

# Fiscal Policy Rules in the Postwar United States

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## **Abstract:**

Recent research has indicated the importance of understanding how governments set fiscal policy in order to stabilize the debt-GDP ratio, if at all. Fiscal Taylor rules and error correction models have represented two different ways of quantifying the feedbacks from fiscal and economic conditions to fiscal policy decisions. This paper synthesizes these two strands of the literature, formulating and estimating a fiscal Taylor rule as a special case of an error correction model. Using quarterly postwar U.S. data, estimates of a fiscal Taylor rule find that the government sector has sought to stabilize its debt through adjustments to purchases and taxes, in that order. The estimates also show that the government sector has appeared extremely reluctant to adjust transfers in response to fiscal imbalances. In cyclical terms, government spending and transfers rise strongly with unemployment while taxes fall strongly. Furthermore, fiscal policy has not remained constant over time. Since 1981, the feedback from debt into fiscal decisions has almost vanished, while the cyclical behavior of fiscal variables has not changed.

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# I. Introduction

In the period since Taylor (1993) formulated a reduced-form rule relating the Fed's interest rate target to output and inflation, the relationship between systematic monetary policy and economic performance has fueled a large amount of discussion. Much less discussion has gone into evaluating the effects of systematic fiscal policy for a number of reasons. For one thing, fiscal policymakers do not have a single instrument like the Fed Funds Rate or the growth rate of outside money to target. They can adjust purchases, transfer payments, and tax rates, or they can issue money in response to short-run conditions. In this sense, deficits are an accounting identity, not a control variable. Secondly, fiscal authorities must take their intertemporal budget constraint into account, in a way that monetary authorities do not have to.<sup>1</sup> Fiscal authorities must fashion their policy so that the debt-GDP ratio does not explode while attempting to smooth out transitory fluctuations in the economy. A satisfactory analysis of reduced-form fiscal feedback functions will therefore necessarily account for long-run fiscal imbalances in addition to short-run cyclical conditions.

The analysis proceeds in two parts. The first part lays out a general fiscal response function in a nonstationary context, relating fiscal Taylor rules to the more general fiscal response function. The second part presents estimates of this multivariate fiscal Taylor rule using quarterly data covering the entire government sector of the United States from 1952 through 2006. These estimates quantify the degree to which fiscal authorities have adjusted their behavior in order to stabilize the debt-GDP ratio,

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<sup>1</sup> Sargent and Wallace (1981) and Leeper (1991) show the potential importance of fiscal responses to debt in determining the interactions between monetary and fiscal policy. Woodford (2001) and Benigno and Woodford (2006) provide good discussions of current thinking on the subject. Bohn (1992) shows how an optimizing government might reduce spending in response to fiscal imbalances, and how this might induce violations of Ricardian equivalence among consumers and investors.

using a growth-adjusted deficit measure derived from the government's balance sheet. The estimation strategy takes the nonstationarity of the individual fiscal variables into account. In doing so, the results mostly confirm conventional wisdom, with the added finding that the government sector appears reluctant to stabilize the deficit by adjusting transfer payments.

First of all, the major instruments of fiscal policy have responded exactly as expected in response to cyclical conditions. Government purchases rise slightly as a share of GDP when unemployment rises. Transfers as a share of GDP increase strongly with increases in unemployment. Taxes as a share of GDP fall strongly. By contrast, the major instruments of fiscal policy have responded sluggishly to fiscal imbalances. When fiscal adjustment has finally occurred, government purchases have played a surprisingly large role in that adjustment, with taxes playing a somewhat smaller role. Transfers have performed little if any role in fiscal adjustment. The findings regarding taxes and government spending reflect previous findings from the literature on vector error correction models (VECMs), but the finding regarding transfers is a new result.

The sample at hand also indicates that fiscal authorities have not behaved in a consistent manner over time, as Crowder (1997) has suggested. For the full sample, counterfactually holding unemployment and growth-adjusted interest constant, the fiscal Taylor rule suggests that primary *deficits* have had a quarterly persistence of about 96.2 percent. That is, structural fiscal imbalances have appeared, on average, to have a half life of a little bit less than five years. Since the 1981 tax cuts, however, this quarterly persistence has increased to over 99 percent, and it is in fact statistically impossible to distinguish the observed fiscal policy since that date from one that does not directly seek

to stabilize the debt-GDP ratio at all. Fiscal policy has apparently become much more active and much less responsive to debt, so that a chart of the debt-GDP ratio since 1981 even looks dramatically different from its predecessor to the naked eye.

