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WIDER Working Paper 2021/156

The macroeconomic effect of fiscal policy in South Africa

A narrative analysis

Tumisang Loate[1], Romain Houssa[2], and Nicola Viegi[1]

October 2021

United Nations University World Institute for Development Economics Research
wider.unu.edu

Abstract: This paper analyses the macroeconomic effect of legislated personal income tax changes in South Africa over the 1996–2019 period. We identify personal income tax shocks using a narrative approach and incorporate these shocks in a proxySVAR model. Our analysis shows that permanent changes in personal income taxes have a larger and significant effect on output through both the investment and consumption channels. We also find that personal tax cuts have a persistent effect on output through the investment channel in the 1996–2010 sub-sample.

Key words: tax changes, narrative approach, proxySVAR, macroeconomic effects, South Africa

JEL classification: C32, E23, E62, H24

Acknowledgements: We are grateful to research assistant Ayrton Amaral for his assistance in constructing the narratives. We would like to thank the staff from the National Treasury's tax team for their support with the data. We also wish to thank Ian Stuart, Marle Van Niekerk, and Christopher Axelson for comments and suggestions. The views expressed in this paper are those of the authors and do not represent those of the National Treasury. This working paper was written during Tumisang Loate's term at the National Treasury under the 'South Africa—Towards Inclusive Economic Development' (SA-TIED) programme. This work was supported by the Fonds Wetenschappelijk Onderzoek – Vlaanderen (FWO) and the Fonds de la Recherche Scientifique – FNRS under EOS Project O020918F (EOS ID 30784531).

Note: On 22 November 2021, missing acknowledgements were added.

[1] Department of Economics, University of Pretoria, South Africa; [2] Department of Economics, University of Namur, Belgium. Corresponding author, Tumisang Loate: tumi.tubefa@gmail.com.

This study has been prepared within the UNU-WIDER project Southern Africa—Towards Inclusive Economic Development (SA-TIED).

Information and requests: publications@wider.unu.edu

ISSN 1798-7237 ISBN 978-92-9267-096-2

https://doi.org/10.35188/UNU-WIDER/2021/096-2

Typescript prepared by Mary Lukkonen.

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Katajanokanlaituri 6 B, 00160 Helsinki, Finland

1 Introduction

What are the macroeconomic effects of average personal tax changes in South Africa? This paper analyses legislated tax changes using primary sources over the 1996–2019 period as a starting point to answering this question. Our aim is to first construct a narrative fiscal policy measure as in Romer and Romer (2009, 2010), hereafter referred to as Romer and Romer. Then using this newly constructed data set, we follow the methodology by Mertens and Ravn (2013, 2014) to empirically answer the question. This methodology seeks to reconcile the traditional narrative analysis with the vector autoregression (VAR) model to address concerns raised over the two separate identification methods. Our results indicate that personal income tax cuts are expansionary. While the results for consumption depend on the lag length, overall a reduction in personal income taxes increases output and consumption and reduces unemployment. We also find that changes in marginal tax rates have a bigger effect on output, investment, and unemployment. The reduction in personal income tax revenue in the first year of the average tax rate shock indicates that tax cuts are not tax neutral in their first year of implementation. An evaluation of our narrative measure indicates that there is a positive relationship between the measure and the latent structural shocks. We also find that when we look at the shorter sample size the correlation between the two improves with R^2 increasing from 0.26 to 0.47.

The investigation of the causal effects between variables follows a broad two-step process: the researcher has to identify or construct the shock and then use this shock within a specified model to estimate the dynamic effect of this shock on other variables. In their review of identification strategies in the macroeconomics literature, Nakamura and Steinsson (2018) provide a survey together with some criticism of current empirical methods used in identifying exogenous shocks. The major criticism deals with the credibility of the identified shock—that is, how sure is the researcher that he or she has identified the part of the variable that is exogenous and not its response to other shocks? For the traditional VAR restrictions method, such as the cholesky decomposition, the authors argue that this method makes 'strong implicit assumptions' about the information set of the policy maker and the reverse causality between the variables. These strong assumptions can result in identifying endogenous variation of the variable of interest as exogenous. In the fiscal policy literature, time series measures, such as the cyclically adjusted primary budget balance or its revenue counterpart aimed at removing the endogeneity of fiscal policy, still fail to remove non-policy factors correlated with economic activity (Devries et al. 2011).

One of the various identification alternatives to VAR parameter restrictions is the narrative method. Narrative measures are constructed by using historical records of policy makers to identify the reason and the size of the change in the policy instrument (Ramey 2016). Similar to the VAR shocks, these narrative accounts are also subject to measurement errors. Nakamura and Steinsson (2018) indicate that while narrative measures are valuable in identifying shocks, measurement errors arise from (1) the subjectivity or opacity of constructing the shock, which can lead to difficulty by other researchers to replicate the constructed measure; (2) a few data points that may also be randomly correlated with other shocks; (3) and even endogeneity. Alesina et al. (2015) argue that, given how fiscal policies are executed as a multi-year plan, it is not surprising that the narrative measures are endogenous. According to the authors, the endogeneity is a consequence of the structure of the plan and should not invalidate the exogeneity of the plan.

The two broad ways of using the narrative measure are directly as a perfect measure for the true shock, such as in Romer and Romer (2010), or within a proxySVAR model (also called structural vector autoregression instrumental variable (SVAR-IV) by Stock and Watson (2018)). In the Romer and Romer (2010) case, the authors regress their exogenous narrative measure for fiscal shocks on gross domestic product (GDP) in a single-equation model and in a two-variable model. According to Stock and Watson (2018), treating '*external instruments*' such as narrative measures as a true shock can lead to biased estimates. In this paper, we focus on the latter methodology of using the narrative measure in a proxySVAR

model to answer our empirical question. Despite the challenges of using narrative measures, their use in SVAR models as instruments is seen as a promising method to incorporate external information in a VAR model to identify shocks (Ramey 2016) and 'holds out the potential for more credible identification than is typically provided by SVARs identified using internal restrictions' (Stock and Watson 2018). In fact, Nakamura and Steinsson (2018) indicate that the main advantage of this method is that it allows the inclusion of fast-moving variables in a VAR model of lower frequency. In addition, the authors show that another advantage is that it relaxes the contemporaneous restriction in cholesky identification, allowing the contemporaneous response of variables in the model to be non-zero. However, the authors indicate that the VAR misspecification still remains an issue. [1]

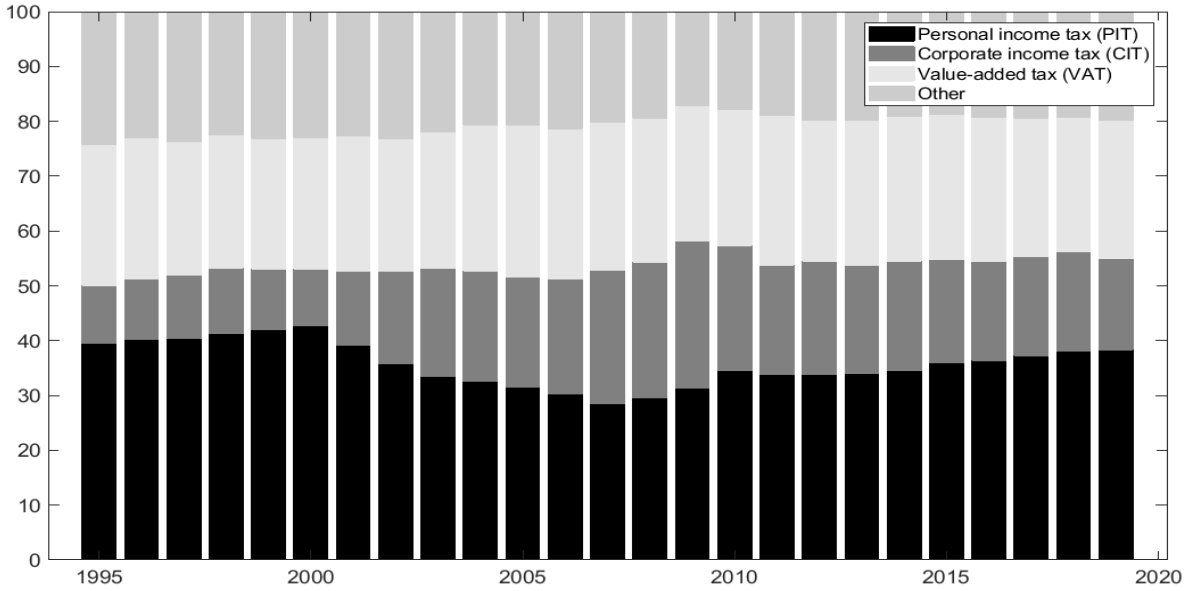
In line with this trend in international literature, this paper contributes to the literature in three ways. First, we construct a new narrative measure that can be used as a proxy for structural personal income tax shocks for South Africa. Second, we contribute to the empirical literature of fiscal multipliers using a different data set and identification strategy. Last, we look at the macroeconomic effects of personal income taxes. Figure 1 shows the contribution of different tax categories to total revenue during the 1994–95 to 2018–19 fiscal years. Between this period, personal income tax, corporate income tax, and value-added tax (VAT) accounted for around 80 per cent of total revenue. Personal income taxes contribute a substantial amount to total revenue, with their share fluctuating between 30 per cent and 40 per cent during the period under investigation.

For our first contribution, we follow the literature on narrative accounts and identify tax-based policy actions by the government over the 1996Q1–2019Q4 period. Our focus is only on tax changes that affect personal income taxes.[2] The policy has to be both significant and result in a change in tax liability. For the latter, this can either be a change in average or marginal tax rate. The significance of a tax change is not necessarily determined by its size but rather by its potential socioeconomic and/or economic impact. Following Romer and Romer (2009, 2010), identified tax changes are then classified under four categories based on their motivation: government spending driven, countercyclical (to return economic growth to trend), budget deficit driven, and increasing long-run economic growth. Tax changes classified under the latter two motivations are considered policy changes unrelated to other developments affecting economic activity—'exogenous' fiscal policy shocks—and form the basis of our paper.

[1] See Section B of Nakamura and Steinsson (2018)'s online appendix.

[2] Narrative accounts for corporate and VAT changes are also analysed but excluded in this paper.

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



Note: 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.

Source: authors' calculations based on data from South African Revenue Service (SARS).

Our second and third contributions are empirical. In this regard, we use the new constructed quarterly tax narrative shocks and follow Mertens and Ravn (2013, 2014) by incorporating the narrative within a VAR model. The underlying assumption of this methodology is that the narrative measure is positively correlated with the structural fiscal shock of the SVAR model but uncorrelated with the other remaining structural shocks. Unlike with the narrative literature, this correlation is not assumed to be perfect—that is not a one-on-one mapping. After all, the narrative measure can only measure some parts or the noisiness of the true shock, thereby providing an imperfect measure (Stock and Watson 2017). Using this assumption, a procedure is followed to recover the impact matrix.

Our study is not without limitations. The obvious limitation of our study is that by using a linear model, we assume that fiscal multipliers have remained constant during the sample period. van Rensburg et al. (2021) find that fiscal multipliers in South Africa have been declining after 2010 and were even negative during the 2015–18 period. Notwithstanding this limitation, we hope that the use of the narrative data opens avenues to explore the different methodologies and model specifications such as in Kliem and Kriwoluzky (2013) in future research. Furthermore, we see this research being in line with the trend in the international literature of using external information to identify shocks. These include Hussain and Malik (2016), who investigate the asymmetric effects—tax increase vs decrease effect—of US tax changes using the Romer and Romer exogenous tax shocks in a non-linear model to compute impulse responses. Other papers that use narrative shocks in a proxySVAR model include Olea et al. (2020), Ferrara et al. (2020), and Mertens and Montiel Olea (2018). The benchmark results in Mertens and Ravn (2013) show that a cut in both personal and corporate income taxes increases both output and the respective tax bases. However, the results show that personal income taxes have a higher effect on output and also reduce personal tax revenue while the effect of corporate taxes on corporate revenue is insignificant. The authors view this insignificance of corporate revenue as evidence that changes in average corporate income taxes are self-financing or revenue neutral.

The rest of the paper is organized as follows. Section 2 and 3 discuss the literature and characteristics of macroeconomic shocks we seek to investigate. In Section 4 we discuss the proxySVAR methodology,

which is then followed by the results in Section 5. In Section 6 we provide some robustness checks before concluding in Section 7.

2 Literature

Identifying macroeconomic shocks is important as misidentified shocks can lead to incorrect conclusions about the interrelationships between variables and therefore misleading policy advice. In this section we briefly discuss selected literature in South Africa on fiscal policy and the gap in this literature we are trying to fill. We then proceed to look at the characteristics (and their importance) of the shocks we seek to identify before applying criteria to identify them in the next section.

