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**Abstract**

This paper aims to characterize the interactions between fiscal and monetary and policy in New Zealand. We estimate a multivariate Markov-switching model and document frequent policy switches. We identify two regime: accommodative and non-accommodative monetary policy. In the non-accommodative regime, monetary policy does not respond to changes in government debt, while it does so in the accommodative regime. Further, we show that the underlying shocks are characterized by a fair amount of heteroscedasticity.

Keywords: Fiscal Theory of the Price Level, Markov-Switching, Monetaty and Fiscal Policy.

JEL codes: C32, E43, E63.

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# 1 Introduction

Fiscal and monetary policy in almost all industrial countries are decided by two separate institutions. However, those polices are hardly independent as changes in one policy will impact the effectiveness of the other.[1] A second common ground is that those interactions are subject to changes over time. For example, Davig and Leeper (2011) show that the efficiency of fiscal policy interventions depends on the intertemporal financing decisions of those interventions. They go on and show that switches in monetary and fiscal policy regimes crucially effect government spending multipliers. Chung et al. (2007) show that if agents believe that policy interactions might be subject to changes in the future, fiscal and monetary policy shocks generate wealth effects that change the impact of shocks and the ability of policy makers to response to those shocks.

Along this line, the Fiscal Theory of the Price Level (FTPL, for short) describes monetary-fiscal policy interactions. The FTPL claims that the price level in an economy can only be determined by fiscal policy. Here, the interpretation of the government budget constraint is at the heart of this theory. It is interpreted as an equilibrium restriction that generates changes in the price level whenever fiscal variables (such as debt) change. From a more-game theoretical viewpoint, fiscal policy chooses a strategy for its instruments (e.g. spending and taxes, ultimately surplus and debt) and, conditional on this strategy, monetary policy chooses its strategy, i.e. the interest rate.

Monetary and fiscal policy interactions are particularly interesting in New Zealand. New Zealand being an advanced, small-open economy is the most business-friendly economy in the world. Its economy was characterized by high and stable growth rates of about 2.6 percent until recently, combined with low inflation rates (around 2 percent) and low unemployment rates (reaching its minimum at about 4 percent in 2007) and has outperformed other advanced economies. Further, New Zealand has a real government debt of roughly 40 percent of GDP which is remarkably low compared to other advanced economies.[2] Therefore, it is particularly interesting to analyze the interactions between fiscal and monetary policy that contributed to this outstanding economic performance.

This paper aims at shedding light on the interactions between monetary and fiscal policy. For this purpose, we employ a multivariate Markov-switching model and document regime instability in the conduct of monetary and fiscal policy and their interactions. We show that in the twenty years of our sample, five policy switches occured. We identify two disticnt regimes and label them accommodative and non-accommodative monetary policy. In the non-accommodative regime, monetary policy does not respond to changes in government debt. In contrast, in the accommodative regime, the monetary authority lowers the interest rate with increasing debt. Further, the non-accommodative regime is characterized by a Taylor-type interest rate rule solely driven by the

[1] There are several other possible transmission channels between fiscal and monetary policy. For example, expectations of higher deficits may cause a lack of confidence in the fiscal sustainability of debt and trigger turbulence in financial markets, havin adverse real effects. More common are wage-price spirals caused by the impact of tax policy on prices.

[2] In the United States, for example, this share is roughly 70 percent of GDP.

inflation rate with a negative coefficient. In the accommodative regime, debt, output, and inflation drive interest rates.

For the fiscal authority, the accommodative regime is characterized by a positive relation between output and debt. In the non-accommodative, an increase in output reduces debt which follows the countercyclical Keynesian point of view. Finally, we document sizable differences in the variance of the monetary policy and debt shocks. We find that the non-accommodative regime is associated with larger shocks.

Our results are related to the work by Muscatelli et al. (2002) use (Bayesian) VAR models to estimate the fiscal-monetary interactions. They find that both policies are used as strategic complements rather than substitutes. Further, they show that fiscal policy responds less to the business cycles since the 1980's. Earlier work by Mélitz (1997, 2000) and Wyplosz (1999) using panel data on a set of countries shows that both policies are, in contrast, used as substitutes. Dungey and Fry (2009) use a SVAR model that allows for stationary and non-stationary variables, therefore allowing for temporary and permanent shocks. They find that in New Zealand fiscal policy shocks have been larger than monetary policy shocks. For fiscal policy, they show that government spending shocks played a minor role compared to tax and debt policy shocks.

