The macroeconomic effect of fiscal policy in South Africa: A narrative analysis

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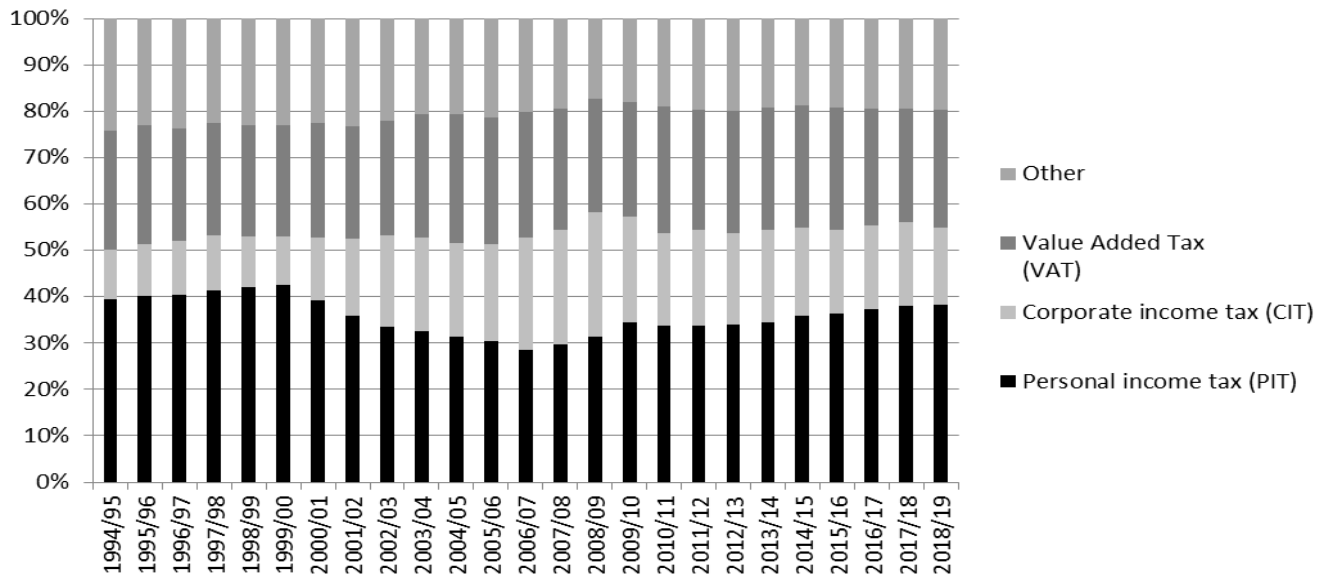
Overview

- Research question
  - What are the macroeconomic effects of average personal income tax changes in South Africa?
- Contributions
  - Construct a new narrative measure for structural personal income tax shocks for SA
  - Contribution to the empirical literature of fiscal multipliers using a new dataset and identification strategy
  - Investigation of macroeconomic effects of personal income taxes

Background and Motivation

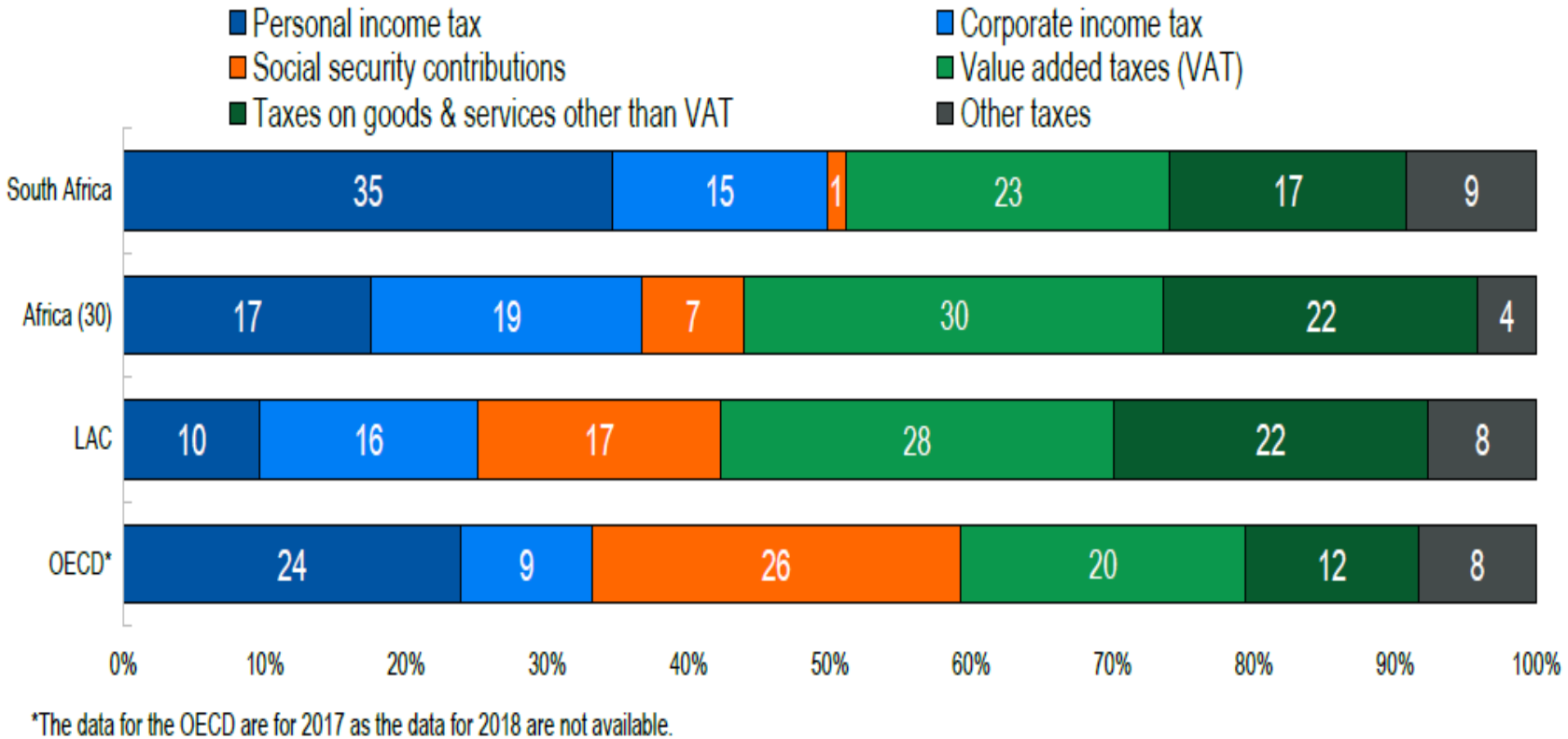
Figure 1: Share of each tax type by fiscal year (% of total revenue)



Note: Data source: South African Revenue Service (SARS) and Authors calculations. Category for Other includes dividends tax (DT)/ secondary tax on companies (STC), fuel levy, customs duties, specific excise duties and other indirect and direct taxes.