Studies on macroeconomic effects of fiscal policy in South Africa have mainly focused on exploring different empirical methodologies and theoretical or macro-econometric models. [3] Studies based on macro-econometric and theoretical dynamic stochastic general equilibrium (DSGE) models include Akanbi (2013) and Kemp and Hollander (2020), respectively. The former finds that when there are structural supply constraints in the economy, as has been the case for South Africa, tax-based fiscal policy is more effective than government expenditure-based policy. Jooste et al. (2013) explore three identification strategies—a DSGE model, a structural vector error correction model (SVECM), and a time-varying parameter VAR (TVP-VAR)—for the 1970Q1–2010Q4 period. In this paper, a tax increase reduces output in the SVECM results. In a similar multi-methodology study—cholesky decomposition, Blanchard-Perotti method, and sign restrictions—for the 1970Q1–2018Q4 sample period, Kemp (2020) finds tax multipliers higher than spending multipliers, albeit smaller than one, with tax increases having a negative effect on total private consumption and private investment. In contrast, Nuru (2020) finds no significant effect of taxes on output for the sample period 1994Q2–2014Q2 using an SVAR model. We seek to add to this literature not only in terms of exploring a new methodology but also adding a new data set for personal income tax policy shock. To the best of our knowledge, this is the first research that creates this data set and uses it within a proxySVAR methodology for South Africa. We hope that this new data will further be explored in other research projects.

According to Ramey (2016), amongst others, a shock has the following characteristics: it should be (1) uncorrelated with the current and lags of other endogenous variables; (2) uncorrelated with other exogenous shocks; (3) and contain unanticipated changes in the exogenous variables or some news about future changes in it. We start by discussing the last characteristic before briefly discussing the first two.

The third characteristic of a shock is that it should contain *unanticipated* movements in the exogenous variable or news about future movement of the exogenous variable. The later captures *anticipation* of future policy changes—policy foresight. Chapter 2 (Section 2.5) in Ramey (2016) provides a discussion of the literature on the issue of policy or fiscal foresight. The author indicates that policy foresight arises either from private agents or the policy maker. In the first case, private agents anticipate policy changes and change behaviours prior to these changes being implemented. As discussed in Yang (2005), fiscal foresight from private agents comes from the lag between policy announcement and legislation enactment and between the enactment and implementation. In the second case, policy makers have private information about the current state of the economy and the forecast of macroeconomic variables and make policy changes in response. However, if the econometrician does not include this information, the identified shock in the model could partly capture the endogeneity of the shock to forecast.

[3] See van Rensburg et al. (2021) for the current survey and criticism of the current literature on fiscal multipliers in South Africa.

Why can policy foresight be an econometric issue? The problem with policy foresight can result in the SVAR model not being able to capture the anticipated or news effects of the shock as these would occur before the actual shock. In her paper 'Identifying Government Spending Shocks: It's All in the Timing', Ramey (2011) shows that the difference between the results of narratively identified government spending shock and VAR shock is caused by the different timings of the shocks. According to the author, the VAR shock timing lagged that of the narrative, and hence, by delaying the timing of the narrative shocks to align with that of the VAR, the author was able to reconcile the two results. The author concluded that the VAR shocks lacked the timing of the news contained in the narrative. The proxySVAR method we follow in this paper seeks to reconcile the traditional narrative method and SVAR method of identifying shocks.

The proxySVAR literature by Mertens and Ravn (2013) treats the narrative measure as a proxy for the unobservable structural shocks. The two conditions set out in the proxySVAR literature for the narrative measure to qualify as an instrument for the unobserved structural shocks are instrument relevance (narrative to be correlated to the latent shock) and exogeneity (or validity). To test for the correlation, Mertens and Ravn (2013, 2014) construct a reliability statistic. This statistic can take on a value between 0 and 1 with a high value indicating higher correlation between the narrative measure and the unobserved structural shocks. [4]

Several papers have used this methodology in both the fiscal and monetary policy literature. Seminal contributions include Mertens and Ravn (2013, 2014). Mertens and Ravn (2014) find larger tax multipliers for the United States. One of the attributions for these large multipliers is the use of the proxySVAR. The authors argue that by being able to account for measurement errors inherent in narrative measures, they are able to find higher multipliers. Using this methodology, Hussain and Malik (2016) find that tax cuts have a positive and significant effect on output whereas the effect of tax increases is insignificant (and also exhibits non-Keynesian effects on output). While the authors employ a non-linear model, their results are qualitatively similar to those of Afonso and Sousa (2012) for the United States. Mertens and Montiel Olea (2018) also use the proxySVAR, together with the local projections instrumental variable (LP-IV) method, to investigate macroeconomic effects of changes in marginal tax rates. The authors find that cuts in marginal tax rates increase output and reduce unemployment.

Kliem and Kriwoluzky (2013) follow Mertens and Ravn (2013, 2014) and incorporate the narratively identified monetary policy shocks into a VAR model. Their aim is to investigate if this methodology can reconcile the differing results about the contribution of monetary policy shocks arising from how monetary policy shocks are identified. They find that, while this methodology slightly increases the correlation between the two shocks, using the correct lag length improves the results further. These results are promising, but as the authors indicate, this misalignment of the two shocks can be attributed either to measurement errors in the narrative measure or misspecification of the VAR model. The authors indicate that understanding which of the two issues matter the most is important for both academic research and policy analysis.

Last, in addition to the three characteristics, a shock can either be once-off or permanent. The application of these characteristics and conditions in our study—relevance, exogeneity, and transitory vs permanent and anticipated vs unanticipated—are discussed in the next sections.

[4] In Mertens and Ravn (2014), the authors find a value of 0.57, which is higher than what they find for all the exogenous Romer and Romer shocks. The authors claim that by using only Romer and Romer's unanticipated shocks instead of all the shocks, they were able to improve the quality of the narrative measure/instrument. However, using a different instrument relevance test, Ramey (2016) shows that, even with this improvement, unanticipated shocks had a lower instrument relevance with the exogenous Romer and Romer shocks having twice a higher relevance.

3 Narrative tax-based fiscal shocks

We construct a narrative account of legislated personal income tax (PIT) changes between 1996Q1 and 2019Q4 in the same spirit of Romer and Romer (2009, 2010) and Mertens and Ravn (2013).

The starting point in identifying tax policies is deciding what constitutes a significant tax change. While it is not our intention to go into detail of every component of the tax change, careful consideration is given to what goes into the aggregate narrative tax measure. For our analysis, the significance of a tax change is not necessarily determined by its size but rather by its potential socio-economic and/or economic impact, as long as it results in a change in average or marginal tax rate. Therefore, policies that on their own would be considered insignificant in terms of their revenue impact are also considered for the aggregate measure. This attempt to not simply exclude small tax policy changes partially aims to address one of the measurement errors that arises during the construction of narrative measures, which is excluding minor changes, as mentioned in Mertens and Ravn (2013). However, we restrict our analysis to tax policies affecting the majority of the society or households. We exclude policies that are targeted at specific financial transactions or use certain instruments to avoid paying tax or reduce tax liabilities.

3.1 Sources

The main documents[5] for the analysis are National Treasury's Budget Reviews and Speeches and Explanatory Memorandums for Taxation Laws Amendment Acts or Bills and Revenue Laws Amendment Acts or Bills. The Budget Review is released every year in February on the day of the annual Budget Speech.

The Medium Term Budget Policy Statement (MTBPS), which was first published on 2 December 1997, provides three-year macroeconomics, expenditure, and tax revenue projections, among other information. This document is consulted for an initial starting point of the government's fiscal strategy for the upcoming three years. It is used to detect any significant changes in the government's actions. Throughout the document, government means national government.

The Budget Review, which is published three months after the MTBPS, is a detailed document providing more details on government expenditure and tax proposals, together with a review of the previous year's revenue performance. We obtain our tax proposals from this document, which in some cases are also published together with their revenue effect. Not all tax changes are quantified. However, our inability to quantify them does not mean that we exclude them at first. Where possible, we make an effort to quantify their effects. Lastly, the Explanatory Memorandums provide the background and motivation for the tax proposal. These are the main source for the motivation. The memorandums are usually published alongside the bills or final act. In addition, we also look at the State of the Nation Address (SONA) by the president, which is customarily delivered a week or so before the Budget Speech. These documents were obtained from the National Treasury, South African government, and South African Revenue Services (SARS) websites.

[5] A list of the main documents can be found in Appendix A1.

3.2 Tax change categories

As in Romer and Romer (2009, 2010), we classify tax changes into two main categories based on their motivations or reasons: endogenous and exogenous. Below is a brief summary of the two categories, as discussed in Romer and Romer (2009, 2010).[6]

Endogenous tax changes: Endogenous tax changes are intended to return economic growth to its potential level. In this category, the government is concerned about current or future economic growth. Hence, these tax policies will be correlated with output or other factors affecting output. Tax changes in this category include, amongst others, increasing (decreasing) taxes or decreasing (increasing) government spending during an economic boom (downturn); responding to other shocks that might move output from its potential; and increasing taxes to fund an increase in government spending. The latter is classified as a spending-driven tax change, whereas the former two are considered counter-cyclical tax changes. These tax policies do not form part of our analysis on the macroeconomic effect of tax changes.

Exogenous tax changes: Tax changes in this category are not concerned with current or future economic growth. These changes are taken for long-term reasons irrespective of current conditions or future outlook. The two main sub-categories are deficit-driven and long-run tax changes. Deficit-driven tax changes are aimed at addressing past economic policy choices. Long-run tax changes encompass a wide range of changes aimed at raising the potential growth. These include policies aimed at making the tax system fair and equitable, pro-cyclical tax policies to raise potential growth, and new tax policies aimed at increasing the tax base.

The aim of this study, as is in the literature, is to analyse discretionary fiscal policy changes. In the South African context, adjusting rebates and tax brackets for inflation is an automatic process, to avoid fiscal drag, at least during the period under investigation. While this choice is 'discretionary', because it has been implemented every year, we classify it as automatic tax change. Only in a few cases are these inflation indexations accompanied by changes in marginal tax rates. Given this automatic change, our rule is to classify them as counter-cyclical—especially when the government is explicit that the aim is to counter inflation—and thereby endogenous.[7] There are two cases in which we deviate from this rule: higher-than-inflation adjustments during an economic boom and using fiscal drag to raise taxes. Both are pro-cyclical tax policies that go against the counter-cyclical tax policy stance of the government.

The first case of higher-than-inflation changes in the tax brackets and rebates to achieve an even higher economic growth falls under the classification of tax policies to raise potential growth. For example, in 2002–03 and 2003–04 fiscal years, the economy was estimated to grow by 2.3 per cent and 3.3 per cent in those years and further expected to continue to grow over the remaining years of the three-year medium terms. During the same years, the government provided personal income tax reliefs of about ZAR15 billion and ZAR13 billion, respectively, with the following reasons cited in the Budget Review documents: 'The proposed tax relief will increase the disposable income of employees, easing the pressure on wage costs to firms, as well as the pressure on household budgets that may arise from higher than anticipated inflation following the depreciation of the currency' in 2002, and 'The adjustments compensate fully for inflation and provides real relief to all taxpayers...and increasing the take-home pay of wage earners to encourage consumption and saving' in 2003. In the 2003–04 case, economic growth for 2002 was estimated to be 3 per cent, which was higher than the estimate of 2.3 per cent in the 2002–03 Budget (as indicated in Table 2.4 in the 2002 Budget Review and Table 2.5 in the 2003 Budget Review). In both cases, the government indicated that strong revenue growth was the reason for these

[6] It is not our intention to provide a detailed explanation of these motivations; for this, consult the two papers.

[7] As indicated in Romer and Romer (2010), automatic tax changes have minimal news value; therefore, it is not a shock.

generous tax reliefs; therefore, there were no fears of widening the budget deficit, and the economy was expected to grow at higher rates in the three-year medium terms. In such cases, we estimate the inflation adjustment amount, and the remaining amount is then allocated as the size of the shock.

The second case is when the government chose not to make the inflation indexations. Because these adjustments result in foregone revenue by the government, fiscal drag when the government has limited fiscal scope is classified as a deficit-driven tax increase and therefore exogenous. The tax relief for personal income tax in the 2010 Budget for the 2010–11 fiscal year was estimated at ZAR6.5 billion in the Budget documents. Because the government was clear that the relief was moderate and to help the economy recover—'moderate tax relief for households, to assist in sustaining the economic recovery'—we classify the relief as a deficit-driven tax increase. While the statement indicates that the relief is to assist the recovery, the lower than inflation adjustment to both the tax brackets and rebates is contradictory to supporting economic growth and indicates that this is an implicit tax increase. In anticipation of lower tax revenue (and therefore a higher than previously expected budget deficit) caused by lower economic growth, the government chose to offer a modest tax relief. [8] Subsequently, the 2011 Budget allocated ZAR8.1 billion for tax relief in the 2011–12 fiscal year but also to compensate for some of the 2010–11 year that could not be accommodated in the last fiscal year's relief.

Lastly, in an effort to balance fiscal policy objectives with the negative effects of taxes on the economy, the government can pursue multiple policy objectives. For example, during an economic downturn, the government might indicate its support for economic growth while also maintaining its position for fiscal sustainability. To address these competing motivations, we take a bottom-up approach: we look at the motivation for the identified individual change and then calculate the net effect of all identified tax changes in that year. In this way, we ensure that even small but relevant tax changes are included in our analysis.

3.3 Revenue source, sizing, and timing

In this paper, we only look at the personal income tax changes. However, the categorization of some of the taxes is obscured by statutory vs legal or economic obligation. To ensure consistency with the data and how taxes are administered, we follow the revenue collector's tax categories. These are obtained in the 'Statement of the National Revenue, Expenditure and Borrowing' taken from the National Treasury's monthly press releases. For example, while employment tax incentives are treated as business incentives, they are administered as refunds against employees' pay-as-you-earn (PAYE) and are therefore categorized under personal income tax. Similarly, while dividend tax is legally or economically paid by shareholders, it is administered as a withholding tax by the paying party and hence categorized under corporate income tax.

