paper is on household savings behavior it make sense to include the federal funds rate, since the federal funds rate has a more clear connection to borrowing and lending behavior in the private sector than the cost of federal debt service.

3 Evidence from National Product

This section demonstrates the effect of controlling for recessions on the response of output to tax shocks. I also show the effects on the components of national product. I find that, when controlling for recessions the effect of tax shocks on output before 1980 is smaller, but the effect of tax shocks after 1980 does not depend on the business cycle. Controlling for recession reduces the gap in the response across periods by roughly half. However, even when controlling for recessions, there is significant heterogeneity across responses. Increases in total RR-narrative taxes for the full period causes a medium-term

 $^{^4\}mathrm{Interest}$ payments by the federal government divided by the previous quarter's federal public debt level.

decline in total GDP. This full period response is being driven by the response of output to tax increases before 1980. The decline in output before 1980 is being driven by a decline in nondurable goods consumption and nonresidential fixed investment. After 1980, while there is only weak evidence to suggest a decline in output, residential investment does decline in response to tax shocks.

3.1 GDP

Figure ?? shows the results of a 1% tax increase on GDP. Panel A shows the response to output without controlling for recessions and Panel B shows the response to output when a recession dummy is used. Controlling for recessions reduced the economic effect of tax shocks before 1980 significantly, though the difference in sub periods does not disappear completely.

For the full 1952Q1–2007Q4 period, without a control for recessions, the two specifications suggest a medium-run response of output to tax changes from quarter 5 to quarter 10. The RR specification predicts a larger response of output with a peak response of 2.5% of GDP at quarter 8 while the MR specification predicts a peak response in quarter 7 of 1.6%.

The size of the response for both specifications is similar before 1980, with a peak decline after 8 quarters of 4.8% for the RR specification and a decline in quarter 6 of 4.5% for the MR specification in response to a tax increase equal to 1% of GDP. After 1980 the RR specification shows a peak decline of 2.2% after 9 quarters while the MR specification shows a decline of 1.0% after 8 quarters. Relevant to interpreting the results of this paper is the fact that the response to tax shocks of this augmented RR specification, without controlling for recessions, is similar to the subperiod findings of the original RR paper (2010). They find a peak effect of tax shocks on GDP before 1980 of 4.3% after 7 quarters; after 1980 the effect is 3.1% after 8 quarters. Also corroborating the similarity in responses between this paper and the original paper is that RR also do not find an "impact" effect of tax shocks, though their specification produces a significant result in both subperiods earlier in the impulse response than I find. The differences in findings likely stem from the fact that our sub periods are slightly different, and probably more importantly, I add to their simple three-variable specification by also including a control for monetary policy and inflation. Also, my specification makes a point of controlling for tax behavior correlated with the RR shocks not included in the original specification. Nonetheless, the similarity of the results is worth pointing out, especially since this paper seeks to explain the difference in subperiods discussed in the original paper. It is also important to point out that the MR specification corroborates the sign of the pre-1980 response but does not find a significant response after 1980. As a general rule of the results presented here, the RR specification is more prone towards showing a significant effect than the MR specification.

Adding a control for recessions significantly reduces the response of output to tax shocks before 1980. Figure ?? shows that for the RR specification, controlling for recessions before 1980 produces an eight-quarter peak response of -3.1% compared with the baseline specification's 4.8% decline. Controlling for recessions also reduces the effect of tax shocks on GDP after 1980, but the change is small. The decline in GDP in response to a 1% increase in taxes for the RR specification is -1.8% compared with the uncontrolled 2.2% after nine quarters.

The change is similar for the MR specification. When controlling for recessions, the effect of a tax shock equal to 1% of GDP before 1980 decreases GDP by 2.8% after 6 quarters as opposed to 4.6% without recession controls. When controlling for recessions after 1980, the MR specification produces a, not statistically significant, peak effect of 1.4% after 8 quarters as opposed to 1.0% for the uncontrolled effect.

