The Neglected Effect of Fiscal Policy on Stock and Bond Returns *

José Tavares
Economics Department
Universidade Nova, Lisbon
and
Economics Department
University of California, Los Angeles

Rossen Valkanov [a]
The Anderson School
University of California, Los Angeles

October 2001

[a] Corresponding author. The Anderson School; University of California, Los Angeles; 110 Westwood Plaza; Los Angeles, CA 90095-1481; Phone: (310) 825-7246; Fax: (310) 206-5455; Email: rossen.valkanov@anderson.ucla.edu. The latest version of the paper can be found at: http://www.personal.anderson.ucla.edu/rossen.valkanov/page1.htm

The Neglected Effect of Fiscal Policy on Stock and Bond Returns

October 2001

Abstract

We analyze the effect of taxes and government spending on quarterly market returns of stocks, government bonds, and corporate bonds. In US data from 1960 to 2000, a one standard deviation increase in the share of tax receipts in GDP has a statistically and economically significant effect on returns, lowering annualized expected returns by 4% and 9% at quarterly and yearly horizons, respectively. Interestingly, the impact of taxes is quantitatively similar for stock and bond returns. These results can partly be explained by the high persistence of the tax series so that increases today imply permanently higher tax levels in the future. An increase in government spending has a positive impact on expected returns, but the effect is statistically significant only for bonds, at short horizons. Our findings represent a novel test of Ricardian Equivalence, using market returns. Fiscal policy shocks account for 3-4% of the variation in unexpected excess stock returns and 8-10% of the variation in unexpected excess bond returns. When fiscal and monetary policy changes are jointly identified, our results remain qualitatively unchanged and the quantitative results are only reinforced. More importantly, we find that fiscal policy is at least as important a source of return variability as is the policy of the Federal Reserve. The findings are surprisingly robust to various system specifications, such as cointegration assumptions and variable choice. Our results strongly suggest that fiscal policy shocks should be given more serious consideration in asset pricing.

1 Introduction

> When it comes to concrete policies to counter a slump, economists across the political spectrum say that the most potent weapon a president has is fiscal stimulus, either in the form of a big spending increase or an instant tax cut. –The Wall Street Journal, March 28, 2001.

In this paper, we examine the effect of fiscal policy on stock and bond market returns. While the popular and academic press have always been interested in the role played by economic policies in financial markets, most of the attention has been devoted to the actions of the Federal Reserve and the effect of monetary policy on stock returns. There is virtually no corresponding empirical literature that analyzes the more direct, but perhaps not as high-profile, impact of fiscal policy on financial markets. We find that not only do government taxation and expenditure policies have a statistically significant effect on market returns, but that their economic significance is at least as, if not more, important than previously documented monetary interventions.

Taxes and government spending play a significant role in the determination of stock and especially bond returns. Broadly speaking, fiscal policy can have a direct and an indirect effect on financial markets. The direct effect stems from the government's ability to influence the bonds market by issuing (or retiring) public debt. For instance, an increase in taxes (tax receipts as a share of GDP), while government spending is held constant, lowers the supply of government debt. Government bond prices would increase, while their expected returns would decrease. Investors, faced with less attractive bond returns, would rebalance their portfolios. In equilibrium, the positive shock to taxes would lead to lower returns across assets, at short horizons. The magnitude and duration of the effect would depend on, among other factors, the nature of the tax policy. A temporary tax increase will lead to a small effect, while a permanent increase would surely be associated with larger movements in prices. Moreover, if investors perceive that an increase in taxes signals higher future tax rates, then expected returns would decrease significantly, even at long horizons.

To the extent that fiscal policy has an impact on the state of the economy, it will also have an indirect effect on market returns. There is a large literature analyzing whether, to what extent, and through what channels do fiscal decisions affect consumption and investment choices (for surveys, see Seater (1993), and Elmendorf and Mankiw (1999)). A consensus on these questions has yet to emerge, but most financial economists would agree that taxes and government spending do have an impact on expected firm cash flows. In addition, the uncertainty surrounding the enactment,

1

implementation, and impact of fiscal policies should affect the discount factor at which future cash flows are capitalized. In addition, fiscal policy shocks must be disentangled from monetary shocks, since the latter have previously been shown to significantly impact market returns.

Motivated by the above reasoning, we answer four specific questions. First, do unanticipated fiscal policy changes affect expected and unexpected market returns of stocks, corporate bonds, and government bonds? Second, what is the economic and statistical significance of the variance of returns that is attributable to changes in taxes and government spending? Third, are the effects of fiscal policy robust to careful scrutiny of the role of monetary policy? Fourth, is the importance of fiscal policy changes comparable to that of monetary policy indicators? Given the well-established link between macroeconomic state variables and market returns (Campbell (1999), Chen et al. (1986), Cochrane (1996), Fama (1990), Schwert (1990)), and between measures of fiscal policy and macroeconomic variables (Ramey and Shapiro (1997), Blanchard and Perotti (1998), Edelberg et al. (1998)), the natural next step is to assess the impact of fiscal policy on market returns.

To answer these questions, we use vector autoregression (VAR) methods similar to those introduced by Campbell and Shiller (1988a,b) and Campbell (1991). VARs are unrestricted dynamic systems that allow us to produce forecasts of expected returns and, thereby, to decompose ex-post returns into expected and unexpected returns. More specifically, we use VARs to trace out the effect of changes in taxes and government spending on expected market returns. VARs are also employed to decompose unexpected returns–the difference between expected returns and realized returns–into various economic shocks. Such a decomposition allows us to investigate the provenance of unexpected return movements. In this study, we use weak identifying restrictions to assess the fraction of unexpected returns that is due to fiscal policy shocks.

We find that an increase in taxes has an immediate negative effect on expected stock and bond returns. The effect of taxes on returns is economically and statistically significant. A one standard deviation shock to the aggregate tax rate (tax receipts over GDP) lowers future quarterly, yearly, and 4-year holding returns by about 4%, 9%, and 17%, respectively. On the other hand, increases in government spending (as a share of GDP) have a positive but statistically insignificant effect on expected stock and bond returns, irrespective of the holding horizon. Shocks to fiscal variables account for 3-4% of the total variation in unexpected stock returns and for about 8-10% of the total variation in unexpected bond returns. All our empirical results are robust to consideration of the role of monetary policy shocks. More importantly, our findings show that variations in fiscal policy

2

are a relatively important source of market volatility. While we corroborate previous results that monetary shocks contribute around 3% of the total stock return variability (Thorbecke (1997) and Patelis (1997)), our findings suggest that taxes and spending policies play at least as important a role in determining asset returns as Federal Reserve behavior.

The paper puts forward other important contributions. While the impact of monetary policy on stock returns has been widely analyzed (Fama (1981), Patelis (1997)), ours is the first paper to jointly examine the effect of fiscal and monetary policy on market returns. Our approach offers two main advantages over partial analyzes. First, the consideration of monetary shocks provides a natural robustness test of the new fiscal policy results. We reproduce previous results on the effects of monetary policy shocks on stock returns, which lends credence to our identification of fiscal shocks. More importantly, fiscal and monetary policy are inter-related arms of economic policy. Fiscal decisions, such as debt issue, are likely to affect future monetary policy choices.[1] Similarly, an ineffective monetary policy might induce the federal government to enact fiscal policy changes.[2] Therefore, considering the effects of one policy with no explicit accounting for these inter-relations is likely to deliver biased results.

Another contribution is the theoretical interpretation of our results. As discussed below, the Ricardian Equivalence theorem in economic theory provides strong results as to what is the effect of taxes on the return on capital. Namely, for given public spending levels, the choice between taxes and public debt should not affect market rates of return. The Ricardian Equivalence theorem, similarly to the Modigliani-Miller theorem, is a theoretical benchmark that holds only under very restrictive assumptions. The use of market stock and bond returns in the current paper provides a novel and powerful test of the Ricardian Equivalence proposition.

The paper is divided into 6 sections. Section 2 discusses the relationship between fiscal policy and returns and presents the first set of results. In section 3, we estimate the joint effect of fiscal and monetary changes on asset returns. Section 4 presents several specification tests that further establish the robustness of our results. In section 5, we discuss the implications of our results for Ricardian equivalence. Section 6 concludes.

---

[1]There is a large literature that looks at the joint optimal determination of monetary and fiscal policy. For a good overview, see Chari and Kehoe (1999). We discuss this issue in Section 3 below.

[2]Some would argue that this is the case with the recent Bush tax cut.

2 Identifying the Effect of Fiscal Policy on Returns

In this section, we undertake a VAR analysis of fiscal and financial variables. Our goal is to characterize the empirical relationship between taxes, government spending and market returns, while placing as few theoretical restrictions as possible on system dynamics. More specifically, we analyze how changes in taxes and public spending affect unexpected and expected market returns. A VAR framework is particularly appropriate for this task. To identify the structural fiscal policy shocks, we rely on the observation that fiscal policies are slower to respond to changing economic conditions than are other variables. This simple assumption does not impose extreme restrictions on the contemporaneous relationship or temporal behavior of the variables. Before delving deeper into our empirical methodology, we present the data.

Our objective is not to specify a theoretical asset pricing model with fiscal policy variables. While such a model would certainly be of interest, it would have to take a stand on the effect of taxes and government spending on real variables–output, consumption, investment–and on how those variables affect market returns. Both of these links remain unresolved in the empirical literature.[3] Moreover, the lack of stylized facts pertaining to fiscal policy variables and returns makes the assumptions and implications of such a model much less defensible. Therefore, modelling the links between fiscal variables and market returns would be unlikely to advance our understanding until more is known of the specific interactions between fiscal policy decisions and financial markets.

2.1 Data

We use quarterly US data on national accounts and market returns, covering the period 1960:1 to 2000:4. Detailed descriptions and summary statistics of all variables are provided in Table 1, panels A and B. The variables used in our VAR specification are:

- TY: Net tax receipts (excluding transfers) as a share of GDP. This variable proxies for an "aggregate tax rate," as it measures the average share of output collected by the government

---

[3]Indeed, there is no consensus as to what is the effect (if any) of fiscal policy interventions on other real variables and on future fiscal variables. While the conventional view is that higher taxes lead to lower consumption and higher private investment (Elmendorf and Mankiw (1999)), the empirical evidence is not conclusive. Moreover, the Ricardian Equivalence result, to which we turn to in Section 5, argues against the existence of any effect at all (Barro (1974, 1989a)). Similarly, while there is an agreement in the finance literature that a considerable fraction of the variation in returns can be attributed to macroeconomic fluctuations (Fama (1990)), an asset pricing model that captures those variations is still lacking. It may be tempting to put the two literatures together. For instance, one might argue that if an increase in taxes leads to lower consumption, then, using the standard consumption CAPM arguments, the expected return of an asset must be higher. Such a direct link through consumption alone would ignore other important channels through which taxes might have an effect on returns.

4

as taxes.

- SY: Government purchases (net of transfers) as a share of GDP. This ratio captures government demands on output produced in the economy.

- MKTRF: Log stock return of the S&P 500 index portfolio in excess of the 3-month Treasury bill rate. The log, or continuously compounded, return is defined as $\log(1+R(t))$, where $R(t)$ is the simple, one-period holding return. The use of continuously compounded returns greatly facilitates the manipulation and interpretation of the results at various horizons, as discussed below.

- CBRF: Log return on corporate bonds in excess of the 3-month Treasury bill rate.

- GBRF: Log return on government bonds in excess of the 3-month Treasury bill rate.

- GY: Rate of per capita output growth, an indicator of business cycle fluctuations.

- GC: Rate of per capita consumption growth, used as an alternative indicator of business cycle fluctuations.

- TSPR: Term spread (of 10-year bond minus 3-month bill) is also another alternative indicator of business cycle conditions, which has been used by Chen et al. (1986) and Fama and French (1989), among others.

- FFR: Federal Funds rate, an indicator of monetary policy stance.

- INF: Inflation rate, measured as growth rate of the consumer price index.

A few remarks are in order. First, the government budget constraint provides an inter-temporal link between tax receipts, spending, and government debt. The inclusion of any two of these variables is sufficient to recover the third. In this study, fiscal policy actions are captured by fluctuations in taxes over GDP (TY) and government spending over GDP (SY), whose coefficients are easy to interpret and of immediate interest. It must be pointed out that any one variable from the government budget constraint is not enough to identify the exact fiscal policy. This point was first made by Feldstein (1982), who argued that the effect of government spending on macroeconomic variables "cannot be determined a priori on the basis of the effects of government deficits alone." Indeed, previous studies of the effect of deficits on interest rates have used deficits

5

as the only right-hand side fiscal policy variable,[4] which implies one of two extreme assumptions. Either the deficit has only financial implications and does not affect interest rates through changes in future government spending or taxes, an argument disputed by Bohn (1991). Or changes in taxes and government spending have exactly symmetric effects on interest rates, so that changes in the deficit variable have a similar impact whether they arise through an increase in spending or a cut in taxes. In sum, only by jointly controlling for taxes and spending, can we unambiguously interpret our results as being motivated by a government budget constraint.[5] This is the approach taken in this paper.

Second, fiscal policy may affect the aggregate economy and, through this indirect channel, market returns. This is precisely the reason we control for the business cycle in all our specifications, using alternatively output growth, consumption growth and the term spread. Higher taxes imply a disincentive to invest and can thus affect the cycle. Certain categories of spending, such as public investment, may impact productivity in a positive way, while others help individuals overcome temporary liquidity constraints and capital market imperfections, thus stimulating the economy in the short term.[6] The effect of taxes and government spending on the economy is hard to identify as the shares of taxes and of spending fluctuate cyclically. Blanchard and Perotti (1999) use a mix of structural VAR and event study approach to identify shocks to government purchases with institutional and timing information on tax and transfer systems. They find a negative effect of taxes, and a weak positive effect of government purchases on output. Burnside et al. (2000) identify fiscal shocks with exogenous increases in military purchases (due to wars) and find that individuals work more hours when government purchases are higher (and concomitant tax rates are higher). We find that the aggregate economy indeed responds to fiscal policy shocks.