In short, a proper estimation of fiscal response functions for the United States shows a conventional fiscal response to cyclical and fiscal imbalances, with two important qualifications. Adjustments to government purchases perform a large role alongside taxes in fiscal stabilization, while transfer payments perform a tiny role in stabilization. Models that rely purely on taxes to perform fiscal adjustment therefore miss out on an important feedback mechanism from fiscal conditions into the real economy. Also in accordance with views commonly held by the public, fiscal policy has become much less focused on fiscal stabilization since the late 1970s and early 1980s. Interestingly, fiscal policy has appeared to move away from debt stabilization at about the same time that the Federal Reserve moved toward inflation stabilization.

## **II. Previous Literature**

Previous estimates of fiscal responses for the United States have taken two main forms—simple fiscal Taylor rules and vector error correction models (or VECMs). Taylor (2000), in applying his name to fiscal rules, models fiscal deficits as a structural component plus a systematic response to cyclical conditions. He estimates a response of the federal deficit-GDP ratio to a measure of an output gap, as a percent of GDP, of about 0.5. He does not include a response of fiscal variables to fiscal imbalances in his estimates. Galí and Perotti (2003) and Claeys (2006) estimate univariate fiscal policy rules for the United States—they find evidence of sluggish fiscal adjustment and of lower

responses of deficits to output than Taylor. Favero and Monacelli (2005) estimate a fiscal rule in a regime-switching framework, relating U.S. federal deficits to an output gap and the *level* of the debt-GDP ratio. They find little evidence of deliberate debt stabilization at most times by fiscal authorities. Their only estimated episodes of fiscal stabilization appear in 1975 during the Ford tax cuts and from 1995 through 2001. They do not find evidence of a sustained change in fiscal policy throughout their sample. They use a strong notion of fiscal sustainability under which fiscal stabilization implies a stationary debt-GDP ratio.

Another take on the issue of fiscal responses, which allows for nonstationarity, involves the formulation and estimation of vector error correction models (VECMs). Fiscal VECMs are basically vector autoregressions of nonstationary fiscal and economic variables, in first differences, with an additional term on the right hand side reflecting a stationary deficit-GDP ratio (but a nonstationary debt-GDP ratio).<sup>2</sup> Unlike reduced form fiscal rules, VECMs take the nonstationary time-series behavior of individual deficit components and of the debt into account. Using this approach, Bohn (1991, 1998, and 2005) documents continual fiscal stabilization efforts throughout the history of the United States. Crowder (1997) estimates a small-scale error correction model for the United States federal government using postwar data and finds evidence of a regime shift sometime late in the 1970s or early in the 1980s.

Bohn and Crowder both find that broad categories of government expenditures perform much of the adjustment necessary to keep the public debt-GDP ratio from exploding, with taxes doing less of the adjustment. Crowder also documents a change in

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<sup>2</sup> In the language of time series econometrics, this is appropriate when individual deficit components such as taxes and spending as a share of GDP are nonstationary but cointegrated.

fiscal policy away from fiscal stabilization toward the late 1970s or early 1980s. More recently, Favero and Giavazzi (2007) set up and estimate something like a vector error correction model augmented by output in response to Blanchard and Perotti (2002) and Perotti's (2005) use of vector autoregressions to estimate the dynamic effects of innovations to government spending and taxes. Favero and Giavazzi recommend using a model with explicit responses to *levels* of the debt-GDP ratio instead—their model is basically a VAR with an extra debt variable on the right-hand side. That is, Favero and Giavazzi assume the debt-GDP ratio to be stationary in levels rather than difference-stationary. They get the exact opposite results from Crowder. As it happens, a fiscal Taylor rule which takes proper account of nonstationarity delivers conclusions more like those of Bohn and Crowder and less like those of Favero et al.