Background and Motivation

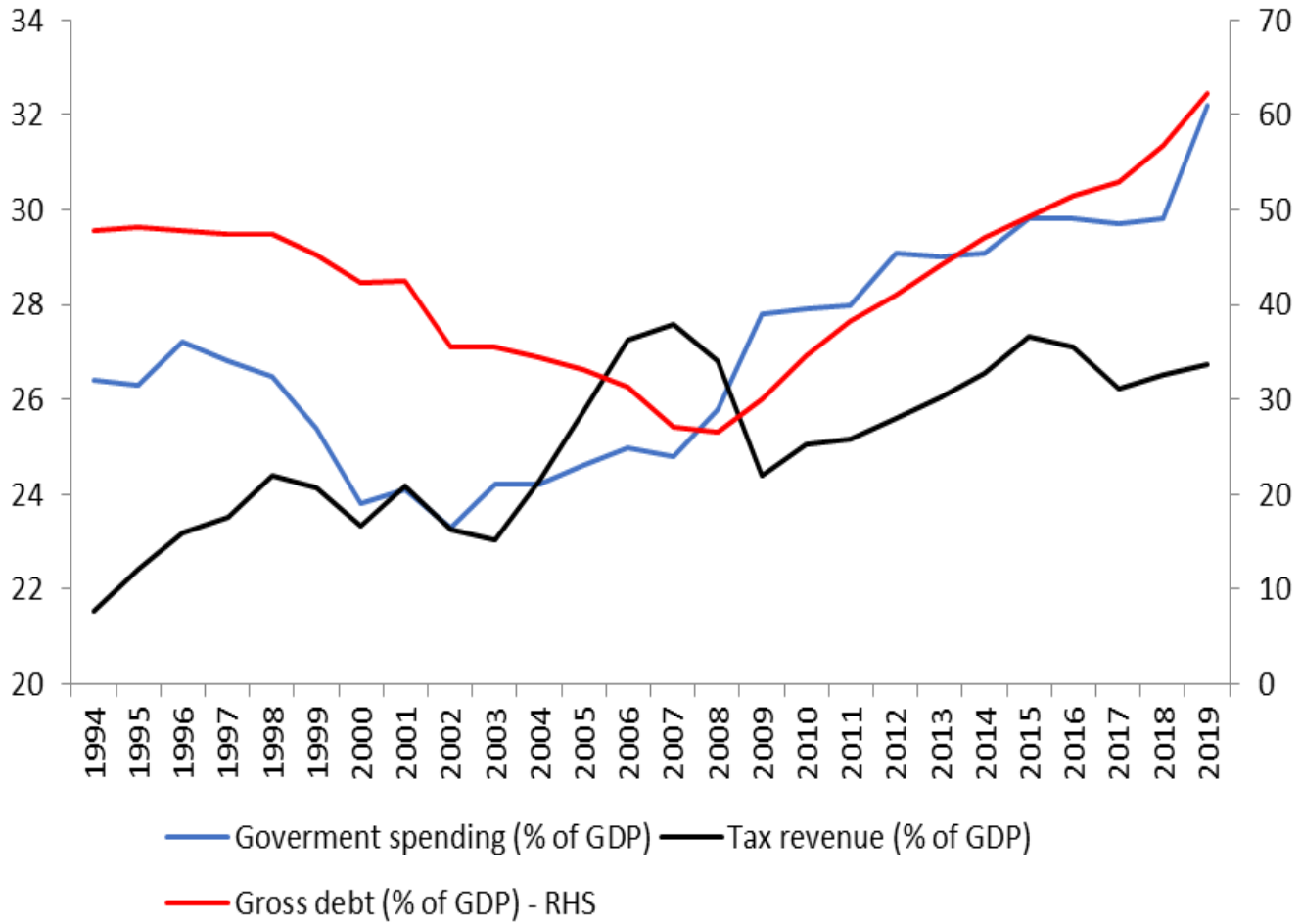
Figure 2: Comparison to other countries for 2018 (% of total revenue)



Source: OECD.

Background and Motivation

Figure 3: Tax revenue, Government spending and Debt (% of GDP)



Background and Motivation

- General view (van Rensburg et al. (2021), Loewald et al. (2019))
  - Fiscal policy has lost its efficacy
  - Tax increases have stifled growth
- This paper seeks to empirically investigate the macroeconomic effects of personal income taxes
- Contributions
  - **Main:** A new narrative dataset for tax shocks as in Romer and Romer (2009) and IMF's Devries et al. (2011) and David and Leigh (2018)
  - The use of a new methodology for SA
  - Specific focus on disaggregate effect of personal income taxes

Summary of our findings

- Sample period: 1996Q1 - 2019Q4
- Proxy measure
  - Positive relationship between the shock and narrative
  - Higher for the 1996 - 2010 period
    - R^2 increases from 0.26 to 0.47
- Tax cuts in average personal income tax rates are expansionary
  - Positive effect on Consumption, Investment and Output
- Permanent shocks = bigger effects
- Estimated tax multipliers: 0.13 to 1.79

Literature

- South Africa
  - Focus on using different methodologies
  - DSGE vs SVECM vs TVP-VAR - Jooste et al. (2013)
  - Various SVARs - Kemp (2020)
  - Macro-model - van Rensburg et al. (2021), Akanbi (2013)
- Narrative approach to identify fiscal shocks
  - Fiscal policy shocks include Romer and Romer (2009, 2010), Ramey (2011) and IMF's Devries et al. (2011) and David and Leigh (2018)
  - Applications include Olea et al. (2020), Hussain and Malik (2016) and Mertens and Ravn (2013, 2014)

Narrative analysis: endogenous vs exogenous

- History and motivation of legislated tax changes
- Classifications follows Romer and Romer (2009, 2010)

$$\Delta T = \sum_{i=1}^{K} \beta_t^i \varepsilon_t^i + \sum_{i=1}^{J} \omega_t^i \tag{1}$$

- Endogenous tax changes: return growth to potential
  - Countercyclical measures
  - Government spending tax driven changes
- Exogenous tax changes: changes are taken for long-term reasons
  - Deficit-driven tax changes
  - Long-run tax changes

Narrative analysis

- Narrative account of legislated personal income tax (PIT) changes between 1996Q1 and 2019Q4
- Sources: Budget speeches and reviews, MTBPS, Acts/Bills and Explanatory Memos[4]
- Timing of the shocks = effective date
- Size of the shocks = expected revenue effects
- Scaling of shocks by tax base (% of wages)
- PIT incl. PAYE/Employee tax and Employment Tax Incentive (2014)

[4] MTBPS is the Medium Term Budget Policy Statement; Acts/Bills include Taxation Laws Amendment Act/Bills and Revenue Laws Amendment Act.

Narrative analysis

- FP instrument = Average Personal Income Tax Rate (APITR)

$$\text{APITR}_t = \Delta\text{Personal Income Tax Revenue}_t / \text{ Personal Taxable Income}_{t-i}$$

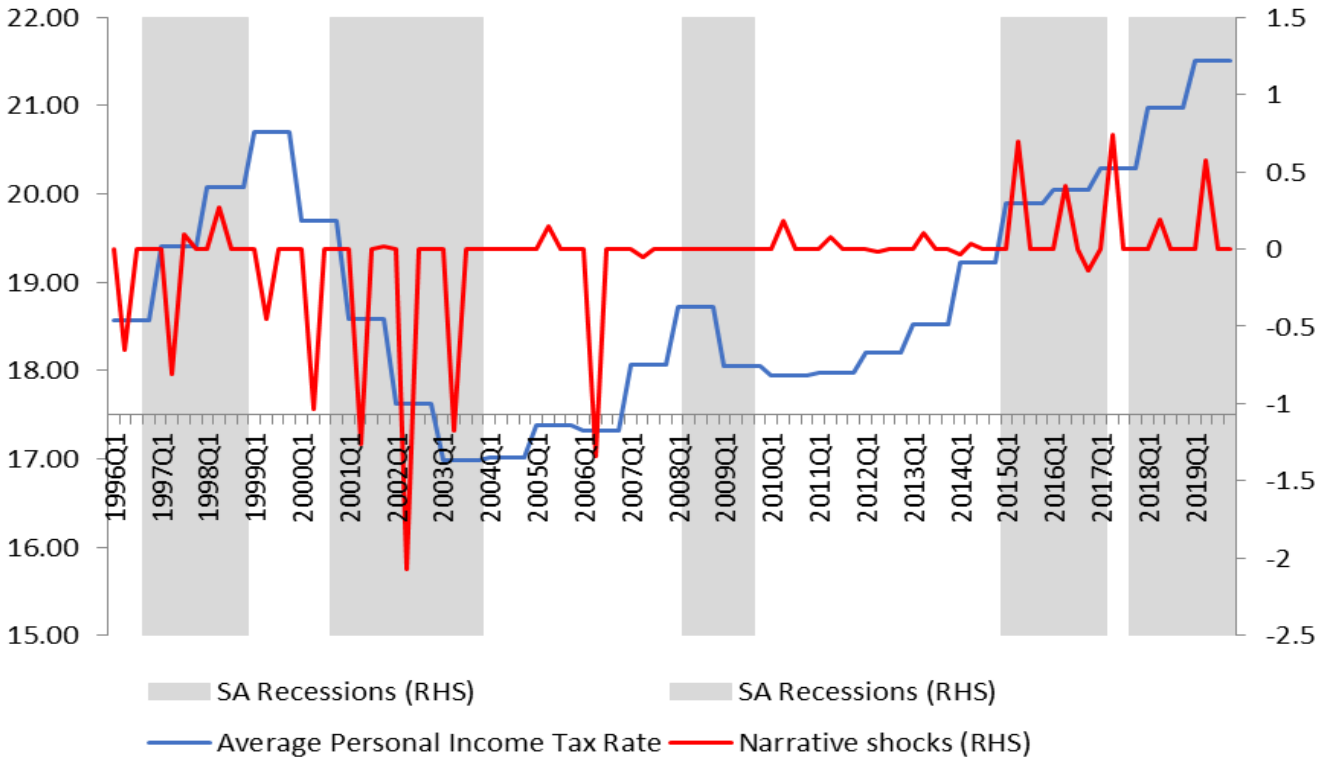
- Proxy for exogenous changes in APITR

$$\Delta\text{PIT}_t^{narr} = \Delta \text{ Personal Income Tax}_t / \text{ Personal Taxable Income}_{t-1}$$