[Table 1 about here]

Third, it is clear that, conceptually, fiscal policy variables must be stationary since, by definition, their range is bound between 0 and 1. In the post-war period, and after transfers are netted out, taxes and government spending have steadily declined in the US. This ex-post persistent behavior

---

[4]Recently, Fatas and Mihov (1998) use the deficit as the lone fiscal policy indicator while Rotemberg and Woodford (1992) use only partial expenditure indicators (military personnel and military purchases).

[5]The government budget constraint is an accounting identity linking tax receipts, public spending, and the government deficit. The behavior of any two of these variables necessarily has implications for the behavior of the third variable.

[6]The argument that public expenditure has a productive impact was tested in Aschauer (1989). Barro (1981) presents a model where increases in government purchases lead to a rise in output and in interest rates.

of the fiscal variables is consistent with the hypothesis that an unexpected change in taxes is likely to signal future tax increases.[7] In our sample, TY and SY exhibit persistent behavior, as shown by the order of integration tests in Table 2. The persistence of taxes and government spending, even after expressing them as shares of GDP, has also been observed by Bohn (1991), who studies the behavior of taxes and spending in the United States over the very long-run. Since we don't want to impose any a-priori restrictions on those variables, we leave their dynamics unrestricted. To correct for biases introduced by the persistent processes, all statistics and confidence intervals are computed using bootstrap methods.

[Table 2 about here]

Fourth, since average and marginal tax rates are highly correlated over time, TY is a sensible proxy for the tax variables relevant for investors decisions. Lastly, given our focus on government financing, we exclude transfers and use net tax receipts and net government spending. Transfer policies, by their nature, have different financial implications than do taxes and spending.

2.2 VAR and Fiscal Policy Shocks

We want to explore the effect of fiscal policy on stock and bond returns while placing as few restrictions as possible on the data dynamics. In the spirit of the recent VAR literature, we collect the variables of interest into a vector Y_t and estimate the system of equations

$$Y_t = F(L)Y_{t-1} + u_t$$

where $F(L) = F_1 + F_2 L + ... + F_k L^{k-1}$ is a polynomial in the lag operator of degree $k-1$ and F_j, $j = 1, ..., k$ are unrestricted matrices that capture the dynamic interaction between the variables. The residuals u_t are generally correlated, with a covariance matrix $E(u_t u_t\prime) = \Sigma_u$ and do not have an economic interpretation. The vector $Y_t = [TY_t, SY_t, GY_t, INF_t, MKTRF_t]$ contains the fiscal, macroeconomic, and financial variables. We define e_j to be a row vector whose j-th element is 1 and the other elements are zero and $Y_{j,t}$ to denote the j-th element of vector Y_t, or $Y_{j,t} = e_j Y_t$.

As in Campbell and Shiller (1988a,b), we use the VAR as an unrestricted mechanism to decompose returns into *expected* and *unexpected* returns. We can decompose excess stock market returns, the fifth variable in the VAR, as

---

[7]Feldstein (1982) points out that "a rise in current taxes may cause individuals to revise their expectations of future taxes in the same direction," and similarly for government spending.

7

$$Y_{5,t} = e_5 Y_t = e_5 E_{t-1} Y_t + e_5 u_t$$

$$= e_5 F(L) Y_{t-1} + e_5 u_t$$

The variation in unexpected returns $e_5 u_t$ can be due to several different economic factors. To decompose u_t into interpretable economic innovations, we exploit the fact that fiscal policy variables do not respond to business cycle fluctuations within the period of one quarter. In other words, taxes (TY_t) and spending (SY_t) do not respond contemporaneously to business cycle fluctuations, inflation or market returns. Slow legislative and bureaucratic processes and the restrictions imposed by the fiscal calendar year itself stand in the way of quarterly changes in taxes and spending in response to contemporaneous behavior of economic and financial variables. We also assume that output does not adjust, within the quarter, to inflationary shocks. Market returns are assumed to respond to all other variables within the period. The lagged behavior of taxes, spending, and output (captured by $F(L)$) is unrestricted.

The conditions described above impose a recursive contemporaneous (or Cholesky) ordering used, among others, by Sims (1980, 1986) and Christiano et al. (1996, 1998). We summarize these conditions by introducing restrictions on the contemporaneous covariance matrix of the residuals u_t. Specifically, we assume that

$$u_t = A w_t$$

where A is a lower triangular matrix, with a diagonal of ones and unrestricted parameters below the diagonal:

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{12} & 1 & 0 & 0 & 0 \\ a_{13} & a_{23} & 1 & 0 & 0 \\ a_{14} & a_{24} & a_{34} & 1 & 0 \\ a_{15} & a_{25} & a_{35} & a_{45} & 1 \end{bmatrix}$$

The Cholesky ordering restrictions imply that economic shocks impact contemporaneously only variables placed at the same level, or lower, in the system. The number of restrictions in A are just sufficient to allow us to identify the system and recover the economic shocks w_t from the residuals

u_t.[8]

Several alternative specifications are certainly possible and we make an effort to analyze those that we feel are more relevant. For instance, we examine the effect of taxes and government spending on stock ($MKTRF_t$), corporate bond ($CBRF_t$) and government bond ($GBRF_t$) returns, respectively. All these specifications are discussed at length below. Similarly, we use several controls for business cycle fluctuations. In place of output growth, we include consumption growth (GC_t) and term spread ($TSPR_t$) in the VARs. A more extensive discussion and results from the robustness checks are provided below.

2.3 Breaks vs Shocks; Anticipated vs Unanticipated Changes

Our identification of fiscal policy effects, while similar to most VAR applications, differs from the recent papers by Edelberg, Eichenbaum, Fisher (1998) and Blanchard and Perotti (1998), who identify fiscal policy shocks through exogenous breaks in the mean of the series. Such breaks, imposed with a dummy variable at a pre-specified date, are reminiscent of an event study approach. As we show in subsequent sections, the fiscal policy shocks identified by our procedure are very close to the exogenously pre-set break dates in the above studies.

We chose not to identify shocks with a-priori imposed dummy variables for two reasons. First, the exact timing of the shock is unknown ex-ante. In the case of the Edelberg, Eichenbaum, Fisher (1998) and Blanchard and Perotti (1998) the exact time at which information about fiscal policy becomes available to market participants is not crucial, because their focus is on the effects of fiscal policy on output, a relatively slowly moving variable. But timing becomes a crucial issue when analyzing prices and returns on financial assets. It is likely that the effect is strongest when the new information on the policy first becomes available to market participants. In fact, the date of actual policy implementation is not all that important once market participants have incorporated the new information in asset prices. Since there is no exact way of assessing when the new information reaches financial markets, we let our system identify the time and magnitude of the shocks.

Second, in the present application, the structural shocks are quite easy to identify since the recursive ordering of the variables can be defended in a compelling fashion. The use of structural VARs is especially appropriate in the case of fiscal policy, since these variables are less responsive to variations in output and market returns, as discussed above. In the next section, we show that

---

[8]Since the Cholesky identification scheme is standard in the literature, we do not provide a detailed explanation. For more details, see Hamilton (1994) or Watson (1994).

the identified fiscal shocks correspond very closely to the events in Ramey and Shapiro (1997) and Blanchard and Perotti (1998), thus attesting to the success of our identification.

We must emphasize that the choice of capturing fiscal policy as a shock versus a break is strictly dictated by the application at hand. While there has been a lot of debate on what specification is more appropriate, such a discussion makes little sense without specifying the question at hand. The break-in-series parameterization, which can be traced to Box and Tiao's (1975) "intervention analysis," searches to separate "aberrant" events from the noise and models those events as changes (or "interventions") in the deterministic part of the series. A similar approach was adopted by Perron (1991) in his influential paper on structural breaks. Such a parameterization is convenient in macroeconomic time series applications when the exact timing of the break is not of great significance. However, in our application of market returns, the timing of fiscal policy shocks is of paramount importance.

2.4 Impulse Responses and Variance Decomposition

Impulse responses and variance decomposition are the two main tools to analyze the propagation of shocks through linear dynamic systems. Since those tools are commonly used in the literature, here we offer only a quick exposition of their specific use.

2.4.1 Impulse Responses

We capture the effects of taxes and spending on other variables through the impulse response functions

$$\frac{dY_{t+k}}{dw_{1,t}} \text{ and } \frac{dY_{t+k}}{dw_{2,t}}$$

for a given horizon k. Our main interest is in the effect of $w_{1,t}$ and $w_{2,t}$ (tax and spending shocks) on excess returns, $Y_{5,t}$. Since we work with continuously compounded returns, it must be noted that a k-th period continuously compounded return, $Y_{5,t}^k$, can be written as a sum of k, one-period holding returns, or $Y_{5,t}^k = Y_{5,t+1} + Y_{5,t+2} + ... + Y_{5,t+k}$. The impact of an unanticipated fiscal shock on the k-th period continuously compounded market return is captured by the cumulative impulse response function:

$$\sum_{i=1}^{k} \frac{dY_{5,t+k}}{dw_{1,t}} \text{ and } \sum_{i=1}^{k} \frac{dY_{5,t+k}}{dw_{2,t}}$$

We will use the cumulative impulse response function to analyze the effect of tax and spending on expected returns. The use of log returns greatly facilitates our calculations by overcoming the difficulty of working with simple returns and geometric averages. It is worth noting that the cumulative impulse response functions are similar in spirit to the coefficients of long-horizon regressions, which are now commonly used in the finance VAR literature (Campbell (1991, 1993), Patelis (1997), and recently, Lettau and Ludvigson (2000)). The difference is that, in long horizon regressions, the interest is on the impact of a *conditioning variable* on long horizon returns, while in our application, we are interested in the effect of economic (fiscal policy) *shocks* on long horizon returns.

2.4.2 Variance Decomposition

The variance decomposition offers a convenient way of assessing the importance of the identified shocks to the variables of interest. The VAR can narrowly be seen as a way of producing forecasts at different horizons. Under the identifying assumptions discussed above, we can decompose the mean square error (MSE) of the s-period ahead VAR forecast as a sum of the orthogonal structural shocks w_t. In such a way, we can compute the contribution of each shock toward the MSE, at a given horizon. As the horizon increases, under the assumption of covariance stationarity, this contribution can be interpreted as the fraction of the variance of the variable that is due to a particular shock.

In this paper, we decompose the variance of excess stock and bond returns into the orthogonal components identified by our assumptions. The main interest is in finding the fraction of returns variance that is due to fiscal policy shocks, i.e. to unexpected changes in taxes and government spending. As a way of understanding the mechanisms through which taxes impact market returns, we also look at their effect on other variables, such as GDP growth and inflation.

The variance decomposition has become a standard tool in finance largely due to the influential papers of Campbell and Shiller (1988 a,b) and Campbell (1991), who decompose the variance of excess stock returns into variations due to news about future dividends, future interest rate fluctuations, and future excess returns. The variance decomposition has been used by, among others, Thorbecke (1997) and Patelis (1997). It is also a standard tool in empirical macroeconomics (see Watson (1994) for a survey).

2.5 Results

In this section, all VARs are estimated using least squares, equation by equation. We present estimates from VARs using $Y_t = [TY_t, SY_t, GY_t, INF_t, MKTRF_t]$ and the two complementary specifications where we substitute stock returns by corporate $(CBRF_t)$ and government bond $(GBRF_t)$ returns. Important results are presented for all three asset returns.

Figure 1 displays the main results, namely, the cumulative responses of output and market returns to spending and net taxes. The three panels display the results from the VARs with excess stock, corporate bond, and government bond returns, respectively. The impulse responses are plotted over a 16-period (4-year) horizon along with a centered 95% confidence interval, computed using a bootstrap resampling.[9] We use bootstrap methods extensively in this work because, given the small sample and the persistence of some variables, asymptotic results are unlikely to provide accurate confidence bounds. Focusing on the third column of panels 1 through 3, the effect of a tax increase has a significant and immediate effect on market stock and bond returns. In the period of the unanticipated tax increase, one-period holding returns decrease by about 4% to 5%. The effect is stronger at longer horizons: the 2-year and 4-year holding returns decrease by as much as 10% and 15%, respectively. For bonds, the economic and statistical significance is more pronounced at all horizons, which undoubtedly reflects the fact that bond returns are less noisy than stock returns (see Table 1).

[Figure 1 about here]

The effect of unanticipated government spending on market returns, shown in column 4 of panels 1 through 3, while positive, is statistically insignificant. Its economic magnitude is modest when compared to the tax results. In the case of bond returns, spending shocks deliver a significant effect only at short horizons. For stock returns, the impulse responses are not significant.[10] It must be pointed out that, given the number of parameters estimated in the VAR, the power of our statistical

---

[9]For the bootsrap procedure, we follow Runkle (1987), Lutkepohl (1990), and Hamilton (1994). Given our small sample (relative to the number of parameters in the VAR), we use the bootstrap, because asymptotic distributions might not adequately approximate the finite sample distributions of the parameters. The advantage of the bootstrap over a Monte-Carlo procedure is that we don't need to make any distributional assumptions about the residuals.

[10]Plosser (1982) estimates the effect of changes in government purchases and changes in public debt on Treasury Bill rates and finds that government purchases are negatively related to Treasury bill rates while government debt is not significantly related to interest rates. In a follow-up, Plosser (1987) examines the effect of government purchases, public debt and holdings of debt by the Federal Reserve on rates of return for government bonds of different maturity. Federal Reserve holdings of government debt are used as an indicator of monetary policy. Here the main finding is instead of a positive association between government purchases and bond returns.

tests is quite small. Finding statistically significant results in such a large and unrestricted system is nothing short of surprising.