For the size and timing of the shock, we follow the literature where the size of the shock is proxied by the *expected* annual revenue impact. For example, to construct a government spending shock, Ramey (2011) constructs a narrative measure of government spending using the expected change in the present value of government spending from newspaper sources. In our case, and similar to Romer and Romer (2010), we obtain these estimates from the Budget documents.

The timing of a shock is determined by its effective date. Following Yang (2005), we take note of three important dates in the tax policy process: (1) the date of the announcement of the tax policy to the parliament or public; (2) the date of the enactment of the legislation of the announced tax policy; and (3) the effective date of the legislated tax policy. For date (1), we use the date of the SONA or Budget policy

[8] The 2010 Budget Review indicated that the estimated previous, current, and next year's inflation were 7.1 per cent, 5.8 per cent, and 6.1 per cent, respectively. However, the tax brackets and rebates were adjusted by 5.3 per cent and 5.1 per cent, respectively, which are both below any of the estimated inflation rates.

as a proxy. At a quarterly frequency, these do not matter as they are only two weeks apart. For date (2), we use the date on which the legislation was assented. Lastly, for date (3) we use the effective date of the change, which in some cases is also mentioned in the Budget Review ex-ante. As in Romer and Romer (2010), any tax change effective after the midpoint of a quarter is assigned to the next quarter.

The last two important characteristics of the shock look at whether the shock is temporary or permanent and anticipated or unanticipated. Mertens and Ravn (2013) classify unanticipated tax changes as policies implemented within a quarter after being legislated. Hussain and Malik (2016) also follow the same classification approach. This classification allows researchers to investigate if anticipated and unanticipated shocks have different macroeconomic effects.

Tax change shocks are classified as temporary if they are effective for a specified period. Therefore, permanent tax changes remain effective until future tax changes or repeals. Some tax changes have an element of both temporary and permanent effect. For example, if the government adjusts tax brackets for fiscal drag but also increases the top marginal tax rate, such as in the 2017–18 fiscal year, we treat the adjustment of rebates and tax brackets as temporary—whether a full or partial adjustment. However, we treat the increase in marginal tax rates as permanent because it is rarely effective for one year and tends to stay in place until the government decides otherwise.

3.4 Tax narrative examples

A summary of the tax changes analysed is provided in Table A2 in Appendix A4. Of the 66 analysed tax changes, 35 are classified as endogenous and 31 as exogenous. After aggregation, we end up with 47 personal income tax shocks—25 exogenous and 22 endogenous. The 25 exogenous tax shocks form part of our analysis. For an illustration of how we applied the criteria for classifying tax changes, we provide two examples below.

Example 1: Personal income tax increase

[Rates and Monetary Amounts and Amendment of Revenue Laws Act, 2015—Act No. 13 of 2015]

Assented: 8 November 2015

Shock period: 2015Q2

Shock type: PIT (exogenous—debt-deficit)

Size: ZAR9.420 billion (+) - (Relief (endogenous): -ZAR8.5 billion; marginal tax rate increase (exogenous): +ZAR9.42 billion)

This tax policy provided relief to taxpayers by adjusting all rebates and tax brackets for inflation by 4.2 per cent while also raising revenue through a 1 per cent increase in marginal personal income tax rates for all income tax brackets (and trusts) except the lowest, which remained at 18 per cent. According to the 2015 Budget Review, this policy stance raised revenue by 'enhancing the progressive character of the tax system'.

The tax policy at the time was implemented to 'close the structural deficit in the public finances over the medium term'. The 2014 MTBPS stated that the favourable conditions (i.e. lower interest rates, high commodity prices, and a stronger rand) that created fiscal space in the run-up to the 2008 global financial crisis (GFC), and that allowed government to respond with stimulus when the economy went into recession, had dissipated. Accordingly, the government planned to narrow the deficit and stabilize the debt by lowering spending and increasing revenues. These sentiments were further iterated in the Budget Review. 'In the period of low global growth forecast over the next several years, South Africa has

begun to promote structural reforms needed for the long term. Reducing macroeconomic imbalances, including narrowing the budget deficit as a proportion of GDP and consolidating the debt ratio, will provide a sound and predictable basis for achieving these structural reforms. This is the principle underlying fiscal policy'. In addition, the government aimed to 'limit the erosion of the corporate tax base, increase incentives for small businesses and promote a greener economy'. Increasing marginal personal income tax rates was one of the recommendations by the Davis Tax Committee, 2015 Budget Review. According to the Review, the 2015 Budget was implementing the measures announced in the MTBS in October 2014 to 'narrow the budget deficit, stabilise debt and begin to rebuild fiscal space'.

Therefore, the inflation adjustment is endogenous while the net effect of ZAR9.420 billion is exogenous (deficit-driven). The government hoped to raise ZAR16.8 billion (before fiscal drag) in revenue, making the ZAR9.420 billion revenue from increases in marginal tax rates a significant contributor. The tax change is deemed to have come into operation on 1 March 2015 and applied in respect of years of assessment commencing on or after that date. The tax relief is transitory, whereas the increase in the top marginal tax bracket is permanent.

Example 2: Employment tax incentive

[Employment Tax Incentive Act, 2013—Act No. 26 of 2013]

Assented: 17 December 2013

Shock period: 2014Q1

Shock type: PIT (exogenous—long-run)

Size: ZAR500 million (-)

This new policy aimed to increase youth employment through a cost-sharing mechanism between the employer and government. The Explanatory Memorandum on the Employment Tax Incentive (ETI) bill, which was later enacted, stated that: '[it] gives effect to the announcement by the President in his 2010 SONA, as well as in the 2010 Budget, that government will table proposals to subsidise the cost of hiring younger workers. The draft bill also gives effect to the 2013 Budget'.

The issue of high youth unemployment was a key focus for government in the run-up to the ETI. The 2012 MTBPS highlighted accelerating youth employment as a key area to broaden participation in economic recovery. In the February 2013 SONA, the President announced that National Economic Development and Labour Council (NEDLAC) constituencies would be signing a Youth Employment Accord. One of the commitments of this Accord was to engage with the private sector to expand youth employment with targeted support and incentives. The incentive was structured in a way that it would benefit those who earned less than the PIT threshold: '...Targeting those earning below the personal income tax threshold means that the incentive effectively targets the most vulnerable'. The economic significance of this incentive was that it was implemented to address partly the labour market dynamics and encourage the private sector to employ inexperienced youth: 'In South Africa's labour market, the current lack of skills and experience as well as perceptions regarding the restrictiveness of labour regulations, make some prospective employers reluctant to hire youth who may lack experience or qualifications. Given that the private sector contributes about 82 per cent of GDP, and employs over 70 per cent of those in formal employment outside of agriculture, it is critical that in order to have the biggest impact, this involves the private sector. The incentive seeks to do exactly this'.

The government was clear that the incentive would be temporary and its effectiveness would be evaluated after two years: 'The incentive is meant as a temporary programme to stimulate demand for young workers, and this incentive cannot possibly address all structural issues in the youth labour market. The

first phase of the incentive is intended to be simple and easy to implement using existing tax administration platforms. The National Treasury and South African Revenue Service (SARS) will monitor the incentive closely to evaluate the impact. After a review of the effectiveness and impact of the incentive after two years, the second phase can include additional policy features and possible refinement'. Therefore, this policy is transitory.

Despite the shortness of the incentive, its aim was to address the lack of skills impeding long-term economic growth: 'High youth unemployment means young people are not gaining the skills or experience needed to drive the economy forward. This lack of skills can easily become a lifelong experience, thereby having long-term adverse effects on the economy'. Therefore, this tax policy is a long-run driven exogenous policy. The tax expenditure for the 2013–14 fiscal year was ZAR500 million.

4 Methodology

Following Mertens and Ravn (2013), we construct a narrative shock for PIT as the expected tax change in personal income tax revenue normalized by its tax base:

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

where Δ is the change. Personal taxable income is proxied by non-agricultural sector wages. An alternative measure is scaled by the previous period gross domestic income, which is similar to Romer and Romer (2010) and Devries et al. (2011).

The above narrative measure is a proxy or instrument for the latent shock of the APITR, which is calculated as:

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

where i can represent current tax base ($i = 0$), one-quarter lag ($i = 1$), or four-quarter lag ($i = 4$).

We now look at the exogenous tax shocks identified in this paper. These are shown in Figure 2 alongside the APITR. The top panel of the figure plots the two variables against South Africa recession dates from St Louis FRED, whereas the bottom panel plots them against the South African Reserve Bank (SARB) expansion dates. The changes in personal income taxes can be summarized in three episodes over the sample. The first episode is in the second half of the 1990s after the installation of a new government in 1994 under the new democratic regime. These changes formed part of the government's tax reforms and are mainly classified as philosophical under the Romer and Romer classifications because they were aimed at making the tax system progressive and equitable.

The second episode in the early 2000s follows from the successful tax reforms and the increase in tax revenue that followed in those years. During this period, the government felt that the beneficiaries of increased tax revenue should be households because this tax source contributed more to total tax revenue. On the backdrop of increasing revenue and economic growth and optimism for the country, the government wanted to raise the potential growth of the economy. The top panel of the figure indicates that tax changes between 2001 and 2003 coincide with recession dates. The bottom panel, however, paints a slightly different narrative during the 2001–03 period. Tax cuts in the 2000s until the global crisis coincided with the SARB expansion dates and thus suggest that tax policy was pro-cyclical. Therefore, the tax cuts and marginal tax rate reductions in the early 2000s are classified as long-run under the Romer and Romer classifications. This means the first two periods are classified under the long-run Romer and Romer category—tax changes not motivated by counteracting any shock to the economy or reducing

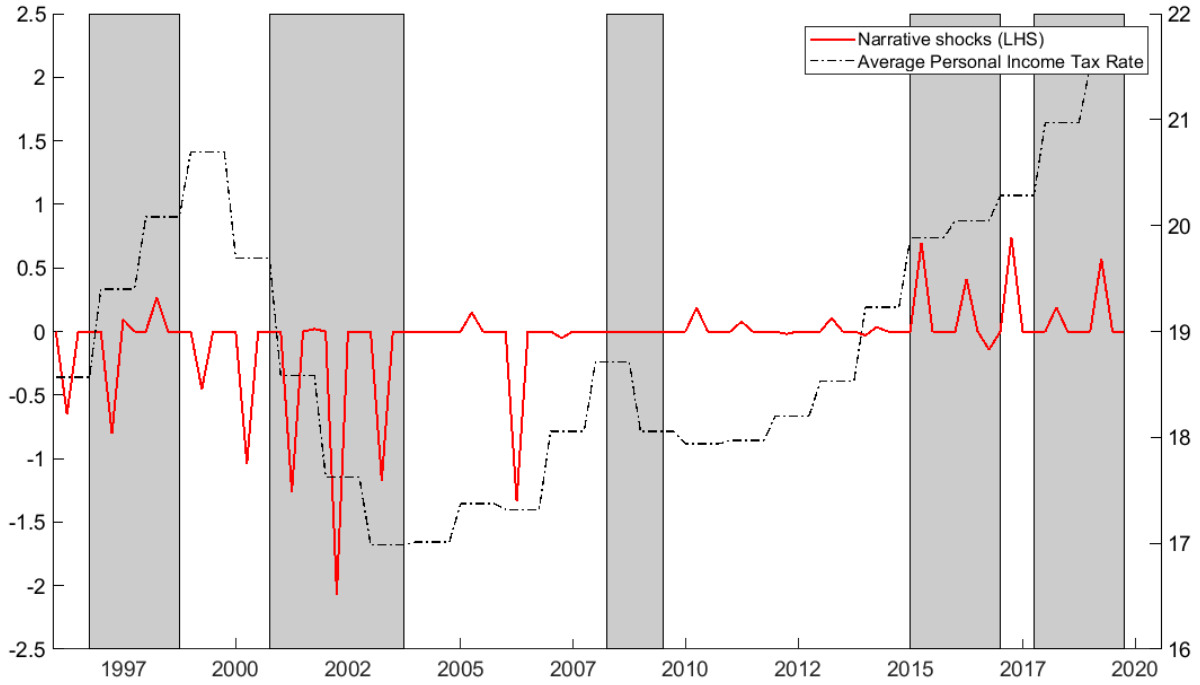
the budget deficit. During these two episodes, the average tax rate declined before increasing around 2005.

The last episode is in contrast to the first two expansionary episodes. This episode consists of contractionary fiscal policy changes during the second half of the 2010s. In this episode, which also coincides with both the recession and contraction dates, the government was concerned about the increasing budget deficit following the cumulative increase in debt that started in 2008. In his study into the role of macroeconomic fundamentals to increasing yield spread between the South African and US long-term rates, Fedderke (2021) found that the increase in public debt from 25 per cent to 60 per cent of GDP contributed 280 basis points to the yield spread. This is a significant portion of the total 368 basis point increase from all macroeconomic factors, which in addition to public debt included an increase in inflation, declining potential growth, and rand-dollar depreciation. Against this backdrop of increasing public debt, low tax revenue, and declining potential growth, the government instituted a pro-cyclical fiscal consolidation plan that included tax increases through fiscal drag, an increase in marginal tax rates, and an introduction of a new top bracket. Under Romer and Romer classifications, these changes are deficit-driven tax changes.

