Appendix A: Effects of Subcomponents of tax shocks

This appendix documents the response of GDP before and after 1980 to various decompositions of the Romer and Romer (RR 2010) narrative tax shocks. I look at personal and corporate income taxes following Mertens and Ravn (MR 2013). I look at the effect of positive and negative tax shocks following Hussian and Malik (HM 2016) and Jones, Olson, and Wohar (JOW 2015). Finally, I look at the effect of changing marginal tax rates by income percentile (top 1% and bottom 99%) following Mertens and Montiel Olea (MMO, 2018).

This appendix should be interpreted as showing weak corroborating evidence that personal income tax changes had a clearer effect after 1980 than before. There is evidence that the response across both periods is being driven by negative shocks. However, these negative shocks are strongly correlated with personal income tax shocks, suggesting that there is large overlap in the two categories of shocks. Importantly, there is evidence that negative RR narrative shocks are correlated with personal income shocks after 1980 and positive tax shocks are correlated with corporate tax changes. This is evident both in simple correlation among shocks as well as in the pattern of response of GDP to tax shocks after 1980. In fact, negative shocks are heavily correlated with personal income tax changes across both periods. Before 1980 total narrative tax shocks, negative narrative tax shocks, and personal income taxes have very high correlation and negative tax shocks dominate positive tax shocks, as measured by cumulative percent of GDP, by almost 4 to 1, so it is unsurprising that output shows a stronger response to negative tax shocks.

I also test for the response of output to marginal tax rate changes across income percentiles, but this response is not different across subperiods in a way that is distinct from total personal income tax shocks.

A.1 Personal and Corporate Taxes.

Figure A1 shows the response of GDP to total RR shocks as well as personal and corporate income tax shocks. The specification for personal and corporate income taxes is slightly different than for the response of the full set of RR shocks. Following MR when studying one type of income shock an effort is made to control for the other, highly correlated shock. Also, both tax shocks are used in the construction of the μ variable.

Decomposing the shocks to output:

$$X_t = A(L)p_t + A(L)c_t + B(L)X_{t-12} + r_t + \mu_{t-12} + e_t$$
(1)

Where the augmented RR and MR models are as specified as in the main paper. The difference in the specification used here is that for the personal income tax response (p_t) and corporate taxes (c_t) are included as controls (and vice versa) as in the original MR paper. As you can see from Figure A1b and A1c personal income and corporate taxes do not have an effect on output by themselves before 1980. However, after 1980 the RR specification shows a strong negative effect on output of an increase in personal income taxes and a strong increase in output in response to an increase in corporate taxes. The MR specification does not corroborate this, however, showing no statistically significant effect and a response with the opposite sign as the RR specification in both cases.



Black: RR Specification. Gray: MR specification. Dashed lines are 95% Confidence Intervals.

Figure A1: Percentage response of GDP to personal and corporate tax increases equal to 1% of personal and corporate income, respectively.

A.2 Negative and Positive Shocks

Following HM (2016) I divide up the personal income tax shocks from MR (2013) into a negative and positive series. As well, following JOW I divide the total RR series into negative and positive shocks. As with personal and corporate income taxes both of these specifications require a modification relative to the baseline specification used in the main paper. For the HM personal income tax shocks I include both positive and negative shocks. As well, I control for corporate income tax shocks as well:

$$X_t = A(L)p_t^+ A(L)p_t^- + A(L)c_t + B(L)X_{t-12} + r_t + \mu_{t-12} + e_t$$
(2)

Where p_t^+ and p_t^- are positive and negative personal income tax shocks.

As Figure ?? shows, the response of positive and negative personal tax shocks after 1980 is essentially the same as the response for all personal shocks. Before 1980 the sign of the response is different across positive and negative taxes, but these responses are not statistically significant for either empirical model.



Black: RR Specification. Gray: MR specification. Dashed lines are 95% Confidence Intervals.

Figure A2: Percentage response of GDP to positive and negative income taxes equal to 1% of GDP.

We can also look at the response of negative and positive shocks from the full narrative RR series following JO&W. The specification for this model is the same as that used in the main paper, but with the shocks of different signs included individually:

$$X_t = A(L)d_t^+ A(L)d_t^- + B(L)X_{t-12} + r_t + \mu_{t-12} + e_t$$
(3)

Where d_t^+ and d_t^- are the positive and negative RR narrative tax shocks.

