New Zealand's lauded fiscal legislation: has it reduced fiscal uncertainty?

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Abstract

The two pieces of legislation that govern New Zealand's fiscal policy and fiscal management are lauded and even copied. Both pieces of legislation contain provisions to reduce the uncertainty from fiscal policy. This paper evaluates their success in reducing net taxation and government spending uncertainty. We find the legislation probably reduced net taxation uncertainty and government spending uncertainty; although we are more certain about the net taxation result than the government spending result. That the legislation reduced net taxation uncertainty is a positive as we also show that recently net tax uncertainty has been more detrimental to output than government spending uncertainty.

1 Introduction

New Zealand's Public Finance Act (1989) just celebrated its 30th anniversary and the Fiscal Responsibility Act (1994) is only a few years off that mark. These two pieces of legislation are key institutions in governing fiscal policy and fiscal management in New Zealand.[1] Significant anniversaries are often a time for reflection and, in the case of these two pieces of legislation, this reflection has begun. The title of an opinion piece on the Public Finance Act (1989) on its 30th anniversary, by one of its architects, stated the: 'Public Finance Act has proved its worth in good times and bad'; similarly, Gill (2018, p. i) states '[t]he Fiscal Responsibility Act 1994 is an astonishing success story of a weak non-binding policy instrument'.[2] There is no doubt the pieces of legislation have been associated with successful outcomes: the government's net worth has improved and the government has run sustained fiscal surpluses since their implementation (Gill, 2018, p. i).

North (1991) stated that institutions—humanly-derived constraints on behaviour, such as laws—are created by humans to reduce uncertainty. This paper therefore argues that another relevant metric by which to assess these pieces of legislation is on whether they have reduced uncertainty, specifically fiscal uncertainty. Indeed, there are provisions in both Acts which can be interpreted as seeking to reduce uncertainty. In addition, to the principles of reducing 'debt to a prudent level', and once that is achieved, of ensuring that 'over a reasonable period operating expenditure does

[1]The original provisions of the Fiscal Responsibility Act 1994 were subsequently folded into the Public Finance Act 1989 in 2004 (Gill, 2018).

[2]The opinion piece on the Public Finance Act is: Ball, I (2022), *Public Finance Act has proved its worth in good times and bad*, and is available: https://www.stuff.co.nz/national/politics/opinion/114464570/public-finance-act-has-proved-its-worth-in-good-times-and-bad [accessed 8 February 2022].

not exceed operating revenue', the Public Finance Act (1989) requires that the 'government pursue policies which are consistent with maintaining a reasonable degree of predictability about the level and stability of taxation rates in the future' (Barker et al., 2008, p. 34). Further, the Act contains various reporting requirements to set out forecasts and intentions over various periods of time. The Fiscal Responsibility Act, by requiring the government, via the Fiscal Strategy Report, to state their short-term fiscal intentions and long term fiscal objectives for fiscal policy, seeks to reduce the public's uncertainty concerning policy, as it provides, in the words of Gill (2018, p. 10), a 'commitment device'.

Not all readers, on the face of it, will be interested in the success or otherwise of two pieces of legislation in a small country at the bottom of the world. However, we would argue there are reasons they should be. Firstly, for those readers interested in the structure and nature of institutions, the Fiscal Responsibility Act is interesting. As Gill (2018) points out, the Fiscal Responsibility Act is not legally enforceable, and thus it does not bind the government; it is only because both major parties in the New Zealand parliament have endorsed it, that there is an enforcement mechanism in place: political pressure. As Treasury (2015, p. 6) notes, the requirements of the Act to outline intentions and objectives approximate 'the legislated fiscal rules of other countries, with the difference being that specific targets are not set down in law.'

Secondly, the pieces of legislation are lauded—a former Director of the Fiscal Affairs Department at the International Monetary Fund, said: 'New Zealand has pioneered, and refined over the years, comprehensive fiscal reporting requirements, intended to ensure transparency, and to promote time consistency and a broad debate of the fiscal policy choices of successive Governments'.[3] Further, many countries have adopted similar pieces of legislation; Gill (2018, p. i) states: 'New Zealand's pioneering approach based on fiscal transparency was followed by other countries including Australia with the Charter of Budget Responsibility Act (1998) and the United Kingdom with the Charter for Budget Responsibility (2011)'. Thus what we learn from studying New Zealand's legislation will apply to other countries that have adopted similar legislation (or are considering it).

The specific research question this paper addresses is: did the change in laws constraining and informing the conduct of fiscal management and fiscal policy in New Zealand lead to a reduction in fiscal policy uncertainty? In particular, was government spending uncertainty and net tax uncertainty reduced? The chief contribution of this paper is an econometric-based evaluation of whether these two pieces of world-leading legislation did indeed reduce fiscal policy uncertainty. The second contribution of this paper is to show which type of fiscal policy uncertainty is more detrimental to the New Zealand economy. In line, with some studies from other countries, we find that, at least since 1994, net tax uncertainty has been more damaging.

The paper is structured as follows. Section 2 describes the data we use, as well as our modelling framework. Section 3 reports our results and section 4 concludes.

2 Data and modelling framework

Constructing our data set

Our baseline model has three variables: real GDP per capita, real government spending and real net taxation per capita. All variables are expressed in 2009/10 dollar terms. In discussing the construction of these variables we begin with the fiscal series. Government spending is the aggregate

[3] Ter-Minassian, T. (2014). External Review of the Treasury's Fiscal Policy Advice; available https://www.treasury.govt.nz/sites/default/files/2014-10/tfpa-2908566.pdf

of government consumption and government investment, whilst net taxation is tax revenue less government transfers. Constructing historically consistent fiscal series is complicated by a number of changes in accounting practices for the New Zealand Crown accounts through the years: the change from cash to accrual/GAAP accounting principles in 1994 being the most significant. For the period 1982Q2 to 2010Q4 our real government consumption, real government investment, nominal tax and nominal transfer series are taken from the dataset used in Claus et al. (2006) (further updated to 2010Q4 by Dungey & Fry, 2009 and then by Treasury analysts); these authors, either employed by the Treasury or under contract to the Treasury (Dungey and Fry) appear to have done as best they could to reconcile the series constructed under different arrangements.[4]

To ensure we have a sufficient sample prior to the legislative reform we seek to extend the fiscal series backwards from 1982Q2. For the real (volume) government consumption series and the real government investment series from 1961Q1 to 1979Q1, we use the corresponding series of Grindell (1981); Grindell created a set of quarterly national accounts on an SNA basis before Statistics New Zealand started officially producing them. The challenge is then how to estimate the missing data from 1979Q2 to 1982Q1 when the 'Treasury data set', the data set described above, begins. Our procedure for doing so is a two-step process which takes advantage of the Chow-Lin procedure (Chow & Lin, 1971). The Chow-Lin procedure is a regression-based procedure for temporal disaggregation; it estimates higher frequency data from lower frequency data. It has two inputs: a lower frequency series (annual in our case) and an 'indicator' series on the same frequency as the lower frequency data you wish to estimate (quarterly in our case); the indicator informs the lower frequency pattern of disaggregation.[5]

To create (separate) indicator variables for the real (volume) government consumption series and the real government investment series, we use a Kalman smoothing algorithm to generate estimates of the series from 1961Q1 (we call this series the 'Kalman-derived series'). The Kalman smoothing algorithm, in this case, uses the time series properties of the known quarterly values to interpolate the missing quarters.[6] Then, having created the indicator series, we can now implement the Chow-Lin procedure. The lower frequency data for the real (volume) government consumption series and the real government investment series are the corresponding March year totals from Dalziel and Lattimore (2001). We impose the restriction that the quarterly series produced by the Chow-Lin procedure need to add to the relevant March year total.

The Chow-Lin procedure creates quarterly estimates from 1961Q1, from this time series the quarterly estimates for the period 1979Q2 to 1982Q1 are then used as our final estimates for the missing values (after they are rebased into 2009/10 dollars) and they are spliced into Grindell and Treasury datasets.[7] The Treasury dataset ends in 2010Q4, to extend the two series forward we source government consumption and government investment series from Statistics New Zealand's Infoshare and splice these on to the end of our dataset.[8]

In terms of extending our tax series backwards, we follow a similar process as discussed above.

[4]We are grateful to the New Zealand Treasury for supplying the data.

[5]An indicator is not a necessary requirement of the Chow-Lin procedure but (a relevant) indicator will improve lower frequency estimates. As a regression-based method, the Chow-Lin procedure only incorporates information from the indicator variable if it is correlated with the higher frequency variable. We implemented the Chow-Lin procedure using R's tempdisagg package (Sax & Steiner, 2013).