Columns 1 and 2 of panels 1 through 3 show that an unanticipated increase of the aggregate tax rate has an initially positive, but eventually an overall negative effect on output growth. An unanticipated increase in the government spending rate has a temporary negative effect on future economic growth that translates into a positive effect at a longer horizon. Given that financial markets are forward looking, it is not surprising to find that, since taxes have a negative effect on future economic growth, market stock and bond returns correctly anticipate, and immediately reflect, that information. Thus, we can conjecture that at least some of the effect of tax rates on returns is due to a decrease in future cash flows.

Table 3 presents the variance decomposition for output growth and market returns in the VARs with stock, corporate bond and government bond returns. As discussed above, the variance decomposition can be interpreted as a decomposition of unexpected returns into components due to various economic shocks. In the first row, we can verify that spending shocks account for a substantial fraction of the variability in output for all three VARs. Unexpected shocks to spending are twice as important as inflation. The importance of shocks to tax receipts, at around 5 percent, is not negligible. Both spending and taxes are more important than market returns in explaining the variability of output. When we turn to the variability of returns, in the second panel of the table, we verify that unexpected shocks to tax receipts are an important source of return variability, of the same order of magnitude as inflation. For corporate and government bonds, tax receipts are the single most important source of variability with the exception of returns themselves.

[Table 3 about here]

Our results are broadly consistent with the previous empirical literature as far as government purchases are concerned. The use of market returns, instead of interest rates, leads to stronger statistical results. The scarce number of studies and the common use of debt rather than taxes make our results harder to compare directly with previous studies. Our evidence is in line with the argument in McGrattan and Prescott (2001), who compare two periods of stable tax rates in the United States and find that the value of equity as a share of GDP almost doubles for the period with the lower rates.[11] The authors conclude that the fall in effective tax rates led directly to the

---
[11]The periods are just before the Kennedy tax changes in the early 60's and just after the Reagan tax reform act of 1986.

doubling in equity values as a share of GDP, as investors recognized the increased opportunity for investing in stocks, stimulating the demand for equities and raising equity prices[12] In the current paper, we take an empirical approach that is complementary to McGrattan and Prescott (2001) as we examine directly the impact of tax changes on market returns instead of periods of stable tax rates. But our results are consistent since we find a negative trend of taxes net of transfers which leads to increased equity values over time. While McGrattan and Prescott's explanation might be an important part of the story, it is likely that other mechanisms are at play since bond returns have seen an equally impressive performance following tax reductions, as described below.

Let us summarize the important results in this section. An increase of the tax rate leads to an instantaneous decrease of market stock and bond returns at any holding horizon up to 4 years. This effect, which is statistically and economically significant, can partly be attributed to taxes having an unexpected negative impact on future GDP growth, which undoubtedly impacts the future cash flows of companies. Shocks to government purchases are associated with an insignificant increase in market stocks and bonds returns. For stocks, taxes are a significant source of unexpected return variations, on a par with inflation (and more important than output). In the case of bonds, tax shocks are clearly more important than any other economic shocks.

3 Fiscal and Monetary Policy Shocks

The introduction of monetary policy variables in our VAR is necessary for three reasons. At the very least, the VAR specification of monetary policy shocks serves as a robustness check of the previous results. More importantly, fiscal policy cannot be analyzed without taking into account the stabilizing interventions of the monetary authority. The importance of the Federal Reserve Board (Fed) policy on the equity and debt markets has been investigated extensively both in finance and macroeconomics (Fama (1981), Thorbecke (1997), Patelis (1997), Goto and Valkanov (2001)). In addition, there is an extensive literature on the joint determination of fiscal and monetary policy over the business cycle.[13] For instance, an increase in spending is likely to result in an upward pressure on interest rates, as the government issues more debt. To the extent that the Fed sees such actions as threatening economic growth, it will counterbalance that pressure by using its main

---

[12]Tax rate changes had a substantial impact on returns on equity since total returns are equal to dividends plus capital gains, and the latter includes both anticipated gains as productive assets grow and unanticipated gains due to unanticipated changes in tax rates. At the higher marginal tax rates of the pre-Kennedy years, investors had to be "compensated" for the fact that their dividends would be more heavily taxed and equity yields were correspondingly higher.

[13]See Chari and Kehoe (1999) for a review.

instrument, the federal funds rate.[14] In our data, we find evidence of a negative response of the federal funds rate to increases in spending (or decreases in taxes), which is consistent with this view. Monetary and fiscal policy should thus be taken into account simultaneously.

Lastly, by considering monetary and fiscal policies simultaneously, we can allocate the variability in returns to fiscal or to monetary policy shocks and assess the relative importance of the two policies. To our knowledge, such a direct comparison has never been carried out in the literature. Studies of monetary policy and market returns that ignore fiscal actions may erroneously attribute too great of an importance to Fed policy shocks. By jointly identifying fiscal and monetary policy changes, our study is not exposed to this criticism.[15]

3.1 Identification

In recent years, a lot of attention has been devoted to the issue of how to conduct monetary policy. This increased interest can be credited to the success of recent empirical papers showing that monetary shocks do have an impact on the real economy. A virtual consensus in this literature is that monetary policy can be characterized by looking at the federal funds rate (FFR) rather than at monetary aggregates, such as M0, M1, or M2. In this study, we take the federal funds rate to be the policy instrument of the central bank. In other words, FFR is not a state variable, but rather captures the monetary authority's response to economic conditions.

Following recent papers by Taylor (1998), Rotemberg and Woodford (1997), and Clarida et al. (2000), we specify that the Fed responds quickly to fluctuations in inflation and output growth by setting the federal funds rate as:

$$FFR_t = a + \eta INF_t + \delta GY_t + \phi FFR_{t-1} + v_t \tag{1}$$

This version of the Fed policy function, also called a "Taylor rule," is a modification of the original version in Taylor (1998). It implies that the Fed sets the short rate in response to inflation and output growth. The main idea is that, when output growth or inflation deviate from certain

---

[14]The rationale for lowering the Fed Funds rate after a fall in output is summarized by the Taylor policy rule, which we discuss below and explicitly test for in our specifications.

[15]Alternatively, one might argue that the results in section 2 are a good first step for two reasons. In the United States the monetary authority enjoys a high degree of independence. In addition, because seignorage revenue has a minimal role as a source of government funding, monetary policy may be immaterial for our discussion of taxes and debt. In fact, as claimed in Mack (2000), net seigniorage from issuing dollars is about $25 billion a year, less than 1.5% of total US government revenue and about 0.3 percent of US GDP. According to Hausmann (1999), that is also true for most countries, with seignorage revenue always less than 0.5 per cent of GDP. Our approach in this paper is to leave the issue of the interaction of fiscal and monetary policies to be decided empirically.

steady-state levels, the federal funds rate should be adjusted to bring the economy back to stability. The lagged term is added to capture the smooth and gradual adjustment of the FFR. Exogenous monetary policy shocks, captured by v_t, are, by definition, deviations from the systematic policy function. The Taylor rule has both normative value–describing what monetary policy ought to be followed–and positive value–describing what policy is actually followed.

We include the federal funds rate in the VAR as a way to incorporate monetary policy shocks, or $Y_t = [TY_t, SY_t, GY_t, INF_t, FFR_t, MKTRF_t]$. Similarly to the previous section, our identifying assumptions are:

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \tag{2}$$

For reference purposes, we call this simple Cholesky identification Model 0. This system of shocks is exactly identified, i.e. we have just enough restrictions to uniquely obtain the structural shocks from the estimated residuals.

Model 0 is a straight-forward extension of the VAR in the previous section. Its restrictions imply that the Fed responds contemporaneously to variations in fiscal variables in addition to inflation and output growth. However, there is no evidence to indicate that monetary policy accommodates fluctuations in taxes and spending. For example, Plosser (1987) finds very little correlation between growth in government debt and monetization of debt (increased holdings of debt by the Federal Reserve), suggesting a weak link between fiscal and monetary policy. Model 0, while serving as a good first step toward integrating fiscal and monetary policy shocks, is not strictly consistent with the conduct of monetary policy as captured by a Taylor rule.

The restrictions imposed by the Taylor rule (1) are:

$$a_{51} = a_{52} = 0 \tag{3}$$

We will refer to identification (2) and (3) as Model 1. The Taylor rule (3) provides us with two over-identifying restrictions. We will use those restrictions to construct a likelihood ratio statistic, testing whether (3) leads to a significant decrease in the fit of the model. The null hypothesis is

16

that the restrictions are valid, or that there is no statistically significant difference between Model 0 and Model 1. A rejection of the hypothesis implies that the restrictions are not valid.

In the same spirit, Model 2 imposes further restrictions on Model 1. Namely, we assume that, in addition to (2) and (3), we have:

$$a_{31} = a_{32} = a_{41} = a_{42} = 0 \qquad (4)$$

In other words, we restrict GDP growth, inflation and the federal funds rate not to respond contemporaneously to fiscal policy changes. While assumptions (4) seem restrictive, there are reasons for considering them. The response of output to fiscal policy variables has been found to be quantitatively weak (Blanchard and Perotti (1999)), so that assumptions $a_{31} = a_{32} = 0$ may not be too stringent. It is also unlikely that inflation is responsive to fluctuations in taxes and government spending within the same period. At the very least, restrictions (4) can serve as a robustness check for our results.

[Table 4 about here]

In Table 4, we test the restrictions in models 1 and 2. Tests of over-identifying restrictions cannot reject Model 1 as compared to Model 0, thus implying that the Taylor rule restrictions do not significantly worsen the fit of the system. By contrast, the restrictions that output growth, inflation, and the Fed funds rate do not respond contemporaneously to fiscal policy variables are clearly rejected. Henceforth, we use the over-identifying restrictions imposed by Model 1 to conduct our empirical analysis.

It is important to point out that we adopt Model 1 only to be entirely consistent with our interpretation of federal funds rate shocks as deviations from a Taylor rule. However, none of the results hinge on restrictions (3). In fact, the impulse response functions and the variance decomposition tables, presented below, are almost identical whether or not we impose restrictions (3).[16]

3.2 Results

In Figures 3 through 5, we present impulse response functions of output growth, the Fed funds rate and market returns to shocks in taxes and spending. As in Section 2, we look in turn at

---

[16]We would be happy to provide those results upon request.

17

excess stock returns, corporate bond excess returns and government bond excess returns. Market returns of all three assets respond negatively to tax shocks. The magnitude and the significance of the response is of the same order as in the previous section. The impact of government spending on returns remains positive, but insignificant. Therefore, the introduction of the Fed funds rate changes virtually nothing in our results.

[Figures 3, 4, and 5 about here]

A shock to the Fed funds rate has a negative impact on stock returns, as already demonstrated in the literature, but an insignificant effect on bonds. The impact of taxes on expected returns is of the same order of magnitude as the effect of the Fed funds rate. Taxes, however, have a more persistent and significant impact in the long-run, especially as far as corporate and government bonds are concerned.

The response of the Fed funds rate to fiscal shocks deserves some attention. Our results are consistent with previous tests of Ricardian equivalence (see survey article by Seater (1993)), which find a negative relationship between deficit and short-term interest rates. An increase in taxes, while controlling for government spending, leads to lower debt obligations by the government. As shown in Figures 3-5, higher taxes (lower government debt) are associated with an increase in the Fed funds rate. Given that the Fed funds rate is the main policy instrument of the Federal Reserve and that it is almost perfectly correlated with other short rates, the use of the latter in previous Ricardian equivalence tests confounds monetary and fiscal policies. By using market returns, this paper is not subject to this shortcoming.

Previous studies have found that monetary variables, including the Fed funds rate and inflation, have a statistically significant effect on market returns. To assess the economic significance of the fiscal policy shocks, we use a variance decomposition analysis to compare their effect to that of monetary policy shocks. Tables 5 through 7 present the results from that comparison, including also the variance decomposition for output growth and for the Fed funds rate. Our results are very stable across horizons. We find that taxes explain about 3.5% of the total stock return variance, a larger fraction than that explained by inflation and similar to that explained by the Fed Funds rate. For corporate and government bonds, the results are more dramatic: shocks to tax and spending explain between 7.5% and 10.5% of the variance in returns—twice as much as shocks to the Fed Funds rate and three times as much as changes in inflation. In sum, as far as bonds are concerned, fiscal policy is a more important source of returns fluctuations than monetary policy. Tax receipts

are also more important than output growth in explaining excess market returns, especially in the case of stocks and corporate bonds. While shocks to spending do not seem to explain an important fraction of excess stock returns, they do explain excess bond returns by an order of magnitude similar to that of inflation or the Fed funds rate.

[Tables 5, 6, and 7 about here]

The responses of output growth and market returns to taxes and spending are virtually unchanged relative to the fiscal policy only specification (see Section 2). Output responds negatively to taxes, after an initial and short-lived positive response. The response of output to spending is positive in the long-run after a brief negative effect. As explained in Section 2, these results are consistent with the lower expected returns, which are forward looking and correctly anticipate the slower economic growth.

As to the variance of output, taxes explain at least as much as each of the monetary variables, from 6.5 to 7.5 percent, depending on the model. Spending shocks are substantially more important in explaining changes in output, accounting for about 20 percent of total variability. Both tax and spending shocks are less important in explaining Fed funds rate changes than variables such as output and inflation, which corroborates our previous acceptance of the Taylor rule restrictions and Model 1.

To summarize, our main results remain unchanged with the addition of monetary policy shocks: an increase in taxes is associated with significantly lower expected returns, while a rise in spending leads to insignificantly higher returns. Fiscal policy variables, namely tax receipts, account for at least as much of the variability in market returns as does the main monetary policy instrument, the Fed funds rate. Moreover, the impact of an increase in tax receipts is similar in magnitude to that of a Fed funds rate shock, but more persistent and significant in the longer-run.