3.2 Consumption

Figure ?? shows the response of nondurable consumption across periods. Both the full period and the pre-1980 subperiod show a permanent decrease in consumption in response to a tax shock. There is a suggestion that there is also a long-run/permanent effect of tax shocks on nondurable consumption after 1980, but the evidence is mixed and statistically weak.

For the full period the RR specification produced a decline of nondurable consumption of 3.5% after 10 quarters in response to a tax shock of 1% of GDP. The MR specification suggests an effect about half the size of the RR effect, at 1.7% after 10 quarters. The pre-1980 period shows a similar pattern of response. However, the effect is larger. The RR specification produces a 6.9% reduction in nondurbale goods consumption after nine quarters in response to a tax shock equal to 1% of GDP. The MR specification produces a 4.3% decline after 6 quarters. After 20 quarters the RR specification predicts 5.3% decline and the MR specification predicts a 3.9% decline in nondurable consumption in response to a tax increase of 1% of total GDP. After 1980 there is some evidence to suggest a long term effect of tax shocks on consumption in line with the effect of tax shocks for the full period, but the evidence for this is weak, only the RR specification shows a statistically significant effect of a tax increase in nondurable consumption post-1980 after 20 quarters.

Figure ?? shows the response of durable goods consumption. Before 1980 the RR specification produces a 8.2% decrease in durable consumption of to a tax increase of 1% at 5 quarters. The MR specification produces a larger response of durable consumption before 1980 of -9.7% after 5 quarters. However, the RR specification does not show a significant response of durables consumption for the pre-1980 period. For the post-1980 period there is no statistically significant relationship between durables consumption and narrative tax shocks for either specification.

3.3 Investment

While the primary focus in this paper is on the behavior of households it is useful to look at how residential and nonresidential fixed investment evolve in response to tax shocks. Both specifications produce a statistically significant response of residential investment to tax shocks after 1980. In a statistical sense, the response of fixed investment to tax shocks before 1980 is weak, but the analysis is included because it is helpful in trying to explain why tax effects affect household behavior indirectly before 1980 and directly after 1980.

There is weak evidence to suggest that nonresidential investment falls in response to tax increases before 1980 but not after 1980. However, only the RR specification is statistically significant at a 95% confidence level, though the MR specification produces an effect with a statistical significance just shy of the 5% decision rule at 7 quarters. Also of interest is that residential investment *increases* in response to tax increases before 1980, though the MR specification is not statistically significant.

Figure ?? shows that nonresidential fixed investment falls by 10.6% after 6 quarters in response to a tax increase equal to 1% of GDP before 1980, when the RR specification is used. The MR specification produces a smaller effect of 5.7%, that is of marginal statistical significance after 7 quarters. Figure ?? shows the response of residential investment. Before 1980 residential investment increases by 32% after 12 quarters in response to a tax increase of 1% of GDP. The MR response is smaller and not statistically significant, but the sign of the MR response is the same. After 1980 the response of residential investment is negative and the RR specification produces a peak response of -17.1 after 7 quarters. The MR response is smaller at 12.3%.

4 Evidence from Personal Income

Changes in personal income offer a useful insight into the change in the response to tax changes between the two subperiods. Total personal income is more directly affected by tax shocks after 1980. After 1980 total personal income does not respond as clearly to tax shocks. However, tax changes after 1980 translate directly into changes in total personal tax payments, thus lowering disposable income. As well, savings behavior responds to tax changes after 1980 but personal savings does not change in response to tax changed before 1980. The evidence suggests that tax changes before 1980 are more likely to have a permanent and direct effect on total personal income. After 1980, however, an increase in taxes results in lower disposable income (total personal income minus taxes) because household tax payments increase. The increased tax payments are offset by a decrease in savings.