[6]The Kalman smoothing algorithm uses the state space representation of an ARIMA model to estimate quarterly values; the best ARIMA model is chosen using Information Criterion. We implement this in R's ImputeTS package (Moritz & Bartz-Beielstein, 2017).

[7]When we use the term splice throughout this paper, we use this as shorthand for the following procedure: (1) examine the overlapping values for the two series, (2) decide which of the two series has the most 'reliable' level value at the point of overlap, (3) apply the growth rates of the other series to this level value.

[8]Government consumption is seasonally adjusted Final Consumption Expenditure: General Government (SNE046AA); Government investment is seasonally adjusted Gross Capital Formation: General government (SNE037AA)

To create an indicator series we start with quarterly government revenue data from Buckle and Snively (1979), which are available from 1960Q1 to 1979Q2. This revenue data are revenue from taxation, as well as revenue from the government's trading activities; the latter is very small relative to the former, however. The first thing we note with these data is they are highly seasonal, so we seasonally adjust them using the X-13 procedure. Then, as with the government consumption and investment series, we use Kalman smoothing to generate an indicator series (this time from 1960Q1 to 1984Q2).

Again, this indicator series is used with the Chow-Lin procedure; the other input into the Chow-Lin procedure, a lower frequency series, is the annual totals of taxation revenue (in March years). The annual totals of taxation revenue are from the Treasury's historical fiscal indicators dataset for the March years 1972 to 1983 ('Total Crown Tax Receipts'), while for the March years 1961 to 1971, the taxation totals are from NZPC (1979) ('Total Central Government Taxes').[9] The restriction is again applied that the resulting quarterly disaggregated series need to add to the relevant March year taxation total. The quarterly disaggregated series are produced for the period 1961Q1 to 1984Q2; this series is then spliced to the beginning of the Treasury dataset. For taxation, however, there is an important difference in our splicing procedure compared to what we did with the government investment and consumption series. For those latter series we used the data reported in Grindell (1981) for the 1961Q2 to 1979Q1 period and only used the interpolated data for missing period: 1979Q2 to 1982Q1. In the case of tax, the quarterly data we had for 1961Q2 to 1979Q2 were revenue estimates, which reflect tax but also a small amount (around five percent on average) of government trading revenue. To avoid changes in government trading revenue being conflated with tax changes, we use Chow-Lin generated tax series estimates for the period 1961Q2 to 1982Q1 , rather than just the period of the missing data: 1979Q3 to 1982Q1 (and using the revenue estimates from Buckle & Snively, 1979 for the 1961Q2 to 1979Q2 period). To extend the Treasury data set forward to 2017Q4, we splice the tax data for the period 2011Q1 to 2017Q4 as reported in Hamer-Adams and Wong (2018) on to the end of it.

We were unable to source any historical quarterly transfer data prior to 1982Q2. Claus et al. (2006, p.5) seem to have run into this problem as well: '[p]rior to 1994 transfer payments data are available on a less frequent basis'. They interpolate the data for 1982 to 1994 using 'known relative quarterly allocations'. Again we use the Kalman smoother to create a quarterly indicator series back to 1961Q2. Dalziel and Lattimore (2001) provide annual estimates of social security expenditure for the period 1960-2000, which we then update with Treasury data until 2010. We use the Chow-Lin procedure with our Kalman smoothed estimates for the period 1961Q2 to 2010Q4 as an indicator, and a restriction that the resulting quarterly estimates must add to the relevant annual totals, to generate quarterly estimates for the period 1961Q2 to 1982Q1. These estimates are then spliced to the Treasury data set. As with the tax data, we also splice the transfer data for the period 2011Q1 to 2017Q4, as reported in Hamer-Adams and Wong (2018), on to the end of the Treasury data set to extend it forward to 2017Q4.

We need three more variables. The first is real GDP, this is taken from NZIER's Data1850 database, which in turn is an update of the historical estimates of Hall and McDermott (2011).[10] The second is the nominal GDP deflator. The Treasury dataset again provides a series for the period 1982Q2 to 2010Q4 and this is easy to extend forward using data available from Statistics New Zealand's Infoshare (series code: SNE173AA). For the period 1961Q2 to 1979Q1, a series is reported

[9] NZPC (1979) contains data up until 1979. The 1972-79 estimates for 'Total Central Government Taxes' are the same as the corresponding estimates for 'Total Crown Tax Receipts' in the Treasury's historical fiscal indicators data set. The Treasury's historical fiscal indicators data set is available here: https://www.treasury.govt.nz/publications/information-release/data-fiscal-time-series-historical-fiscal-indicators

[10] NZIER's Data1850 database is the raw data presented in Briggs (2003); it can be accessed here: https://data1850.nz/

by Grindell (1981). This again leaves a period with missing data: 1979Q2 and 1982Q1. To interpolate this series we use Chow-Lin procedure with the following indicator variables: the consumer price index, the overseas price indices for exports, and the overseas price indices for (all sourced from Infoshare). We impose the requirement that interpolated quarterly series must average to relevant the March year annual index value. These March year index values are calculated by dividing the March year nominal GDP estimates from the Data1850 database by the corresponding March year real GDP estimates.

The final series we need is total population. Up and until 2010Q4, we get the annual totals from the Data1850 database. We then use the Chow-Lin procedure (with no indicator), with the requirement that the quarterly estimates must average (mean) to the corresponding March year total. From 2010Q4, we base our estimates on the quarterly growth rate in the working age population series from Infoshare (series: DPE059AA).

There are two final things to note regarding the data construction. Although many of the real and deflator series we use to construct our time series start off with different base years, we are careful to ensure that the final time series are all expressed in 2009/10 dollars. Secondly, our data set stops at 2017Q4 as this was the last quarter we could find transfer data for, it begins in 1961Q2 as this is the first quarter Grindell (1981) reports the GDP deflator for.

Figure 1 plots tax and transfers expressed as a percentage of nominal GDP; as well as real government spending (consumption plus investment) expressed as a share of real GDP. Starting with government spending (the top panel of the figure), what is noticeable is the sharp drop of the ratio of government spending to GDP in 1972Q1 before it rebounds straight away—the ratio is 0.24 in 1971Q4, 0.19 in 1972Q1 and 0.24 in 1972Q3—1972Q1 is clearly an unusual data point. This anomaly is evident in the raw data as well of Grindell (1981). We can not think of an economic reason to explain this phenomenon. In terms of how to handle it, we leave it in our data set and we run a robustness test where we omit it from the sample to see if our results change.

Hawke (1985, p. 315) notes that before the early 1970s fiscal policy 'did not usually make a direct injection to demand in New Zealand'. In contrast, Wells (1987) notes 1976 until 1984 was a period where the government sought to use fiscal policy as a tool of active demand management hence the increase in its share of the economy. The evolution of government spending over the 1960s, 1970s and until 1984, we observe in panel one of figure 1, concurs with the idea of government playing an increasing role in the economy from the mid-1970s. From its peak in 1983, government spending slowly edges down over the 1980s (although with a sharp spike in 1985). Post the election of a new National government in late 1990, we see a noticeable decline in government expenditure fall as a share of GDP, as the government sought to pay down debt. From this low point, government spending has slowly drifted up again as lower debt allowed governments more fiscal space (and the Global Financial Crisis necessitated the use of that fiscal space).

Tax cycles between 20 and 25 percent of GDP until the mid-1970s; see panel two of figure 1. The ratio then trends up to around 28 percent of GDP in 1984. Drawing on a comment in Hawke (1985, p. 301), we conjecture that the interaction of the high inflation in the period 1975 to 1982 with the progressivity of the income tax system, was a reason for this increase in tax revenue as average tax rates increased. There is a further shift upwards in the tax ratio again from 1986 to just prior to the global financial crisis. This second shift reflects the desire of successive governments to initially pay down debt and then keep it at low levels. Finally around 2009 there a slight shift down in the tax ratio: a result of effects of the global financial crisis on incomes and consumption and, two, the 2010 tax reform (Gemmell & Gill, 2016, p. 6).