### **III. The Data: Debt, Revenues, and Expenditures**

The National Income and Product Accounts contain quarterly data, dating from 1947, on revenues and expenditures by category for the entire government sector of the United States. This allows one to properly construct series for government consumption and investment purchases, net transfer payments, and revenues. The Flow of Funds Accounts contain seasonally adjusted quarterly information on the financial assets and liabilities for the entire government sector plus the stock of outside money, dating from 1952 at a quarterly frequency and 1945 at an annual frequency. The analysis will cover the behavior of five aggregate fiscal variables as a share of GDP: Growth-adjusted interest on the net public debt, government purchases (net of consumption of fixed

capital), net transfer payments, net revenues, and the creation of outside money.<sup>3</sup> The series on the five fiscal variables, debt, and outside money are constructed in such a way that the change in net liabilities equals implicit interest plus purchases and transfers, minus tax revenues and seigniorage. Quarterly net liabilities data are constructed using end-of-year balances adjusted for intervening flows.

Figure 1 displays the resulting end-of-period quarterly net liabilities-GDP ratio from the first quarter of 1947 through the fourth quarter of 2006. It also displays the ratio of the stock of outside money to GDP and the resulting net debt-GDP ratio from the first quarter of 1952 through the fourth quarter of 2006. The fiscal picture for the government sector of the United States primarily follows the conventional story of the federal debt. First of all, the net liabilities and debt of the government sector as a share of GDP decreased rather steadily from the end of World War II through the 1970s, with notable exceptions during the Korean War and most recessions. Both ratios then rose fairly strongly from the early 1980s through the early 1990s, with the debt-GDP ratio reaching a peak of about 48% at the end of 1993. It fell to just under 29% by the third quarter of 2001. By the end of the sample at the end of 2006, the debt-GDP ratio appeared to stabilize at about 36%.

Figure 2 shows the values of the implicit interest expense, government purchases, transfer payments, revenue, and seigniorage scaled by GDP at a quarterly frequency. The implicit interest expense equals the residual change in the net debt-GDP ratio after taking the other non-interest expenditure and revenue items into account. Implicit interest has

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<sup>3</sup> The Flow of Funds Accounts contain the data on the par value of the government's financial assets and liabilities used here. The Dallas Fed publishes figures for the market value of the federal debt. They track each other closely, with deviations primarily reflecting swings in long-run nominal interest rates. Hamilton and Flavin (1986), for instance, use the market value of the federal debt in their analysis. For coverage reasons, the estimates in this paper use par values.

averaged about -0.03% of GDP throughout the sample, indicating that economic growth has equaled or slightly exceeded the interest payments on government debt. Government purchases spiked upward during the Korean War and have shown a downward trend since then as defense spending has gradually shrunken as a share of GDP. A rise in transfers has more than made up for the fall in government consumption and investment purchases, with notably large fluctuations during recessions and during the welfare state expansions of the late 1960s and early 1970s.

Figure 3 shows the effect of adjusting government deficits for growth—that is, taking the first difference of the debt-GDP ratio rather than taking the first difference of nominal debt and then scaling it by GDP as done conventionally. The growth-adjusted deficit measure lies well below the growth-unadjusted measure. The difference primarily reflects the treatment of interest payments. The conventional measure uses nominal interest payments to measure the interest expense paid by the government sector on its debt. The adjusted measure subtracts a “growth dividend” which, on average, cancels out the nominal interest expense. Bohn (2005) finds a similar result throughout the entire history of the United States at the federal level. Properly adjusting for nominal growth removes the illusory “deficit bias” from most of the post-World-War-II data.

With respect to time series properties, it appears that the series for government purchases, transfers, and revenues are not individually stationary—purchases seem to have drifted downward throughout the sample, while transfers and taxes have both drifted upward. Bohn (1998, 2005) shows that standard time-series methods cannot reject a unit root in the debt-GDP ratio. He finds substantial evidence of deliberate fiscal stabilization when this nonstationarity is properly taken into account. That is, he finds that *changes* in

the debt-GDP ratio, or growth-adjusted deficits, appear to be stationary and well-behaved. Nonstationary deficit components and debt, accompanied by stationary deficits, imply cointegration and error correction. If deficits become too large or small, fiscal authorities will slowly adjust fiscal variables to bring the growth-adjusted budget back into balance. In essence, one can think of fiscal responses as the systematic actions taken by the government sector, in the aggregate, to maintain a nonexplosive debt-GDP ratio in the presence of ongoing changes in fiscal and economic conditions.