- Aggregation leads to 45 personal income tax shocks - **25 exogenous** and 22 endogenous
- Unanticipated vs anticipated
  - Mertens and Ravn (2013) = (-) 90 days after legislation
  - SA PIT changes are legislated retroactive
- Transitory vs permanent
  - SA - mostly classified as transitory

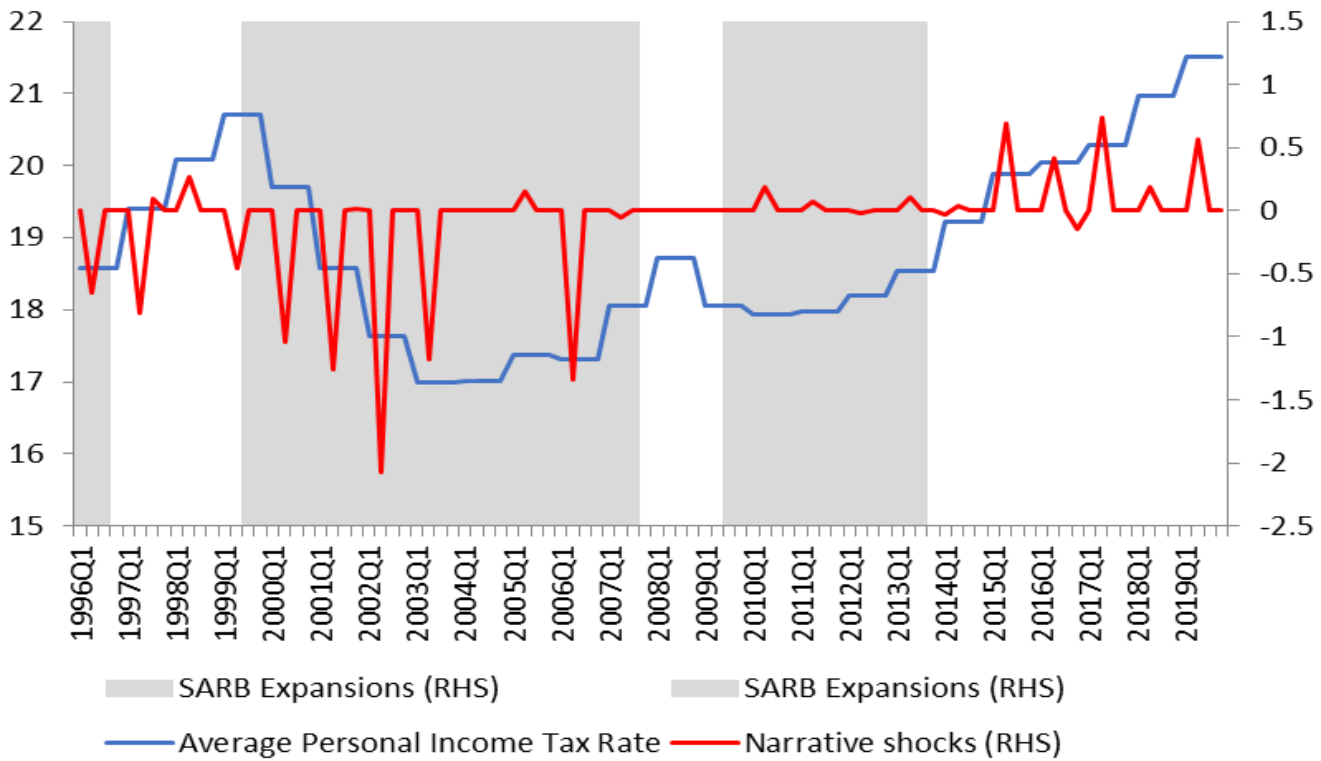
	Fiscal year	Inflation adjustment			Overall	MTR	Tax brackets	Classification	Permanent
		Previous	Current	Next					
1	1996/97						Yes (10 to 8)	Exo - long-run	
	1997/98					Yes	Yes (8 to 7)	Exo - long-run	Yes
	1998/99				Yes	Yes	Yes (7 to 6)	Endo - Countercyclical	
2	1999/00				Yes	Yes	Yes	Exo - long-run	Yes
	2000/*01	Exp.	Exp.	Exp.	Yes	Yes (45% to 42%)		Exo - long-run	Yes
	2001/*02	Exp.	Exp.	Exp.	Yes			Exo - long-run	
	2002/*03	Exp.	Exp.	Exp.	Yes	Yes (various)		Exo - long-run	Yes
	2003/*04	Exp.	Exp.	Exp.	Yes			Exo - long-run	
	2004/*05	Contr.	Exp.	Exp.				Exo - deficit-driven	
	2005/*06	Exp.	Exp.	Exp.				Endo	
	2006/*07	Exp.	Exp.	Exp.	Yes			Exo - procyclical	
	2007/*08	Exp.	Exp.	Exp.				Endo	
	2008/*09	Exp.	Exp.	Exp.				Endo - Countercyclical	
	2009/*10	Contr.	Exp.	Exp.				Endo - Countercyclical	
	2010/*11	Contr.	Contr.	Contr.				Exo - deficit-driven	
	2011/*12	Exp.	Exp.	Exp.				Endo - Countercyclical	
	2012/*13	Exp.	Exp.	Exp.				Endo - Countercyclical	
	2013/*14	Contr.	Contr.	Contr.				Endo/Exo	
3	2014/*15	Contr.	Contr.	Contr.				Endo/Exo	
	2015/*16	Contr.	Contr.	Contr.		Yes (1% various)		Exo - deficit-driven	Yes
	2016/*17	Contr.	Contr.	Contr.				Exo - deficit-driven	
	2017/*18	Contr.	Contr.	Contr.		Yes (45%)		Exo - deficit-driven	Yes
	2018/*19	Contr.	Contr.	Contr.				Exo - deficit-driven	
	2019/*20	Contr.	Contr.	Contr.				Exo - deficit-driven	

Figure 4: Narrative shocks (% of Wages) vs. APITR vs. Recessions



Source: SARB, St. Louis FRED and Authors own calculation. South African recession dates as classified by the St. Louis FRED.

Figure 5: Narrative shocks (% of Wages) vs. APITR vs. SARB Expansions



Note: This figure shows all documented and legislated exogenous Personal income tax (PIT) shocks. The shocks are not demeaned. APITR is average personal income tax rate which is the ratio of personal income tax revenue and personal taxable income (wages).