Transfers fall slightly as a share of GDP from 1960 to 1970 but from the mid-1970s, transfers pick up (see panel three of figure 1). Gibbons (2017, figure 12) suggests this is primarily driven by an increase in superannuation expenditure; this is consistent with a 'relatively generous uni-

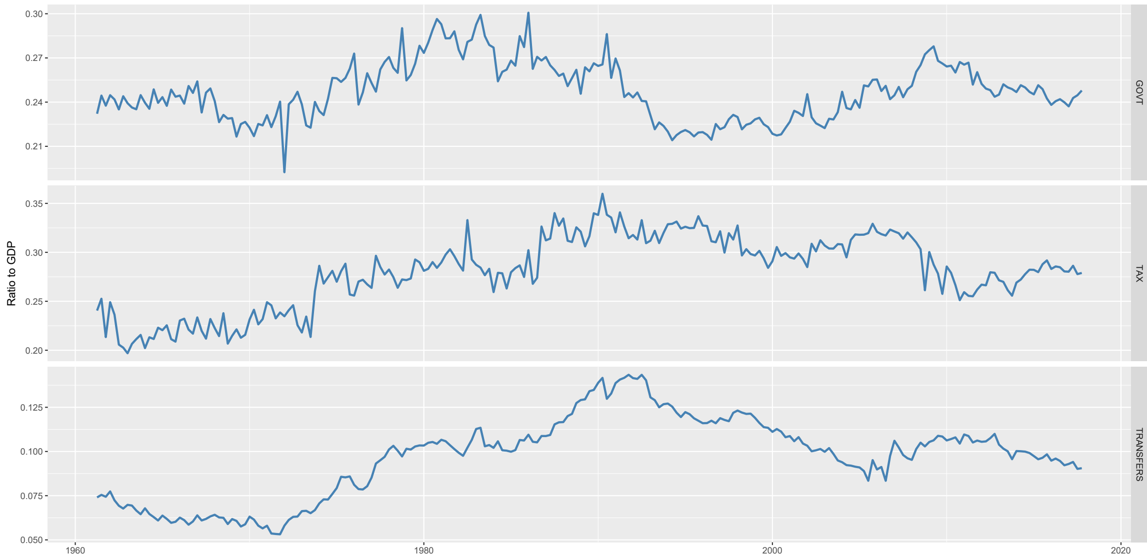

Figure 1: Variables used in the estimation of the VAR

All variables are a percent of GDP

versal pension' introduced in 1976 (Boston, 1993). In addition, unemployment benefit payments increased in the 1980s and early 1990s owing to raising unemployment (Gemmell & Gill, 2016, p. 6); the combined effects of these two developments see transfers peak as a percent of GDP in 1992. The transfer series then starts to fall as a share of GDP, in part, reflecting an increase of the eligibility age for superannuation from 60 to 65 in the 1991 Budget as well as cuts to most welfare benefits in the 1990 December mini-budget ('the Economic and Social Initiative'). Only in 2005, when Labour introduced Working for Families does the fall in the share of transfers of GDP cease and very partially reverse itself.

2.1 Our empirical framework

Our empirical framework for estimating government spending and net tax (revenue) uncertainty is the model developed by Popiel (2020). Popiel (2020) expands on the model of Blanchard and Perotti (2002) to allow for stochastic volatility—as we shall see, the stochastic volatility forms the basis for estimating fiscal policy uncertainty.

Popiel (2020) starts with the Blanchard and Perotti (2002) model. This model estimates the effects of surprise government spending and net tax changes on GDP using a Structural VAR model. The model starts from a reduced form of:

$$y_t = C + \sum_{i=1}^{i=p} \Gamma_i y_{t-i} + u_t \tag{1}$$

where y_t is a vector containing (natural log of the following variables): real net taxation per capita (nominal taxation minus nominal transfers deflated into real terms using the nominal GDP deflator), real government spending per capita (consumption plus investment) and real GDP per capita. C is a matrix containing a constant and, in some specifications, a trend term. In estimating the model, the number of lags, p, is set to four in line with other studies (Popiel, 2020; Claus et al., 2006). The above equation can be estimated by OLS to obtain the reduced form errors, u_t.

The contemporaneous relationship between the reduced form errors, u_t and structural shocks, ϵ_t, takes the following form:

$$u_t = \beta H^{1/2} \epsilon_t, \epsilon_t \sim N(0, I) \tag{2}$$

where the H matrix normalises the structural shocks to have a unit variance.

$$H = \begin{bmatrix} \sigma_\tau^2 & 0 & 0 \\ 0 & \sigma_g^2 & 0 \\ 0 & 0 & \sigma_y^2 \end{bmatrix} \tag{3}$$

The structural shocks we wish to identify are composites of reduced form errors and other structural shocks.

$$\epsilon_t^\tau = a_1 \epsilon_t^y + a_2 u_t^g + a_3 u_t^\tau \tag{4}$$

$$\epsilon_t^g = b_1 \epsilon_t^y + b_2 u_t^\tau + b_3 u_t^g \tag{5}$$

$$\epsilon_t^y = c_1 \epsilon_t^\tau + c_2 \epsilon_t^g + c_3 u_t^y \tag{6}$$

In order to identify the structural shocks, we need place some restrictions on equations 4, 5, and 6. Following Blanchard and Perotti (2002), and others, we set b_1 equal to zero; that is, we assume government spending does not respond automatically to surprise changes in GDP in the same quarter, as changes to government spending take time to legislate (and any automatic stabiliser effects will be captured by the net tax variable, which includes transfers). Following Hamer-Adams and Wong (2018), who use a similar framework in a New Zealand context, we set a_1, the tax to output elasticity, to 1.2.[11] Following Claus et al. (2006) and Popiel (2020), we set a_2 = 0; that is we order net taxes ahead of government spending and therefore we are assuming that net taxes do not respond to government spending changes in the same quarter.

To incorporate fiscal uncertainty into the model, Popiel (2020) augments equations 1 and 2 with additional terms that allow for stochastic volatility:

$$y_t = C + \sum_{i=1}^{i=p} \Gamma_i y_{t-i} + \psi_1 log(h_t) + u_t \tag{7}$$

$$H = \begin{bmatrix} h_\tau & 0 & 0 \\ 0 & h_g & 0 \\ 0 & 0 & h_y \end{bmatrix} \tag{8}$$

and adds the following equation to define the equation of the time evolution of the time-varying variances of structural shocks, h_t:

$$log(h_t) = \mu + \rho log(h_{t-1}) + v_t, v_t \sim N(0, Q) \tag{9}$$

In equation 9, ρ is a diagonal matrix of autoregressive coefficients and Q 'is a diagonal matrix of variances of the second moment innovations' (Popiel, 2020, p. 4). Most importantly, $h_t = h_\tau, h_g, h_y$

[11] This is slightly higher than the value of one used by Claus et al. (2006) and Parkyn and Vehbi (2014).

are the time-varying variances of the structural shocks. Following Popiel (2020, p. 4), we use the square root of the time-varying variances of structural shocks as our estimates of uncertainty as they represent the dispersion of the one-step ahead forecast errors (Popiel, 2020). In short, we are equating periods where fiscal variables are hard to predict, with being periods of high uncertainty. In equation 7, it is assumed, as in Popiel (2020, p. 4), that fiscal uncertainty only affects other variables in the model contemporaneously, although if we relax this assumption none of our key results change as none of the model estimates of uncertainty change significantly.

The model is estimated via Bayesian methods (see Popiel, 2020 for more details). We use the initial 40 observations as our training sample to calibrate the model's priors. Therefore our training sample is 1961Q2 to 1971Q1 and our estimation sample 1971Q2 to 2017Q4.All estimates from the model presented in the rest of the paper are based on the last 15,000 of the 20,000 draws from the Gibbs sampler.

There are two possible trend specifications for the model: one where the trend is assumed to be stochastic, and one where the trend is assumed to be deterministic. Results from a Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test (Kwiatkowski et al., 1992) on the log of the three variables are reported below and show for all three variables we can reject the null hypothesis of stationarity at a five percent level in both the trend and intercept specifications, and intercept only specifications. We therefore prefer the stochastic trend (growth rate) version of the model.

	log(Net tax)	log(Government spending)	log(GDP)
Trend, intercept	0.01	0.01	0.01
Intercept	0.01	0.01	0.01

Table 1: KPSS tests of stationarity of three series in line model: p-values

All three variables are real and expressed in per capital terms

3 Results

3.1 Model validation

Before we report on the uncertainty estimates from our model, we wish to try and validate the model—that is, see if the structural shocks are properly identified. In figure 2 we present the impulse responses of output to a surprise fiscal expansion: a surprise government spending increase and a surprise net tax *cut*. Following Mertens and Ravn (2014) and Popiel (2020), the fiscal shocks are normalised by their average ratio to GDP in the sample.[12] Mertens and Ravn (2014, p. S3) notes this means the impulse responses can be interpreted two ways. The first is as the dollar impact on GDP from a dollar change in the fiscal variables. The second interpretation is as the response of GDP in percent terms to a one percentage point of GDP change in the fiscal variable. In figure 2 we see that the surprise net tax cut results in output growth as expected. Specifically, a one dollar net tax cut will initially lead to a $ 0.20 impact on GDP, increasing to around $0.32 after one year. This impact estimate is comparable with Parkyn and Vehbi (2014) who find an immediate $0.18 impact on GDP from a net tax cut. Where we differ is their tax multiplier turns negative after the first quarter; ours stays positive. Claus et al. (2006), in their stochastic trend version of the model, find a $0.25 GDP effect on impact from a net tax cut, their tax multiplier estimate, like Parkyn and Vehbi

[12] Ramey and Zubairy (2018) highlight a problem with this method if the relevant ratio varies greatly over time; as estimating fiscal multipliers is not the focus of this paper we do not implement their alternative method.