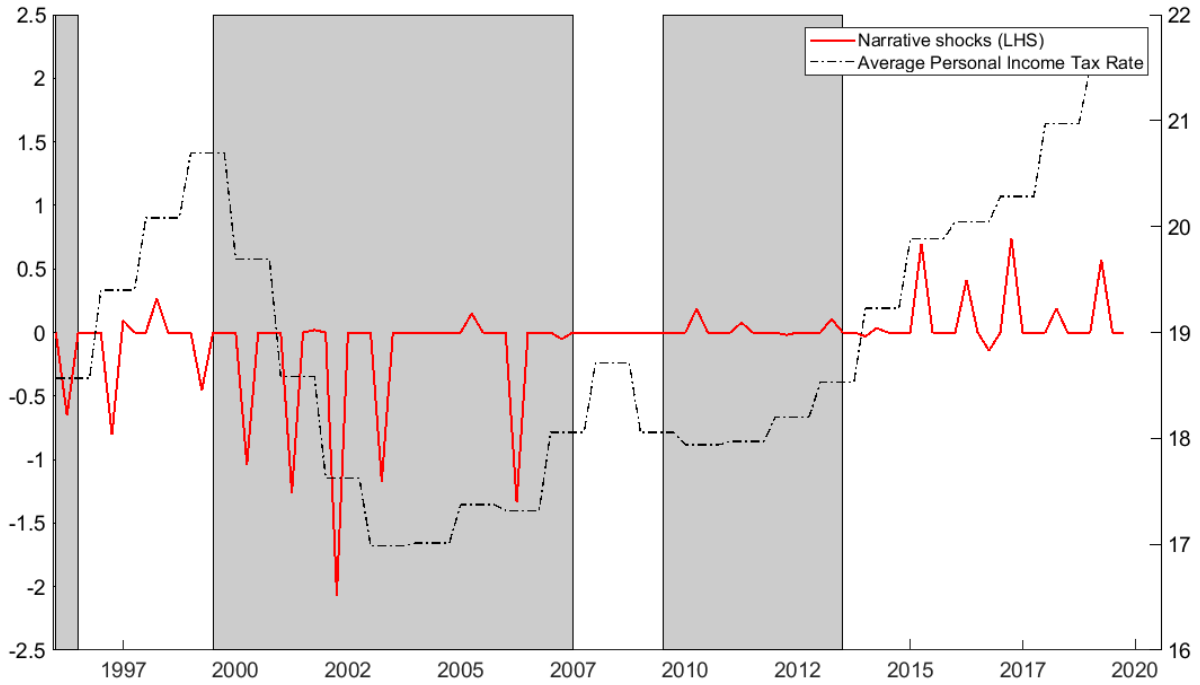
Overall, the graphical analysis indicates that fiscal policy was very active. Next, we look at the macroeconomic effects of this fiscal activism. Before we proceed with the proxySVAR analysis, we check whether the other variables in the model do not Granger cause our narrative shock. The test is performed on stationary data and indicate that only government spending Granger causes the narrative shock for personal income taxes at a 10 per cent level. However, when we use government spending as a percentage of GDP, the null hypothesis of causality is rejected.

Figure 2: Narrative shocks vs APITR—% of wages

(a) Including SA recession dates



(b) Including SARB expansion dates



Note: this figure shows all documented and legislated exogenous personal income tax (PIT) shocks. The shaded areas indicate either the SA recession dates or the SARB expansion dates. The shocks are not demeaned.

Source: authors' own calculations.

4.1 The proxySVAR model

The structural VAR framework assumes the following structure for n endogenous variables:

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

where A is an $n \times n$ impact matrix, Y_t is a vector of endogenous variables, A_0 is a matrix of intercepts, A_i is the lagged coefficient matrix for lags i until p, and ε_t' is an $n \times 1$ vector of structural shocks. To be invertible, the A must be nonsingular whereas the structural shocks are $E[\varepsilon_t] = 0$ and $E[\varepsilon_t \varepsilon_s'] = I$ for $t = s$ and zero otherwise. The reduced form is then written as follows:

$$Y_t = B_0 + \sum_{i=1}^{p} B_i Y_{t-i} + \mu_t \tag{2}$$

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

$$\mu_t = A^{-1}\varepsilon_t \tag{3}$$

where μ_t is the reduced form residuals with $E[\mu_t \mu_t'] = BB'$. The SVAR literature recovers the structural shocks in equation 3 by imposing $n(n-1)$ identifying restrictions on the impulse matrix B. Instead of imposing these identifying restrictions, the proxySVAR literature proposes using the narrative measures to recover the structural shocks. We provide a brief explanation of the methodology as discussed in Mertens and Ravn (2013, 2014). With the first variable in Y_t being APITR, the first row b_1' $(n \times 1)$ of the impulse matrix B together with the structural shocks ε_t' $(n \times 1)$ and reduced form residuals μ_t' $(n \times 1)$ can be partitioned as follows:

$$\begin{aligned} b_1 &= [b_{11} b_{21}']' \\ \varepsilon_t &= [\varepsilon_{1,t} \varepsilon_{2,t}']' \\ \mu_t &= [\mu_{1,t} \mu_{2,t}']' \end{aligned} \tag{4}$$

where b_{11} (1×1) is the tax shock of interest and b_{21}' $((n-1) \times 1)$ is the coefficient corresponding to the response of other variables to the shock of interest. $\varepsilon_{1,t}$ and $\mu_{1,t}$ are both 1×1 and correspond to the structural shock and reduced form residual for APITR, whereas $\varepsilon_{2,t}$ and $\mu_{2,t}$ are of dimension $(n-1) \times 1$ and correspond to other structural shocks and residuals, respectively. As already discussed in Section 2, the two conditions for the identified narrative measure to qualify as an instrument for the unobserved structural shocks are instrument relevance and exogeneity. The former condition requires that the narrative measure and structural shock be contemporaneously correlated:

$$E_t[Z_t \varepsilon_{1,t}] = \Phi \neq 0 \tag{5}$$

where Z_t is the narrative measure with $E[Z_t] = 0$. The exogeneity condition requires that the narrative measure should be orthogonal to other structural shocks included to the model—that is, be contemporaneously uncorrelated with other structural shocks.

$$E_t[Z_t \varepsilon_{2,t}] = 0 \tag{6}$$

where $\varepsilon_{i,t}$ captures other exogenous structural shocks. According to Mertens and Ravn (2013), these two conditions are similar to the instrument validity condition and are the key identifying restrictions for the impact matrix B. By partitioning the first row b_1 of the impulse matrix B in equation 4, the authors show that conditions 5 and 6 yield additional identifying restrictions for the tax policy coefficient as:

$$b_{21} = (\Sigma_{z\mu_1}^{-1} \Sigma_{z\mu_2'})' b_{11} \tag{7}$$

The three-step process, as discussed in Mertens and Ravn (2013), is then as follows:

- estimate the reduced-form VAR model in equation 2 by using ordinary least squares to get the reduced-form residuals;
- regress the VAR residuals on the narrative measure to get the covariance matrix;
- impose restriction in equation 7 to uncover the responses of other variables to the narrative shock.

The final stage can also include additional restrictions. As we will shortly discuss, in addition to the restriction in equation 7, we only apply the Cholesky decomposition. The authors indicate that estimation of $\Sigma_{z\mu_1}^{-1} \Sigma_{z\mu_2'}$ is akin to the two-stage least estimator of regression of $\mu_{2,t}$ on $\mu_{1,t}$ using the narrative measure Z_t as an instrument.

As in the instrumental variable regression, it is important to evaluate the relevance of an instrument. To do so, Mertens and Ravn (2013, 2014) develop a reliability statistic. Unlike in the traditional narrative literature where the narrative measure is assumed to have perfect correlation with the unobservable structural shock, in this case such a strong assumption is not made. However, the narrative measure has to have some positive correlation with the latent structural shock—that is, contain some information about the structural shock. This measure seeks to uncover how much of that information is relevant for identifying the structural shock. In the case of a single proxy, as in our case, the statistic measures the squared correlation between the narrative measure and the latent structural shock. The statistic lies between zero and one with higher values indicating that the narrative contains useful information. We use this statistic in our analysis. The statistic is reported together with its 95 per cent confidence intervals.

Using this procedure, we run a five-variable proxySVAR model with lag of 2.[9] The ordering of the variables is as follows: Y_t =[APITR, GOVSPENDING, RGDP, PRIVINV, GOVDEBT], where APITR is the average personal income tax rate, GOVSPENDING is the log of real government spending, RGDP is the log of real gross domestic product, PRIVINV is the log of private investment, and GOVDEBT is the log of real government debt. Further details on the data are presented in Appendix A2. Barro and Redlick (2011) discuss dealing with two identification problems that arise when estimating the contemporaneous effect of taxes on GDP. The first is that current tax rates can also be endogenous to current GDP. The second is that legislated tax changes can be in response to GDP—the spending-driven tax changes in Romer and Romer (2009). The authors argue that computing average tax rates that are weighted by $t-1$ incomes, where in their case t is 1 year, eliminate the endogeneity of tax rates to income—that is, higher income in time t shifts taxpayers into higher tax rates in time t. Following the authors, we also use the average tax rates normalized by $t-1$ tax bases. In addition, the use of the

[9] The choice for using two lags is for parsimony given the shortness of the sample. Similar results are also obtained with lags 3 and 4.

narratively identified exogenous tax policy shocks deals with the second endogeneity problem discussed by Barro and Redlick (2011). We also order the average tax rates first to ensure that they respond with a lag to GDP. The assumption that taxes respond with a lag to GDP is consistent with Blanchard and Perotti (2002). The authors argue that it takes more than a quarter for the government to learn about a GDP shock and respond to it because of legislation and implementation lags. Lastly, we follow Mertens and Ravn (2013) and demean the shocks. The shocks are demeaned by subtracting the mean of the non-zero elements of the shocks. Our a priori expectation of tax shocks is that a reduction in tax rates should be expansionary in line with the Keynesian view, especially for the earlier years. We expect consumption to increase, resulting in an overall increase in output.

5 Results—proxySVAR

5.1 Benchmark results

We start the results by looking at the effects of all the documented 25 exogenous personal income taxes. The impulse responses are presented in Figures 3 and 4. Figure 3 shows percentage responses of government spending, output, private investment, and government debt to a 1 per cent point reduction in the APITR. In Figure 4 the last two variables are replaced by personal income revenue and durable consumption and unemployment and non-durable consumption, respectively. Since the significance of the benchmark results is sensitive to the lag length selection, we include impulses for lag length 3 and one for Figures 3 and 4, respectively, in addition to lag length 2. Impulse responses for using two lags are presented in blue with the 95 per cent confidence intervals in dashed blue lines. The shaded areas show the 95 per cent confidence intervals for using alternative lags.

Figures 3 and 4 indicate that irrespective of the lag length, the impulses are qualitatively the same and mainly exhibit the Keynesian effect of fiscal policy. A reduction in personal income taxes increases both durable and non-durable consumption of goods. Private investment declines on impact before increasing. Overall, the results indicate that personal income tax cuts have a positive effect on economic activity as output increases while unemployment declines. However, these results are mainly significant at the 95 per cent level when we use lag 3 in Figure 3 and lag 1 in Figure 4. [10] Using these lag lengths, we find that tax cuts have a peak effect of 0.98 per cent on output 11 quarters after the shock. This translates into a tax multiplier of 1.06.[11] This finding is consistent with Kemp (2020) who also finds maximum tax multipliers (non-accumulated), albeit smaller than 1, in quarter 10 or 12 depending on the SVAR used. Unemployment also falls by just over 1 percentage point. Personal income tax revenue declines during the first year of the shock before increasing, suggesting that this tax policy is not tax revenue neutral in the short run. Government spending increases, and the increase is significant at the 95 per cent level for at least 15 quarters. The increase in government debt suggests that the government finances the tax shortfall through debt.