4   Robustness Tests

In any empirical exercise, the results are always subject to the data set used in the analysis, the definition of the variables, and the identifying econometric assumptions. The short sample and the number of parameters in the VAR does not allow us to break the 1960-2000 period into smaller sub-samples. As a robustness check of our results, we ran the truncated samples 1970-2000 and 1960-1990 which yielded similar results. In this section, we provide a summary of a number of other robustness checks that document the stability of our findings.

19

First, we use consumption growth (GC) and the term spread (TSPR) as alternative control variables. Unfortunately, our small sample and the number of parameters in the VAR preclude us from including GY, GC and TSPR all at once. Since consumption growth and term spread are strongly correlated with output growth, it is not surprising that our results do not change significantly. The output from the VARs with GC and TSPR are shown in the Appendix, Figure A1.

Second, while the identification of tax and spending shocks is based on the observation that fiscal variables are not likely to respond to fluctuations from the other variables, it is not clear whether taxes are adjusted to respond to government spending patterns, or whether expenditures are adjusted to accommodate current tax receipts. Our Cholesky ordering $Y_t = [TY_t, SY_t, GY_t, INF_t, FFR_t, MKTRF_t]$ assumes that taxes do not respond contemporaneously to spending, but this assumption is not crucial. In fact, we have also tried the ordering $Y_t = [SY_t, TY_t, GY_t, INF_t, FFR_t, MKTRF_t]$ and the results are virtually identical. Tax and government spending shocks are only weakly correlated (correlation of -0.02), which implies that short term imbalances in the government budget constraint are captured by changes in the deficit. For completeness, we present the results from the Cholesky ordering $Y_t = [SY_t, TY_t, GY_t, INF_t, FFR_t, MKTRF_t]$ in the Appendix, Figure A2.

Third, we mentioned above that while taxes and spending, as a fraction of GDP, must conceptually be stationary, in our sample they exhibit a great deal of persistence. This statistical finding has prompted some researchers to argue that, while tax rates and government spending may be non-stationary, the inter-temporal government budget constraint imposes that their linear combination be stationary. In other words, taxes and spending must be cointegrated.[17] Instead of entering into a statistical debate about the exact properties of the series, we estimate the VAR by imposing one and two cointegrating vectors. The results from those VARs, estimated using the Johansen (1991) method, are presented in Figure A3. The main point from those graphs is that the number of cointegrating vectors does not alter the effect of taxes and spending on market returns.

Fourth, in the VARs with monetary policy shocks, we have followed the recent monetary literature and used the Fed funds rate as the monetary policy instrument. Some papers use non-borrowed reserves, as an alternative measure (Christiano et al. (2001)). When we substitute the Fed funds rate by non-borrowed reserves, the effect of fiscal policy on market returns remains unchanged.

---

[17]For two such studies, see Bohn (1991) and Becker (1997).

However, the effect of monetary policy shocks on returns decreases significantly. In the interest of brevity, those results are only available upon request.

We have conducted several other robustness tests such as switching the Cholesky ordering of output and inflation, or running the VAR using the government deficit (TY-SY) instead of one of the other two fiscal variables. Those specifications produce similar results.

5 Implications for Ricardian Equivalence

Thus far, we have worked under the premise that fiscal policy impacts market returns. However, the well-known Ricardian Equivalence theorem in macroeconomics asserts that this may not be the case.[18] The relation between taxes and returns would break down if individuals correctly expect and discount future tax decreases which result from an increase in current taxes. In this case, for a given level of government spending, the present value of future tax decreases exactly equals that of current tax increases and individuals' net worth remains unaffected. Private saving decreases by as much as the increase in public saving so that national saving and all macroeconomic variables, including interest rates, remain unchanged. The government decision to finance government spending by levying taxes or issuing debt would have no real effects. The Ricardian Equivalence result proposing the invariance of economic variables to the government's financing decisions was first presented analytically in Barro (1974). Just as the Modigliani-Miller theorem states the invariance of firm value to its structure of capital, the Ricardian view suggests that an individual's net worth is independent of the structure of government finance. Both theorems rely on stringent assumptions on the efficient working of financial markets and are not meant to be taken literally. But they are valuable benchmarks for theoretical and empirical work.

As mentioned in the introduction, there is very little work on the effect of fiscal policy on market returns. There is a substantial empirical literature on the validity of Ricardian equivalence that examines the effect of changes in government debt on interest rates.[19] This literature, however, is largely inconclusive and a good number of studies find a negative relationship between government debt and interest rates, which is inconsistent with both the Ricardian and the traditional views on the impact of deficits.[20]

This paper investigates the magnitude and direction of deviations from the Ricardian Equiva-

---

[18]Barro (1989a,b) survey the literature on Ricadian equivalence and its assumptions.

[19]Surveyed by Seater (1993) and Elmendorf and Mankiw (1999).

[20]See, for instance, Becker (1997).

lence benchmark. Interpreting a positive tax shock as a substitution of taxes for debt, our results contradict Ricardian Equivalence. Increases in taxes today decrease market returns on government bonds, corporate bonds and stocks. The methods used in this paper have several advantages over previous tests. First, we use market returns rather than a short-term interest rate, whose behavior is strongly correlated with the federal funds rate, the main monetary policy instrument. Second, in addition to government bond returns, we examine aggregate stock and corporate bond returns.[21] Third, we identify tax and spending shocks jointly, rather than one fiscal variable in isolation, for the reasons explained in Section 2. Finally, we take into account the interaction between monetary and fiscal policy.

6 Conclusion

In this paper, we demonstrate empirically that the impact of fiscal policy on market returns cannot be neglected. Tax shocks have a negative effect on expected stock, corporate bond, and government bond returns. This effect is statistically and economically significant at all horizons up to 4 years. Spending shocks impact expected returns positively but this effect is statistically significant only in the short horizon for corporate and government bonds. As to unexpected returns, we find that taxes are at least as important a source of variation as is inflation.

The inclusion of the federal funds rate, as a proxy for monetary policy, leaves our results virtually unchanged, in qualitative and quantitative terms. Taxes remain an important determinant of stock and bond returns, and higher taxes lower returns at all time horizons. The impact of taxes is of the same order of magnitude as that of the federal funds rate. The variance decomposition reveals that unexpected shocks to taxes account for as much of the variability in returns as does the federal funds rate. For bonds, taxes are twice as important.

We attribute the results to the direct effect of fiscal policy on the government bond market and to the persistence of fiscal policy shocks. Tax increases lower the supply of government bonds and increase government bond prices, leading to lower expected returns across assets, in equilibrium. Tax changes have an effect on expected returns because short-run changes in taxes signal new long-term levels of taxation, as revealed by the persistence of tax shocks. Higher future taxes imply lower market returns, as individuals expected pay-off net of taxes decreases. As to spending, the

---

[21]The literature on Ricardian Equivalence has completely ignored stock and corporate bond returns. The exception is Darrat (1988, 1990), which examines the impact of the Canadian government deficit on stock market returns and finds evidence of an effect of fiscal policy on financial markets. However, since only deficits are used as an indicator of fiscal policy, this paper does not inform us about the impact of taxes and spending, our variables of interest.

inclusion of very different types of public expenditures—including potentially productive public investments—may have counter-balancing effects that lead to a non-significant long-term effect of spending on market returns.

Our results suggest several directions for future research. For instance, the analysis of disaggregated fiscal variables, such as various components of taxes (income, corporate, and consumption) and spending (public consumption versus public investment), are likely to have different or countervailing effects on market returns. Moreover, the strength of these effects might vary depending on industry, market capitalization, or leverage characteristics. Thus, a cross-sectional analysis of returns might yield further insights into the transmission mechanisms at play. At a more aggregate level, the existence of partisan fiscal differences may lead to variations in average returns during left- and right-wing cabinets.[22] Finally, while our empirical findings are in line with simple economic intuition, a complete asset pricing model that captures the transmission of taxing and spending shocks onto financial markets would be of great interest.

References

[1] Aschauer, David (1988),"The Equilibrium Approach to Fiscal Policy", Journal of Money, Credit and Banking, 20 (1), 41-62.

[2] Aschauer, David (1989), "Is Public Expenditure Productive?", Journal of Monetary Economics, 23, 177-200.

[3] Barro, Robert (1974), "Are Government Bonds Net Wealth?", The Journal of Political Economy, Vol. 82 (6), 1095-1117.

[4] Barro, Robert (1981), "Output Effects of Government Purchases", The Journal of Political Economy, Vol. 89 (6), 1086-1121.

[5] Barro, Robert (1989a), "The Ricardian Approach to Budget Deficits", Journal of Economic Perspectives, 3 (2), p. 37-54.

[6] Barro, Robert (1989b),"The Neoclassical Approach to Fiscal Policy", in Robert Barro (ed.), "Modern Business Cycle Theory", Harvard University Press, Cambridge, Massachusetts.
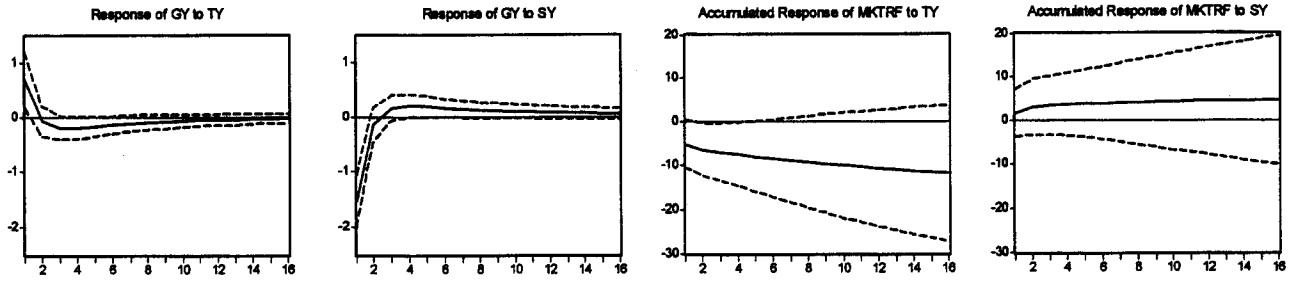
---

[22]See Santa-Clara and Valkanov (2001) for evidence of partisan effects on stock returns in the US economy.

[7] Becker, Torjbörn (1997),"An Investigation of Ricardian Equivalence in a Common Trends Model", Journal of Monetary Economics 39, 405-31.

[8] Blanchard, Olivier and Perotti, Roberto (1999), "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output", NBER Working Paper No. W7269.

[9] Bohn, Henning (1991), "Budget Balance Through Revenue or Spending Adjustments? Some Historical Evidence for the United States", Journal of Monetary Economics, 27, p. 333-359.

[10] Burnside, Craig, Eichenbaum, Martin and Fisher, Jonas D.M. (2000), "Assessing the Effects of Fiscal Shocks", NBER Working Paper No. W7459.

[11] Campbell, J. (1999), "Asset Prices, Consumption and the Business Cycle", Handbook of Macroeconomics Vol.1, Taylor, John B., and Michael Woodford,eds., Amsterdam: North Holland Press, 1999, Chapter 19, pp. 1231-1303.

[12] Chari, V.V. and Patrick Kehoe (1999), "Optimal Fiscal and Monetary Policy," in Taylor, J. B. and M. Woodford (Eds), Handbook of Macroeconomics, Vol. I, Chapter 26, North-Holland.

[13] Christiano, Lawrence (1990), Comment on "Oligopolistic Pricing and the Effects of Aggregate Demand on Economic Activity" by Rotemberg and Woodford, NBER Economic Fluctuations Meetings, Palo Alto, California, 1990.

[14] Christiano, Lawrence, Eichenbaum, Martin and Evans, Charles (2001), "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policiy", Mimeo, Northwestern University.

[15] Clarida, R., J.Gali, and M.Gertler (2000), "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory," Quarterly Journal of Economics, forthcoming.

[16] Cochrane, J. (1996), "A Cross-Sectional Test of an Investment-Based Asset Pricing Model", Journal of Political Economy, 104 (3), p.572-621.

[17] Darrat, A. (1988), "Stock Returns, Money and Fiscal Deficits", Journal of Financial and Quantitative Analysis, 25 (3), p. 387-398.

[18] Darrat, A. (1990), "On Fiscal Policy and the Stock Market", Journal of Money, Credit and Banking, 20 (3), p. 353-368
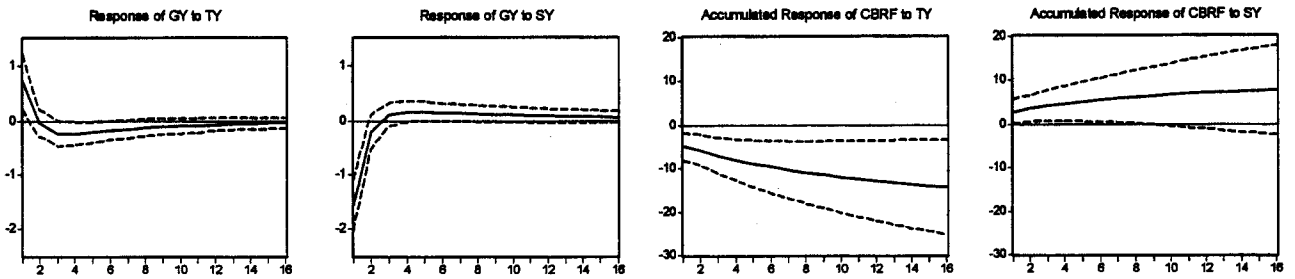
[19] Edelberg, Wendy, Eichenbaum, Martin and Fisher, Jonas D.M. (1998), "Understanding the Effects of a Shock to Government Purchases", NBER Working Paper No. W6737.

[20] Elmendorf, D., and Mankiw, N. (1999), "Government Debt," in Handbook of Macroeconomics, Vol. 1, Taylor, J.B. and M. Woodford, eds.,Elsevier Science, B.V., 1999, pp. 1615-1699.

[21] Fama, E.F., 1990, "Stock Returns, Expected Returns, and Real Activity," Journal of Finance, 45(4), 1089-1108.