## 2 A Multivariate Markov-Switching Model

In this section we aim to identify regime changes in the conduct of monetary and fiscal policy interaction. For this purpose, we use a multivariate Markov-switching model. This tool enables me to analyze non-linearities in the observed time series by assuming structural breaks in subsamples.

Markov-switching models are employed by Choi et al. (2003) studying the effects of inflation targeting in New Zealand. They find a structural break in the inflation rate right at the time of the policy change. Further Buckle et al. (2002) and Halland McDermott (2006) use Markov-switching models to study the dynamics of growth, volatility, and business cycles.

In the following, we consider a multivariate setting to describe the evolution of fiscal and monetary policy. For this purpose, government debt is a function of the interest rate - since interest payments depend on the interest rate -, and output, $Y_t$. The idea is to treat this equation as a reduced form equation, where expenditures and revenues are driven by fiscal rules with feedback to output and interest rates. Further, monetary policy is explained by an augmented Taylor-type interest rate rule with feedback to inflation, output, and government debt. The innovations $\varepsilon_{B,t}$ and $\varepsilon_{i,t}$ are normally distributed. This model can be formulated as

$$
\begin{aligned}
i_t &= \beta_0 + \beta_{1,R_t} B_t + \beta_{2,R_t} Y_t + \beta_{3,R_t} \pi_t + \varepsilon_{i,t}, && (1)\\
B_t &= \alpha_0 + \alpha_{1,R_t} Y_t + \alpha_{2,R_t} i_t + \varepsilon_{B,t}, && (2)\\
\varepsilon_{i,t} &\sim \mathcal{N}\left(0, \sigma^2_{i,R_t}\right), && (3)\\
\varepsilon_{S,t} &\sim \mathcal{N}\left(0, \sigma^2_{S,R_t}\right), && (4)
\end{aligned}
$$

where $cov\left(\varepsilon_{B,t}, \varepsilon_{i,t}\right) = 0$. Then, $R_t$ is the state in time $t$ and we assume two states. The state-dependent variance of the innovations is $\sigma_B^2$ and $\sigma_i^2$, while the $\alpha$'s and $\beta$'s are the coefficients of the explanatory variables. Further, there exists a transition matrix $\mathbb{P}$ that describes the likelihood of state changes,

$$\mathbb{P}_t = \begin{bmatrix} p_{11,t} & p_{12,t} \\ p_{21,t} & p_{22,t} \end{bmatrix}, \tag{5}$$

where $p_{ij,t}$ gives the probability from changing from state $i$ to state $j$ at time $t$, which we relate to the inflation rate.

In our analysis, we use quarterly data from 1994Q2 to 2014Q1 which gives a total of 80 observations. Time series are seasonally adjusted (using Census X-12 method) and are measured in million U.S. Dollars. All time series are taken from the Reserve Bank of New Zealand. To be precise, the time series for government debt is total Government securities on issue (table D1). The inflation rate is measured as the quarter-to-quarter change in the consumer price index (table M1). For output, we use the time series for real gross domestic product (GDP) (table M5). Finally, the interest rate is computed from the monthly overnight interbank cash rate (table B2).

# 3 Discussion

The results of the Markov-switching estimation are as follows

$$i_t = \underset{(0.46)}{4.96} + \begin{Bmatrix} \underset{(3.9)}{-10.29} \\ \underset{(3.98)}{2.4} \end{Bmatrix} B_t + \begin{Bmatrix} \underset{(4.91)}{28.15} \\ \underset{(8.46)}{-9.26} \end{Bmatrix} Y_t + \begin{Bmatrix} \underset{(0.56)}{2.08} \\ \underset{(0.6)}{-1.97} \end{Bmatrix} \pi_t + \varepsilon_{i,t}, \tag{6}$$

$$B_t = \underset{(0.02)}{0.11} + \begin{Bmatrix} \underset{(0.16)}{0.97} \\ \underset{(0.48)}{-0.13} \end{Bmatrix} Y_t + \begin{Bmatrix} \underset{(0.48)}{-0.02} \\ \underset{(0.01)}{-0.05} \end{Bmatrix} i_t + \varepsilon_{B,t}, \tag{7}$$

$$\varepsilon_{i,t} \sim \mathcal{N}\left(0, \begin{Bmatrix} \underset{(0.0003)}{0.002} \\ \underset{(0.004)}{0.01} \end{Bmatrix}\right), \tag{8}$$

$$\varepsilon_{B,t} \sim \mathcal{N}\left(0, \begin{Bmatrix} \underset{(0.43)}{2.03} \\ \underset{(1.39)}{2.70} \end{Bmatrix}\right). \tag{9}$$