The SVAR-IV model - Mertens and Ravn (2013)

$$E_t[Z_t \varepsilon_{1,t}] = \Phi \neq 0 \tag{2}$$

$$E_t[Z_t \varepsilon_{2,t}] = 0 \tag{3}$$

$$\mu = B\varepsilon_t \tag{4}$$

$$\Phi B_1 = \Sigma_{z\mu'} \tag{5}$$

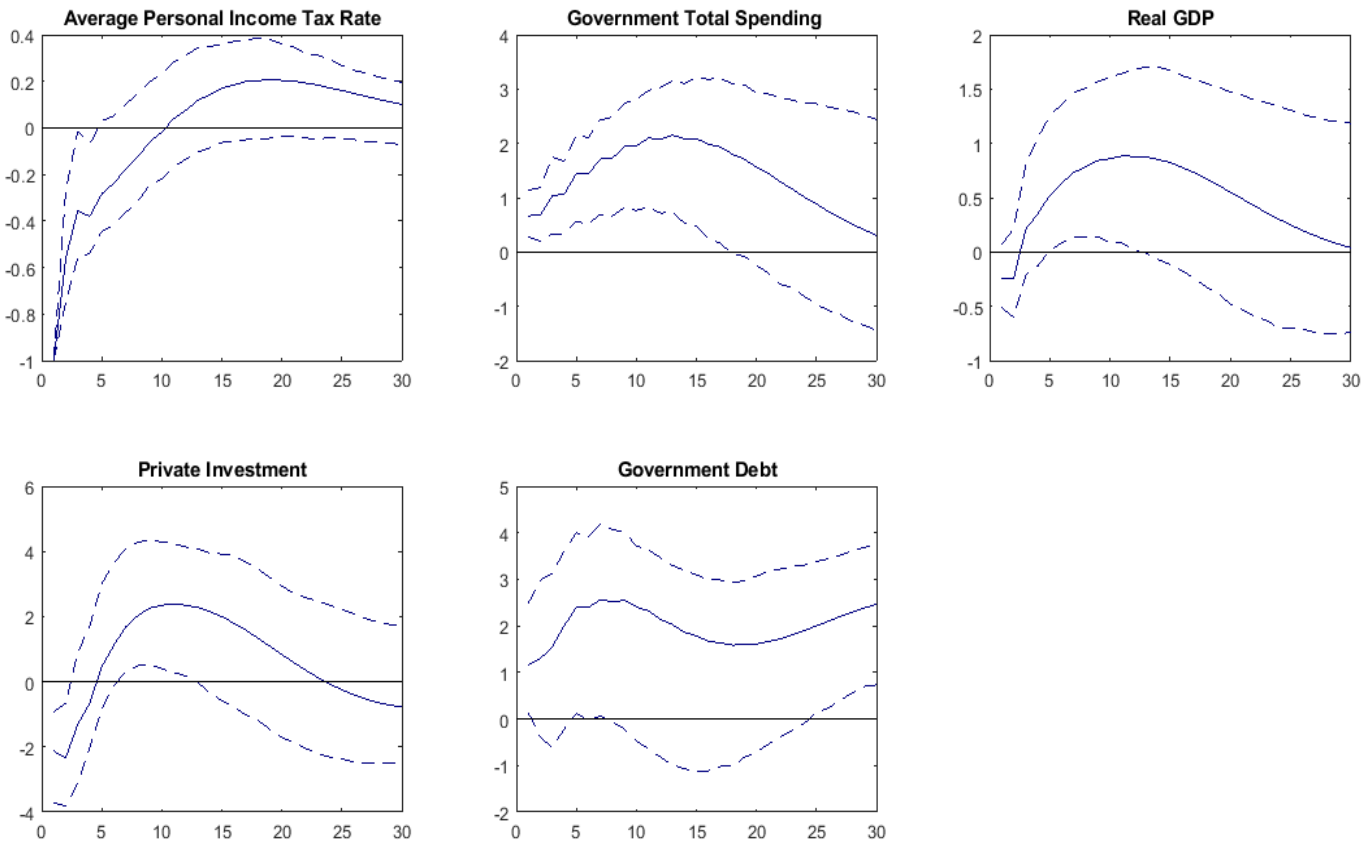
$$b_{21} = (\Sigma^{-1}_{z\mu_1'} \Sigma_{z\mu_2'})' b_{11} \tag{6}$$

- Estimate the reduced form residuals
- Regress the residuals on the narrative measure ($\Sigma_{z\mu'}$)
- Impose restrictions in 6 to calculate B_1

- Period: 1996Q1 to 2019Q4
- Variables in log levels except for rates
- Benchmark specification
  - Full sample + All shocks
- Permanent tax shocks specification
  - Full sample + Changes affecting marginal tax rates
- 1996Q1 to 2010Q4 specification
  - 1996Q1 to 2010Q4 + All shocks
- Y_t =[APITR, GOVSPENDING, RGDP, X]'
- X = [PRIVINV, GOVDEBT]'; [UNEMPLOY, CONSUMDUR]'; [PITREV, CONSUM]'