(2014) eventually turns negative. The results of Hamer-Adams and Wong (2018) are also similar to Claus et al. (2006) and Parkyn and Vehbi (2014).

In our model, a surprise government spending increase has a statistically significant impact on output only two and three quarters after impact; after 3 quarters a dollar increase in government expenditure increases GDP by 22 cents. This is slightly smaller than the estimate of Parkyn and Vehbi (2014) after three quarters, who find a dollar increase in government expenditure increases GDP by 33 cents. As with their tax estimates, they find in the long run the government spending multiplier turns negative. Claus et al. (2006) find a boost of $0.12 to GDP on impact from government spending, raising to $0.44 after three quarters and then settling around $0.26 in the long run. Apart from the $0.44 peak this is very similar to the dynamic we observe. Hamer-Adams and Wong (2018) find that a dollar increase in government spending will increase GDP by $0.44 on impact, this positive impact dies out quickly and turns negative. Power and Haug (2021), in their linear model, find that a one dollar increase in government spending leads to a $0.26 and $0.18 increase in real GDP two and four quarters respectively after the impact; the impact then dies out to zero in their case.[13]

The purpose of this exercise was to try and see if the structural shocks are properly identified. We tentatively conclude the structural shocks are properly identified for two reasons. One, the direction of the impulse responses are as expected. Two, the model produces estimates 'roughly' similar to previous studies. Given that none of the other papers we compare our results to have the period 1973 to 1981 in their estimation period, we would not expect our results to be exactly the same. Further some of papers have estimations periods starting around 1990 (Hamer-Adams & Wong, 2018 starts in 1991; Power & Haug, 2021 starts in 1991), while the estimation period of Claus et al. (2006) and Parkyn and Vehbi (2014) end in 2006 and 2010 respectively.

3.2 Estimates of uncertainty

Figure 3 plots our estimates of the net tax and government spending uncertainty from our preferred (stochastic trend) specification; output uncertainty is also included. The figure also contains two dashed lines for when the Public Finance and Fiscal Responsibility Acts were respectively passed by parliament (1989Q3 and 1994Q3 respectively); the pink-shaded areas are recession dates from Hall and McDermott (2016).

Beginning with the first panel, the time series estimates of output uncertainty, we see that it spikes during recessions and it is elevated over the period structural reform the New Zealand economy went through in the 1984-1995 period. Further output uncertainty is higher pre-reform than post-reform. All of these observations are consistent with what we established, using different data and uncertainty measures, in Ryan (2020).

Looking at the second panel of Figure 3, we see government spending uncertainty is high (relative to the latter period) from 1972Q3 to 1989Q2. Within this period, there are several noticeable spikes: 1976 and 1978/79. Gould (1982, p.141) notes that in 1976, the newly elected National government imposed 'sharp restraint' to dampen down activity and reverse the expansionary influence on demand (in particular, import demand in the face of an unsustainable current account deficit) of the previous Budget. The 1978 Budget, an election year budget, saw a policy reversal with the austerity of the previous two years abandoned—Gould (1982, p.147) reports the overall deficit before borrowing jumping to 8.3 percent of GDP in the 1979 March year up from 3.7 and 4.6 per cent in the previous two years.

[13]The major innovation of the Power and Haug (2021) paper is to see if the size of the government spending multiplier depends on the state of monetary policy (that is, is it tight or loose?); they find that the government spending multiplier two periods after impact is $0.54 if monetary policy is loose and zero if it is tight.

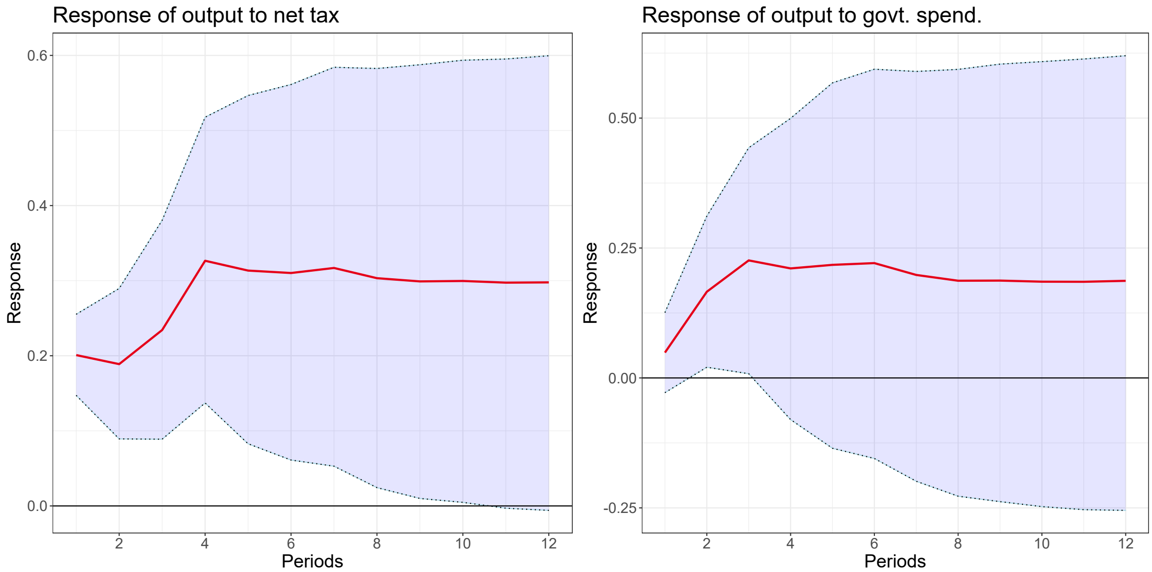

Figure 2: Cumulative impulse responses to unexpected expansionary fiscal policy: main specification

Shaded area represents 68 percent credible set; red line is posterior median; both responses are normalised by their average ratio to GDP over the sample period.

Post 1989Q2, the period between the Public Finance Act and the Fiscal Responsibility Act being enacted is also a period of high government spending uncertainty. In particular, there is a large spike in uncertainty over 1990 and 1991. The Treasury's 1990 *Briefing for the Incoming Minister*, issued in October 1990, warned 'the major [economic] uncertainty centres on the fiscal outlook' (p. 30) as the deficits were not deemed sustainable. Then in December of 1990 the government was forced to commit around 620 million dollars (around 0.9 per cent of nominal GDP) to bail out the Bank of New Zealand. Although this transaction did not directly impact government consumption and investment, this lead to a further strain on public finances and an austere 'mini budget' in December 1990.

Post 1991, estimates of government spending uncertainty fall and remain relatively stable through the 1990s before increasing after the election of new left-leaning government in 1999; uncertainty then peaks in 2005 before declining again. In explaining the dynamic over 1999 to 2005, it is of note that upon Labour's election in 1999, there was the so-called 'winter of discontent' — a fall in business confidence caused by concerns the government would reverse previously implemented market-based policies. Standard and Poors voiced a popular concern that 'the economy could weaken thanks to more regulation and spending, higher taxes and a return to interventionist policies'.[14] In response, the Labour government scaled back their spending plans and established their fiscal credibility. Indeed, the theme of the 2006 budget was 'the fool who spends on the upturn will find himself broke on the downturn.'[15] Post the Global Financial Crisis, there is small spike in

[14]Quote is from The Spinoff, June 7 2018, *Does Jacinda Ardern face a Helen Clark style winter of discontent?* available at: https://thespinoff.co.nz/politics/07-06-2018/does-jacinda-ardern-face-a-helen-clark-style-winter-of-discontent [accessed 8 February 2022].

[15]Pierard, L. *EDITORIAL: Economy no task for caretaker*, Hawkes Bay Today, May 19 2006 [accessed 8 February].

government spending uncertainty in 2011—perhaps this reflects the government's investments in rebuilding Christchurch after its earthquake (which would have been initially unforecastable given the variables in the model).