## **IV. Sustainability, error correction, and Taylor Rules**

### **A. Fiscal responses and sustainability**

The definition of sustainability used here is a fairly loose one. Much of the original time-series literature on fiscal sustainability, such as Hamilton and Flavin (1986), formulates and develops tests for the stationarity of the federal debt-GDP ratio (“strong sustainability”). Trehan and Walsh (1991) show that a *difference*-stationary debt-GDP ratio satisfies a form of sustainability (“weak sustainability”) that still respects the government’s budget constraint. Bohn (2007) extends this line of thought to its logical conclusion and shows that a debt-GDP ratio integrated of any finite order satisfies the budget constraint, and that revenues and spending do not even need to be cointegrated (“absurdly weak sustainability”). As a result, given a finite-length sample, one cannot ever truly test for fiscal sustainability. In practice, Bohn’s result simply means that one must not confuse sufficient conditions for sustainability with necessary ones, and that the time-series properties of the underlying processes for spending and revenues matter when estimating feedback functions. Keeping Bohn’s critique in mind, this paper will assume

weak sustainability since there is not much evidence that the debt-GDP ratio is integrated of any order greater than one.

To put the notion of systematic fiscal policy into a concrete context, one might model fiscal policy and economic feedbacks as a fiscal response function embodying a systematic response of fiscal and other economic variables to debt and to cyclical conditions. A general fiscal response function might involve responses to lags of debt and cyclical conditions as well, since it takes Congress and state legislatures time to issue legislation or to respond to fiscal imbalances. In such a case, the fiscal response might take the form

$$x_t = \alpha_b(L)b_t + \alpha_u(L)u_t + \varepsilon_t, \quad (\text{FR})$$

where  $x_t$  represents the fiscal variables stacked into a vector;  $u_t$  equals the unemployment rate; and  $b_t$  equals the debt-GDP ratio. The exogenous process  $\varepsilon_t$  is integrated of a finite order and may have some dynamics associated with it. The response coefficients  $\alpha_b(L)$  and  $\alpha_u(L)$  take the form of lag polynomials and represent the explicit structural response of fiscal policymakers to current and previous values of the debt-GDP ratio and unemployment rate. In general, if the exogenous process governing fiscal policy has dynamics associated with it, it is not possible to estimate these objects without making further restrictions. The entire system has a reduced-form VECM representation and it is possible to estimate impulse responses.<sup>4</sup> Without further restrictions on the dynamics, though, it is not possible to estimate the structural feedback coefficients.

In the absence of explicit feedback rules, fiscal policy would follow the process  $\varepsilon_t$  which is exogenous to the system. For instance, changes in demographics affect the

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<sup>4</sup> Hamilton (1994) goes through the algebra which follows after taking the fiscal rule in first differences and substituting the budget constraint in the form  $\Delta b_t = mx_t$ .

politics of transfer payments—with rising numbers of elderly voters, expansions of Social Security and Medicare tend to follow. International events such as the Soviet invasion of Afghanistan in 1979 or the Vietnam escalation in 1965 initiated long periods of relatively high levels of government purchases. Political events such as the California property tax revolt or the divisions between the executive branch and Congress in the late 1990s (or the end of that situation in early 2001) represent independent shocks to taxes.<sup>5</sup> These shocks have dynamics of their own—the post-1979 military buildup did not fully play out until the mid-1980s but much of it was forecastable. Demographic and political considerations regarding transfer payments and taxes—the percentage of the population over 65 or with children in school, for instance—may show some dynamics as well.

Formulated this way, statements about fiscal stability are actually statements about the joint behavior of fiscal and economic variables as expressed by the budget constraint and fiscal response function. Debt is nothing more or less than the sum of past deficits, properly scaled. What determines the stability or instability of debt is precisely the total feedback effect that debt has upon the individual elements of  $x_t$ . Insofar as the fiscal variables themselves are concerned, if policy acts in such a manner as to reduce deficits in response to a rise in debt, then this satisfies weak sustainability. In this sense, fiscal response functions capture the government's deliberate response to fiscal conditions undertaken in order to keep the debt-GDP ratio from exploding.