[22] Fama, E.F. and K.French, 1989, "Business Conditions and Expected Returns on Stocks and Bonds," Journal of Financial Economics, 25, 23-49.

[23] Fatas, Antonio and Mihov, I. (1998) "Measuring the Effects of Fiscal Policy", Mimeo, INSEAD.

[24] Feldstein, Martin (1982), "Government Deficits and Aggregate Demand", Journal of Monetary Economics, 9, p. 1-20.

[25] Hamliton, J., 1994, Time Series Analysis, Princeton University Press.

[26] Haug, Alfred (1990),"Ricardian Equivalence, Rational Expectations, and the Permanent Income Hypothesis", Journal of Money, Credit, and Banking, 22 (3), 305-22.

[27] Hausmann, R. (1999). "Should There Be Five Currencies or One Hundred and Five?" Foreign Policy, 116 (Fall): 6579.

[28] Johansen, Soren (1991), "Estimation and Hypothesis Testing of Cointegrated Vectors in Gaussian Vector Autoregressive Models," Econometrica 59: 1551-80.

[29] Lutkepohl, Helmut, (1990), "Asymptotic Distributions of Impulse Response Functions and Forecast Error Variance Decompositions of Vector Autoreressive Models," Review of Economics and Statistics 72: 116-25.

[30] Mack, C. (2000), "Basics of Dollarization," Joint Economic Committee Staff Report, U.S. Congress, Jan. 2000.

[31] McGrattan E. and Prescott, E. (2001), "Taxes, Regulations, and Asset Prices", Federal Reserve Bank of Minneapolis, Research Department, Working Paper 610

[32] Modigliani, F., and Miller , M. (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment", American Economic Review, June 1958, 48 (3), p. 261-97.

[33] Ng, S. and P. Perron, 1998, Lag length selection and the construction of unit-root tests with good size and power, manuscript, Boston University.

[34] Patelis, A.D., 1997, "Stock Return Predictability and the Role of Monetary Policy," Journal of Finance, 52(5), 1951-1972.

[35] Plosser, Charles (1982), "Government Financing Decisions and Asset Returns", Journal of Monetary Economics, 9, 325-352.

[36] Plosser, Charles (1987), "Fiscal Policy and the Term Structure", Journal of Monetary Economics, 20, 343-367.

[37] Ramey, Valerie and Shapiro, M. (1997), "Costly Capital Reallocation and the Effects of Government Spending", Carnegie-Rochester Conference Series on Public Policy.

[38] Rotemberg and Woodford (1992), "Oligopolistic Pricing and the Effects of Aggregate Demand on Economic Activity", Journal of Political Economy, 110 (6), 1153-1207.

[39] Runkle, David E. (1987), "Vector Autoregressions and Reality," Journal of Business and Economic Statistics 5: 437-42.

[40] Santa-Clara, Pedro and Valkanov, Rossen (2001), "Political Cycles and Stock Market Returns", Mimeo, Anderson Graduate School of Business, University of California Los Angeles.

[41] Seater, John (1993), "Ricardian Equivalence", Journal of Economic Literature, XXXI, 142-90.

[42] Goto, Shingo and Valkanov, Rossen (2001), "The Fed's Effect on Excess Returns and Inflation is Much Bigger than You Think".Mimeo, Anderson Graduate School of Business, University of California Los Angeles.

[43] Taylor, J. (1998), "Monetary Policy Guidelines" in "Inflation, Unemployment, and Monetary Policy", MIT Press, 1998

[44] Thorbecke, W., 1997, "On Stock Market Returns and Monetary Policy," Journal of Finance, 52(2), 635-654.

[45] Watson, M., 1994, "Vector Autoregressions and Cointegration," Chapter 47.in R. Engle and D. McFadden (Eds.), Handbook of Econometrics, Elsevier Science.

Response of GY to TY   Response of GY to SY   Accumulated Response of MKTRF to TY   Accumulated Response of MKTRF to SY

Panel 2: VAR with Excess Corporate Bond Returns (CBRF)

Response of GY to TY   Response of GY to SY   Accumulated Response of CBRF to TY   Accumulated Response of CBRF to SY

Panel 3: VAR with Excess Government Bond Returns (GBRF)

Response of GY to TY   Response of GY to SY   Accumulated Response of GBRF to TY   Accumulated Response of GBRF to SY
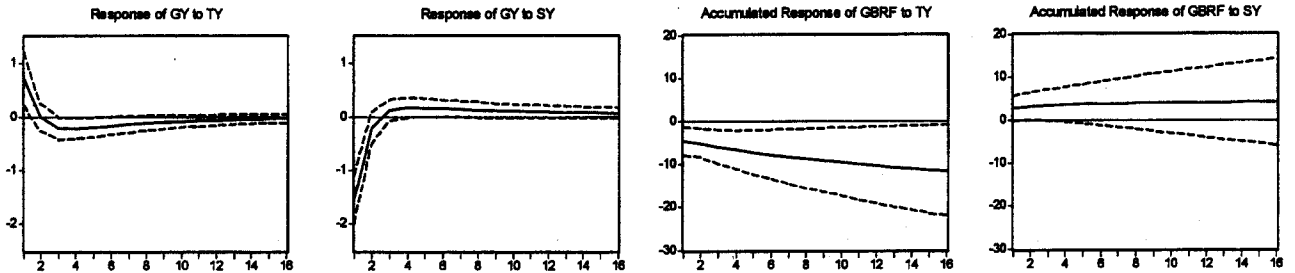
Notes: See next page.

Notes: The graphs in Panel 1 present the response of expected GDP growth and excess stock returns of different holding periods to shocks in taxes and in spending. The estimated VAR is $Y_t = F(L)Y_{t-1} + u_t$, where $Y_t = [TY_t \ SY_t \ GY_t \ INF_t \ MKTRF_t]$, and $F(L)$ is a polynomial in the lag operator, chosen with sequential pre-testing (Ng and Perron (1998)). The fiscal policy shocks are identified recursively using a Cholesky decomposition (see sections 3 and 4), as $u_t = Aw_t$, where A is a lower triangular matrix with ones on the diagonal. The accumulated impulse response functions $\sum_{i=0}^{k} \frac{dY_{t+k}^s}{du_t}$ capture the response of a k-period holding return to a structural shock u_t, as explained in section 2.4. The graphs in Panels 2 and 3 display the same responses, with the exception that $MKTRF_t$ is replaced with corporate bond ($CBRF_t$) and government bond ($GBRF_t$) returns, respectively. 95 percent centered confidence intervals, constructed by bootstrapping 5,000 times the VAR residuals, are displayed in dashed lines. The results in all three panels are quantitatively similar. After an inital increase, a shock to taxes is followed by lower growth in GDP (GY). An increase in government spending is followed by a protracted increase in GDP growth, after an initial decrease. More interestingly, expected returns on stocks, corporate bonds, and government bonds all decrease following a tax increase. The magnitude of the results is similar across all three assets: a one-standard deviation shock to taxes decreases quarterly, annual, and 4-year returns by about 4%, 9%, and 17%, respectively. The importance of the results is clearer for bond returns, which are much less volatile than stock returns (see Table 1). An increase in government spending has a positive, although insignificant, effect.

**Figure 2: Structural Shocks from a VAR with Excess Stock Returns
—Fiscal and and Monetary Policy**
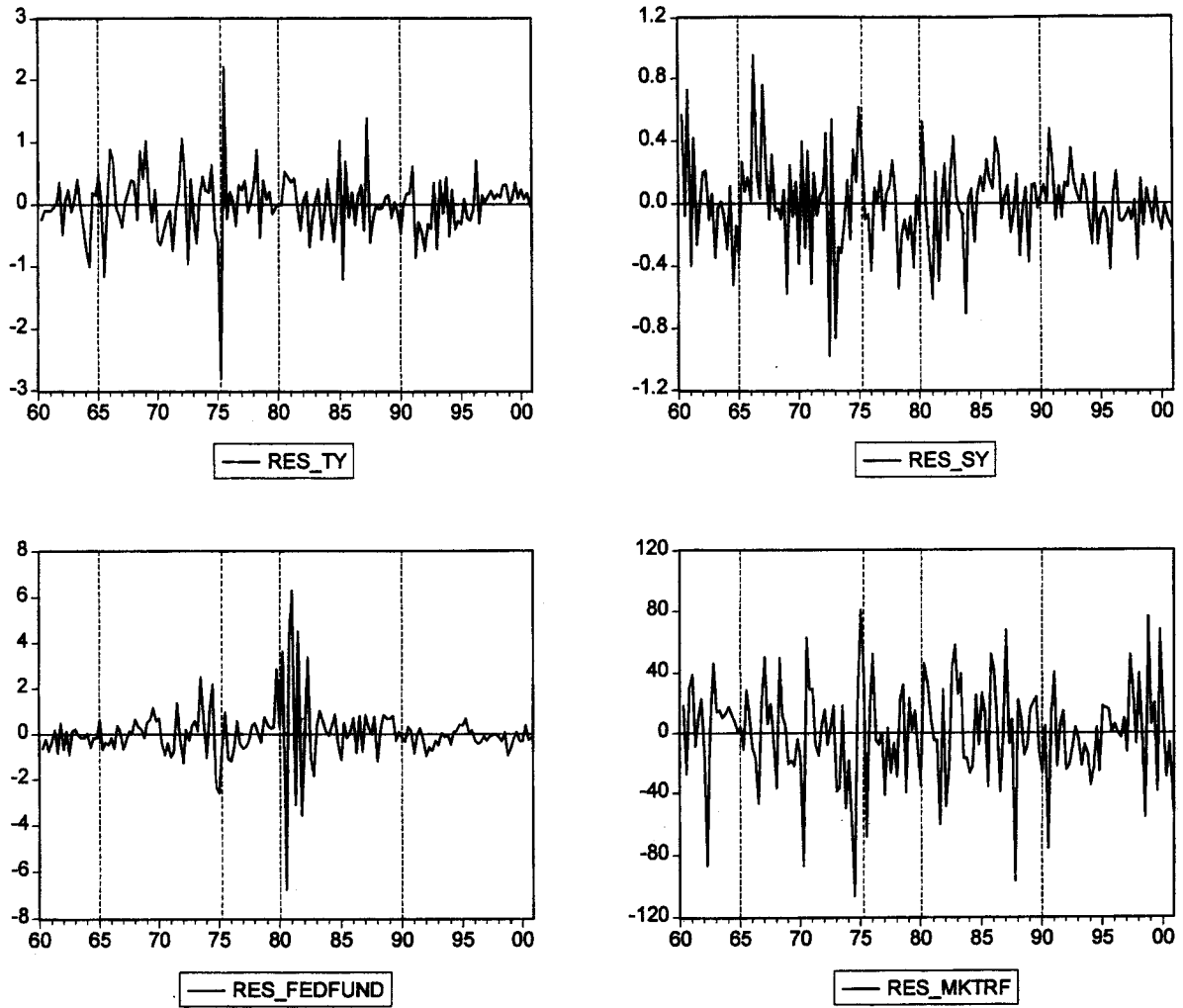
Notes: Figure 2 plots the structural shocks from a VAR with excess stock returns and monetary policy shocks. In order to be consistent with our previous discussion of monetary policy behavior, we impose some additional restrictions on A, which correspond to Model 1 in the text. However, the over-identifying restrictions have virtually no impact on the time-series behavior of the identified shocks. VARs with excess corporate and government bond returns produce very similar results, and are hence omitted (but available upon request). The light dashed line in 1975:2 marks a large legislated tax cut that took effect at that time. The light dashed lines in 1965:1, 1980:1, and 1990:1 represent dates of increased government spending due to wars (Vietnam War, Cold War, Gulf War), as determined in Ramey and Shapiro (1997).