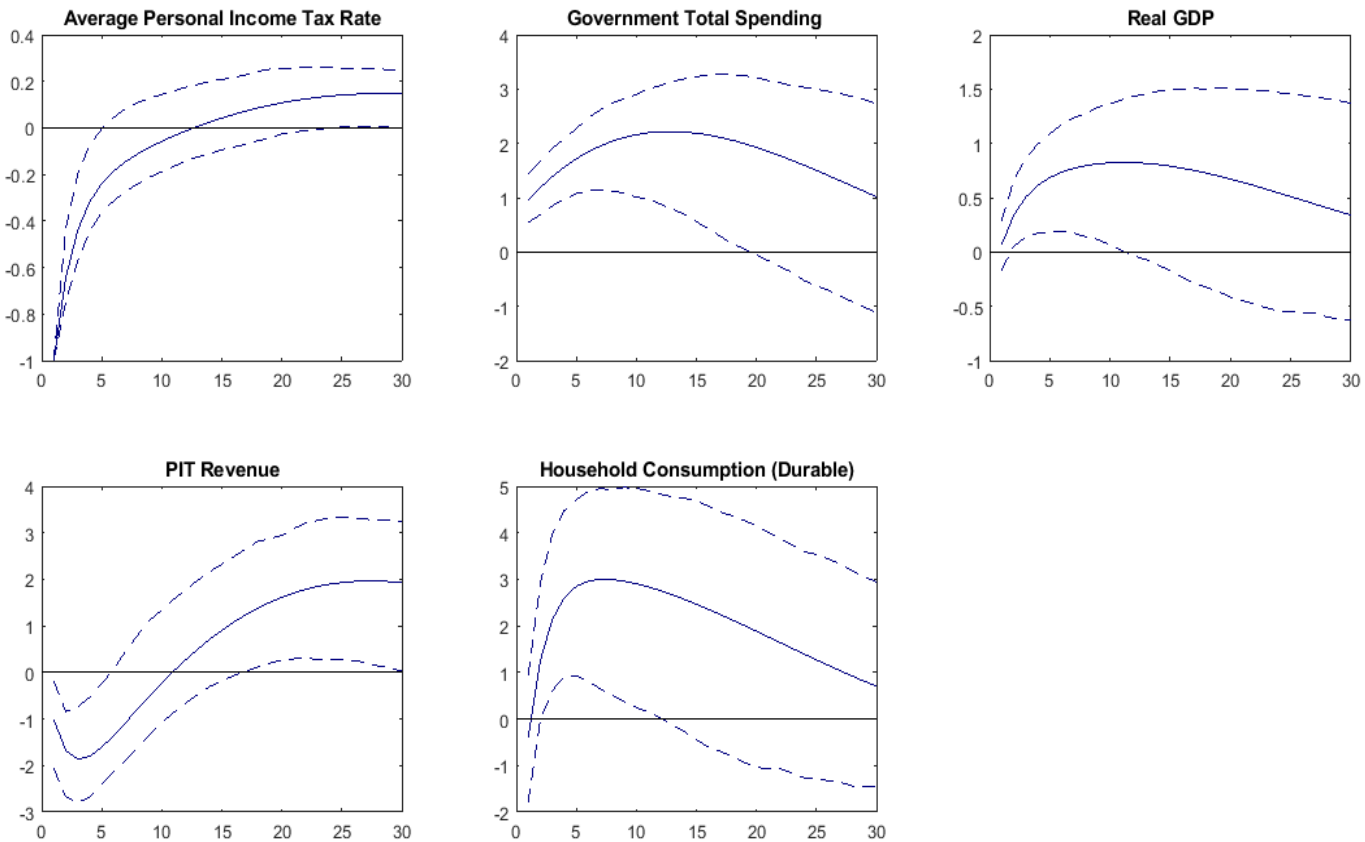
Full sample + All shocks

Figure 6: Investment and Debt: Full sample



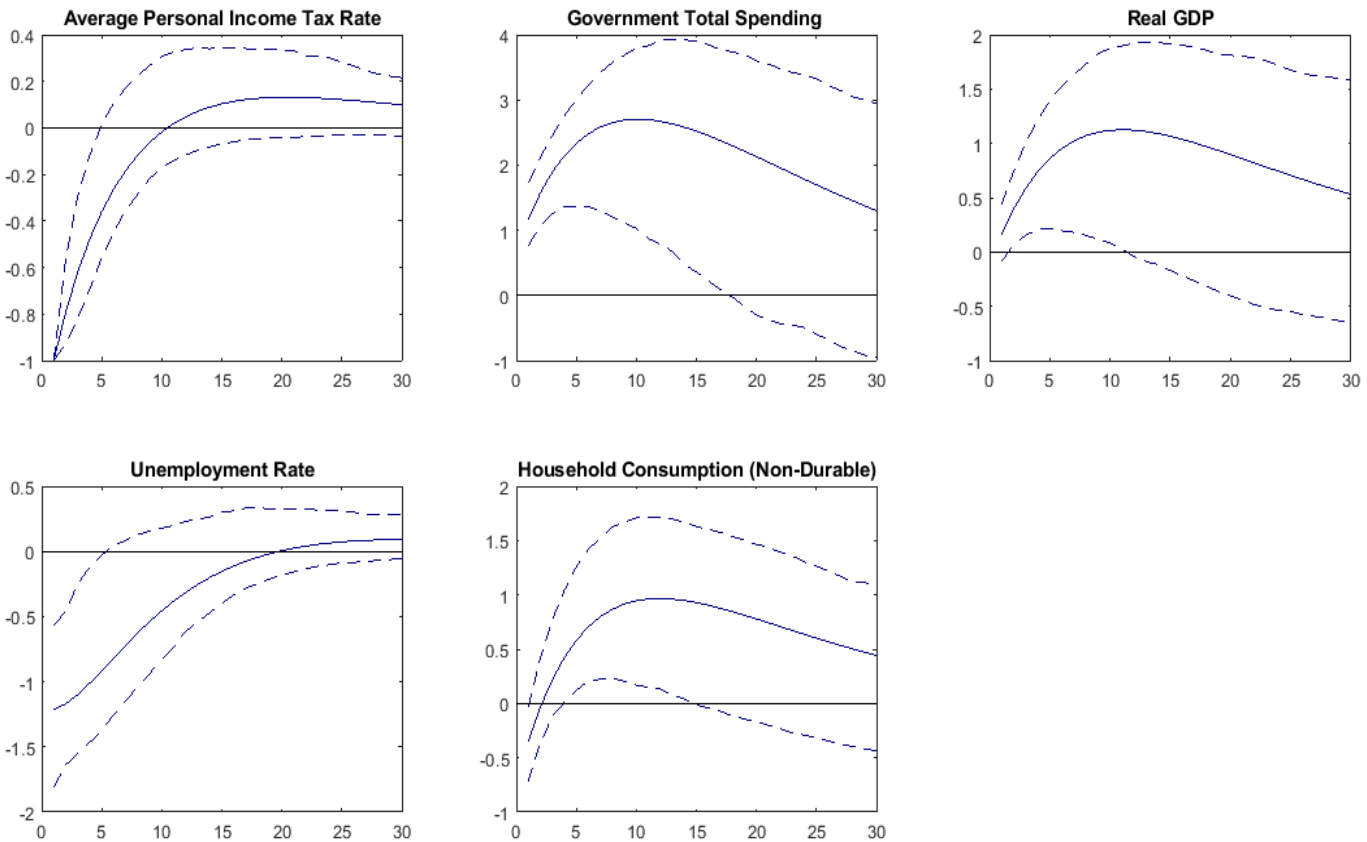
Full sample + All shocks

Figure 7: Personal tax revenue and Cons. (durable)



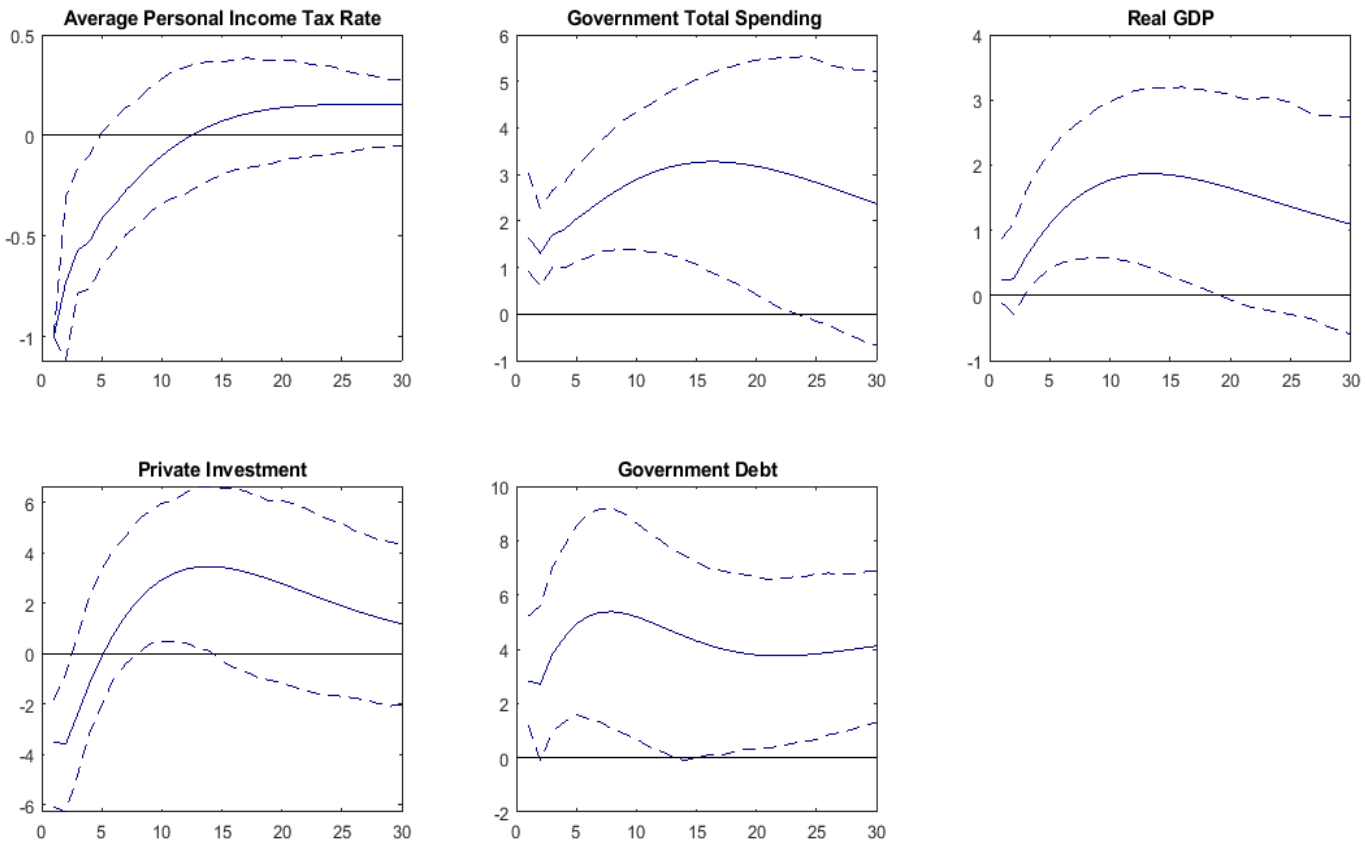
Full sample + All shocks

Figure 8: Unemployment and Cons. (non-durable)