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<sup>5</sup> Romer and Romer (2007), for instance, document a number of large, discontinuous changes in the tax code that correspond with well-known political events.

## B. A Restricted Model: A Fiscal Taylor Rule

Assuming no dynamics for  $\varepsilon_t$  and no delays in fiscal responses to debt or unemployment, it is possible to estimate a fiscal response function such as (FR) rather easily. It is necessary to take the possible endogeneity of current-period unemployment into account, but apart from that, it means that taking first differences of (FR) will yield a simple estimation problem. Since levels of debt and their lags are predetermined at time  $t$ , past deficits can instrument for themselves. Since unemployment may be stationary, past levels and changes in unemployment provide additional valid and relevant instruments for current-period changes in unemployment.

As a result, for each fiscal variable of interest, estimating a fiscal Taylor rule boils down to estimating individual rows of the expression

$$\Delta x_{it} = \mu + \alpha_{bi} \Delta b_t + \alpha_{ui} \Delta u_t + \eta_{it}. \quad (\text{FTR})$$

Estimates of the fiscal Taylor rule deliver a rough idea of the response of individual fiscal variables to fiscal and cyclical conditions. To the extent that budget deficits are highly autocorrelated, it does not matter much whether the government responds to current debt or debt with a slight lag. If the government makes fiscal projections and preemptively adjusts spending or taxes to take possible imbalances into account, using current debt might even yield better estimates than using lagged debt.

Taking a fiscal Taylor rule in first differences, so long as the omitted dynamics do not cause much of a problem, can therefore provide consistent estimates of the response of different fiscal variables to fiscal and economic conditions. Because of the inclusion of both a fiscal and a cyclical indicator, the coefficient on changes in debt will capture the response of individual policy categories to long-term fiscal imbalances, while the

coefficient on unemployment will capture those short-term imbalances attributable to business cycle conditions. A fiscal Taylor rule does not represent a complete model of debt and deficit dynamics with which to estimate impulse responses—for this, a larger-scale model like a VECM is necessary. Nonetheless, it gives a good indication about how fiscal authorities adjust fiscal variables in response to fiscal imbalances and cyclical conditions.

## **V. Results**

### **A. Coefficients on Unemployment**

The estimates for the fiscal Taylor rule for the full sample suggest a strong, Keynesian-style response of fiscal variables to the business cycle. Table 1 contains OLS and two-stage least squares estimates for the simplified fiscal Taylor rule over the entire 1952-2006 sample. For the most part, they appear rather similar to each other. The first stage OLS regression, which predicts changes in unemployment using lagged levels and first differences in unemployment and the change in the debt-GDP ratio, has an R-squared of 0.42. An F-test overwhelmingly rejects the null hypothesis of no relationship between changes in unemployment and its own lagged levels and first differences. Such a fit indicates the likely relevance of these instruments in predicting unemployment. As a result, the small-sample bias of the two-stage estimator is exceedingly small, and its variance does not much exceed that of the OLS estimator.

Based on the coefficients on unemployment from the two-stage estimates, government purchases as a share of GDP tend to fall by 0.162 points in response to a one percentage point increase in unemployment. A coefficient of this magnitude, given a

0.183 share of GDP for government purchases and an Okun's Law coefficient greater than one, implies that the level of government purchases actually falls slightly in response to a rise in unemployment.<sup>6</sup> It seems that, since state and local governments appear reluctant to issue debt, they prefer to defer purchases until an economic recovery when tax revenues recover. The statistically and economically significant positive coefficient on unemployment provides strong evidence that the government sector attempts to smooth purchases relative to economic fluctuations.