Figure 3: Results From VARs with Excess Market Returns (MKTRF)
−Fiscal and and Monetary Policy
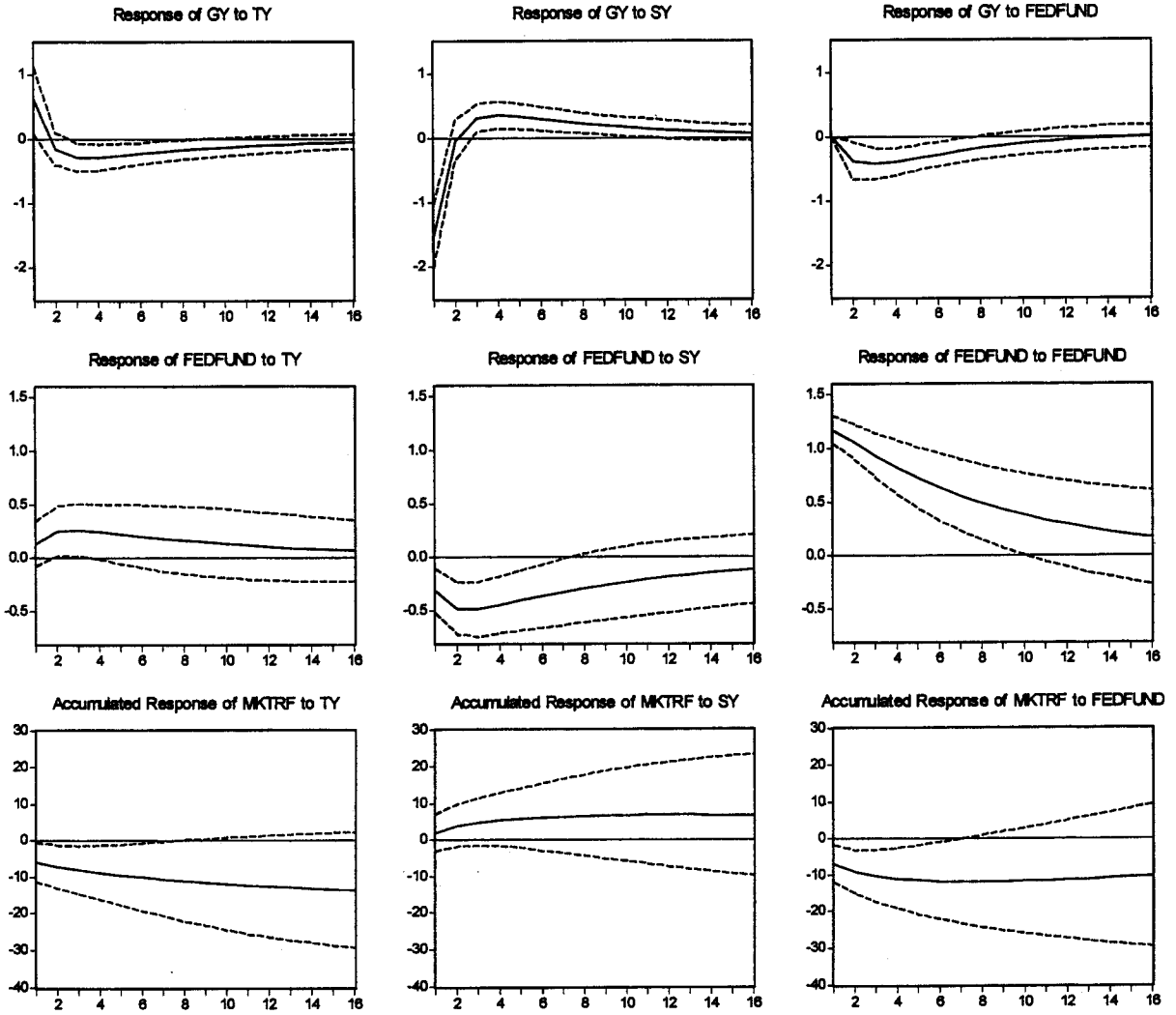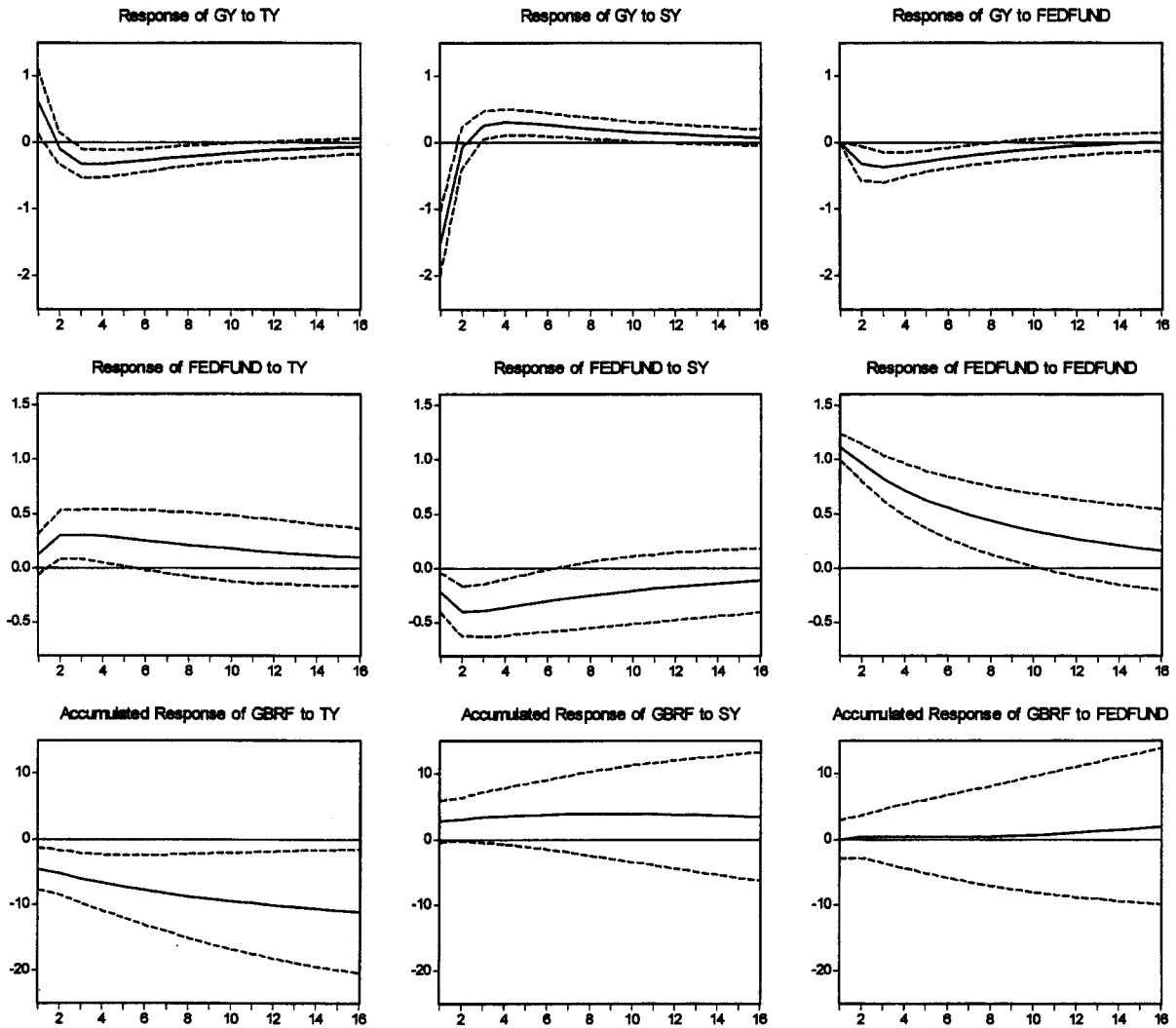

Notes: See next page.

Notes: The graphs in Figure 3 present the response of expected GDP growth, federal funds rate, and excess stock returns to shocks in taxes, spending, and the federal funds rate. The first two shocks capture fiscal policy interventions whereas the federal funds rate shock is the unexpected monetary policy move. The estimated VAR is $Y_t = F(L) Y_{t-1} + u_t$, where $Y_t = [TY_t \ SY_t \ GY_t \ INF_t \ FFR_t \ MKTRF_t]$, and $F(L)$ is a polynomial in the lag operator, chosen with sequential pre-testing (Ng and Perron (1998)). The fiscal policy shocks are identified recursively using a Cholesky decomposition (see sections 3 and 4), as $u_t = Aw_t$. The matrix A is lower triangular, with ones on the diagonal and $a_{51} = a_{52} = 0$, which corresponds to Model 1 in section 3. The accumulated impulse response functions $\sum_{i=0}^{k} \frac{dY_{t+k}^6}{du_t}$ capture the response of a k-period holding return to a structural shock u_t, as explained in section 2.4. 95 percent centered confidence intervals, constructed by bootstrapping 5,000 times the VAR residuals, are displayed in dashed lines. The results from the graphs can be summarized as follows. Expected market returns are negatively affected by an increase in taxes. The increase is reflected in holding periods of all horizons up to 4 years. Spending has a positive, but statistically insignificant, effect on returns. The figures suggest that some of the fluctuations in expected returns are due to changing economic conditions following the fiscal policy shock. For instance, a tax increase is followed by a prolonged decrease in GDP growth, after an inital increase. To the extent that market participants are able to forecast the slowing growth rate of the economy, future returns must incorporate that information accordingly. The magnitude of the result is similar to the VAR without monetary policy shocks (Figure 1). A positive shock to FFR has a negative effect on GDP growth, as one expects after a contractionary monetary policy move. FFR increases (decreases) following a tax (spending) shock, which is consistent with our monetary policy interpretation. For instance, a tax increase (which leads to lower debt, higher bond prices, or lower interest rates) might induce the Fed to engage in a expansionary policy through the Taylor rule, thereby raising the FFR.

Figure 4: Results From VARs with Excess Corporate Bond Returns
–Fiscal and Monetary Policy
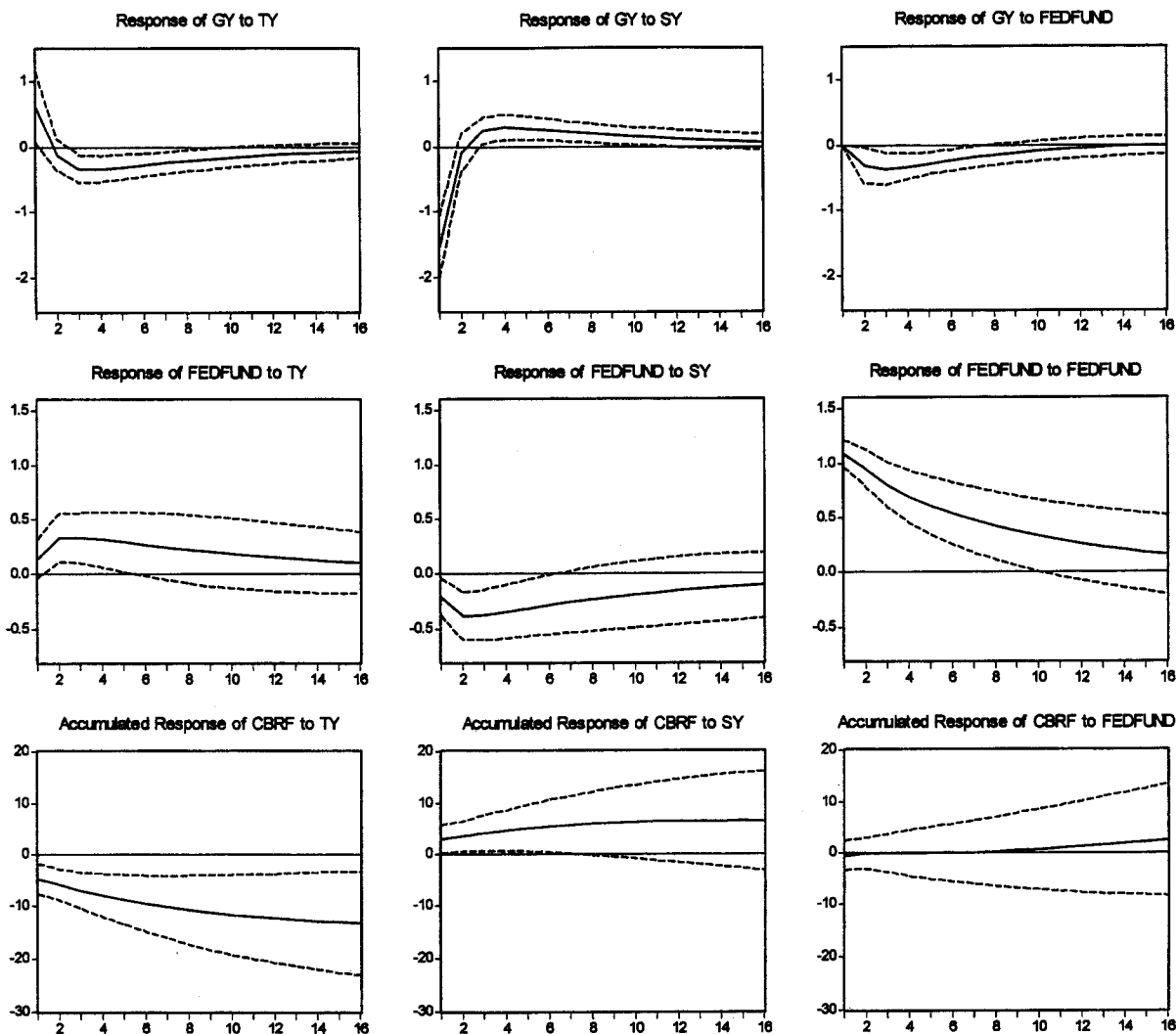
Notes: The graphs in Figure 4 present the response of the expected GDP growth rate, federal funds rate, and excess corporate bond returns of different holding periods to shocks in taxes, spending, and the federal funds rate. The variables in the VAR system are $Y_t = [TY_t\ SY_t\ GY_t\ INF_t\ FFR_t\ CBRF_t]$. 95 percent centered confidence intervals, constructed by bootstrapping 5,000 times the VAR residuals, are displayed in dashed lines. Expected corporate bond returns are negatively affected by an increase in taxes. The increase is reflected in holding periods of all horizons up to 4 years. Spending has a positive, but barely statistically significant, effect on returns. The figures suggest that some of the fluctuations in expected returns are due to changing economic conditions, following the fiscal policy shock. For instance, a tax increase is followed by a prolonged decrease in GDP growth, after an inital increase. To the extent that market participants are able to forecast the slowing growth rate of the economy, expected returns must incorporate that information accordingly. The opposite holds true for spending shocks. For a complete description of the methods, please refer to the notes following Figure 3.

Figure 5: Results From VARs with Excess Government Bond Returns
–Fiscal and Monetary Policy

Notes: The graphs in Figure 5 present the response of the expected GDP growth rate, federal funds rate, and excess corporate bond returns of different holding periods to shocks in taxes, spending, and federal funds rate. The variables in the VAR system are $Y_t = [TY_t \ SY_t \ GY_t \ INF_t \ FFR_t \ GBRF_t]$. 95 percent centered confidence intervals, constructed by bootstrapping 5,000 times the VAR residuals, are displayed in dashed lines. The results are almost identical to those for corporate bond returns (Figure 4). Expected government bond returns are negatively affected by an increase in taxes. The increase is reflected in holding periods of all horizons up to 4 years. Spending has a positive, but insignificant, effect on returns. The figures suggest that some of the fluctuations in expected returns are due to changing economic conditions, following the fiscal policy shock. For instance, a tax increase is followed by a prolonged decrease in GDP growth, after an inital increase. To the extent that market participants are able to forecast the slowing growth rate of the economy, future returns must incorporate that information accordingly. The opposite holds true for spending shocks. For a complete description of the methods, please refer to the notes following Figure 3.