Looking at the third panel of Figure 3 we see that net tax uncertainty is elevated from 1972Q3 right through to the introduction of the Public Finance Act. There are three noticeable spikes in the period: 1973, 1982 and 1986; all of which correspond to significant changes in tax and transfer policy. In the 1972 Budget, National sought to boost demand (and their election chances) through a 10 per cent cut in personal tax cuts, along side more generous allowances and rebates for businesses (Goldsmith, 2008, p.238). Further, following the McCarthy Commission's recommendation, the government removed the child tax exception. Finally, the government doubled the family benefit with a total fiscal cost of $100 million (Goldsmith, 2008, p.258). The 1973 Budget saw a 90 per cent cent tax rate on residential property sale profits for houses sold within six months, the rate lowered to 60 per cent for houses sold between 21-24 months. This law came into effect overnight on Budget night (Goldsmith, 2008, p.264).[16]

The second spike in net tax uncertainty is in 1982. The McCaw taskforce report was released that year and the government followed its recommendation in cutting personal taxes (Goldsmith, 2008, p.281-82) to make a flatter tax scale; although Goldsmith (2008) notes the final design was complex with rebates and surcharges used to achieve desired outcomes for different income groups. The second major change to the tax system was the closure of tax avoidance loopholes, particularly around professionals being able to write off horticultural development expenses against their (professional) business tax liability (Goldsmith, 2008, p.283). Goldsmith (2008, p.282-83) notes in closing the loophole, the government broke one of the maxims of taxation: 'people should have certainty when confronting their tax obligations'— the government had previously been trying to promote horticultural investment through the tax system.

Net tax uncertainty spikes again in 1986, the year in which there was a number of tax reforms.[17] Reform included: measures were included to reduce tax evasion and tax avoidance; changes in the timing of provisional and terminal tax payments and most significantly, a collection of indirect taxes were replaced by a single consumption tax: Goods and Services Tax.

After the 1986 spike, the level of net tax uncertainty falls. It then increases slightly and remains elevated over 1990 and the first half of 1991. The year 1990 saw what is termed the 'fiscal crisis' by Dalziel and Lattimore (2001, p. 67). The incoming government found policy in the previous Budget had not been fully costed and revenue had been inflated via an accounting loophole. The new Minister of Finance responded, primarily, by cutting welfare benefits (Dalziel & Lattimore, 2001, p. 68). Post the Fiscal Responsibility Act in 1994, net tax uncertainty has stayed generally about the same level, albeit with spikes in 1997/98 (the Asian Financial Crisis) and 2008 to 2011 (the Global Financial Crisis, followed by the 2010 tax reform).

Figure 4 provides uncertainty estimates from alternative specifications of our model. Row one in figure 4 shows the results from the baseline specification discussed above. Row two is the uncertainty estimates from the specification where a deterministic rather than stochastic trend is assumed. Row three is a specification where a higher elasticity of tax to output is assumed. Specifically, we assume 3.13, the elasticity Popiel (2020) uses for his modelling in the United States and which was drawn, in turn, from Mertens and Ravn (2014). By way of background, Mertens and Ravn (2014), using an narrative identification approach, find that the output to tax elasticity of 2.08 proposed by Blanchard and Perotti (2002) for the U.S., based on institutional information on the

[16]The family house was excluded.

[17]The following list draws on the Reserve Bank of New Zealand's New Zealand economic and financial chronology 2014 - 1982; and is available at: https://www.rbnz.govt.nz/about-us/nz-economic-and-financial-chronology [accessed 8 February 2022]

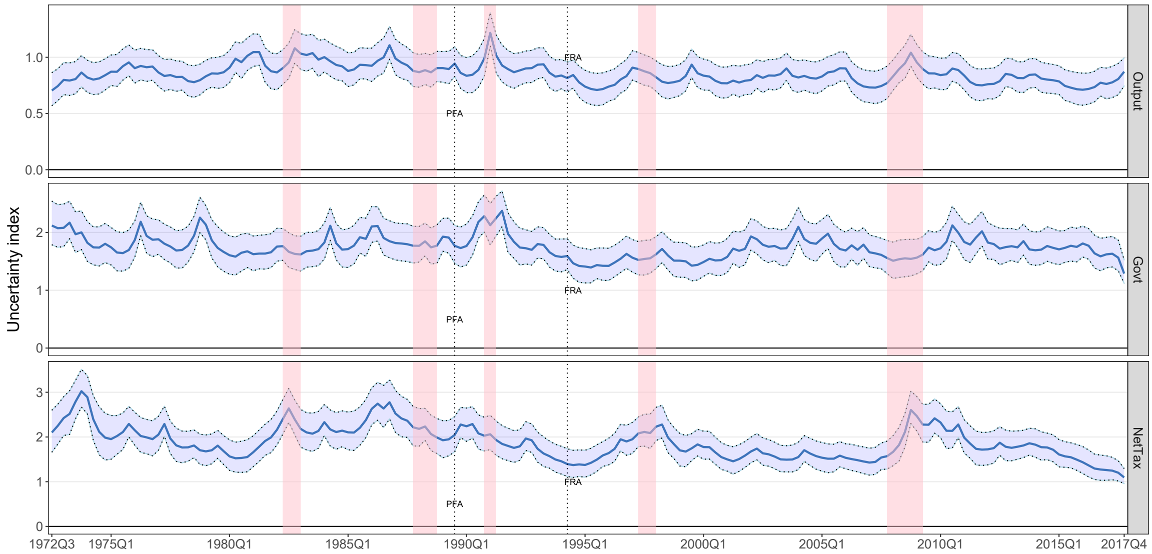

Figure 3: Estimated government spending and net tax uncertainty—main specification

Shaded area represents 68 percent credible set; solid line is the posterior median

tax system, is biased downwards. The value of 1.2 we adopt, taken from Hamer-Adams and Wong (2018), is similarly based on the institutional features of the New Zealand tax system. It is therefore plausible that our number, 1.2, is also biased downward. Row four is the uncertainty estimates from a specification where the nominal 90 day bill rate is included (and ordered last, as per Popiel, 2020) to control for monetary policy; unfortunately we could only find quarterly 90 day rate data back to 1974Q1, which because of the burnin period means we only get uncertainty estimates from 1985Q2.[18] In motivating the addition of monetary policy into the model, Popiel (2020, p. 15) notes:

> failing to control for monetary policy may attribute some of the fluctuations in output to fiscal policy when they are actually driven by actions taken by the Federal Reserve. Moreover, if important monetary policy events occur around times of large fluctuations in the volatility of government spending or revenue, then the same could be true for the effects of fiscal policy uncertainty.

Looking down the first column of figure 4, it seems that the specification makes no significant difference to the estimates of net tax or government spending uncertainty. Table 2 confirms this. For the two alternative specifications where we have uncertainty estimates over the same sample period as our baseline model, the correlation between the estimate from each alternative specification and estimate from the baseline specification is 0.89 or above. For the restricted sample period, 1985Q2 to 2017Q4, where we have uncertainty estimates from the model with monetary policy included, table 3 shows that controlling for monetary policy also makes only a slight difference to our estimates of uncertainty.

[18]Both Dungey and Fry (2009) and Power and Haug (2021) use the 90 day rate to reflect the stance of New Zealand's monetary policy.

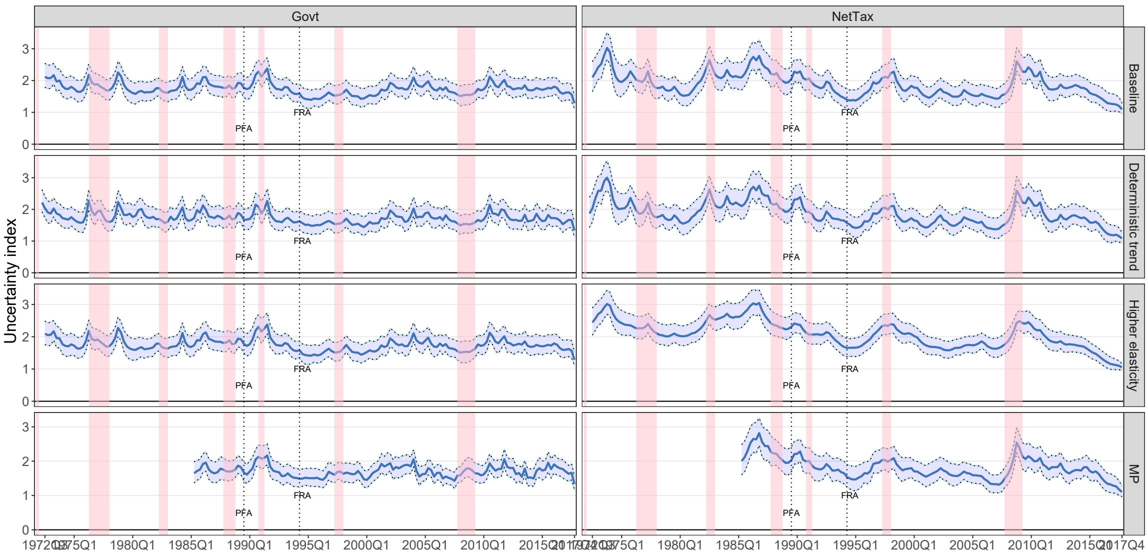

Figure 4: Estimates of government spending and net tax uncertainty from various specifications