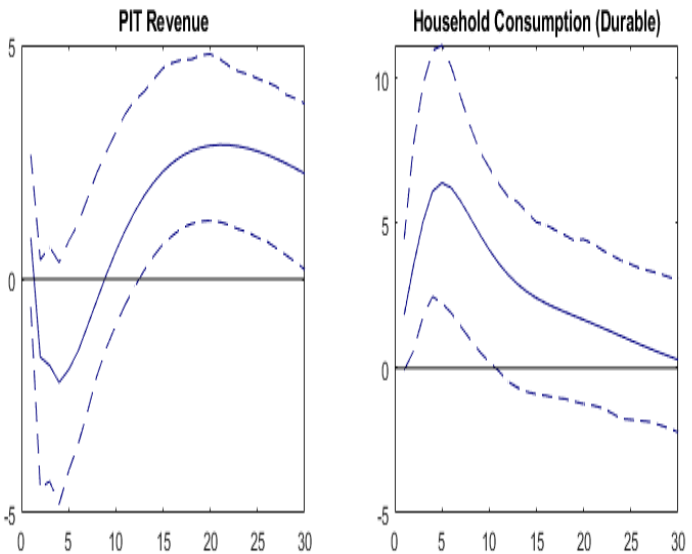
Full sample + Marginal Tax Rates

Figure 9: Investment and Debt: Permanent shocks

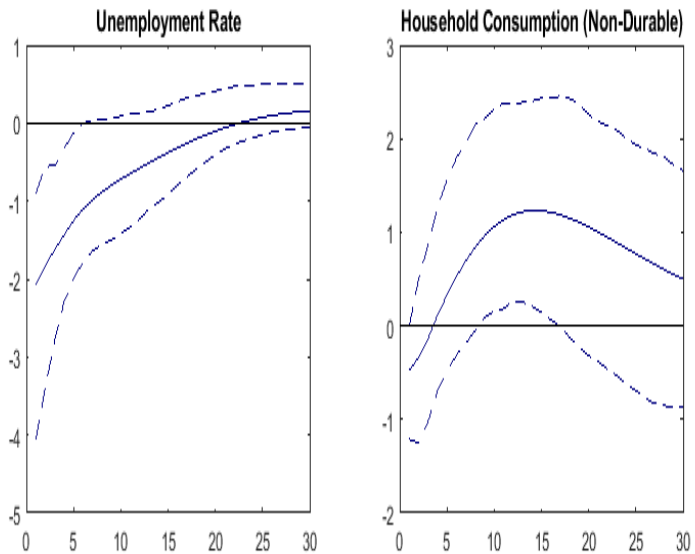


Full sample + Marginal Tax Rates

Figure 10: Revenue, Consumption and Unemployment: Permanent shocks



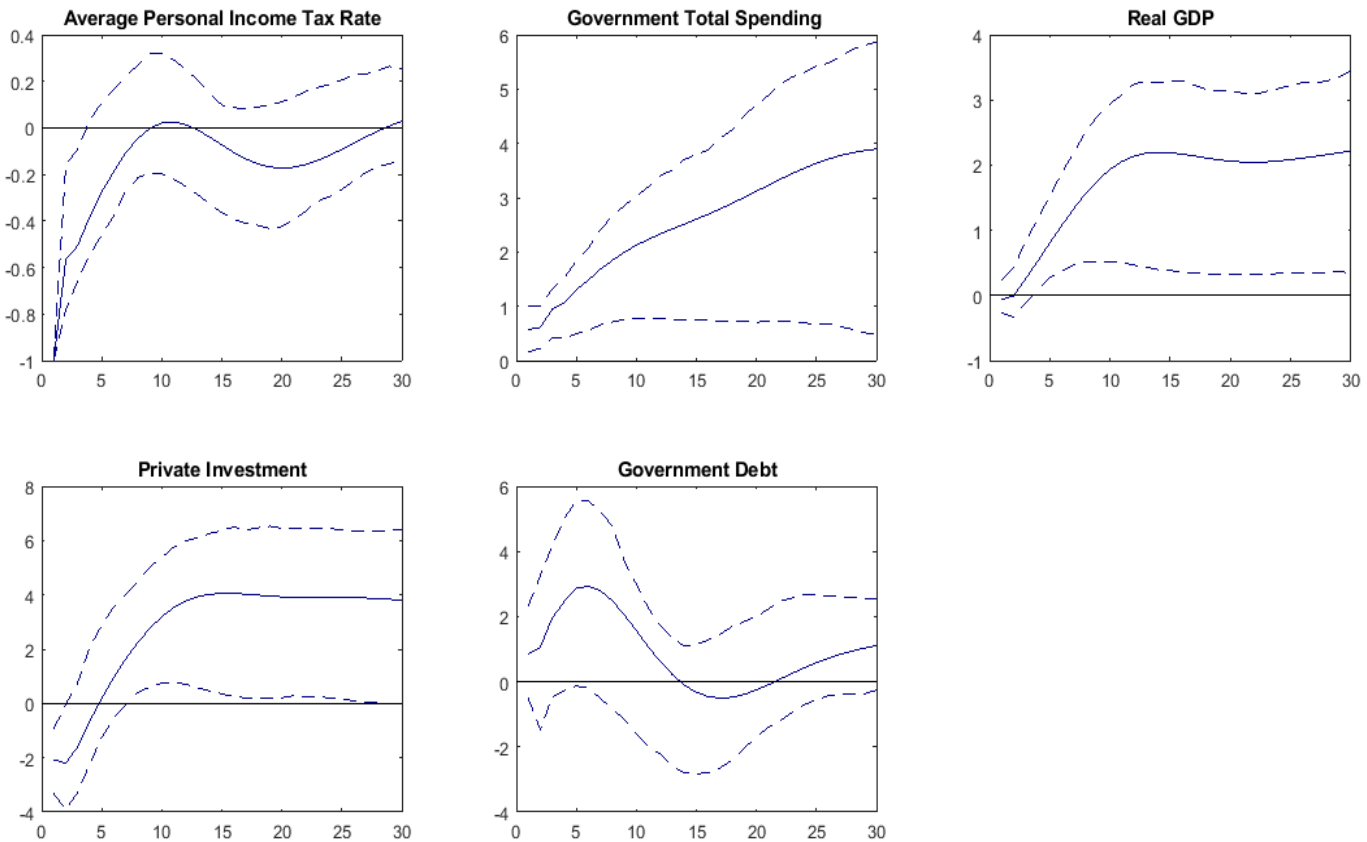
(a) Personal tax revenue and Cons. (durable)



(b) Unemployment and Cons. (non-durable)

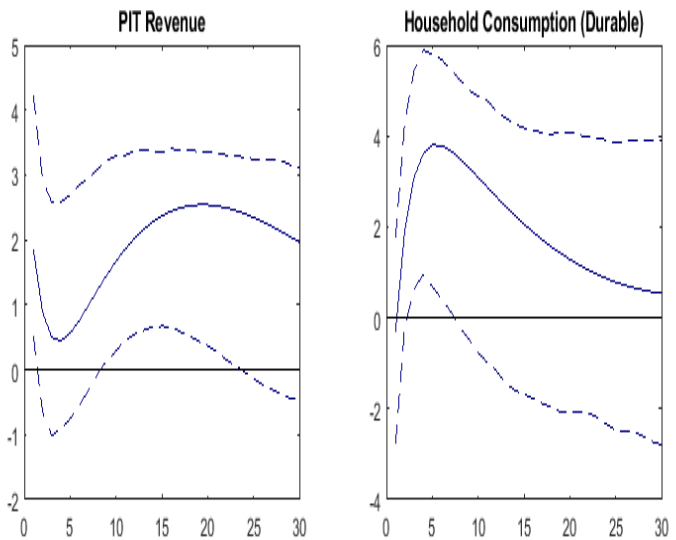
1996Q1 to 2010Q4 + All shocks

Figure 11: Investment and Debt: 1996Q1 to 2010Q4

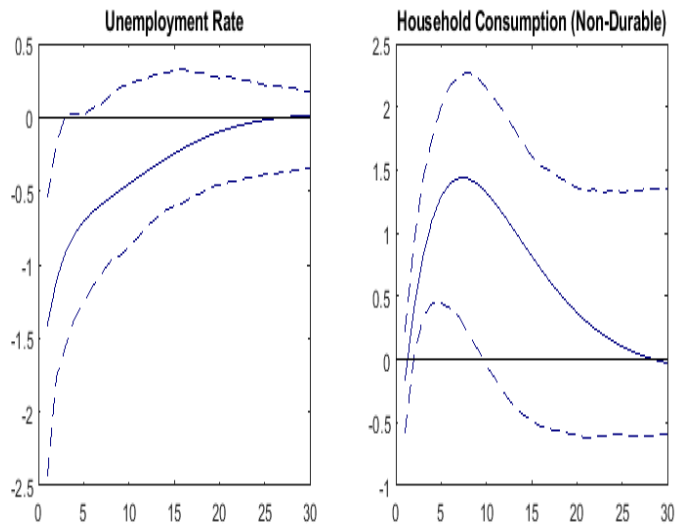


1996Q1 to 2010Q4 + All shocks

Figure 12: Revenue, Consumption and Unemployment: 1996Q1 to 2010Q4



(a) Personal tax revenue and Cons. (durable)