Table 1: Data Description and Summary Statistics

Panel A: Data Description

Variable	Mneumonics	Description
Tax Receipts/GDP	*TY*	Sum of federal, state, and local government receipts net of transfers (Citibase) over GDP (Citibase)
Government Spending/GDP	*SY*	Sum of federal, state, and local government expenditures net of transfers (Citibase) over GDP (Citibase)
Excess Stock Market Return	*MKTRF*	Annualized return of SP500 Index (CRSP) minus the annualized 3-month Treasury bill rate (Fed)
Excess Corporate Bond Return	*CBRF*	Annualized return of Corporate Bonds Index (Ibbotson) minus the annualized 3-month Treasury bill rate (Fed)
Excess Government Bond Return	*GBRF*	Annualized return of Government Bonds Index (Ibbotson)
Growth in GDP per Capita	*GY*	Annual growth in GDP per capita (Citibase)
Growth in Consumption per Capita	*GC*	Annual growth in consumption (Citibase) of nondurable goods and services per capita
Term Spread	*TSPR*	Annualized 10-year government bond yield (Fed) minus the annualized 3-month Treasury bill rate (Fed)
Federal Funds Rate	*FFR*	Annualized federal funds rate (Fed)
Inflation Rate	*INF*	Annual growth in CPI Index (Citibase)

Panel B: Summary Statistics, 1960.1-2000.4

	TY	*SY*	*MKTRF*	*CBRF*	*GBRF*	*GY*	*GC*	*TSPR*	*FFR*	*INF*
Mean	16.89	17.99	7.55	1.31	1.28	2.28	2.47	0.11	6.59	4.34
Median	16.55	17.68	11.32	1.24	-0.71	2.34	2.53	0.11	5.79	3.54
Max	24.25	22.38	96.44	76.11	76.56	13.22	9.74	0.32	19.08	14.62
Min	10.80	13.61	-100.51	-68.23	-74.27	-9.60	-10.25	-0.12	1.17	-4.39
Std. Dev.	4.15	2.70	33.20	18.99	20.65	3.56	2.87	0.10	3.30	3.23
Skewness	0.22	0.02	-0.36	0.10	0.25	-0.34	-0.79	-0.07	1.34	1.07
Kurtosis	1.56	1.60	3.82	5.64	5.09	3.96	5.49	2.42	5.28	4.26
Obs.	164	164	164	164	164	164	164	164	164	164

Notes: See next page.

Notes: All variables are in quarterly frequency. All rates of return and growth rates are expressed in annualized percentage points. The variables "TY" and "SY" are expressed as percents of GDP. The source of the data is indicated in parentheses. For a more extensive discussion of the fiscal variables, see Becker (1997).

Table 2: Unit Root Tests

	TY	SY	MKTRF	CBRF	GBRF	GY	GC	TSPR	FFR	INF
AR Root	0.98	0.99	0.02	0.13	0.04	0.27	0.33	0.84	0.93	0.83
ADF Test	-1.47	-0.14	-5.05	-3.82	-3.95	-4.17	-4.30	-3.29	-2.17	-2.82
PP Test	-1.56	-0.21	-12.29	-12.45	-13.19	-9.52	-10.41	-3.44	-2.77	-5.50
Crit. Value	-2.88	-2.88	-2.88	-2.88	-2.88	-2.88	-2.88	-2.88	-2.88	-2.88

Notes: Table 2 tests for non-stationarity in all series. The row "AR Root" provides the highest autoregressive root in the series, whereas rows "ADF Test" and "PP Test" display the results from Augmented Dickey-Fuller and Phillips-Perron tests, where the lags are chosen with sequential pre-testing (Ng and Perron (1998)). The null hypothesis of a unit-root behavior is tested at the 5-percent level, with the provided asymptotic critical value. Note that the ADF and the PP tests have the same asymptotic distribution and, hence, the same asymptotic critical value. Either by casual inspection of the highest autoregressive roots or by looking at the formal tests (which yield similar results), we come to the same conclusions. The fiscal variables, inflation, and the federal funds rate exhibit strong persistence since their autoregressive roots are close to 1. In other words, an unexpected shock to those series will persist for some time in the future. In the limit, for exact unit-root processes, a shock to the series will permanently change their level.

Table 3: Variance Decomposition in VARs–Fiscal Policy

Panel 1: Variance Decomposition of GY

	VAR with MKTRF					VAR with CBRF					VAR with GBRF				
Period	TY	SY	GY	INF	MKTRF	TY	SY	GY	INF	CBRF	TY	SY	GY	INF	GBRF
1	4.557	22.891	72.552	0.000	0.000	4.839	23.198	71.963	0.000	0.000	4.906	22.492	72.603	0.000	0.000
2	4.093	20.484	68.132	6.012	1.279	4.438	21.581	69.101	4.871	0.009	4.457	20.772	69.502	5.169	0.100
3	4.204	19.569	64.443	10.070	1.715	4.685	20.610	65.696	8.014	0.996	4.653	19.871	66.167	8.365	0.944
6	4.684	19.391	61.346	12.681	1.898	5.421	19.971	61.788	10.780	2.040	5.316	19.357	62.438	11.095	1.794
12	4.975	19.705	60.768	12.664	1.888	5.882	20.217	60.858	10.881	2.162	5.758	19.635	61.551	11.164	1.891
16	5.008	19.788	60.620	12.695	1.890	5.936	20.321	60.696	10.890	2.157	5.812	19.739	61.384	11.179	1.887

Panel 2: Variance Decomposition of MKTRF, CBRF, or GBRF

	VAR with MKTRF					VAR with CBRF					VAR with GBRF				
Period	TY	SY	GY	INF	MKTRF	TY	SY	GY	INF	CBRF	TY	SY	GY	INF	GBRF
1	2.343	0.250	0.317	3.695	93.395	6.935	2.367	3.770	0.000	86.927	5.104	1.792	4.108	0.004	88.992
2	2.473	0.410	0.581	3.702	92.835	7.014	2.447	3.716	1.923	84.900	5.056	1.791	4.040	1.333	87.780
3	2.509	0.428	0.613	3.708	92.742	7.320	2.525	3.707	2.291	84.157	5.195	1.799	4.030	1.548	87.428
6	2.565	0.434	0.621	3.766	92.613	7.835	2.650	3.703	2.517	83.294	5.414	1.803	4.021	1.711	87.050
12	2.634	0.437	0.626	3.835	92.468	8.272	2.745	3.710	2.586	82.686	5.652	1.802	4.021	1.740	86.787
16	2.664	0.438	0.628	3.861	92.410	8.389	2.764	3.709	2.706	82.432	5.743	1.798	4.018	1.799	86.641

Notes: Table 3 presents the results from a variance decomposition of three VARs, all excluding monetary policy shocks (FFR). The first VAR includes the following variables: $[TY_t, SY_t, GY_t, INF_t, MKTRF_t]$. The second and the third VARs include excess corporate bond returns (CBRF) and excess government bond returns (GBRF), respectively, instead of MKTRF. Panel 1 shows the percentage of the variance of "GY" that is explained by shocks in all variables at different horizons, in all three VARs. For instance, at horizon 16 (4 years), 5 percent of the total variance of "GY" is explained by shocks to "TY," and shocks to "SY" account for 19.8 percent, in the VAR with excess market returns. In the VARs with excess corporate and government bond returns, 5.9 and 5.8 of the "GY" variance is explained by shocks to taxes, and 20.3 and 19.7 percent by shocks to government spending, in the respective VARs. Similarly, Panel 2 displays the percentage of the variance of returns explained by the various shocks, in the three VARs. For instance, shocks to taxes and government spending account for approximately 2.7 and 0.4 percent of the total variation in excess stock market returns, at horizon 16. It is interesting to notice that shocks in government spending account for about 20 percent of the variation in GDP growth, and are far more important than any other shocks with the exception of GDP growth shocks. Shocks to taxes account from about 3 percent (MKTRF) to 8 percent (GBRF) of the variations in excess market returns.

Table 4: Tests of Over-Identifying Restrictions for VAR with Excess Stock Returns

−Fiscal and Monetary Policy

Model	Over-Identifying Restrictions	Likelihood	Test	P-value
Model 0: Just-Identified	0	−1901.7	−	−
Model 1: Over-Identified	2	−1903.7	4.0	0.135
Model 2: Over-Identified	8	−1932.9	62.4	0.000

Notes: Table 4 presents the results from a likelihood ratio (LR) test, testing for the validity of the various contemporaneous over-identifying restrictions. Model 0 is the exactly identified (Cholesky) model. Model 1 imposes the restriction $a_{5,1} = a_{5,2} = 0$ to Model 0, or that the federal funds rate does not respond contemporaneously to fiscal policy shocks. This restriction is consistent with the recent literature on monetary policy, where the federal funds rate responds only to variations in inflation and GDP growth. Model 2 imposes the restrictions $a_{3,1} = a_{3,2} = a_{4,1} = a_{4,2} = a_{5,1} = a_{5,2} = 0$, or that none of the variables (except returns) respond contemporaneously to fiscal policy shocks. Under the null that the restricted and the unrestriced models are the same (or that the restrictions are valid), the LR test has a chi-square distribution with degrees of freedom equal to the number of over-identifying restrictions. We cannot reject the restrictions imposed by Model 1, whereas the restrictions imposed by Model 2 are clearly rejected. Henceforth, we work with Model 1. The presented results are from VARs using excess stock returns. The results using corporate and government bond returns are very similar and, hence, omitted.

Table 5: Variance Decomposition in VAR with Market Excess Stock Returns

–Fiscal and Monetary Policy

Panel 1: Variance Decomposition of GY

Period	TY	SY	GY	INF	FFR	MKTRF
1	3.752	23.30	72.95	0.000	0.000	0.000
2	3.740	21.57	70.36	2.837	0.639	0.860
3	4.420	21.37	67.36	4.259	1.595	0.999
6	5.799	22.10	62.59	4.742	3.832	0.942
12	6.414	22.61	60.34	4.599	5.130	0.908
16	6.471	22.67	60.09	4.579	5.285	0.905

Panel 2: Variance Decomposition of FFR

Period	TY	SY	GY	INF	FFR	MKTRF
1	0.921	5.499	0.928	2.326	90.33	0.000
2	1.397	7.692	3.924	4.195	82.79	0.000
3	1.528	8.393	5.446	5.116	79.52	0.000
6	1.457	8.244	6.941	6.282	77.08	0.000
12	1.240	6.907	7.370	7.188	77.29	0.001
16	1.190	6.272	7.390	7.490	77.66	0.002

Panel 3: Variance Decomposition of MKTRF

Period	TY	SY	GY	INF	FFR	MKTRF
1	3.223	0.270	0.133	2.292	3.478	90.60
2	3.396	0.614	0.565	2.474	3.772	89.18
3	3.458	0.711	0.674	2.570	3.876	88.71
6	3.557	0.773	0.733	2.603	3.960	88.38
12	3.633	0.780	0.744	2.603	3.967	88.27
16	3.653	0.781	0.744	2.604	3.970	88.25

Notes: Table 5 presents the results from a variance decomposition in the VAR with excess stock market returns. Panel 1 shows the percentage of the variance of GDP growth (GY) that is explained by shocks in all variables at different horizons. For instance, at horizon 16 (4 years), 6.5 percent of the total variance of "GY" is explained by shocks to "TY," and shocks to "SY" account for 22.7 percent. Similarly, Panels 2 and 3 display the percentage of the variance of "FFR" and "MKTRF", respectively, explained by the various shocks. Spending shocks account for about 6-7 percent of the variation in the federal funds rate and are as important as inflation and GDP growth shocks. Finally, shocks to taxes account for about 3.5 percent of the variation of excess stock returns and are as important, in magnitude, as monetary policy (FFR) and inflation shocks.

Table 6: Variance Decomposition in VAR with Market Excess Corporate Bond Returns

–Fiscal and Monetary Policy

Variance Decomposition of GY

Period	TY	SY	GY	INF	FFR	CBRF
1	3.900	23.42	72.68	0.000	0.000	0.000
2	3.850	22.33	71.48	1.944	0.374	0.019
3	4.735	21.88	68.42	2.774	1.389	0.801
6	6.593	21.74	62.90	3.279	3.479	2.002
12	7.499	21.85	60.32	3.247	4.606	2.476
16	7.595	21.88	60.04	3.236	4.729	2.523

Variance Decomposition of FFR

Period	TY	SY	GY	INF	FFR	CBRF
1	1.268	3.171	1.973	0.000	93.59	0.000
2	2.680	4.438	5.597	0.248	78.89	8.147
3	2.976	4.629	6.932	0.965	74.51	9.993
6	2.991	4.055	7.871	2.634	69.89	12.56
12	2.775	3.045	7.930	4.113	68.21	13.93
16	2.753	2.704	7.877	4.510	67.98	14.18

Variance Decomposition of CBRF

Period	TY	SY	GY	INF	FFR	CBRF
1	6.873	2.389	3.944	0.028	3.960	82.81
2	6.970	2.440	3.886	2.187	3.900	80.62
3	7.303	2.523	3.885	2.449	3.873	79.97
6	7.857	2.674	3.897	2.572	3.845	79.15
12	8.223	2.740	3.894	2.570	3.864	78.71
16	8.272	2.736	3.887	2.586	3.966	78.55

Notes: Table 6 presents the results from a variance decomposition in the VAR with excess corporate bonds market returns. For an exact interpretation of the results in Panels 1, 2, and 3, please refer to the notes of Table 5. Taxes and spending shocks account for a modest 2-3 percent of the variation in the federal funds rate. Finally, shocks to taxes account for 7-8 percent of the variation of excess corporate bond returns and are more important, in magnitude, than any other shocks with the exception of excess return shocks. In particular, they account for more than twice the variance in monetary policy (FFR) and inflation shocks.