4.1 Personal Income

Figure ?? shows the effect of a tax shock of 1% of GDP on total personal income. Before 1980 a tax shock equal to 1% of GDP produces a permanent effect on total personal income with a peak effect of 2.9% of personal income after 8 quarters and a 2.7% effect after 7 quarters for the RR and MR respectively. After 1980 there is not a clear, statistically significant effect of tax shocks on personal income. A weak effect of tax increases on total personal income is suggested by the fact that the MR specification shows a statistically significant decline in total persona income of 1.1% after three quarters. However, the RR specification contradicts this, showing a zero effect after three quarters.

As Figure ?? shows, there is a clear temporary effect of tax shocks on disposable income after 1980. After three quarters, the RR specification shows a decline in disposable income of 1.4% while the MR specification shows a decline of 1.6% in response to a tax increase of 1% of GDP. The patterns of the response of disposable income before 1980 for both specifications is very similar in percentage terms to the response of total personal income.

4.2 Taxes and Savings

Figure ?? shows the response of personal taxes, personal savings, and personal dividend payments to a tax increase of 1% of GDP. Personal taxes and savings do not respond in a statistical sense to tax changes before 1980. However, after 1980 personal tax payments increase and savings decreases in the short run in response to a positive narrative tax shock. Also of note, dividend payments to households decrease in the short run in response to a positive tax shock after 1980. The response of savings is roughly of the same magnitude as the combined change in taxes and dividends, suggesting that tax increases are paid for out of savings and there is a secondary effect on savings of a decrease in income from savings. Figure ?? shows the response of personal tax payments to a narrative tax shock of 1% of GDP. The RR specification shows an increase in tax payments of 10.4% after three quarters. After 1980 the MR specifications shows a response of 3.7% after three quarters. Figure ?? shows the response of personal savings to a tax increase. The RR specification produces a decline in savings of 29.6% after three quarters. The MR specification shows a smaller decline in savings of 18% after three quarters for the post-1980 period. Figure ?? shows the response of dividend income. As with savings and tax payments, there is a statistically zero response of dividend payments to tax increases before 1980. After 1980, a 1% increase in the RR-narrative taxes causes dividend payments to fall by 9.9% and 7.9% after four quarters for the RR and MR specifications, respectively. There is also some suggestion that the effect on dividends is long term after 1980.

It is useful to look at changes relative to GDP. After three quarters, for the RR specification, tax payments increase by 1% of GDP. Savings declines by 1.4% of GDP while dividend income falls by 0.3%. The MR specification shows a similar pattern, but with a smaller magnitude The pattern of response suggests that tax increases are paid for out of savings and—under the assumption that dividend payments are saved—savings also falls because savings income falls.

5 Evidence from the Flow of Funds

The shift in savings from personal income is also evidenced in household's flow of funds data. However, the decline in flow of funds assets in response to a tax increase is permanent. Savings and time deposits and municipal bond holdings by households show a large and permanent decline as do household holdings of municipal bonds. While the response of the holdings of these asset classes is larger and more permanent than the decline in savings, they suggest that tax increases are paid for out of "semi-liquid" assets. That is, the decline in money holdings of households are not from very liquid sources such as checking accounts and currency, but rather from assets that are more likely to be held longer term.

Figure ?? shows the response of household holdings of savings and time deposits and mutual funds to an increase in taxes of 1% of GDP. It is obvious from Figure ?? that the full-period response is being driven by the post-1980 response. After 1980, for the RR specification a 1% increase in taxes causes household holdings of deposits and mutual funds to fall by 15.7% after 20 quarters. This effect is large with respect to holdings of these assets, but to the average decrease in holdings of these assets is equal to 5.5% of total GDP. Still large, but not out of proportion with the size of other effects. The MR specification shows a smaller response of 13.4%, or 4.8%, of GDP after 20 quarters.⁵

Figure ?? shows the response of household municipal bond holdings to a 1% increase in taxes. As with the response of deposits, the full period response is being driven by the post-1980 response. After 1980 according to the RR specification household mutual bond holdings decline over 5 years by almost 47% in response to a 1% increase in taxes. The MR specification shows a a much smaller response of 19%. These translate to a decline in mutual bond holdings of 3.8% or 1.6% of total GDP respectively.