Starting with the equation for government debt, we - again - find a small and significant constant (0.11). The coefficient on output is only significant in regime 1 at a value of roughly 1. This implies a one-to-one movement of output and debt changes. If we think about this as relationship driven by fiscal rules, a one Dollar increase in output affects the fiscal instruments such that debt increases by one Dollar. As debt increases, we can infer that either spending increases or taxes decrease (assuming that we are on the increasing part of the Laffer curve). Furthermore, we find that in regime 1 the coefficient on the interest rate is insignificant, implying that fiscal instruments and

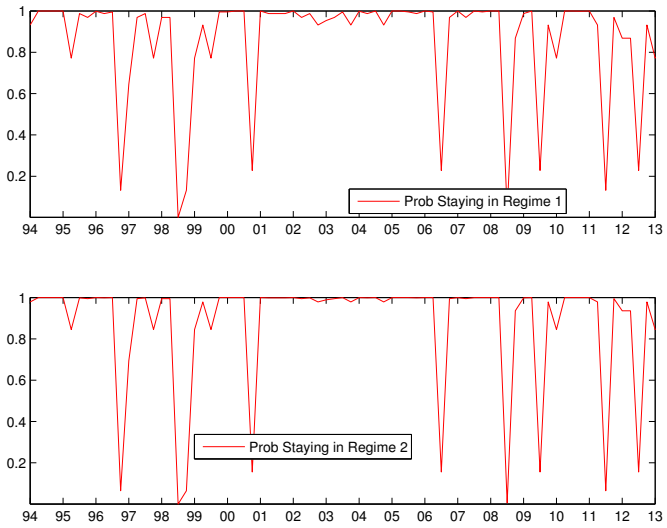


Figure 1: Smoothed transition probabilities - New Zealand.

debt do not respond to this monetary policy tool. In regime 2, the coefficient is significant at a value of -0.05. Increasing the interest rate would reduce government debt. This might be counterintuitive at a first glance, however, given that we understand this equation as a reduced form driven by rules on fiscal instruments, an increase in the interest rate will create an incentive for the fiscal authority to adjust the instruments such that, at the end, debt is reduced. Intuitively, higher interest rate at a given level of government debt will increase the interest payments. Finally, we find that in regime 2, which we label as non-accommodative, the volatility of the debt shocks is 50 percent larger compared to the accommodative regime 1, 2.7 vs. 2.

Turning to the interest rate rule, we find a significant constant of roughly five percent. In regime 2, the interest rate is solely driven by the inflation rate. Interestingly, the results show a negative value of -1.97. However, this value still fulfils the Taylor-principle of larger than one-to-one movements of inflation and the interest rate. In contrast, in regime 1 we obtain three significant coefficients. Government debt enters negatively (-10.29) implying an accommodative behavior of monetary policy. Increasing debt will lead to a reduction in the interest rate further boosting real activity. Further, there is a strong relation between output and the interest rate. We find a larger than usual coefficient of roughly 28. Given that we find a weight of about two on the inflation rate, monetary policy responds stronger to movements in output than to movements in inflation. Moreover, we find that the volatility in the non-accommodative regime (regime 2) is five time larger than in the accommodative regime.