(b) Unemployment and Cons. (non-durable)

Implied tax multipliers

Table 1: Implied tax multipliers

	Coefficients		Implied multipliers	
	Impact	Peak	Impact	Peak
Benchmark results	0.12	0.97 (Q11)	0.13	1.06 (Q11)
Permanent tax shocks	0.45	1.63 (Q11)	0.43	1.79 (Q11)
1996Q1 to 2010Q4	0.11	1.33 (Q07)	0.11	1.65 (Q07)

Quality of identification for the true shocks

- Two tests for the quality of the narrative
- Reliability statistic = quality of identification for the true shocks
  - Squared correlation between APITR shock and narrative
- OLS regression of APITR shock on narrative
- Overall test results
  - Positive relationship between APITR shock and narrative
  - The proxy improves when we look at the 1996Q1 to 2010Q4 period
    - Reliability measure increases from 0.44 to 0.74
    - R^2 increases from 0.26 to 0.47

Quality of the narrative

Table 2: Reliability measure

	A: Benchmark	**B: Permanent shocks**	**C: 1996Q1 to 2010Q4**
Investment and Debt	0.44	0.68	0.74
	[0.23 , 0.55]	[0.29 , 0.78]	[0.68 , 0.83]
Revenue and Consumption (durable)	0.44	0.61	0.78
	[0.24 , 0.58]	[0.27 , 0.74]	[0.60 ,0.86]
Unemployment and Consumption (ND)	0.35	0.41	0.69
	[0.17 , 0.46]	[0.16 , 0.60]	[0.65 , 0.79]
Monetary policy variables	0.29		
	[0.12 , 0.41]		

Note: The 95% confidence bands reported in square brackets. ND stands for non-durables.

Positive relationship between Z and ε

$$E_t[Z_t \varepsilon_{1,t}] = \Phi \neq 0$$

Table 3: Identified tax shocks and narrative measure

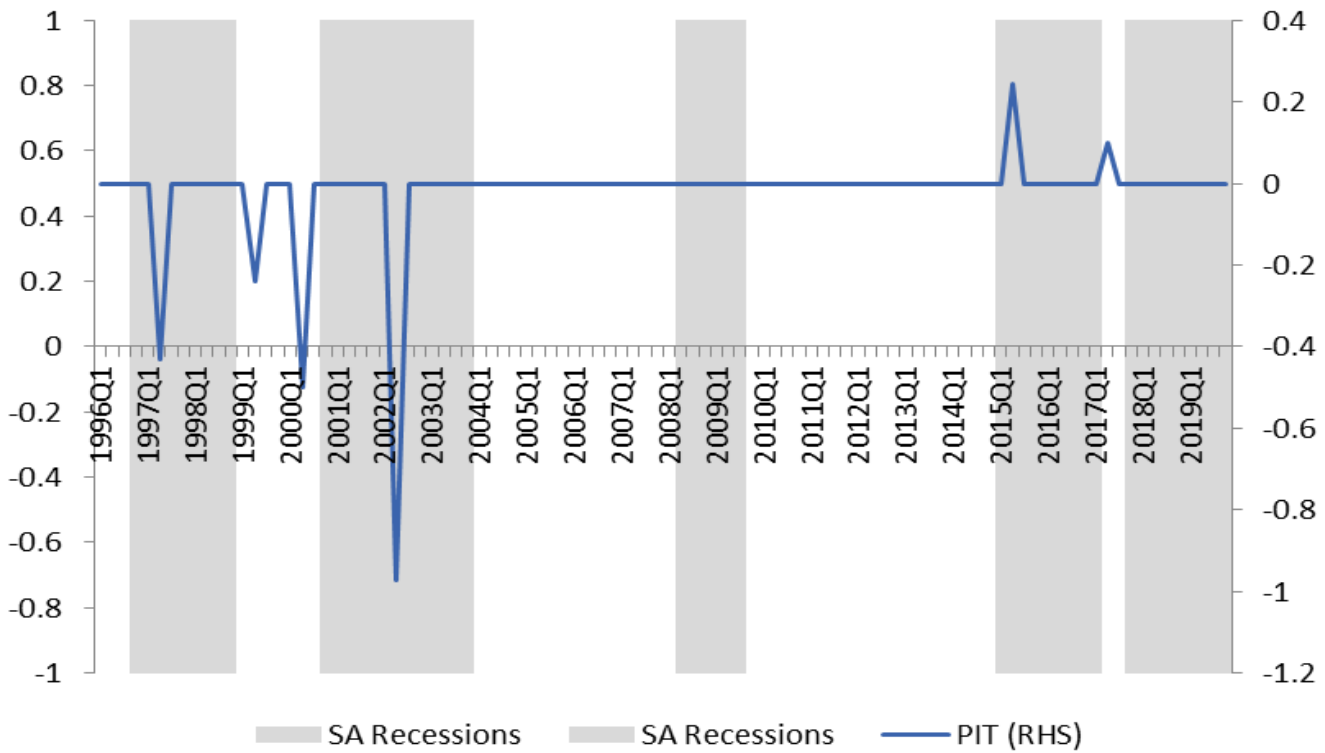
	Coefficient	T-Statistic	R-squared
Dependent variable: ε_t			
Investment and Debt: Full sample			
Z_t	0.80	3.31	0.26
Investment and Debt: Permanent shocks			
Z_t	0.70	2.77	0.13
Investment and Debt: 1996Q1 to 2010Q4			
Z_t	0.88	3.46	0.47

Concluding remarks

- What are the macroeconomic effects of average personal tax changes in South Africa?
- Main contribution - Proxy measure
  - Positive correlation between the shock and narrative
  - Higher correlation for the 1990 - 2010 period (R^2 - 0.26 to 0.47)
- Tax cuts in average personal income tax rates are expansionary
  - Positive effect on Consumption, Investment and Output
  - Permanent shocks = bigger effects
  - Increases in output and private investment are persistent during the period 1996 and 2010
  - Estimated tax multipliers: 0.13 to 1.79