Table 1 shows the reliability statistic of the narrative measure. For ease of comparison to other results, we only show for results using two lags. The value for Figure 3 is 0.44 with 95 per cent confidence intervals of [0.22, 0.55], whereas the values for Figure 4 are 0.44 and 0.35 with confidence intervals of [0.24, 0.58] and [0.17, 0.46], respectively. Values close to zero in the intervals indicate that the information in the narrative measure for all the shocks is not that useful for identifying the latent structural shocks. Table 2 shows the regression of ε_t on Z_t for the investment and debt equation. We can see from the table

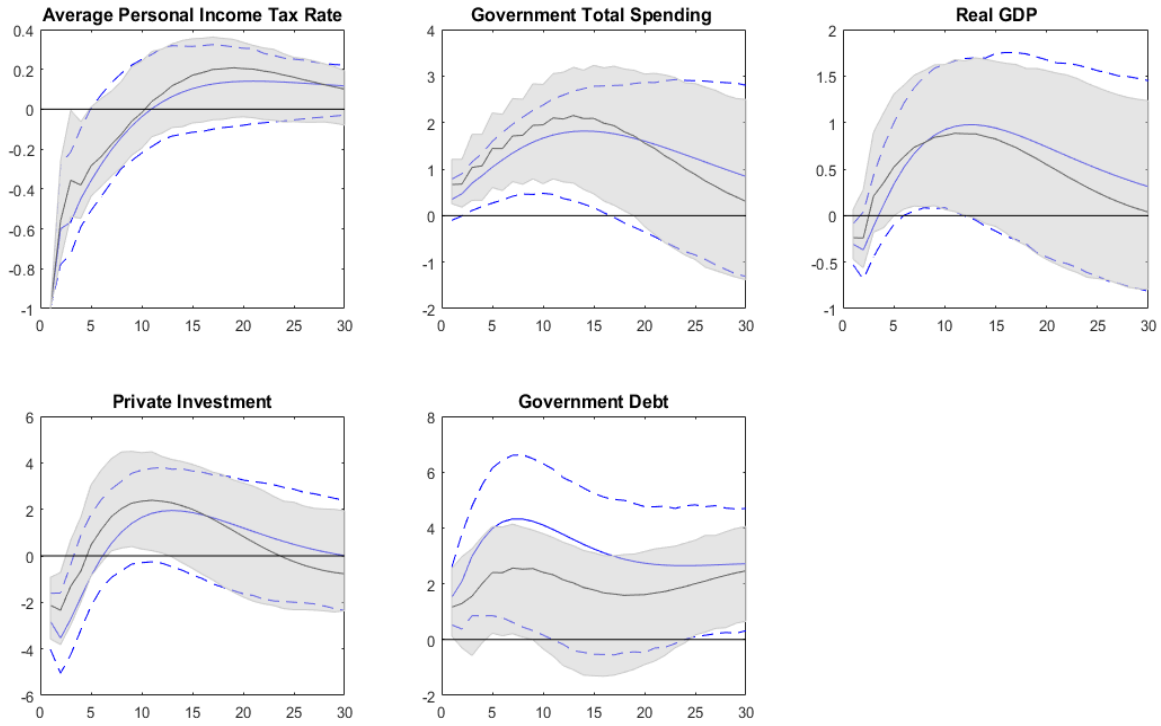
[10] Full results for Figure 4 are shown in Figure A1 in Appendix A3.

[11] To convert elasticities to multipliers, Mertens and Ravn (2013) rescale the impulses by normalizing the implied drop in tax revenue with 1 per cent of GDP. We also follow this method to estimate the multipliers.

that there is a positive relationship between the two variables as we expected. For the benchmark results, the R^2 indicates that the narrative measure explains around 26 per cent of the variation in the structural shocks.

Next, we look at the results when we include monetary policy variables. The efficacy of fiscal policy depends on, amongst other things, monetary policy. If the monetary authorities react to the expansionary fiscal policy by leaning against the wind, then the fiscal multipliers will be reduced. However, the response of inflation would depend on the dominance of the supply-side or demand-side effects. If positive supply-side effects are dominant, we might not observe an increase in inflation. Again, we run the five-variable proxySVAR replacing the last two variables with inflation and short-term interest rate. The results are presented in Figure 5. The results indicate that a personal income tax cut is disinflationary, but this effect is not significant. Even though inflation is not significant, the resultant interest rate decrease within the first four quarters is significant. The results are not affected by the ordering of interest rate and inflation—the interest rate remains significant when it is ordered before inflation. This model specification produces the lowest reliability statistic.

Figure 3: Investment and debt: full sample

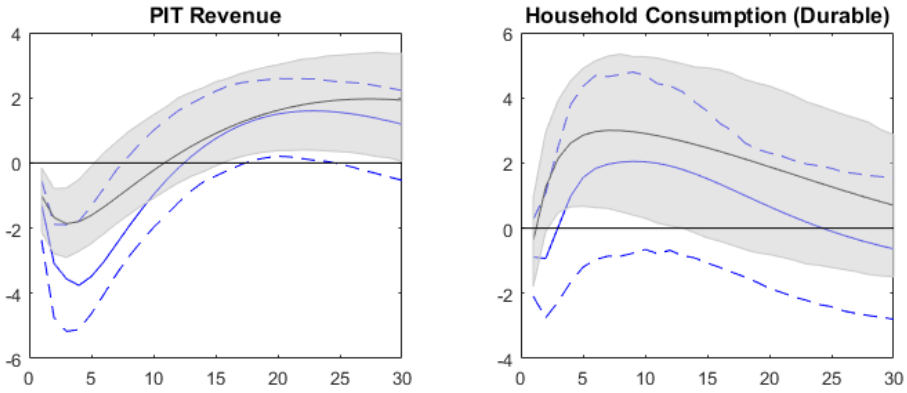


Note: response to a 1 per cent point reduction in the APITR. The impulse responses show the estimations and the 95 per cent confidence intervals. The shocks are demeaned. The horizontal axis represents the period in quarters. The response for APITR is in percentage points whereas other variables are in percentages.

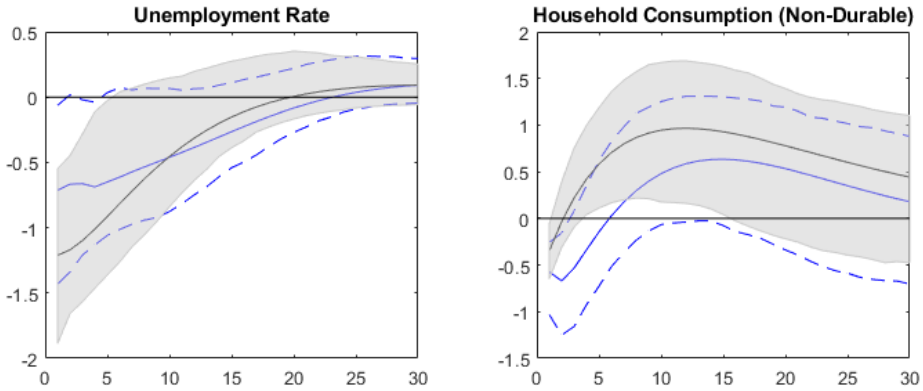
Source: authors' own calculations.

Figure 4: Revenue, consumption, and unemployment: full sample

(a) Personal tax revenue and consumption (durable)



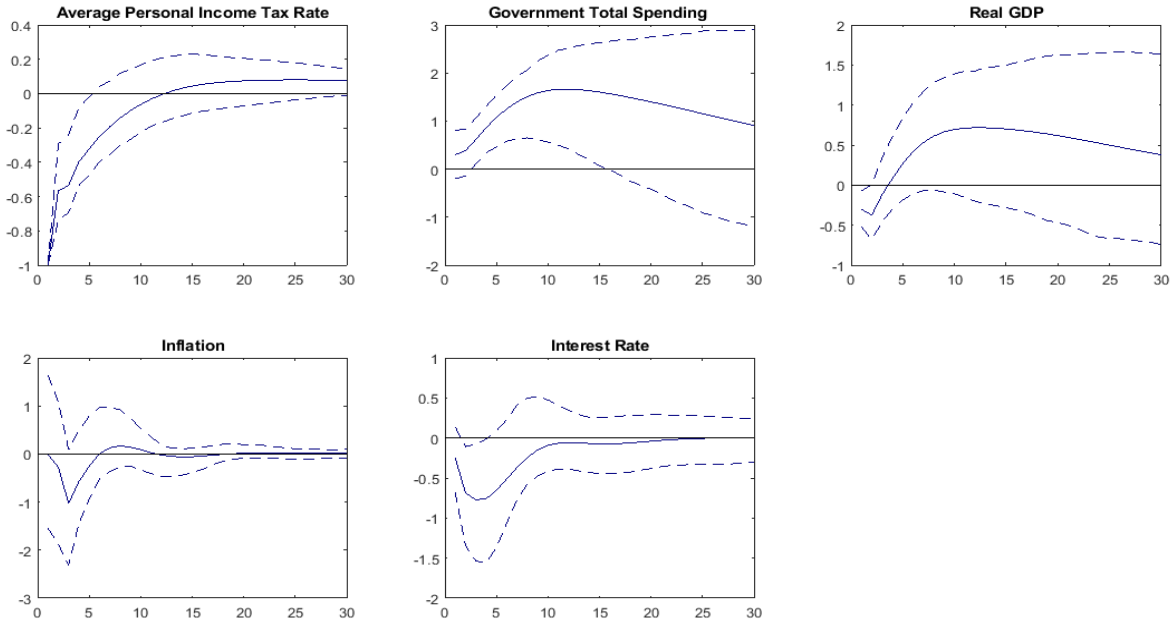
(b) Unemployment and consumption (non-durable)



Note: response to a 1 per cent point reduction in the APITR. The impulse responses show the estimations and the 95 per cent confidence intervals. The shocks are demeaned. The horizontal axis represents the period in quarters. The response for unemployment is in percentage points whereas other variables are in percentages.

Source: authors' own calculations.

Figure 5: Monetary policy variable: full sample



Note: response to a 1 per cent point reduction in the APITR. The impulse responses show the estimations and the 95 per cent confidence intervals. The shocks are demeaned. The horizontal axis represents the period in quarters. The responses for inflation and interest rate are in percentage points whereas other variables are in percentages.

Source: authors' own calculations.

5.2 Permanent tax shocks

In the previous subsection we looked at the effects of all the exogenous tax changes. Now we explore whether other characteristics of the tax changes matter. Mertens and Ravn (2013) only looked at the effects of unanticipated tax changes—changes implemented within three months after being legislated. In our case, most tax changes were effective retroactively. Therefore, we are not able to discriminate tax changes along this dimension. Another important characteristic is whether the tax change is temporary or permanent. Because our sample contains a fair number of both temporary and permanent tax changes, we are able to proceed in this direction.

Changes in tax rates provide a good proxy of permanent tax changes because they are effective for an unspecified period of time. A graphical analysis of the shocks is presented in Figure 6. From the figure we can see that the marginal income tax rates for personal income tax rates were changed six times. Interestingly, while some of the expansionary tax changes are classified as exogenous, they also coincide with the South African recession periods. Again, the motivation for these tax changes was to ensure that individuals benefited from the tax reforms because they are the highest contributor to the national tax revenue. Towards the end of the sample, we see tax increases despite the economy being in recession. These pro-cyclical tax rate changes were deficit-driven to narrow the widening budget deficit. It is evident from the figure that changes in personal income marginal tax rates are the largest and most frequently used tax policy of the four.

Figure 6: Permanent tax shocks (% of GDP)

Note: permanent tax shocks for personal income tax (PIT), corporate income tax (CIT), capital gains tax (CGT), and value-added tax (VAT). All shocks are normalized by gross domestic product. SA recession dates are from St Louis FRED. The shocks are not demeaned.

Source: authors' own calculations.

Figures 7 and 8 show the impulse responses to changes in marginal tax rates as a proxy for permanent personal income tax shocks. Unlike in other sections, we do not demean the shocks. Because the shocks are few, demeaning them makes small shocks appear big and big shocks small. In addition, we also find that the results for demeaned shocks are insignificant.

The impulse responses in Figures 7 and 8 indicate that focusing only on permanent shocks improves the significance of our results. As in the benchmark results, a reduction in the average tax rate is expansionary. However, the results indicate that permanent shocks have a more significant macroeconomic effect irrespective of the lag length. Unlike in the benchmark results, the increase in both output and investment are significant at the 95 per cent level when we use two lags. [12] In addition, the effect on output is even higher. In our benchmark results, the increase in output peaked at 0.98 per cent three years after the shock, even though this peak was not significant. When we only look at permanent shocks, we find that output peaks at 1.87 per cent. The impulse response indicates that the effect on investment is even higher than when we look at all the tax shocks. Unlike in the benchmark results where the response is insignificant when we use two lags, we now find that investment increases to around 3.47 per cent. The response is even higher when we use three lags—around 5 per cent.