The estimated time series for the transition probabilities are shown in figure 1.We observe eight drops in the probability to stay in regime 1, 2 respectively. The average time of regime 1 is 7.08 quarters and 7.82 for regime 2. Therefore, on average, every two years there is a different policy regime in place. Further, let us consider the time series for the regime switches presented in figure

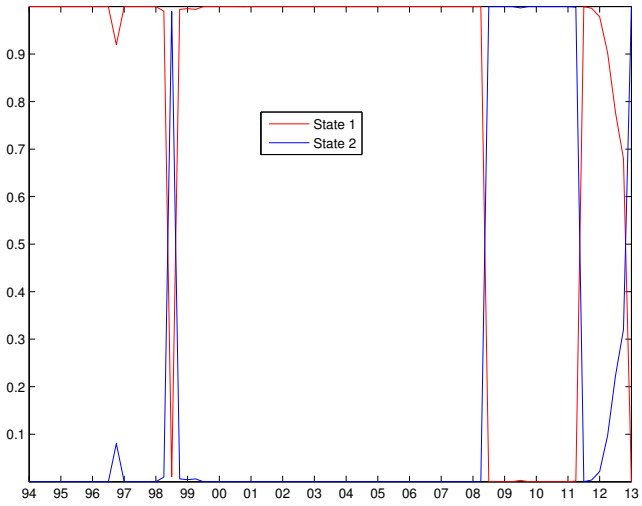


Figure 2: Markov-switching probabilities.

2.We find five regime switches over the time span from 1994 to 2014. The first and the second switch occur in 1998, where policy switches from non-accommodative (regime 1) to accommodative (regime 2) for one quarter. In 1998 it was expected that the next four years would end with a fiscal deficit. However, it was forecasted that the government under some circumstances would run a surplus. Along this line, the so-called "Policies for Progress" programme featured steps that would improve the fiscal position; paying tribute to the fact that debt and government expenditure goals couldn't be reached in time. The observed policy switch might indicate that there was the believe that fiscal policy would generate surpluses and put debt on a stable trajectory. As it turns out, this believe was quickly revised given the fact that the government run deficits in stead of surpluses and the outlook deteriorated.

The third switch from non-accommodative to accommodative occurs in 2008 and lasts for roughly three years. This switch occurs rougly one year before debt started to explode. In 2008, New Zealand entered the Great Recession this might explain why the monetary authority changed its behavior towards running higher debt levels. Reducing the adverse recessionary forces, fostering growth and employment in the global economic crisis might have created an incentive for the monetary authority to accept higher levels of debt given that the expenditures associated with this debt will have positive effects. Again, New Zealand, especially compared to other advanced economies, was running a fairly low level of government debt which gives some space for debt-financed fiscal spending. The fourth switch back from accommodative to non-accommodative happens in 2011 lasting for about two years. This switch occurs right at the time debt levels started to fall. However, the switch indicates that the efforts by the fiscal authority have been viewed critical by the monetary authority such that deemed it necessary to create further incentives to reduce debt levels. The final and fifth switch occurs right at the end of our sample in the beginning of 2013. At the time of the switch debt levels, after falling for two quarters, started to increase again. It

appears that the commitment by the fiscal authority to reduce the debt level (the expense and revenue forecasts) was credible, leading to the accommodative behavior of the monetary authority.

In addition, to those policy switches, we observe four more peaks in the probability to stay in the respective regime (see figure 1). Here, although the probability to leave the regime increased, the model still picked that no switch would fit the data better than a policy switch. Nevertheless, it indicates that around those times (1997, 2001, 2007, 2010) a regime switch was more likely than to stay in the given regime. This further supports our point of view that interactions between fiscal and monetary policy are characterized by a large amount of time variability.

# 4 Conclusion

This paper aims at characterizing the interactions between monetary and fiscal policy in New Zealand. New Zealand is a particularly interesting candidate for such an analysis as its economic performance is outstanding among the advanced economies and it experienced significant changes of fiscal and monetary policy over time.

We use a multivariate Markov-switching model to show that the interactions between monetary anf fiscal policy is subject to frequent regime switches. Our sample starts in 1994 and ends in 2014. Over this time span, we observe five policy switches. We identify two disticnt regimes and label them accommodative and non-accommodative monetary policy. In the non-accommodative regime, monetary policy does not respond to changes in government debt. In contrast, in the accommodative regime, the monetary authority lowers the interest rate with increasing debt. Further, the non-accommodative regime is characterized by a Taylor-type interest rate rule solely driven by the inflation rate with a negative coefficient. In the accommodative regime, debt, output, and inflation drive interest rates. Fiscal policy in the accommodative regime is characterized by a positive relation between output and debt. In the non-accommodative, an increase in output reduces debt which follows the countercyclical Keynesian point of view. Finally, we the variances of the underlying monetary policy and debt shocks vary sizably across the two regimes.

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