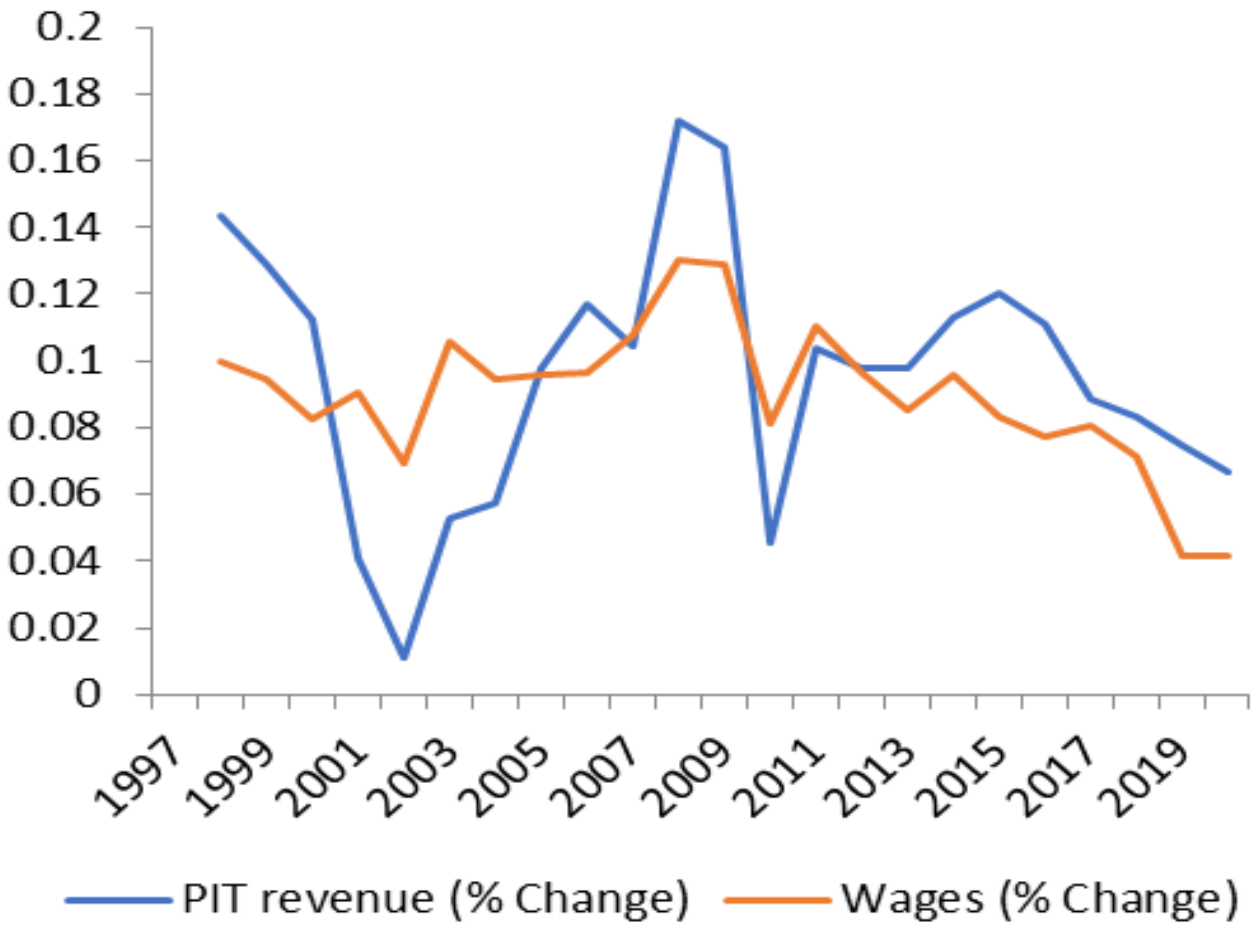
Thank you.

Figure 13: Permanent narrative shocks - % of GDP



Note: Permanent tax shocks for personal income tax (PIT) normalised by gross domestic product. SA recession dates are from St Louis FRED.

Figure 14: PIT revenue and Wages (% growth)



Note: Figure shows the difference of the log of personal income tax revenue and wages.

Instrumental Variable (IV) model

$$Y_t = \alpha + \beta X_t + \eta_t \tag{7}$$

- If Corr$(X_t, \eta_t) \neq 0$, find an instrument Z_t:
  - Correlated with X_t - relevant
  - Uncorrelated with η_t - valid

$$\hat{\beta}_{IV} = \frac{Cov(z, y)}{Cov(z, x)} \tag{8}$$

The SVAR model

- The Structural Vector-auto Regression (SVAR) framework:

$$AY_t = A_0 + \sum_{i=1}^{p} A_i Y_{t-i} + \varepsilon_t \tag{9}$$

$$Y_t = B_0 + \sum_{i=1}^{p} B_i Y_{t-i} + \mu_t \tag{10}$$

- where $B_0 = A^{-1}A_0$, $B_i = A^{-1}A_i$ and

$$\mu_t = A^{-1}\varepsilon_t \tag{11}$$

- Impose restrictions on impulse matrix $B{=}A^{-1}$

The SVAR-IV model

$$
\begin{aligned}
b_1 &= [b_{11} b_{21}']' \\
\varepsilon_t &= [\varepsilon_{1,t} \varepsilon_{2,t}']' \\
\mu_t &= [\mu_{1,t} \mu_{2,t}']'
\end{aligned}
\tag{12}
$$

- Instrument relevance

$$E_t[Z_t \varepsilon_{1,t}] = \Phi \neq 0 \tag{13}$$

- Instrument validity

$$E_t[Z_t \varepsilon_{2,t}] = 0 \tag{14}$$

... continues

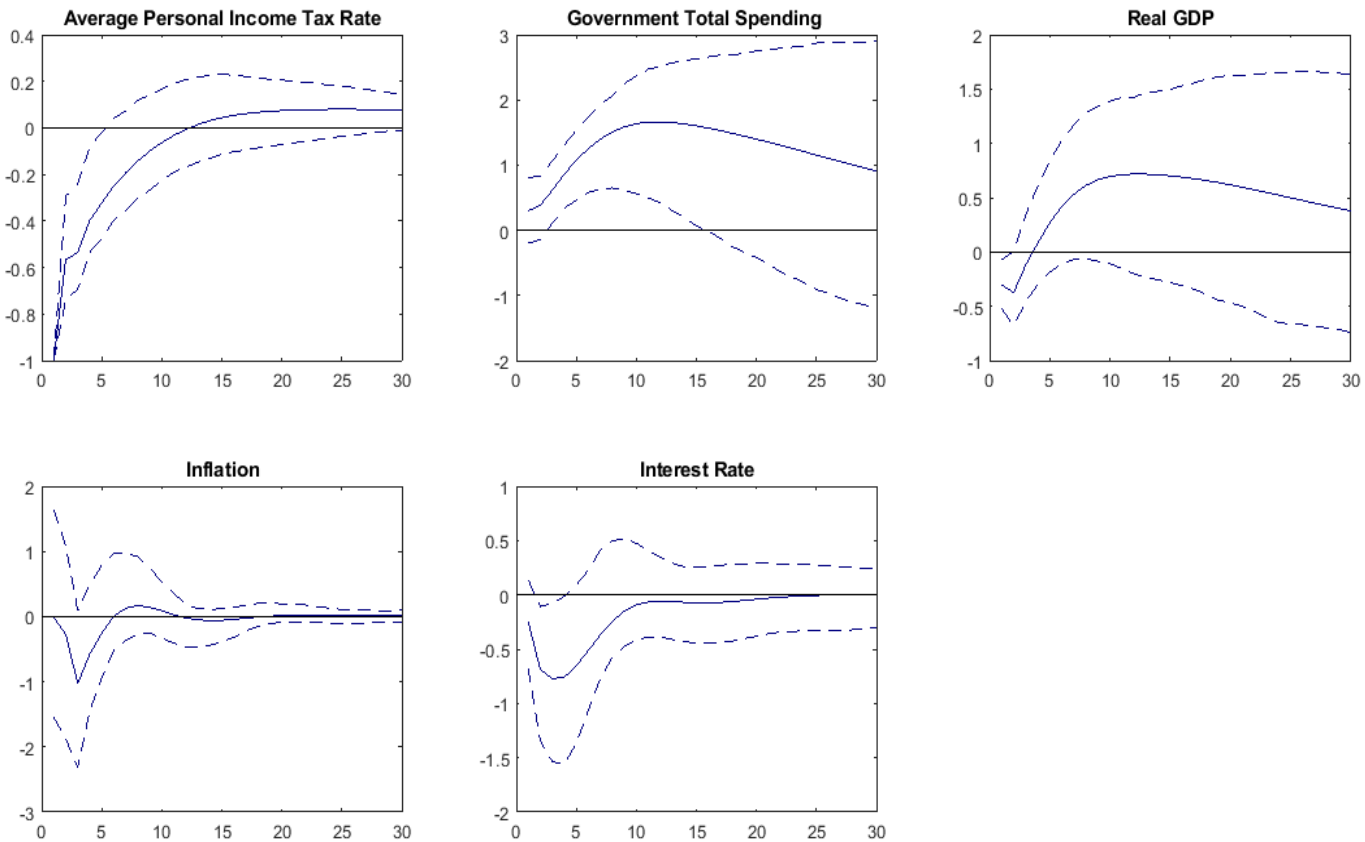
$$b_{21} = (\Sigma^{-1}_{z\mu_1'} \Sigma_{z\mu_2'})' b_{11} \tag{15}$$

The three step process as discussed in Mertens and Ravn (2013):

- Estimate the reduced form VAR model in Equation 10 by using OLS to get residuals
- Regress the VAR residuals on the narrative measure to get the covariance matrix
- Impose restriction in Equation 6 to uncover the responses of other variables to the narrative shock

Monetary policy variables

Figure 15: Monetary policy variables: Full sample



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