6 Alternative Explanations

Besides proposing that changing savings behavior is driving the smaller effect of output to tax changes after 1980, RR also suggest two other possible explanations: a more activist Federal Reserve, and more pessimism about the economy. There is clear evidence to suggest that savings behavior in response to tax shocks changed after 1980 (above); however, the empirical strategy used here produces little evidence to support that these other two proposed

⁵While the response of total M2 has not been shown here because the MR specification does not produce a statistically significant response, given the large size of the response of the less liquid components of M2, it is worth discussing. Overall M2 shows a decline of 10.3% for the RR specification and 4.2% for the MR (again, not statistically significant) after 20 quarters. This suggests that part of the response from figure **??** is absorbed by increases of holdings of more liquid components of M2.

mechanisms explain the decline in the effect of tax changed on output after 1980.

Several papers have looked at different decompositions of the narrative tax shocks. In particular, researchers have focused on personal income tax changes. While the discussion of the effect of these decomposed shocks across subperiods is left to an appendix, evidence from these shocks offer weak corroboration for the finding of this paper that the effect of personal income taxes is stronger after 1980 than before 1980.

6.1 Monetary Policy

One major reason for picking 1980 as the structural break point between periods is because of the clear shift to a less inflation tolerant monetary policy under Paul Volker. It is reasonable, then, to expect the Fed to be more hostile to potentially expansionary fiscal policy than it was before 1980. RR, using a three variable VAR including tax shocks, output and the Federal Funds rate show that monetary policy is accommodating of tax shocks before 1980 but that the Fed Funds rate decreases in response to an increase in taxes after 1980. However, I find, at best, very weak evidence that the Fed Funds rate is more activist with respect to tax shocks after 1980. This is likely because the specification used here controls for inflation among other factors likely to be correlated with tax shocks, and the original RR specification does not. I also look at the behavior of the real Federal Funds rate, measured as the expost real rate assuming a one quarter and one year forward-looking inflation rate. Looking at the real Fed Funds rate is a useful exercise because as Clarida, Gali, and Gertler (CGG 1999) argue, the true stance of monetary policy is a function of the real policy rate and not simply the nominal policy rate. There is some evidence to suggest that in the long run before 1980 the Fed is more accommodating to tax shocks, but the evidence for this is also weak.

Figure ?? shows that for the full period and for the pre-1980 period the nominal Federal Funds rate does not show a statistically significant response to narrative tax shocks. For the post-1980 period, the two empirical models

show responses with opposite signs. The increase in the Fed Funds rate using the RR specification is not statistically significant. However, the decline in the Fed Funds rate produced by the MR specification is statistically significant at two quarters with a 0.9 percentage point decrease in the Fed Funds rate in response to a tax shock equal to 1% of GDP.

Figures ?? and ?? show the response of the real Fed Funds rate under two different assumptions about the inflation rate. Figure ?? shows the real rate under the assumption that the inflation rate is an annualized one quarter ahead inflation rate. Figure ?? uses a one year ahead inflation rate to calculate the real rate. For the one quarter ahead inflation rate, there is no statically significant response to tax shocks. However, as Figure?? shows the one year ahead inflation rate produces a long run increases in the real Fed Funds rate in response to a tax increase before 1980. However, the MR specification does not produce a significant result and the RR response is of marginal significance.