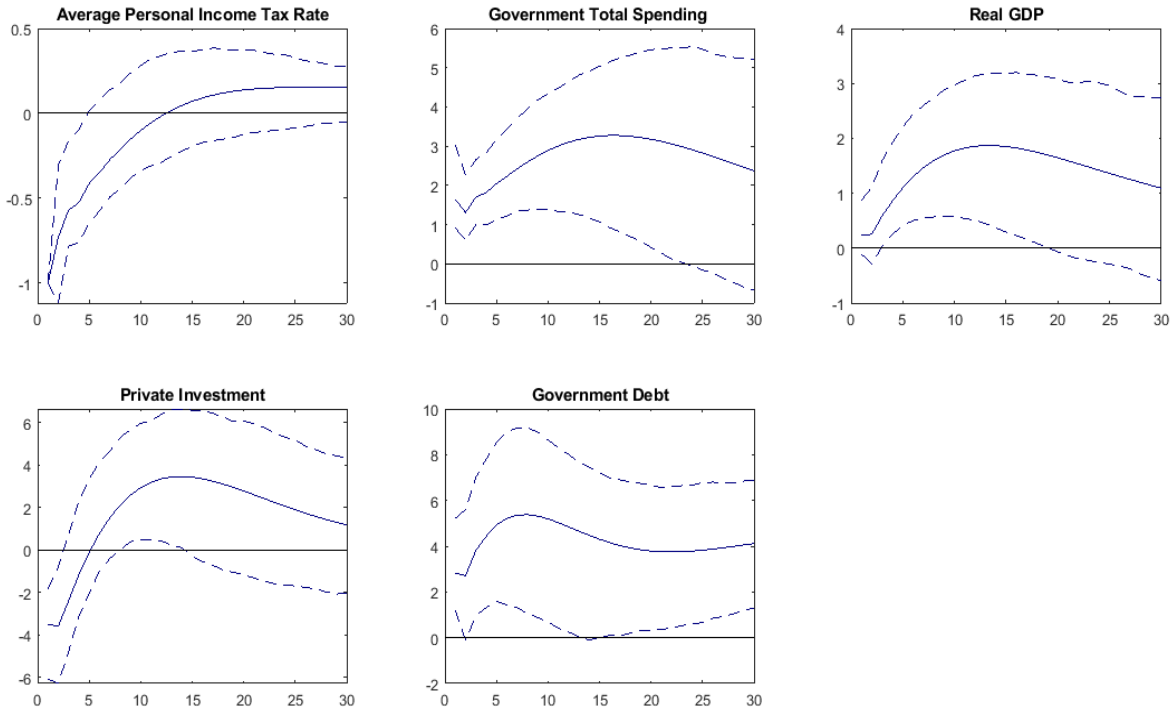
The results for consumption and unemployment are also significant when using two lags. Figure 8 indicates that permanent reductions in APITR reduces unemployment by about 2 percentage points. The effect is only short term as unemployment starts to return to its pre-shock level within two years. For consumption, the results suggest that a permanent tax cut has a positive effect on consumption with the effect on durable goods being in the short term, whereas for non-durable goods the effect is in the long term. The effect on durable goods is also higher than it is on non-durable goods consistent with

[12] As in the benchmark results, investment is also better estimated when we use three lags. See Figure A2 in Appendix A3.

the results by Mertens and Ravn (2013), though in their results the impulse response for non-durable consumption is not significant.

Lastly, the results for government spending and debt are similar to the benchmark results, though slightly higher. The reliability statistics in Table 1 show that when we only focus on permanent tax changes the statistics significantly improve. For Figure 7, the statistics increase from 0.44 to 0.68. Similarly, the statistics for other results also improve. Table 2 shows that, despite the improvement in the reliability statistic, the R^2 for permanent shocks is smaller (0.13) than for the benchmark results (0.26). The results are not surprising as the confidence bands for the reliability statistics still contain numbers close to zero, as in the benchmark specification. Nonetheless, the two measures indicate that there is a positive correlation between our narrative measure and the latent structural shocks.

Figure 7: Investment and debt: permanent shocks

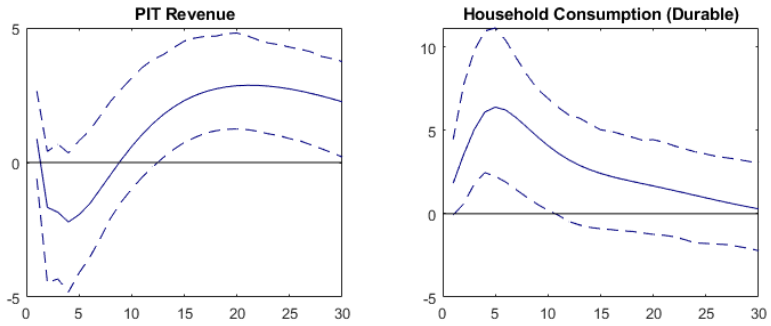


Note: response to a 1 per cent point reduction in the APITR. The impulse responses show the estimations and the 95 per cent confidence intervals. The shocks are not demeaned. The horizontal axis represents the period in quarters. The response for APITR is in percentage points whereas other variables are in percentages.

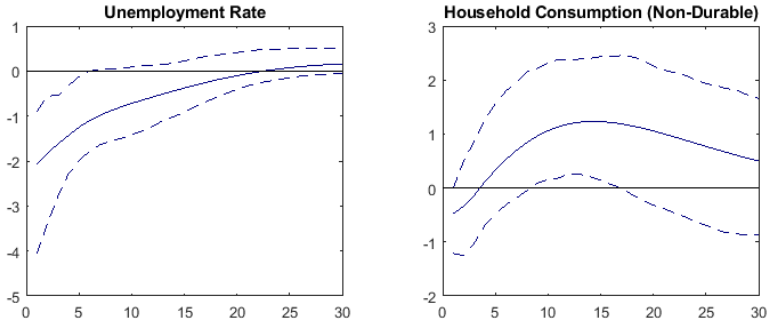
Source: authors' own calculations.

Figure 8: Revenue, consumption, and unemployment: permanent shocks

(a) Personal tax revenue and consumption (durable)



(b) Unemployment and consumption (non-durable)



Note: response to a 1 per cent point reduction in the APITR. The impulse responses show the estimations and the 95 per cent confidence intervals. The shocks are demeaned. The horizontal axis represents the period in quarters. The response for unemployment is in percentage points whereas other variables are in percentages.

Source: authors' own calculations.

Table 1: Diagnostic statistics

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

Note: the 95 per cent confidence bands are reported in square brackets.

Source: authors' own calculations.

Table 2: 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

Source: authors' own calculations.

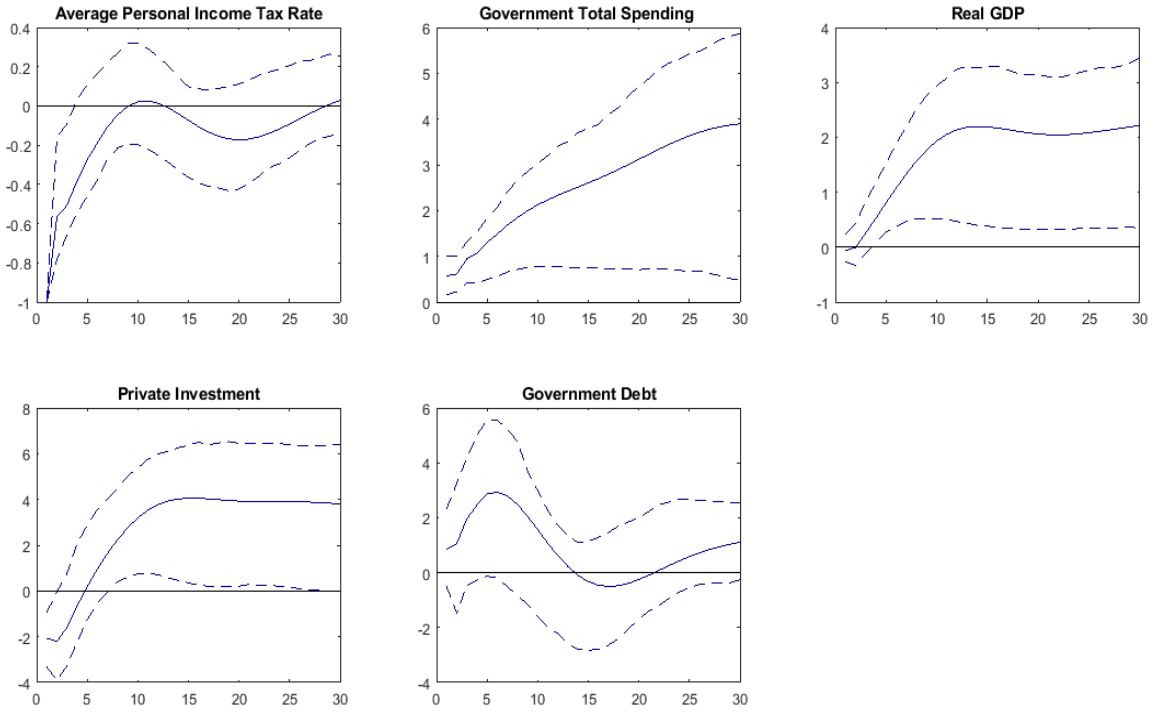
5.3 Fiscal policy from 1996Q1 to 2010Q4

Fiscal policy post the 2008–09 global financial crisis has come under heavy criticism with tax increases. Research by van Rensburg et al. (2021) indicates that fiscal multipliers have been decreasing after 2010. In addition, the authors argue that the increase in taxes over the last few years has contributed negatively to the growth of the economy. These sentiments are also echoed in Soobyah and Steenkamp (2020), Loate et al. (2021), and Loewald et al. (2019). In light of this change in the efficacy of fiscal policy, it is appropriate to look at the two sample periods. Because our sample size is too short to analyse the before and after 2011, we only look at the longer sub-sample, which is 1996Q1–2010Q4. If fiscal multipliers were decreasing after 2010, we would expect a bigger if not significant (significant relative to the benchmark specification with two lags) effect of the tax shocks for the pre-2011 period. The results

are presented in Figures 9 and 10. Again, Figure 10 only shows the response of personal tax revenue, durable and non-durable consumption, and unemployment from the full results.

Unlike in the benchmark results, we can see that the macroeconomic effects are significant, with exception to unemployment. The increase in private investment is significant and persistent. The effects on both durable and non-durable consumption are only in the short term. This suggests that the persistent effect of the tax cut on output is driven by private investment and not consumption. One possible interpretation of these results is that fiscal policy was more effective during this period than in the latter periods. Lastly, the effect on government debt is not insignificant. This is not surprising because, during this period, the government enjoyed higher than expected revenue, which allowed it to cut taxes while also increasing spending. The R^2 reported in Table 2 for the private investment and debt equation is 0.47, which is higher than for the benchmark specification. The improvement in the R^2 is also supported by confidence bands of the reliability statistic. Unlike in the previous two estimations, we do not have numbers close to zero.

Figure 9: Investment and debt: 1996Q1 to 2010Q4

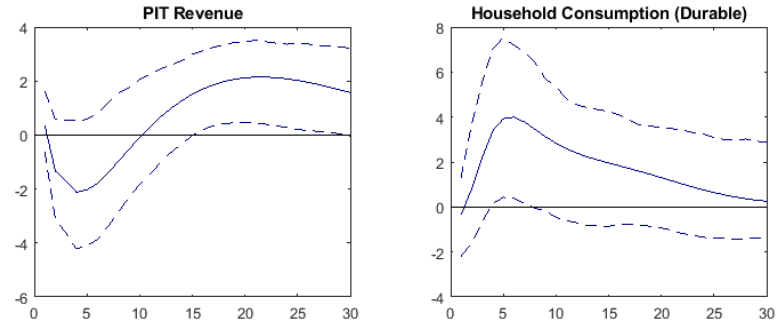


Note: response to a 1 per cent point reduction in the APITR. The impulse responses show the estimations and the 95 per cent confidence intervals. The shocks are demeaned.

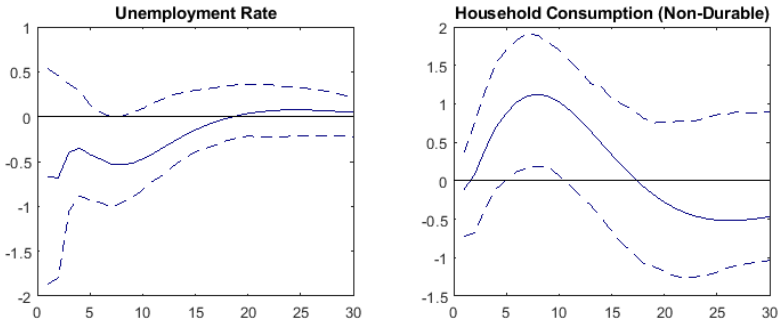
Source: authors' own calculations.

Figure 10: Response to a tax cut: 1996Q1 to 2010Q4

(a) Personal tax revenue and consumption (durable)



(b) Unemployment and consumption (non-durable)



Note: response to a 1 per cent point reduction in the APITR. The impulse responses show the estimations and the 95 per cent confidence intervals. The shocks are demeaned.

Source: authors' own calculations.

6 Robustness checks

The main concern with our results is the correlation of tax changes and government spending. If the government increased spending and reduced taxes at the same time, then we would need to ensure that the identified effect captures tax shocks. As indicated in Blanchard and Perotti (2002), there is no definitive way of knowing if changes in taxes are because of their response to government spending. Even though our constructed measure for exogenous tax changes exclude government-spending-driven changes, this measure might still be correlated to government spending. To deal with this, Blanchard and Perotti (2002) present results under two alternatives. The first alternative is to assume that the contemporaneous response of taxes to government spending is zero by ordering taxes first. This is in line with our benchmark specification. The second alternative is to assume that the response is not zero by ordering taxes after government spending. The results for this second alternative are presented in Figure A3 in Appendix A3. As we can see, the results remain the same. Therefore, the benchmark results are robust to the ordering between taxes and government spending.

Next, we look at whether the results are sensitive to different measures of government debt and spending. We replace the government spending (total national government expenditure) with government expenditure adjusted for cash flows (per cent of GDP) and government debt (gross loan debt) with domestic debt in the benchmark results. The results are presented in Figure A4 in Appendix A3. The results indicate that, while the response of GDP is the same as in the benchmark results, the increase in private investment becomes significant. Though not significant, the alternative measure of government spend-

ing declines while domestic debt increases. We also looked at the effect of using the narrative measure scaled by the previous period GDP on the benchmark results. The results are exactly the same.