Shaded area represents 68 percent credible set; solid blue line is posterior median. ***Base*** *refers to our baseline specification;* ***Deterministic trend*** *refers to our specification with deterministic trend;* ***Higher elasticity*** *refers to our specification with tax to output elasticity of 3.13 assumed;* ***MP*** *refers to our specification 90 day interest rated added to the model;* ***Govt*** *and* ***NetTax*** *refers to uncertainty about government spending and net tax respectively.*

	Govt spending uncertainty	Net Tax uncertainty
Baseline model	1	1
Deterministic trend model	0.96	0.98
Model with higher output/tax elasticity	0.99	0.89

Table 2: Correlation between uncertainty estimates from alternative specifications and the uncertainty estimate from the baseline specification: 1972Q3 to 2017Q4

	Net Tax uncertainty	Govt spending uncertainty
Baseline model	1	1
Deterministic trend model	0.97	0.97
Model with higher output/tax elasticity	0.99	0.91
Model with 90 day rate added	0.93	0.95

Table 3: Correlation between uncertainty estimates from alternative specifications and the uncertainty estimate from the baseline specification: 1985Q2 to 2017Q4

3.3 Should we be concerned about fiscal policy uncertainty?

Before we turn to seeing if the two pieces of legislation lowered fiscal policy uncertainty, it is worth seeing if fiscal policy uncertainty is detrimental to the economy. The legislation can only be seen as successful if it has reduced something that would have otherwise led to negative outcomes.

To date the literature has not been definitive on how fiscal policy uncertainty affects the economy. Two studies find tax uncertainty has significant effects. Mumtaz and Surico (2018) find that net tax/revenue uncertainty decreases output (whereas government spending uncertainty does not). Fernández-Villaverde et al. (2015) finds that capital tax uncertainty reduces output (but for other fiscal policy instruments, such as government spending, they found the 'effects were smaller' in 'preliminary' work; p. 3372).[19]

In contrast to Fernández-Villaverde et al. (2015), Popiel (2020) makes the estimation of uncertainty endogenous to the model, this allows him incorporate the uncertainty around the volatility estimate when examining the effects of volatility on the economy. He shows that once you account for the estimation uncertainty, the finding of Fernández-Villaverde et al. (2015)—that a capital tax rate volatility shock has a negative and statistically significant effect on output—disappears. As Mumtaz and Surico (2018) do, Popiel (2020) finds in his baseline specification (which is the same as our baseline specification) that output falls in response to revenue (net tax) uncertainty but not government spending uncertainty. However, this effect disappears in the alternative specification of Popiel (2020) once monetary policy is controlled for via adding the short term interest rate.[20]

So where do we land? The relevant impulse responses from our baseline model are plotted in figure 5. We see that, over our full sample, either either net tax nor government spending uncertainty affects output growth. Given the New Zealand economy has gone under a lot of structural change over our sample period, we then split the sample into a pre-structural reform sample 1972Q3-1984Q2 and a post-structural reform sample 1995Q1-2017Q4 to see if these results still

[19] Fernández-Villaverde et al. (2015) assume a fiscal rule and estimate a model based on this rule. The volatility in the model's errors is assumed to be capital tax uncertainty. This estimate of capital tax uncertainty is then added to a SVAR. The SVAR is then used to measure the effect of capital tax uncertainty on output.

[20] One final study, Born and Pfeifer (2014) finds, using a DSGE model, that policy risk (which includes fiscal policy risk) has only small effects on output.

hold.[21]

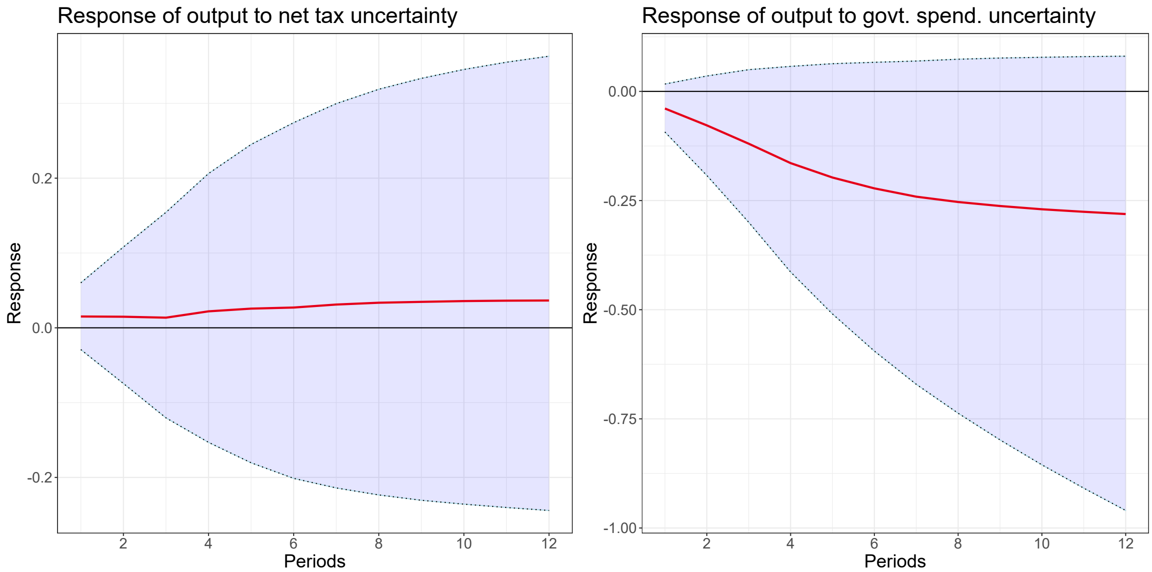

Figure 5: Response of output to fiscal uncertainty

Shaded area represents 68 percent credible set; red line is posterior median, y-axis is in percent growth rates

Figure 6 plots the impulse responses if we restrict the sample from 1972Q3 to 1984Q2. In this restricted sample, government spending uncertainty lowers output but net tax uncertainty has no economically significant effect on output (the positive effect is statistically different from zero on impact but not thereafter). This contrasts to a model estimated on post-1994 data, where net tax uncertainty lowers output, whereas government spending uncertainty does not (see figure 7.

We would expect that net tax uncertainty would be detrimental to output. The literature suggests higher uncertainty is likely to propose investment and consumption (Bloom, 2014), and there is no reason why the effects of net tax uncertainty would be any different from general uncertainty. Further, unlike government spending where the effects are likely to be felt by a few heavily-dependent sectors, all firms and households need to pay tax, thus uncertainty around tax is likely to figure in the investment and consumption decisions of nearly all firms and households. For households that rely on transfer payments, transfer uncertainty represents income uncertainty and may prompt precaution in spending decisions.

In light of our above reasoning, our result for the impact of net tax uncertainty on output for the period 1973-1984 is unexpected. In explaining the result, it is worth noting the period was a somewhat idiosyncratic time in New Zealand economic history. The tax system played a significant role in export development through concessions and incentives. Thus net tax uncertainty, which as we saw in figure 3 tended to be associated with tax policy changes, could have lead to additional investment in the period as firms and other producers responded to the tax incentives. And it may be these additions to output more than offset the negative effects of tax uncertainty on output (for reasons we outlined earlier).

Regarding the post-1994 result—tax uncertainty now has a negative effect on output—the first

[21] These are estimation periods, the 40 quarters prior to the start of the estimation period are used as burnin quarters.

observation is this result is in line with other studies. As discussed above, when studies have found fiscal uncertainty to be detrimental to the economy, it has been net tax uncertainty that has been detrimental to output, not government spending uncertainty (see Fernández-Villaverde et al., 2015, Mumtaz & Surico, 2018 and the baseline model of Popiel, 2020).[22] Secondly, the result is more consistent with what one would expect, given the reasons we discussed earlier.

In contrast to tax policy uncertainty, government spending uncertainty had a detrimental effect on GDP prior to 1984 (see figure 6). However post-1994 government spending uncertainty has no significant effect on the economy (see figure 6). An explanation may lie in the fact fiscal policy has been been replaced by monetary policy as the preferred means of stabilising the economy and thus government spending has had more of a medium run focus; see Barker et al. (2008, p. 24). Further, government spending when used as stabilisation policy in the period was known to be time-inconsistent—Wells (1987) notes during the 1976-84 period the use of fiscal policy as a stabilisation tool, mean fiscal policy had an an increasing short-run focus and the result was: 'producers and consumers had little confidence that a particular set of policies would be sustained' (p. 284). Thus government spending uncertainty would have have lead to private investors and households 'waiting and seeing' before undertaking investment and consumption. Now fiscal policy has a more medium run focus, 'waiting and seeing' is a less engaged in option as policy reversal is less likely. So even through there might be uncertainty associated with government spending as policy is changed, there is at least confidence that the policies are unlikely to be reversed; this contrasts with 1976-84 period.