Figure A3a shows the response of GDP to the total narrative shocks (from the main paper), Figure A3b shows the response to positive narrative tax shocks and A3c shows the response to negative narrative tax shocks.

This response requires some discussion. After 1980, the difference in responses between negative and positive tax shocks, at least for the post-1980 period mirrors the response of personal and corporate income tax shocks, respectively. There are two reasons to believe, particularly after 1980, that negative shocks are roughly the same as personal income shocks and corporate shocks are roughly the same as positive shocks. First, the pattern and magnitude of the response for the RR specification of negative narrative tax shocks and positive shocks is very similar when adjusting for shocks of the different magnitudes.¹ Second, after 1980 corporate shocks are significantly more correlated with positive shocks² and personal income shocks are more highly correlated with negative shocks³ It also bears pointing out that the MR specification does not show a statistically significant response to either directional shock after 1980.

The consistency of the response of total negative shocks and personal shocks, and the pattern of response in the main paper leads me to the conclusion that the evidence presented in the paper offers weak evidence to support the basic conclusion of the main paper that the post-1980 response is being driven by changes in personal income taxes.

¹Corporate tax shocks are 1% of corporate income and and personal tax shocks are 1% of personal income while the narrative shocks are as a percent of GDP.

 $^{^{2}}$ Corporate shocks have a correlation coefficient of .4 correlation to positive shocks and .24 correlation to negative shocks and .4 to total RR shocks

³Coefficient of correlation for personal income tax shocks and negative tax shocks is .46 compared to a correlation of .24 for personal income tax shocks and negative narrative shocks. The correlation between personal income shocks and the total RR shocks is .50.



Black: RR Specification. Gray: MR specification. Dashed lines are 95% Confidence Intervals.

Figure A3: Percentage response of GDP to a negative or positive total narrative shock.

However, the picture for the pre-1980 period is, as in the main paper, less clear. First, it should be stated that the reason this analysis is relegated to an appendix is because the observed responses, as a rule, do not show strong evidence one way or the other, but only hint at possible mechanisms. That having been said, it should be clear from Figures A3b and A3c that negative shocks are driving the response of the RR specification before 1980. There is also limited evidence to suggest that positive increases in narrative taxes have a short-run positive effect on output. However, only the RR specification shows a statistically significant positive response to a tax increase. The response of GDP to negative shocks is basically the same response as the full sample response for the RR specification. This make sense as before 1980, measured as cumulative percentage points of GDP, negative tax shocks are 3.7 times larger than positive shocks before 1980 (only 1.3 time larger after 1980). The correlation between negative shocks and the full narrative shock reinforces this. The coefficient of correlation on the full narrative tax series and the negative narrative tax series is .94. For the positive narrative tax series the correlation is .37.

Generally the evidence points to a large overlap in shocks defined by direction and by targeted income group. As such, there is weak evidence to reinforce the finding that personal income taxes have a more clear effect after 1980 than before. However, what is driving the response of output to taxes before 1980 remains unclear. To muddy the waters further, narrative tax shocks before 1980 are much more tightly correlated with what MR call personal income taxes, which include not only marginal tax changes but also changes to payroll taxes. The correlations between personal income taxes, the RR total narrative taxes, and negative tax shocks are all over .8. Given the empirical findings, this suggests that these shocks are all roughly the same thing before 1980. However, I remind the reader that, looking back at A2c negative personal tax shocks show no effect on output. As discussed above, though, one challenge to unpacking these effects is the relatively low power these empirical models have the more narrow the type of shock being studied.

A.3 Marginal Tax Rates by Income Percentile

Finally, it is worth looking at changes in marginal tax rates for different income share percentiles (1% and 99%) following MMO (2018). As with the other specifications, tweaking the original specification is necessary:

$$X_t = A(L)p_t^{99}A(L)p_t^1 + A(L)c_t + B(L)X_{t-12} + r_t + \mu_{t-12} + e_t$$
(4)

Where p_t^1 and p_t^{99} is a change in marginal tax rates either a shock to bottom 99% of income earners or 1% of income earners. Corporate income taxes (c_t) are also controlled for. It should also be noted that for 1952 to 1980, it is not possible to run the regression in equation 4 for the RR specification because of the paucity of shocks (there are only two of these shocks before 1980). As such, only the MR specification has been included. Looking at Figure A4 it is clear that, generally little new is added from this analysis. There is some weak evidence to suggest that tax shocks for the lower 99% of income earners has a stronger effect on output than tax shocks on the top 1%. However, the MR specification is statistically insignificant for all subperiods. Also, one would expect to see a larger effect for the bottom 99% simply because these tax change affected a much larger share of households.