Both levels of transfers and their share of GDP, on the other hand, rise vigorously in response to unemployment, with a response coefficient of 0.408. Unemployment insurance and welfare payments naturally respond in a strong way when unemployment rises. A glance at Figure 3 shows large increases in transfers as a share of GDP during every major recession from the early 1970s onward, followed by decreases during recoveries. The other major portions of transfer payments, namely Social Security payments and medical programs, do not typically see cuts during a recession either. Politicians seem to increase transfers during bad economic times, waiting until periods of low unemployment to bring them back toward more normal levels.

Tax revenues as a share of GDP also respond strongly to business cycles, varying positively with unemployment and negatively with output. Average tax rates fall by about 0.51 percentage points for every percentage point increase in unemployment. This is about the same under both the OLS and two-stage estimates. Much of this is due to the nonlinear, complicated, nature of the tax code and its interactions with asset prices; Romer and Romer (2007) identify only a handful of deliberate large policy changes in the

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<sup>6</sup> Conventional estimates of Okun's Law find, statistically, a two percent increase in output for a one percentage point decrease in the unemployment rate. The data on hand confirm that estimate.

postwar period. A few such deliberate changes coincide with rising unemployment, particularly the tax cuts of Ford, Reagan, and George W. Bush. Average tax rates move rather strongly with the business cycle through some combination of automatic and discretionary responses to cyclical conditions.

All in all, the responses of deficits and their individual components to unemployment follow their conventional storyline. The government sector in the United States does not cut purchases by nearly the amount that GDP falls during recessions; it attempts to smooth its purchases to a large degree. It increases transfer payments, especially to the unemployed. It adjusts average tax rates over the business cycle, using the progressivity of the tax code to automatically raise taxes during good times and reduce them during bad times. For every one percent increase in unemployment above its average long-run rate, the government sector runs an average primary deficit of about 1.08 percent of GDP.

## **B. Coefficients on Debt**

The coefficient estimates on debt for the full sample suggest that adjustments to government purchases perform about half of all primary deficit stabilization, with adjustments to taxes performing most of the rest. Transfers do not appear to adjust much in response to fiscal imbalances. Counterfactually holding unemployment, seigniorage, and growth-adjusted interest constant, the deliberate portion of fiscal adjustment seems like a sluggish process, with 96.2% (100% minus 3.81%) of primary deficits persisting from one quarter to the next and 85.6% of primary deficits persisting from one year to the next.

Adjustments to government purchases perform about 49% (0.0186% divided by 0.0381%) of deficit stabilization. This suggests that any fiscal reaction function that fails to have government purchases respond to debt suffers from a specification error. Bohn (1991) finds similar results in a VECM using annual federal data which combines government purchases with transfers—there, he finds that adjustments to total government spending together make up the majority of fiscal adjustments undertaken by the federal government. The coefficient of government purchases on debt of -0.0186 is in fact the only coefficient on debt which is statistically significant at conventional levels.

By contrast, the government sector does not adjust transfers much, if at all, in response to fiscal imbalances, with a coefficient of transfers on debt of -0.0055. Transfers only perform a statistically and economically insignificant 14% of fiscal adjustment in spite of comprising nearly a third of total government spending throughout the sample and more in recent years. By and large, transfers seem to respond mostly to business cycle conditions and to exogenous factors such as demographics. Given past history, this suggests that if demographic imbalances in the United States ever bring about large fiscal imbalances, the government sector as a whole would tend to respond by cutting purchases and raising taxes to roughly equal degrees.

Tax rates appear to respond to debt in an economically significant but statistically insignificant way. The estimates suggest that they perform the remaining 37% of deliberate fiscal stabilization. It seems interesting that politicians in the United States would rather cut government spending than raise taxes to stabilize the fiscal situation in the long run. The full-sample coefficient of taxes on debt of 0.0140 indicates that taxes adjust extremely slowly to fiscal imbalances. In the aggregate, the estimates from the

Taylor rule confirm Bohn's analysis of federal spending, with the additional qualification that most fiscal adjustment in response to long-run fiscal imbalances comes through government purchases, then taxes, then transfers.

### **C. Properties of Residuals**

Table 2 contains the standard deviations of the residuals from the OLS and IV regressions. Innovations to government purchases as a share of GDP have a standard deviation of about 0.28 points per quarter; innovations to transfers as a share of GDP have a standard deviation of 0.21 percent per quarter; and innovations to revenues as a share of GDP have a standard deviation of 0.45 percent per quarter. As a whole, innovations to primary deficits have a standard deviation of 0.55 percent per quarter, driven primarily by the relatively large amount of variation in taxes.