6.2 Changes in Confidence

One other possible reason for the diminished response of output after 1980 proposed by RR is that confidence in the economy, stemming from a shift to persistent deficits after 1980, may be muting the response of output. However, I find no response of consumer confidence to tax shocks across either period. There is some limited evidence to suggest business confidence does respond (on impact) to a tax shock, but this weak evidence suggest a decline in business confidence in response to a tax increase. Since a tax increase is more likely to lower deficits, it is not likely that deficit concerns are driving the weak change in business confidence. A tax increase, which is likely to lower deficits, causes business confidence to decline.

Figure ?? shows the quarterly index from the University of Michigan Consumer Sentiment Survey as well as the OECD Business Confidence Index. As Figure ?? shows, consumer sentiment—most relevant to this study of household behavior—increases on average by 2.75 points after 1980. Consumer sentiment is slightly more volatile after 1980, with a standard deviation of 11.41 points after 1980 compared with a standard deviation of 11.74 points before 1980. Business confidence, however, is on average 0.58 points lower after 1980, but less volatile, with a standard deviation of 1.23 compared with a standard deviation of 1.57 points before 1980.

Figure ?? shows the effect of an increase in taxes equal to 1% of GDP on business and consumer confidence. Tax changes do not produce a statistically significant effect on consumer sentiment across periods. However, after 1980 there is limited evidence to suggest that business sentiment declines by 0.9 points on impact. This statistically significant effect is only for the RR specification as the MR specification is not statically significant. Of note, business confidence does show a statistically significant decline on impact in response to a tax increase for the full period by 0.7 points and 0.4 points for the RR and MR specifications, respectively.

6.3 Evidence from Decomposed Narrative Tax Shocks

It is also plausible that the asymmetric effect before and after 1980 may be driven by asymmetries in the tax shocks themselves. Appendix A explores this possibility by looking at the effect of subcomponents of the RR tax shocks, in particular, personal income tax changes. MR (2013) decompose the narrative tax shocks to distinguish between personal and corporate income tax changes. JOW (2015) decompose total RR tax shocks into negative and positive tax shocks. HM (2016) look at potential asymmetries in the response of the economy to positive and negative personal income tax shocks. As well, MMO (2018) look at changes in marginal tax rates for households by income percentile.

The framework used in this paper, and further breaking down the subcomponents of tax shocks by subperiod generally, is biased towards not finding an effect of tax shocks across sub periods. The clearest example of this is for the MMO marginal tax changes, in which there are only 8 shocks in total and only two shocks before 1980. With this in mind, these decomposed tax shocks are treated as only offering some weak corroborating evidence that personal tax changes generally have an effect on output after 1980. There is no evidence to suggest any systematic difference between subperiods in the response of output to positive and negative tax shocks, though there is at least weak evidence to suggest that, as JOW and HM find, negative tax shocks are more effective across subperiods.

7 Discussion

This paper points to two important historical shifts in the effectiveness of tax policy in the United States. Following RR (2010), I explore changes in the impact of narrative tax shocks before and after the 1980 monetary/fiscal structural break. There are two main reasons for the larger impact of narrative tax shocks before 1980. First, the response of output to tax shocks before 1980 is more sensitive to the state of the economy. Controlling for recessions accounts for roughly half of the difference in response between the preand post-1980 period. Second, even controlling for recessions there remains a clear asymmetry in the response between periods. After 1980, tax shocks more clearly and directly manifest themselves as changes in the tax burden for households. Household savings adjusts to tax changes by decreasing (increasing) in response to an increase (decrease) in personal tax payments after 1980. The change in personal savings is corroborated by the response of household's holdings of savings and time deposits and municipal bond holdings. The effect of taxes before 1980 is stronger, but the transmission mechanism is less clear and there is no direct effect of narrative tax changes on household tax burdens or savings behavior.