Table 7: Variance Decomposition in VAR with Market Excess Government Bond Returns

–Fiscal and Monetary Policy

Variance Decomposition of GY

Period	TY	SY	GY	INF	FFR	GBRF
1	3.924	22.80	73.27	0.000	0.000	0.000
2	3.817	21.63	71.92	2.038	0.331	0.256
3	4.672	21.27	68.95	2.822	1.294	0.999
6	6.500	21.29	63.47	3.247	3.350	2.141
12	7.404	21.45	60.82	3.186	4.512	2.628
16	7.502	21.48	60.52	3.174	4.647	2.679

Variance Decomposition of FFR

Period	TY	SY	GY	INF	FFR	GBRF
1	1.236	3.192	1.451	0.002	94.12	0.000
2	2.584	4.524	5.039	0.314	78.66	8.877
3	2.878	4.781	6.404	1.031	74.19	10.71
6	2.908	4.282	7.432	2.571	69.56	13.24
12	2.713	3.262	7.565	3.890	68.04	14.53
16	2.700	2.892	7.530	4.246	67.87	14.76

Variance Decomposition of GBRF

Period	TY	SY	GY	INF	FFR	GBRF
1	5.037	1.803	4.274	0.044	2.165	86.68
2	4.994	1.786	4.199	1.592	2.176	85.25
3	5.148	1.795	4.195	1.737	2.171	84.96
6	5.399	1.809	4.196	1.818	2.170	84.61
12	5.613	1.808	4.194	1.818	2.175	84.39
16	5.663	1.812	4.190	1.826	2.215	84.29

Notes: Table 7 presents the results from a variance decomposition in the VAR with excess corporate bonds market returns. For an exact interpretation of the results in Panels 1, 2, and 3, please refer to the notes of Table 5. Taxes and spending shocks account for a modest 2-3 percent of the variation in the federal funds rate, as in Table 6. Finally, shocks to taxes account for about 5 percent of the variation of excess government bond returns and seem to be more important, in magnitude, than any other shocks with the exception of excess return shocks. In particular, they account for more than twice the variance in monetary policy (FFR) and inflation shocks, as also pointed out in Table 6.
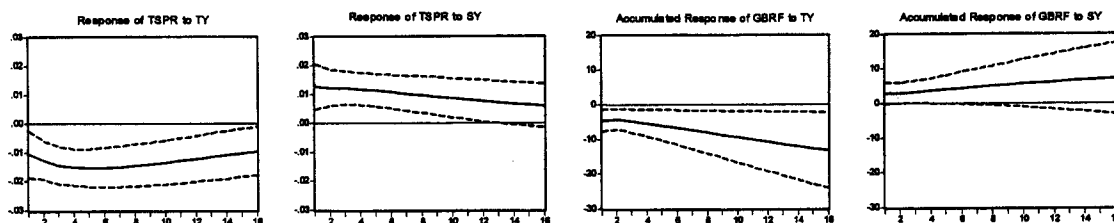
Appendix

Figure A1: Various Controls of Business Cycle Fluctuations
–Fiscal Policy
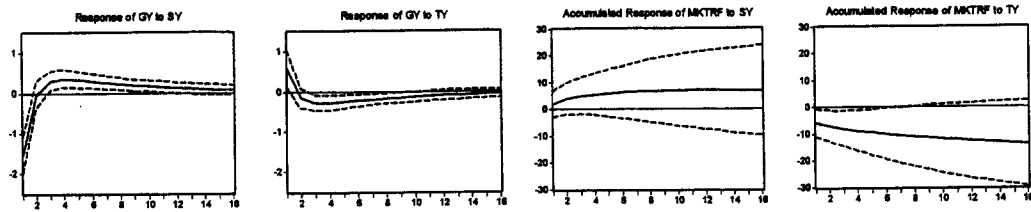Panel 1: Consumption Growth (GC) instead of GDP growth (GY)
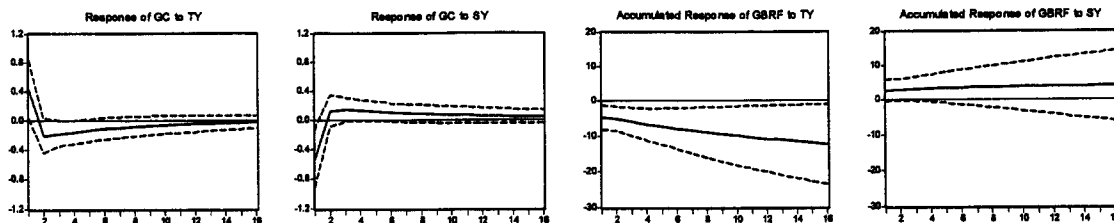
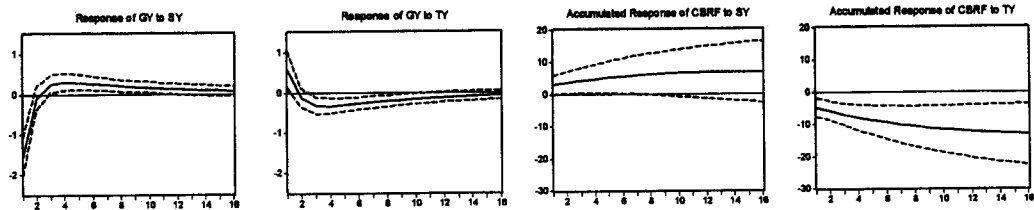Panel 2: Term Spread (TSPR) instead of GDP growth (GY)

Notes: Figure A1 presents robustness results of the main findings, where GDP growth (the proxy for business cycle fluctuations) is replaced by consumption growth (Panel 1) and by the term spread between BAA- and AAA-rated bonds (Panel 2). The results are essentially unchanged. Tax increases lead to a long-run decrease in consumption growth and the term spread. The effect of taxes and spending on returns is also unchanged. The above panels are directly comparable with the results in Figure 1. 95 percent confidence intervals are computed using 5,000 bootstrapped samples.
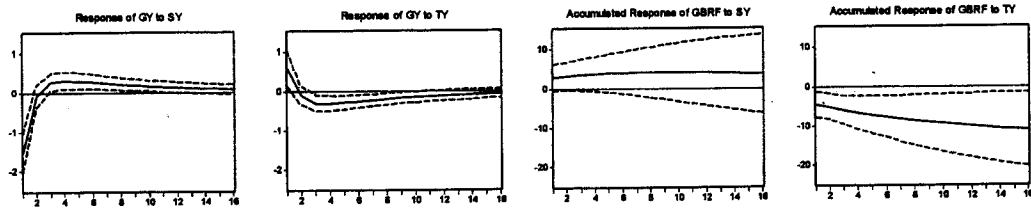
Figure A2: VARs with Spending and Taxes
–Fiscal and and Monetary Policy
Panel 1: VAR with Excess Stock Returns (MKTRF)

Response of GY to SY	Response of GY to TY	Accumulated Response of MKTRF to SY	Accumulated Response of MKTRF to TY

Panel 2: VAR with Excess Corporate Bond Returns (CBRF)

Response of GY to SY	Response of GY to TY	Accumulated Response of CBRF to SY	Accumulated Response of CBRF to TY

Panel 3: VAR with Excess Government Bond Returns (GBRF)

| Response of GY to SY	Response of GY to TY	Accumulated Response of GBRF to SY	Accumulated Response of GBRF to TY

Notes: Figure A2 uses an alternative Cholesky ordering of taxes and spending. In the main text, we assume that taxes are Cholesky-prior to spending, which implies that spending responds to taxes within the period, but not the other way around. This assumption is quite innocuous, since the correlation between the two shocks is only -0.02. To demonstrate the invariance of our results to the ordering of taxes and spending, we run the same VARs as those used to produce Figures 3 through 5, except that we place spending (SY) above taxes (TY) in the identification procedure. If we compare the results from Panels 1 through 3 with the corresponding graphs in Figures 3 through 5, we see that the ordering of fiscal variables has no effect on the results.

Figure A3: Integration and Cointegration Specifications
### –Fiscal and and Monetary Policy

Accumulated Response to Cholesky One S.D. Innovations ± 2 S.E.
No Cointegrating Vectors

Accumulated Response of MKTRF to TY

Accumulated Response of MKTRF to SY
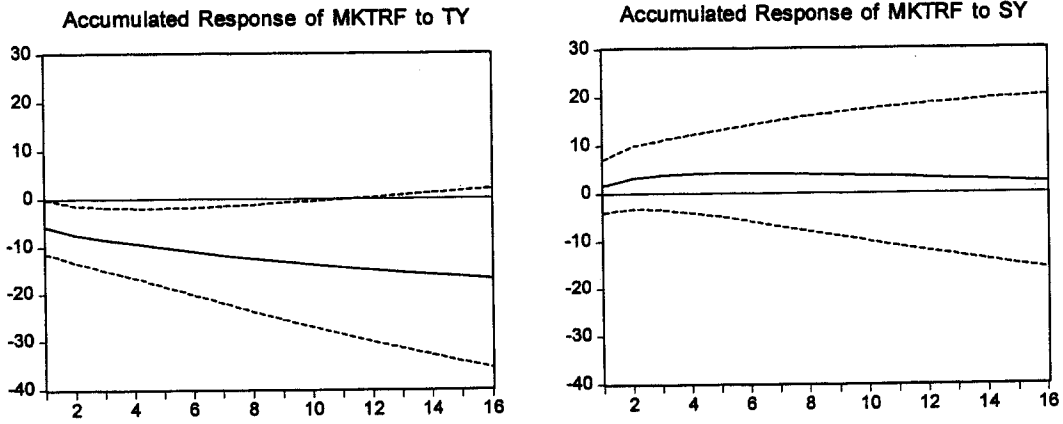
Accumulated Response to Cholesky One S.D. Innovations
One Cointegrating Vector

Accumulated Response of MKTRF to TY

Accumulated Response of MKTRF to SY
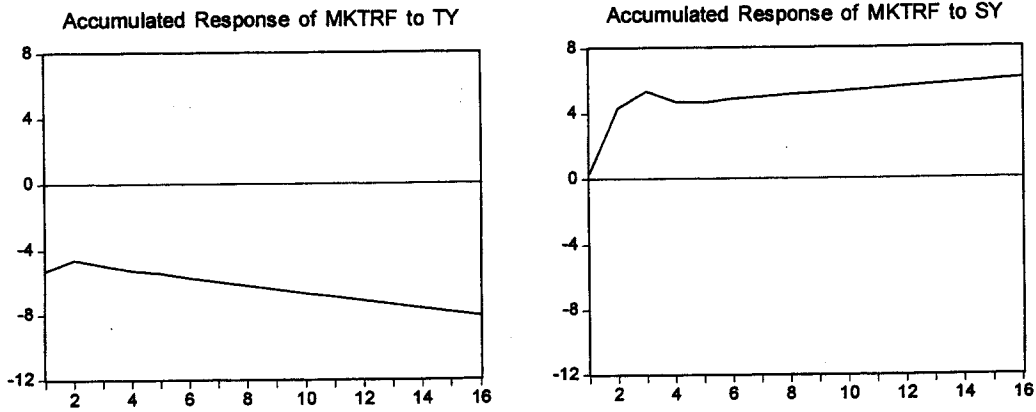
Accumulated Response to Cholesky One S.D. Innovations
Two Cointegrating Vectors

Accumulated Response of MKTRF to TY

Accumulated Response of MKTRF to SY
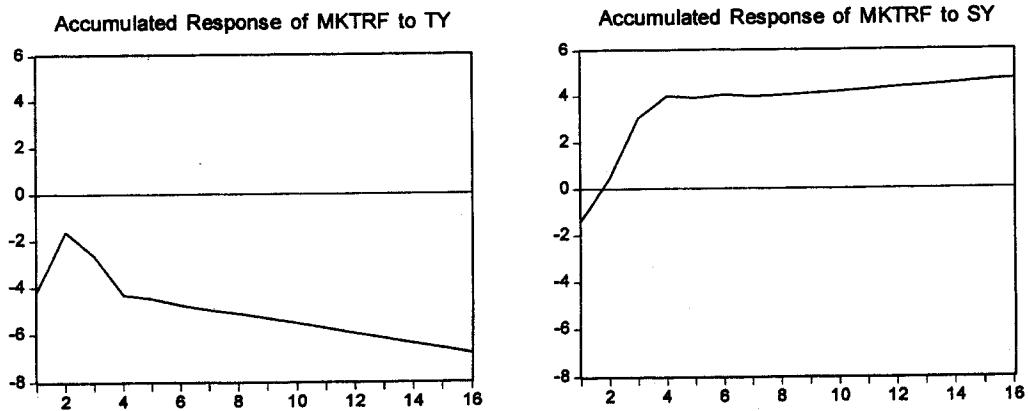
Notes: See next page.

Notes: Figure A3 displays the results from the VAR $Y_t = [TY_t \ SY_t \ GY_t \ INF_t \ MKTRF_t]$ where we impose no cointegrating vectors (top panel, which also corresponds to Figure 3), one cointegrating vector (middle panel), and two cointegrating vectors (bottom panel). Some researchers have argued that while taxes (TY) and spending (SY) behave as non-stationary processes, their linear combination is stationary (Bohn (1991), Becker (1997)). In other words, taxes and spending must be cointegrated. We have tested for a cointegrating relationship between those two series, but formal (Phillips-Oularis (1990)) tests reject the null of cointegration. The rejection is largely due to the late 1970's and the 1980's when the US was running consistent deficits. However, accepting the possibility that the rejection of cointegration might be due to lack of statistical power, we estimated the VARs with one and two cointegrating vectors, using the Johansen (1991) method. The impulse responses from the cointegrated VARs are reported above. From a direct comparison of the non-cointegrated (top panel) and the cointegrated (bottom two panels) VARs, we notice that the results are very similar. Namely, expected returns (at all holding horizons) decrease by about 4% after a one-standard-deviation shock to taxes, and increase, albeit insignificantly, after a one-standard-deviation shock to spending. Hence, our results are robust to various cointegrating assumptions.