The contemporaneous residuals are not closely correlated. The residuals for government purchases and transfers have a -0.14 correlation coefficient, and none of the other combinations has a correlation greater than 0.1 in absolute value. The residuals for government purchases, transfers, and revenues have a first-order autocorrelation of -0.01, -0.20, and -0.30, respectively. To correct for this by including own-lags of each fiscal variable does not change the results much, with one important qualification. The direct responses of taxes and transfers to debt shrink even more, and they respond somewhat negatively to their own lags instead—this might happen, for instance, if taxes and transfers have a significant transitory component. Tables 3 and 4 report these results for the two-stage least squares estimates. As expected, the estimates for the response of government purchases do not change much, while transfers and taxes respond negatively

to their previous changes. In particular, nearly a third of a surprise tax change gets reversed by the following quarter. The disproportionate role of government purchases in long-run fiscal stabilization remains after accounting for lagged values of the individual fiscal variables.<sup>7</sup>

#### **D. Results from a split sample at the fourth quarter of 1981**

Favero and Monacelli (2005) estimate a simple deficit feedback rule, where the level of the debt-GDP ratio feeds back to deficit decisions. They find evidence of regime instability, with regimes of debt stabilization punctuating an otherwise nonstabilizing policy rule. From the VECM literature, Crowder (1997) finds evidence of a possible regime switch in fiscal policy during the late 1970s or early 1980s, with particularly strong evidence of a break in late 1981 toward less fiscal stabilization. A visual examination of the debt-GDP ratio in Figure 1 and of the various measures of deficits in Figure 3 suggests this as a distinct possibility. Favero et al. and Crowder get different results because they assume different orders of integration for debt and different notions of sustainability. It is interesting to ask, under the notion of weak sustainability, if an estimated fiscal Taylor rule can corroborate Crowder's results.

Table 5 contains the estimates for the response coefficients for the simple fiscal Taylor rule from the first quarter of 1952 through the third quarter of 1981, followed by estimates from the fourth quarter of 1981 through the fourth quarter of 2006. Indeed, fiscal policy appears to have changed dramatically surrounding the passage and enactment of the Economic Recovery Tax Act. Before 1981, policymakers acted swiftly

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<sup>7</sup> A full VECM with one lag delivers strikingly similar results to this specification.

to undo any possible fiscal imbalances. As in the full sample, government purchases bore the largest role in fiscal stabilization, followed by taxes and transfers, respectively. All bore a statistically and economically significant role in stabilization. The government sector would close fiscal imbalances at the rate of 12% per quarter or at the rate of 40% per year, for rates of persistence of 88% quarterly and 60% annually.

By contrast, none of the fiscal variables in the post-1981 sample shows a statistically or economically significant effect of fiscal imbalances on policymaking. The point estimate shows weak and approximately equal responses of taxes and government purchases to imbalances, and it even shows a weak positive effect of fiscal imbalances on transfers. It shows a statistically insignificant response of total primary deficits to debt of about 0.89 percent per quarter, meaning that fiscal imbalances have a persistence of 99.1% per quarter or a persistence of 96.5% per year. This is statistically indistinguishable from no deliberate fiscal stabilization whatsoever. It confirms Crowder's findings, to a stunning degree, that the government sector has not responded aggressively to close fiscal imbalances since the late 1970s or early 1980s.

The coefficients on unemployment show much more stability between subsamples. They are slightly stronger than those estimated for the full sample, but the differences between subsamples are not statistically or economically significant. Their interpretation remains unchanged from their interpretation in the full sample. The aggressiveness of fiscal policy in pursuing long-run fiscal stabilization has disappeared, but the cyclical behavior of fiscal policy has apparently not changed.

Table 6 shows the contemporaneous properties of the residuals. Innovations to government purchases show much more volatility in the earlier subsample while taxes

show slightly more volatility in the latter subsample. Contemporaneous residuals in primary deficits show similar properties between subsamples. The residuals from the regressions also indicate that fiscal variables, particularly taxes, have become much more difficult to forecast given cyclical conditions and lagged fiscal imbalances. Part of this is because of the much less volatile business cycle since the 1980s—the large response of deficits to unemployment means that less variation in unemployment will make it more difficult to forecast deficits.