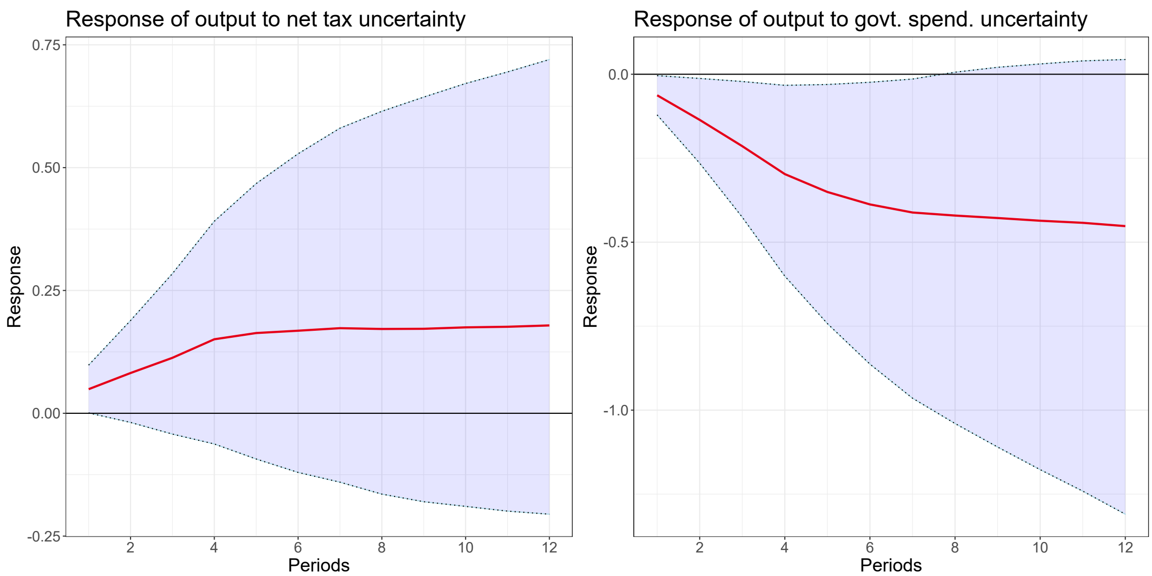

Figure 6: Response of output to fiscal uncertainty: 1972Q3 to 1984Q2

Shaded area represents 68 percent credible set; red line is posterior median, y-axis is in percent growth rates.

[22]Unlike Popiel, 2020 net tax uncertainty still has a negative impact on output in our model, estimated on a post-1994 sample, when monetary policy is controlled for.

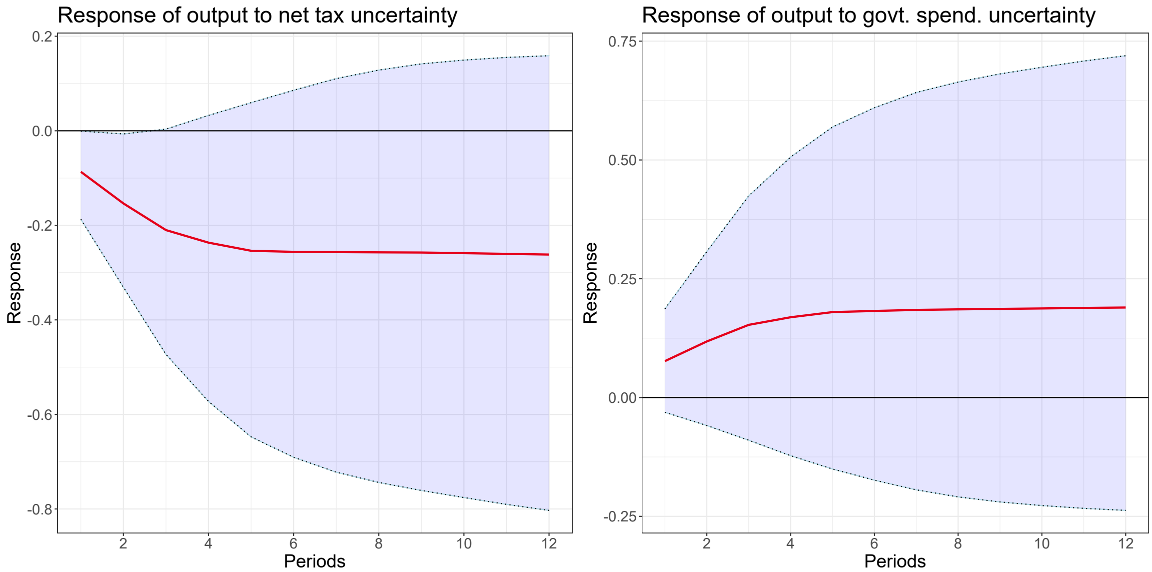

Figure 7: Response of output to fiscal uncertainty: 1995 to 2017

Shaded area represents 68 percent credible set; red line is posterior median, y-axis is in percent growth rates.

3.4 Were the Public Finance Act and Fiscal Responsibility Act successful in reducing uncertainty?

To test if net tax or government spending uncertainty fell post the assent of the two pieces of legislation we estimate the following regressions:

$$Govt.Uncertainty_t = \beta_1 + \beta_2 During_t + \beta_3 Post_t + \beta_4 X_t + \epsilon_t \quad (10)$$

$$Net.tax.Uncertainty_t = \beta_1 + \beta_2 During_t + \beta_3 Post_t + \beta_4 X_t + \epsilon_t \quad (11)$$

where $Net.tax.Uncertainty_t$ and $Govt.Uncertainty_t$ are net tax and government spending uncertainty respectively. $During_t$ is a dummy variable that takes a value of one between 1989Q3 (the Public Finance Act came into force on 1 July 1989) and 1994Q2 (the Fiscal Responsibility Act came into force on 1 July 1994) and zero otherwise. It controls for the fact that one piece of legislation was in place in that period but not the other. Further, it also controls for the fact, as Janssen (2001, p. 29) notes: "the [Fiscal Responsibility] Act also codified a number of developments that had evolved in previous years." $Post_t$ is a dummy variable that takes a value of one post 1994Q2 and zero otherwise. This is our variable of interest. If the two pieces of legislation have been successful in reducing uncertainty, we would expect the coefficient estimate on this variable to be negative and statistically significant.

Equations 10 and 11 also contains the term X_t. This variable takes a different form in different specifications of equations 10 and 11. It is omitted in the first specification; in specification (2) we use the policy uncertainty index from Baker et al. (2016) and in specification (3) we use the equivalent U.S. uncertainty index from Popiel (2020).[23] The Baker et al. (2016) index and the dependent variable equivalent U.S. index from Popiel (2020) are used to control for the effect of the so-called worldwide great moderation on uncertainty in New Zealand. The decline in volatility/uncertainty overseas will have spilt over into New Zealand via a number of different channels, particularly through export and import demand and prices, and financial markets. This, in turn, might have decreased uncertainty about fiscal variables. In specification (4), we use the lag of the output gap as the term X_t in equations 10 and 11.[24] We see value in controlling for the output gap given, one, uncertainty increases during recessions (Bloom, 2014, p. 153) and, two, New Zealand recessions have their genesis in overseas developments (Reddell & Sleeman, 2008). Thus we control for the output gap to ensure that it is not just a high prevalence of recessions in our pre-legislation - implementation period that is driving higher uncertainty in that period (if that is what we observe). Our final specification, specification (5), has dummies for any quarters where we interpolated data (1979Q2 to 1982Q1) to make sure these quarters are not driving our results.

Table 4 reports the results for net tax uncertainty. We estimate that in the period post the assent of both pieces of legislation, net tax uncertainty fell between 0.37 and 0.47 standard deviations (about a 17 to 22 per cent deduction of the pre-reform level). These estimates are all significant at a one percent level. Table 5 reports the results for government spending uncertainty. We estimate that in the period post the assent of the legislation, government spending uncertainty fell 0.39 to 0.47 standard deviations (a between 19 and 23 per cent reduction in mean uncertainty relative to the pre-reform period). These estimates are also all significant at a one percent level.

To test the robustness of our results we then re-estimate specification (1) of equations 10 and 11 for three alternative subsamples (see tables 6, 7); two of the subsamples omit 1972Q1 from their burnin period—we noted earlier this was an unusual data point for government spending. The coefficient estimate for the 'Post' variable is still negative and statistically significant in all equations. There is, however, some variation in the magnitude of these estimates with the smallest effect estimate of the reduction in uncertainty owing to the legislation now being 0.35 and 0.34 for net tax and government spending uncertainty respectively. Table 6 includes an additional estimation where we include dummies for the quarter of, and the three quarters after, four major pieces of tax and transfer reform: the 1972 tax and transfer reform, the 1973 tax reform, the 1982 tax reform, the 1986 introduction of GST. The purpose is to see if these reforms are driving our results of higher net tax uncertainty prior to the laws being introduced. We find that our estimate of the uncertainty reduction falls from 0.38 to 0.26 but it is still statistically significant at one percent.[25]

[23]So if the dependent variable in the equation is net tax (government spending) uncertainty, we use the net tax (government spending) uncertainty variable for the United States from Popiel (2020).