7 Concluding remarks

This paper analyses the macroeconomic effect of legislated personal income tax changes in South Africa over the 1996–2019 period. The paper seeks to contribute to the current literature in three ways. First, we construct a new narrative measure that can be used as a proxy for structural personal income tax shocks for South Africa. Second, we contribute to the empirical literature of fiscal multipliers using a different data set and identification strategy. Last, we look at the macroeconomic effects of personal income taxes. For the first contribution, we analysed 66 personal income tax changes. Of the 66 analysed tax changes, 35 are classified as endogenous and 31 as exogenous. After aggregation, we end up with 47 personal income tax shocks—25 exogenous and 22 endogenous. The 25 exogenous tax shocks form part of our analysis.

Using this new measure in a proxySVAR model, we find that changes in average personal income tax rates have macroeconomic effects. Tax cuts increase output. The results show that both the investment and consumption channels contribute to the output response. The decline in tax revenue in the first year suggests that personal income tax cuts are not self-financed in their year of implementation. The impulse responses indicate that focusing only on permanent shocks improves the significance of our results. As in the benchmark results, a reduction in the average tax rate is expansionary. However, the results indicate that permanent shocks have a more significant macroeconomic effect irrespective of the lag length. In addition, the effects on output and investment are even higher.

Last, we look at fiscal policy during 1996 and 2010. Unlike in the benchmark results, we can see that the macroeconomic effects are significant, with an exception for unemployment. The increase in private investment is significant and persistent. The effects on both durable and non-durable consumption are only in the short term. This suggests that the persistent effect of the tax cut on output is driven by private investment and not consumption. One possible interpretation of these results is that fiscal policy was more effective during this period than in the latter periods.

An evaluation of our narrative measure indicates that there is a positive relationship between the measure and the latent structural shocks. We also find that when we look at the shorter sample size, the correlation between the two improves with R^2 increasing from 0.26 to 0.47.

Our study is not without limitations. The obvious limitation of our study is that by using a linear model, we assume that fiscal multipliers have remained constant during the sample period. We also do not look at the effects of corporate income taxes, which might have a different effect than personal income taxes. We reserve the study of corporate income taxes for future research.

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Appendix

A1 Main documents used for the analysis

National Treasury (2013). *Employment Tax Incentive Act 26 of 2013 for South Africa*. Pretoria: National Treasury, Republic of South Africa.

National Treasury (various years). *Budget Reviews and Speeches of South Africa for Various Years*. Pretoria: National Treasury, Republic of South Africa.

National Treasury (various years). *Explanatory Memorandums on the Employment Tax Incentive Act 26 of 2013 for South Africa for Various Years*. Pretoria: National Treasury and South African Revenue Services.

National Treasury (various years). *Explanatory Memorandums on the Taxation Laws Amendment Acts or Bills and Revenue Laws Amendment Acts or Bills for South Africa for Various Years*. National Treasury and South African Revenue Services.

National Treasury (various years). *Medium Term Budget Policy Statement (MTBPS) for South Africa for Various Years*. Pretoria: National Treasury, Republic of South Africa.

National Treasury (various years). *Rates and Monetary Amounts and Amendment of Revenue Laws Acts or Bills for South Africa for Various Years*. Pretoria: National Treasury, South African government, and South African Revenue Services.

National Treasury (various years). *Taxation Laws Amendment Acts or Bills and Revenue Laws Amendment Acts or Bills for South Africa for Various Years*. Pretoria: National Treasury, South African government, and South African Revenue Services.

A2 Data

Table A1 gives information about the data used. All nominal variables were deflated by the consumer price index (re-indexed to 2010Q1).

Table A1: Data description and transformation

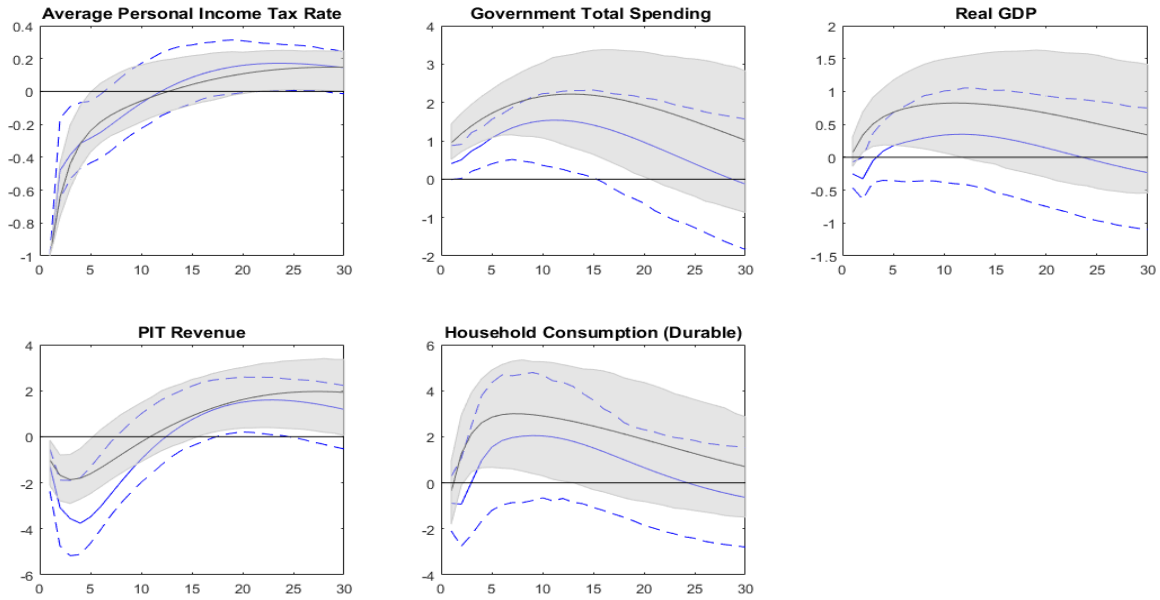
Series name	Description	Code	Source	Transformation
PIT Base	Wage bill; total (formal non-agricultural sector); nat. accounts; current income and savings of households and non-profit institutions serving households; selected items, SA annualized rates - ZAR millions	NA	NT/SARB	Deflated & Log
PIT Revenue	Calculated by multiplying tax payable by persons and individuals as percentage of total revenue (Code KBP4429K) by total revenue (Code KBP4597M) - ZAR millions	KBP4429K	SARB, Own calculation	Annualized, deflated, SA & Log
Average PI Tax Rate	Personal income tax revenue as a percentage of the personal income tax base; not seasonally adjusted -Percentage	NA	Own calculation	SA
Real GDP	Gross domestic product at constant prices - ZAR millions	KBP6006D	SARB	Log
Inflation	Total consumer prices (all urban areas) - Percentage	KBP7170Q	SARB	NA
Gov. Debt	Total loan debt of national government: total gross loan debt - ZAR millions	KBP4114M	SARB, Own calculation	Deflated & Log
Gov. Debt2	Total loan debt of national government - ZAR millions	KBP4113M	SARB, Own calculation	Deflated & Log
Gov. Debt (Domestic)	Total loan debt of national government: total domestic debt - ZAR millions	KBP4105M	SARB, Own calculation	Deflated & Log
Gov. Gross Debt (% GDP)	Total loan debt of national government: total gross loan debt as percentage of GDP - Percentage	KBP4116K	SARB	NA
Gov. Total Spending	National government: total expenditure - ZAR millions	KBP4601M	SARB, Own calculation	Deflated & Log
Gov. Spending (% GDP)	National government expenditure as percentage of GDP - Percentage	KBP4434K	SARB	NA
Gov. Total Spending (% GDP)	National government: total expenditure (% of GDP) - Percentage	KBP4601E	SARB	NA
Gov. Adj. Spending (% GDP)	National government expenditure adjusted for cash flows (% of GDP) - Percentage	KBP4049E	SARB	NA
Interest Rate	Bankrate (lowest rediscount rate at SARB) - Percentage	KBP1401M	SARB, Own calculation	NA
Unemployment Rate	Official unemployment rate - Percentage	KBP7019K	SARB	NA
Private Investment	Gross fixed capital formation; private business enterprises (investment); constant prices - ZAR millions	KBP6109D	SARB	Log
Household Consumption (Durable)	Final consumption expenditure by households; durable goods (PCE); constant prices - ZAR millions	KBP6050D	SARB	Log
Household Consumption (Non-Durable)	Final consumption expenditure by households; non-durable goods (PCE); constant 2010 prices - ZAR millions	KBP6061D	SARB	Log

Note: this table provides the list of the variables included in the VAR model in no particular order. The first and second columns show (respectively) the short names and figure label names of the variables used in the proxySVAR model estimation. The fourth column shows the code of the data by the source. The fifth column shows the unit of measure where Rand is the South African currency. The six column indicates the source of the data. The last column indicates the transformation of the data where SA is seasonally adjusted.
Source: authors' elaboration, based on various sources.

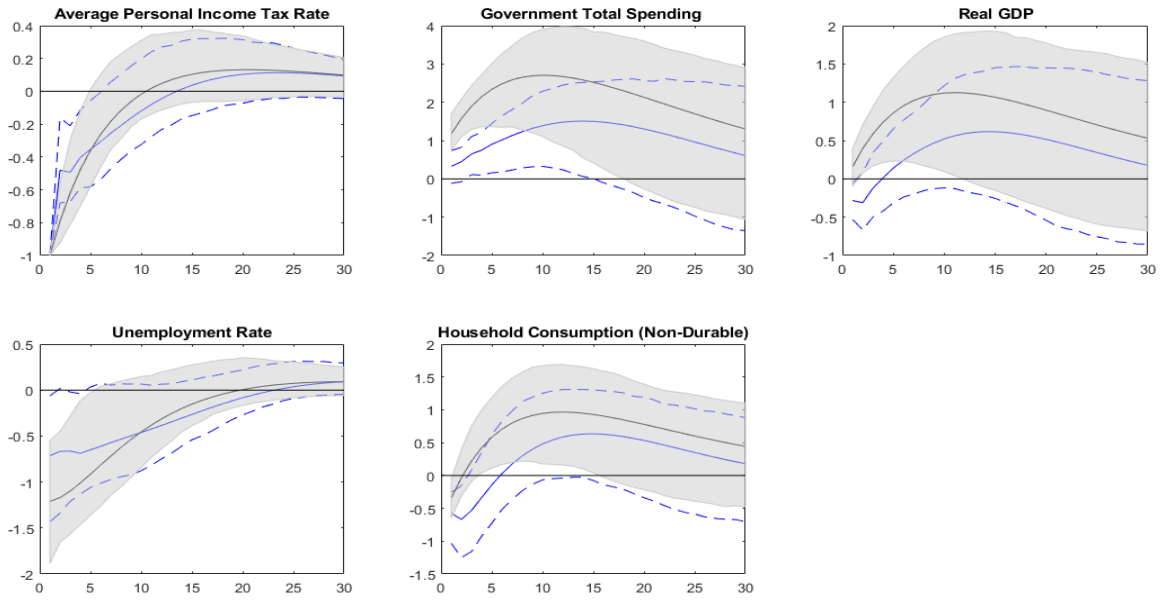
A3 Additional results

Figure A1: Revenue, consumption, and unemployment: full sample

(a) Personal tax revenue and consumption (durable)



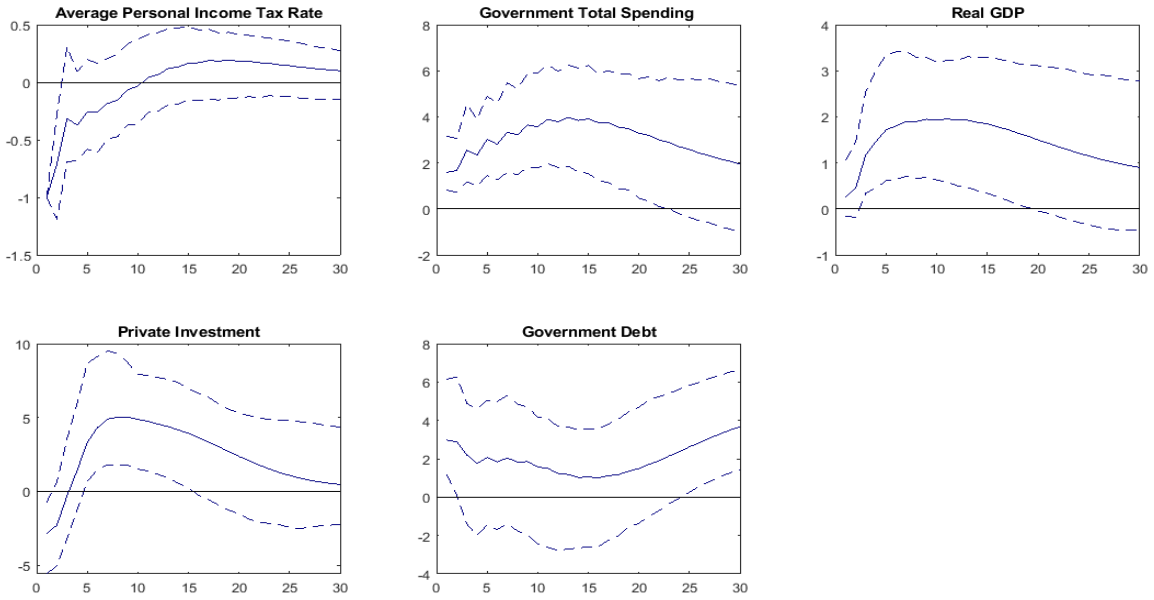
(b) Unemployment and consumption (non-durable)



Note: response to a 1 per cent point reduction in the APITR using one lag. The impulse responses show the estimations and the 95 per cent confidence intervals. The shocks are demeaned. The horizontal axis represents the period in quarters. The response for unemployment is in percentage points, whereas other variables are in percentages.