The decline in household goods consumption before 1980 in response to a narrative tax increase is the result of a shock to total personal income. This decline in personal income is associated with evidence that nonresidential fixed investment also falls, but no clear mechanism for the transmission of tax shocks to household behavior emerges from the data before 1980. Wages and salary income shows a similar pattern to the decline in nonresidential investment (not shown), but the response is only statistically significant for the RR specification as with nonresidential investment. After 1980, however, the effect of tax changes on total personal income is weak, but disposable income falls because personal tax payments increase. The weak effect of this decline in savings on GDP after 1980 is likely from a corresponding reduction in the demand for residential investment. Importantly, this finding for residential investment is not tied to the large tax changes and housing bubble of the 2000s.

The evidence presented here also suggests that household attitudes about the economy do not significantly change in response to tax changes and potential associated changes in deficits. Monetary policy also does not show a clear change in response to tax shocks across periods. As well, changes across time periods to different types of shocks embedded in the RR-narrative tax shocks offer weak evidence that the economy responds more strongly to personal income tax after 1980.

This paper opens two related questions worth further investigation. Most clearly, more examination of the "black box" of the economy's response to narrative tax shocks before 1980 is warranted. It is reasonable to assume that the associated, empirically weak, decline in nonresidential fixed investment is driving the decline in household personal income in response to an increase in taxes. However, there is no clear mechanism for either the decline in investment in response to tax shocks or the effect of the decline in investment on personal income. Also, corporate profits, proprietor's income, and corporate taxes do not change (not shown), either as measured by corporate taxes paid in national income accounts or as an effect of changes in narrative corporate income taxes. There remains a "missing link" for where tax changes affect private economy activity directly before 1980. It is more clear after 1980 where the link is between tax changes and private economic activity in that we can observe that tax changes affect the personal tax burden directly.

An associated question pertains to the asymmetrical effect of tax shocks across periods. Before 1980 exogenous tax changes are dominated by tweaks to social security (effectively income taxes for low- and middle-income households), excise taxes, and various investment and corporate tax changes. It is only later in the period that changes in marginal income tax rates emerge as a prominent tool of tax policy. After 1980, however, while there is still heterogeneity in the types of tax changes, the large tax changes in particular are dominated by across-the-board marginal income tax changes. This paper documents a clear mechanism for personal income taxes to influence household behavior. However, this study suggests that non-personal income tax changes seem to have a larger effect on output than personal income taxes. It remains an open question what specific taxes are driving the pre-1980 response. Much of the research on narrative tax policy has steered towards an examination of personal income taxes specifically, but this study suggests that other types of federal tax changes have a larger impact on output.

Figures and Tables



(a) No Recession Control

(b) Recession Control

Black: RR Specification. Gray: MR specification. Dashed lines are 95% confidence intervals.

Figure 1: Percentage response of GDP to a tax increase equal to 1% of GDP



Black: RR Specification. Gray: MR specification. Dashed lines are 95% confidence intervals.





(a) Nonresidential Fixed Investment

(b) Residential Investment

Black: RR Specification. Gray: MR specification. Dashed lines are 95% confidence intervals.

Figure 3: Percentage response of investment to a tax increase equal to 1% of GDP



(a) Total Personal Income (b) Disposable Personal Income

Black: RR Specification. Gray: MR specification. Dashed lines are 95% confidence intervals.

Figure 4: Percentage response of personal income to a tax increase equal to 1% of GDP



Figure 5: Percentage response of personal taxes and savings to a tax increase equal to 1% of GDP



(a) Deposits and Mutual Funds

(b) Municipal Bonds

Black: RR Specification. Gray: MR specification. Dashed lines are 95% confidence intervals.

Figure 6: Percentage response of selected household assets to a tax increase equal to 1% of GDP



Black: RR Specification. Gray: MR specification. Dashed lines are 95% confidence intervals.

Figure 7: Percentage point response of Federal Funds rate to a tax increase equal to 1% of GDP



Figure 8: Consumer and Business Sentiment 1952-2007



Black: RR Specification. Gray: MR specification. Dashed lines are 95% confidence intervals.

Figure 9: Change in sentiment index in response to a tax increase equal to 1% of GDP