[24]This is created by applying the filter of Kamber et al. (2018) to our GDP series.

[25]One final robustness test we did was dummy out the whole reform period 1984Q3 to 1995Q4. The motivation was perhaps all the change going on in the economy might have heightened uncertainty prior to the legislation being enacted and this would have disappeared anyway. Our estimate on the 'Post' variable falls to 0.33 to next tax uncertainty but virtually unchanged for government spending uncertainty.

Table 4: Net tax uncertainty: tests of the 'Post' variable

	Specification:				
	(1)	(2)	(3)	(4)	(5)
During	−0.171**	−0.205**	−0.200**	−0.172**	−0.268***
	(0.083)	(0.085)	(0.083)	(0.083)	(0.078)
Post	−0.378***	−0.371***	−0.417***	−0.366***	−0.474***
	(0.052)	(0.055)	(0.054)	(0.053)	(0.051)
US Net Tax Uncertainty		−0.054			
		(0.038)			
BBD			0.002**		
			(0.001)		
Lag of output gap				−0.024	
				(0.021)	
Interpolated quarters					−0.544***
					(0.096)
Constant	2.067***	2.174***	1.839***	2.060***	2.163***
	(0.040)	(0.085)	(0.103)	(0.040)	(0.040)
Observations	182	174	182	182	182
R^2	0.230	0.213	0.254	0.236	0.348
Adjusted R^2	0.221	0.199	0.241	0.223	0.337
Residual Std. Error	0.326	0.323	0.322	0.326	0.301
F Statistic	26.703***	15.360***	20.178***	18.308***	31.729***)

Note: HAC standard errors reported *p<0.1; **p<0.05; ***p<0.01

Table 5: Government spending uncertainty: tests of the 'Post' variable

	Specification:				
	(1)	(2)	(3)	(4)	(5)
During	−0.002	−0.062	0.008	−0.003	−0.031
	(0.109)	(0.107)	(0.120)	(0.103)	(0.111)
Post	−0.405***	−0.472***	−0.392***	−0.388***	−0.435***
	(0.053)	(0.045)	(0.061)	(0.058)	(0.055)
US Gov't spending uncertainty		−0.642**			
		(0.308)			
BBD			−0.001		
			(0.001)		
Lag of output gap				−0.037**	
				(0.018)	
Interpolated quarters					−0.166***
					(0.053)
Constant	1.846***	2.430***	1.924***	1.835***	1.875***
	(0.039)	(0.268)	(0.093)	(0.043)	(0.042)
Observations	182	174	182	182	182
R^2	0.528	0.540	0.533	0.552	0.547
Adjusted R^2	0.523	0.532	0.525	0.544	0.540
Residual Std. Error	0.193	0.185	0.192	0.189	0.189
F Statistic	100.104***	66.502***	67.701***	73.045***	71.738***

Note: HAC standard errors reported $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 6: Tax uncertainty: subsamples

	Sample:				
	(Original)	(1984Q1-2017Q4)	(1984Q1-2010Q4)	(1972Q3-2010Q4)	(Original: tax reform)
During	−0.171	−0.362***	−0.360***	−0.161	−0.075
	(0.128)	(0.132)	(0.132)	(0.117)	(0.122)
Post	−0.378***	−0.614***	−0.615***	−0.350***	−0.264***
	(0.098)	(0.095)	(0.103)	(0.099)	(0.091)
Tax reform					0.544***
					(0.127)
Constant	2.067***	2.280***	2.292***	2.082***	1.971***
	(0.081)	(0.080)	(0.087)	(0.077)	(0.072)
Note:	*HAC s.e. reported*		*p<0.1; **p<0.05; ***p<0.01		

Table 7: Gov't spending uncertainty: subsamples

	Sample:			
	(Original sample)	(1984Q1-2017Q4)	(1984Q1-2010Q4)	(1972Q3-2010Q4)
During	−0.002	−0.007	−0.019	0.009
	(0.109)	(0.096)	(0.087)	(0.107)
Post	−0.405***	−0.340***	−0.336***	−0.357***
	(0.053)	(0.064)	(0.066)	(0.060)
Constant	1.846***	1.763***	1.805***	1.832***
	(0.039)	(0.057)	(0.053)	(0.040)
Note:	*HAC standard errors reported*			*p<0.1; **p<0.05; ***p<0.01

Uncertainty variable	Break date	Reduction in mean uncertainty
NZ net tax	1993Q3	0.4
NZ government spending	1993Q1	0.4
US net tax	1984Q1	0.9
US government spending	1987Q1	0.1
	1996Q1	0.05

Table 8: Break locations in New Zealand and U.S. fiscal uncertainty series

A final robustness test attempts to look for 'placebo effects' (see Cunningham, 2021, p. 284): statistically significant effects where there should not be any. The first place we would not expect to see the effects of New Zealand fiscal legislation reform is in the US uncertainty data; that is, if there is a (statistically) significant change in the level of US fiscal uncertainty some time between 1989Q3 and 1994Q3 (or just after), it would suggest other factors might be driving the drop in New Zealand fiscal uncertainty we document at that point. The second cause for concern would be if we found any significant reduction in New Zealand fiscal uncertainty prior to the legislative reform rather than at the times of the law changes.[26] Finding either of these things would suggest we should be cautious in attributing the reduction in fiscal uncertainty we observe to the fiscal legislation reform. To test for these occurrences, we apply a Bai-Perron test (Bai & Perron, 2003) for a break in the series to the New Zealand and US fiscal uncertainty series.[27] Table 8 shows the results. The two New Zealand fiscal uncertainty series record a break in 1993, after the Public Finance Act was enacted but before the Fiscal Responsibility Act. This is consistent with Janssen (2001, p.7) who notes 'the [Fiscal Responsibility] Act also codified a number of developments that had evolved in previous years'. The law was catching up to practice. For the US net tax uncertainty, the break occurs in 1984Q1, well before New Zealand's fiscal reform. This is suggestive that any common influences on net tax uncertainty were more likely to lower net tax uncertainty earlier in our sample. With US government spending uncertainty, in contrast, there are breaks in 1987Q1 and 1996Q1 and both these breaks are associated with a reduction in mean uncertainty. The temporal proximity to New Zealand's fiscal law reform of these breaks suggests caution is applied when attributing the reduction in government spending uncertainty in New Zealand as being due to the Public Finance and Fiscal Responsibility Acts. It may be the great moderation, for example, driving the common result between the two countries and our international uncertainty measures included in specifications (2) and (3) of equations 10 and 11 did not adequately control for the great moderation's effects.

4 Conclusion

From 1984-95, New Zealand undertook a wide-ranging reform of its institutions. One component of this reform was the development of two much-lauded, and copied, pieces of legislation guiding fiscal management and policy: the Public Finance Act (1989) and the Fiscal Responsibility Act (1994). And as we argued, both Acts sought to reduce uncertainty about fiscal variables.

This paper evaluated if the aforementioned legislation were successful in reducing net tax and government spending uncertainty. Our results suggest that the legislation most probably reduced

[26]If this were the case, it may be the earlier 'pre-intervention' reduction in uncertainty caused our 'Post' variable (our intervention variable) to be significant.

[27]This is implemented in EViews, we assume HAC standard errors, and heterogeneous error distributions across breaks.

net tax uncertainty. However, we are less certain about government spending uncertainty, as one of our robustness tests suggest the fall in government spending uncertainty could reflect other influences, such as the worldwide great moderation. The fact we can be more certain that the Public Finance Act and Fiscal Responsibility Act reduced net tax uncertainty is a positive given another finding of this paper is that net tax uncertainty has been recently more detrimental to output growth than government spending uncertainty. From an institutions point of view, reflecting on our finding that these pieces of legislation reduced (at least) net tax uncertainty, it is interesting that an institution that is enforced more by political commitments than legal means is so effective.

Two pieces of further research come to mind. Firstly, given the legislation also refers to the prudent management of public debt, it would be informative to look at government debt uncertainty when evaluating the legislation's success; Mumtaz and Surico (2018) provide a framework for estimating such uncertainty. Secondly, our measure of uncertainty is based on one-step ahead forecast errors. It would be worth using alternative measures of fiscal policy uncertainty—for example, the newspaper text-based measures of Baker et al. (2016)—to see if the results change. This will be achievable once more of New Zealand's historical newspapers are digitised.

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