Source: authors' own calculations.

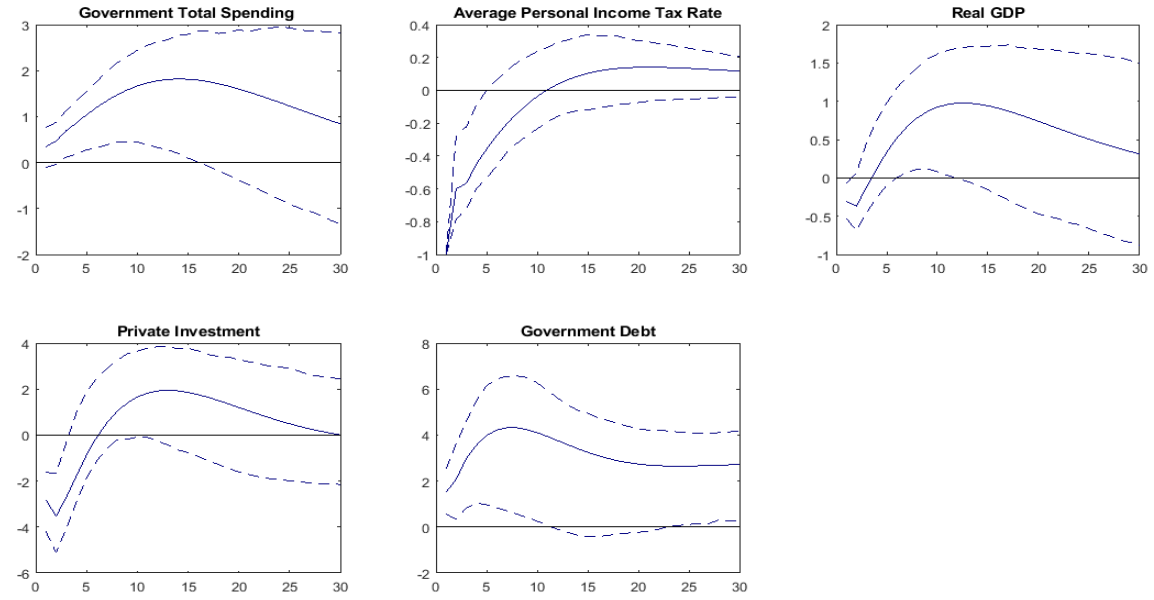
Figure A2: Investment and debt: permanent shocks



Note: response to a 1 per cent point reduction in the APITR using three lags. The impulse responses show the estimations and the 95 per cent confidence intervals.

Source: authors' own calculations.

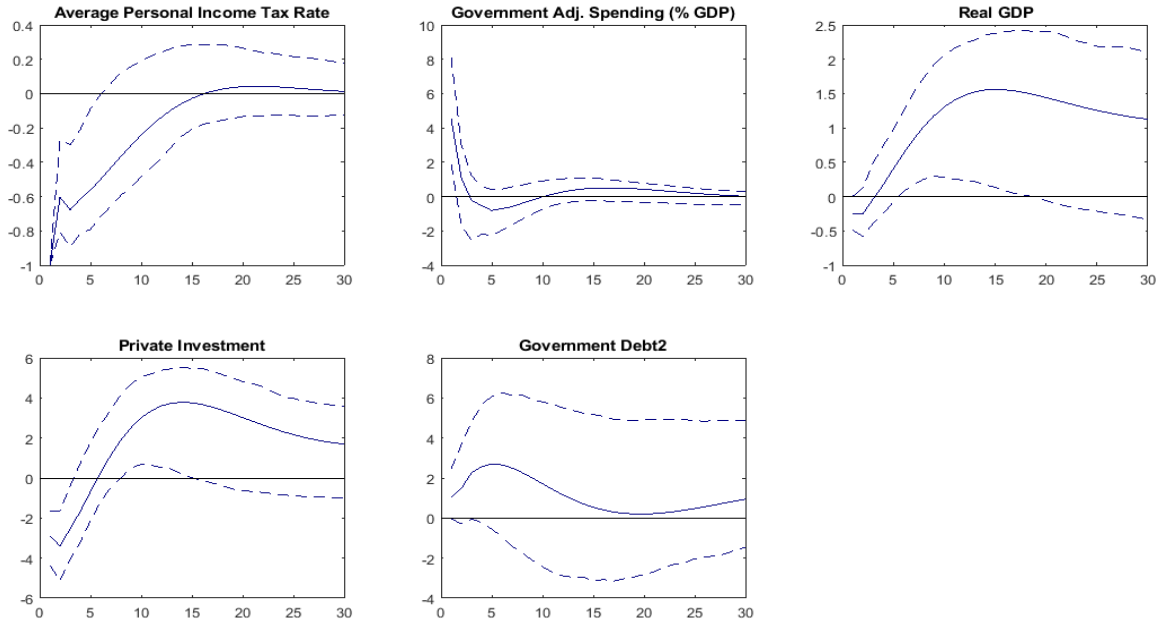
Figure A3: Robustness checks: government spending ordered first



Note: response to a 1 per cent point reduction in the APITR. The impulse responses show the estimations and the 95 per cent confidence intervals. The shocks are demeaned.

Source: authors' own calculations.

Figure A4: Robustness checks: government spending and debt



Note: response to a 1 per cent point reduction in the APITR. The impulse responses show the estimations and the 95 per cent confidence intervals.

Source: authors' own calculations.

A4 Summary of the personal income tax shocks

The classification of shocks follows that of the South African Revenue Services (SARS). Personal income taxes include provisional tax, assessment payments, and penalties; employees' tax; ETI (employment tax incentives); and credit and refunds.

Table A2: List of personal income tax shocks

Budget year	Tax proposal	Legislation date	Effective date	A	U	Endo	Exo	T	P
2019	PIT relief—partial	13 January 2020	01 March 2019	0	1	1	0	1	0
2019	PIT relief (tax increase)	13 January 2020	01 March 2019	0	1	0	1	1	0
2019	Medical tax credits	13 January 2020	01 March 2019	0	1	0	1	1	0
2019	Employment tax incentive	13 January 2020	01 March 2019	0	1	1	0	0	1
2018	PIT relief—partial	16 January 2019	01 March 2018	0	1	1	0	1	0
2018	PIT relief (tax increase)	16 January 2019	01 March 2018	0	1	0	1	1	0
2018	Medical tax credits	16 January 2019	01 March 2018	0	1	0	1	0	1
2018	Employment tax incentive (extension)	16 January 2019	16 January 2019	0	1	0	1	0	1
2017	PIT increase (top bracket)	12 December 2017	01 March 2017	0	1	0	1	1	0
2017	PIT relief—partial	12 December 2017	01 March 2017	0	1	1	0	1	0
2017	PIT relief (tax increase)	12 December 2017	01 March 2017	0	1	0	1	1	0
2017	Medical tax credits	12 December 2017	01 March 2017	0	1	1	0	1	0
2017	Employee bursaries	12 December 2017	01 March 2017	0	1	0	1	0	1
2017	Employee bursaries (disability)	14 December 2017	01 March 2018	0	1	0	1	0	1
2016	PIT relief—partial	18 January 2017	01 March 2016	0	1	1	0	1	0
2016	PIT relief (tax increase)	18 January 2017	01 March 2016	0	1	0	1	1	0
2016	Medical tax credits	18 January 2017	01 March 2016	0	1	1	0	1	0
2016	Capital gains tax	18 January 2017	01 March 2016	0	1	0	1	0	1
2016	Employee bursaries	18 January 2017	01 March 2016	0	1	0	1	0	1
2016	Learnership tax incentive (extension)	18 January 2017	01 October 2016	0	1	0	1	1	0
2016	Employment tax incentive	18 January 2017	01 October 2016	0	1	0	1	1	0
2015	PIT relief	08 November 2015	01 March 2015	0	1	1	0	1	0
2015	PIT increase	08 November 2015	01 March 2015	0	1	0	1	0	1
2015	Medical tax credits	08 November 2015	01 March 2015	0	1	1	0	1	0
2014	PIT relief	16 January 2015	01 March 2014	0	1	1	0	1	0
2014	Medical tax credits	16 January 2015	01 March 2014	0	1	1	0	1	0
2013	PIT relief	02 December 2013	01 March 2013	0	1	1	0	1	0
2013	Medical aid contributions	02 December 2013	01 March 2013	0	1	1	0	1	0
2013	Employment tax incentive	17 December 2013	01 January 2014	0	1	0	1	1	0
2013	Bursaries and scholarship allowance	11 December 2013	01 March 2013	0	1	0	1	0	1
2013	Non-retirement savings	02 December 2013	01 March 2013	0	1	1	0	0	1
2012	PIT relief	05 October 2012	01 March 2012	0	1	1	0	1	0
2012	Medical aid contributions and other monetary thresholds	05 October 2012	01 March 2012	0	1	0	1	0	1
2012	Capital gains tax - individuals	05 October 2012	01 April 2012	0	1	0	1	0	1
2011	PIT relief	28 December 2011	01 March 2011	0	1	1	0	1	0
2011	Medical aid contributions and other monetary thresholds	28 December 2011	01 March 2011	0	1	1	0	1	0

Continued on next page

Table A2 – continued from previous page

Budget year	Tax proposal	Legislation date	Effective date	A	U	Endo	Exo	T	P
2011	Adjustment in capital gains monetary thresholds	28 December 2011	01 March 2011	0	1	0	1	1	0
2011	Taxation of lump sum benefits upon retirement	28 December 2011	01 March 2011	0	1	1	0	0	1
2010	PIT relief	20 October 2010	01 March 2010	0	1	1	0	1	0
2009	PIT relief	29 September 2009	01 March 2009	0	1	1	0	1	0
2008	PIT relief and SITE	17 July 2008	01 March 2008	0	1	1	0	1	1
2007	PIT relief - partial	05 August 2007	01 March 2007	0	1	1	0	1	0
2006	PIT relief - (with tax cuts)	20 July 2006	01 March 2006	0	1	0	1	1	0
2006	PIT relief	20 July 2006	01 March 2006	0	1	1	0	1	0
2006	PIT - tax cuts	20 July 2006	01 March 2006	0	1	0	1	1	0
2005	PIT relief	14 July 2005	01 March 2005	0	1	1	0	1	0
2004	PIT relief	22 July 2004	01 March 2004	0	1	1	0	1	0
2003	PIT relief - (with tax cuts)	30 May 2003	01 March 2003	0	1	0	1	1	0
2003	PIT relief	30 May 2003	01 March 2003	0	1	1	0	1	0
2003	PIT- tax cuts	30 May 2003	01 March 2003	0	1	0	1	1	0
2002	PIT relief - (with tax cuts)	31 July 2002	01 March 2002	0	1	0	1	1	0
2002	PIT relief	31 July 2002	01 March 2002	0	1	1	0	0	1
2002	PIT - tax cuts	31 July 2002	01 March 2002	0	1	0	1	0	1
2002	Provisional tax administrative reform	31 July 2002	01 March 2002	0	1	0	1	0	1
2001	PIT relief -(with tax cuts)	26 July 2001	01 March 2001	0	1	0	1	1	0
2001	PIT relief	26 July 2001	01 March 2001	0	1	1	0	1	0
2001	PIT- tax cuts	26 July 2001	01 March 2001	0	1	0	1	1	0
2001	Raising provisional tax thresholds	26 July 2001	01 March 2001	0	1	0	1	1	0
2000	PIT relief - (with tax cuts)	16 July 2000	01 March 2000	0	1	0	1	0	1
2000	PIT relief	16 July 2000	01 March 2000	0	1	1	0	0	1
2000	PIT- tax cuts	16 July 2000	01 March 2000	0	1	0	1	0	1
2000	Skills development levy	14 April 1999	01 April 2000	1	0	1	0	0	1
1999	PIT relief - marginal tax rates decrease	29 March 1999	01 March 1999	0	1	0	1	1	0
1999	PIT relief - partial (fiscal drag)	29 March 1999	01 March 1999	0	1	1	0	1	0
1998	PIT relief - partial	29 June 1998	01 March 1998	0	1	0	1	1	0
1997	PIT relief - partial	26 June 1997	01 March 1997	0	1	0	1	0	1
Total	66			1	65	35	31	21	44

Note: this table summarizes the tax changes analysed from the Budget documents between 1996Q1 and 2019Q4. Columns 5 and 6 capture whether the legislated change was Anticipated (A) or Unanticipated (U). Columns 7 and 8 capture if the legislated change was Endogenous (Endo) or Exogenous (Exo). Lastly columns 9 and 10 capture if the change was Temporary (T) or Permanent (P). Not all tax proposals were quantified in the source documents. Aggregating the 66 tax changes yields 47 personal income tax shocks—25 exogenous and 22 endogenous.
Source: authors' own calculations.