I take the finding for the effect of marginal tax rates to be more weak

evidence to support the basic finding of the main paper that personal income tax changes had a more clear effect on output after 1980.



Black: RR Specification. Gray: MR specification. Dashed lines are 95% Confidence Intervals.

Figure A4: Percentage response of GDP to a one percentage point increase in marginal tax rates by income percentile.

References

- Hussain, Syed M and Samreen Malik (2016) "Asymmetric effects of exogenous tax changes," *Journal of Economic Dynamics and Control*, Vol. 69, pp. 268–300.
- Jones, Paul M, Eric Olson, and Mark E Wohar (2015) "Asymmetric tax multipliers," Journal of Macroeconomics, Vol. 43, pp. 38–48.
- Mertens, Karel and José Luis Montiel Olea (2018) "Marginal tax rates and income: new time series evidence," The Quarterly Journal of Economics, Vol. 133, pp. 1803–1884.
- Mertens, Karel and Morten O. Ravn (2013) "The dynamic effects of personal and corporate income tax changes in the United States," *American Economic Review*, Vol. 103, pp. 1212–1247.
- Romer, Christina D. and David H. Romer (2010) "The macroeconomic effects of tax changes: Estimates based on a new measure of fiscal shocks," *American Economic Review*, Vol. 100, pp. 763–801.

Appendix B: Data Sources

Variable	Source	Note
BEA Data	Table 1.1.5 Gross Domestic Product	
GDP	Line 1	
Nondurable Goods Consumption	Line 4	
Durable Goods Consumption	Line 5	
Non Residentail Fixed Investment	Line 9	
Residential Fixed Investment	Line 13	
	Table 3.1 Government Current Recipts and Expenditures	
Total Government Current Receipts	Line 1	
Total Government Current Expenditure	Line 15	
Personal Income Data	Table 2.1 Personal Income and it's Disposition	
Personal Income	Line 1	
Disposable Personal Income	Line 27	
Personal Current Taxes	Line 26	
Personal Savings	Lne 34	
Personal Dividend Payments	Line 15	
	Table 1.1.4 Price Indexes for Gross Domestic Product	
GDP Deflator	Line 1	
Tax shock data		
Romer and Romer Narrative Shock	Romer and Romer (2010)	https://eml.berkeley.edu/ dromer/papers/DataSet.zip
Personal Income Narrative Shock	Mertens and Ravn (2013)	https://karelmertenscom.files.wordpress.com/2017/09/mertens_ravn_replication_files.zip
Corporate Income Narrative Shock	Mertens and Ravn (2013)	https://karelmertenscom.files.wordpress.com/2017/09/mertens_ravn_replication_files.zip
Marginal Tax Rate Changes Top 1%	Mertens and Montiel-Olea (2018)	https://karelmertenscom.files.wordpress.com/2018/01/data_mmo.xlsx
Marginal Tax Rate Changes Botom 99%	Mertens and Montiel-Olea (2018)	$https://karelmertenscom.files.wordpress.com/2018/01/data_mmo.xlsx$
Flow of Funds Data	L.101 Household and Nonprofit Organizations	
Savings and	Households and nonprofit organizations; total time and savings deposits; asset	Z1/Z1/FL153030005.Q
-	Households and nonprofit organizations; municipal securities and loans; asset	Z1/Z1/FL153062005.Q
St Louis FRED database		
Consumer Sentiment Index	St Louis Federal Reserve FRED database series: UMCSENT	1953-1960 some quarterly data extrapolated as average of two adjoining periods
Fed Funds Rate	St Louis Federal Reserve FRED database series: DFF	
Fed Funds Proxy	DFF + TB3MS	1952-1955 3 month Treasury bill (FRED series: TB3MS) rate used to complete series
NBER Recession Indicator	St Louis Federal Reserve FRED database series: USREC	
Misc		
Business Sentiment Index	OECD (2019), Business confidence index (BCI)	doi: 10.1787/3092dc4f-en
Population	Favero and Giavazzi (2012) (FRED Series: POP)	https://www.aeaweb.org/aej/pol/data/2010-0171_data.zip

<u>⊢</u>