In general, these estimates indicate a disappearing role for fiscal stabilization in setting fiscal policy but also indicate that fiscal responses to business cycle conditions have not changed much. Changes to government purchases have also become less volatile and changes to taxes more volatile, hence one possible explanation for the declining role of shocks to government purchases in driving output fluctuations noted by Perotti (2005) and confirmed by Favero and Giavazzi (2007). It appears that fiscal policy has in fact changed radically during the postwar period.

## **VI. Conclusion**

Carefully taking the pitfalls of nonstationarity and the multiplicity of fiscal instruments into account, it is possible to estimate reduced-form fiscal feedback functions relating fiscal policy decisions to fiscal and economic imbalances. An estimate of a multivariate fiscal Taylor rule as a special case of an error correction model for the entire U.S. government, using postwar data, suggests that adjustments to government purchases have performed a large role in fiscal stabilization, with adjustments to tax rates accounting for most of the rest. Transfers have performed very little role in fiscal

adjustment—policymakers seem to prefer to adjust government purchases and taxes before they adjust transfers. All three major components of fiscal policy appear to have responded in expected ways to cyclical conditions. During periods of high unemployment, deficits as a share of GDP have risen by a little more than one percentage point for each one percentage point increase in unemployment, with taxes and transfers accounting for most of that increase. Notably, these estimates imply quantitatively important feedback from fiscal imbalances to government purchases. Structural models that do not allow for such a feedback miss out on a potentially important source of real effects for fiscal shocks.

The postwar period also shows important evidence of structural instability in fiscal feedback mechanisms, as estimated by a fiscal Taylor rule. This break is even visible to the naked eye when presented with a deficit series. Up through the late 1970s or early 1980s, fiscal policymakers had responded aggressively to close fiscal imbalances. Since that time, fiscal policymakers have responded in a statistically and economically insignificant way to fiscal imbalances. Innovations to government purchases have also become less volatile while innovations to taxes have become more volatile. Interestingly, a fiscal policy change in 1981 also corresponds with a period with a radical shift in monetary policy toward inflation stabilization. The persistent change toward a less stabilizing fiscal policy combined with greater inflation stabilization poses a potential challenge to the fiscal theory of the price level. The fiscal policy change also corresponds with evidence of reduced Keynesian effects of government purchases in the U.S. Both of these issues deserve further investigation.

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**Table 1 – Estimates of Response Coefficients from  
Fiscal Taylor Rule, Full Sample**

Dependent Variable	OLS		2SLS	
	<i>Coeff. on u</i>	<i>Coeff. on b</i>	<i>Coeff. on u</i>	<i>Coeff. on b</i>
<b>Govt. Purchases / GDP</b> (Std. Err.)	<b>0.2959</b> 0.0526	<b>-0.0226</b> 0.0076	<b>0.1622</b> 0.0854	<b>-0.0186</b> 0.0079
<b>Transfers / GDP</b> (Std. Err.)	<b>0.3191</b> 0.0402	<b>-0.0028</b> 0.0058	<b>0.4084</b> 0.0650	<b>-0.0055</b> 0.0060
<b>Revenues / GDP</b> (Std. Err.)	<b>-0.4509</b> 0.0845	<b>0.0121</b> 0.0122	<b>-0.5118</b> 0.1354	<b>0.0140</b> 0.0126
<b>Primary Deficit / GDP</b> (Std. Err.)	<b>1.0659</b> 0.1038	<b>-0.0376</b> 0.0149	<b>1.0824</b> 0.1661	<b>-0.0381</b> 0.0154

**Table 2 – Properties of Residuals from  
Fiscal Taylor Rule, Full Sample**

Dependent Variable	OLS		2SLS	
	<i>Std (<math>\eta_{it}</math>)</i>	<i>R<sup>2</sup></i>	<i>Std (<math>\eta_{it}</math>)</i>	<i>R<sup>2</sup></i>
<b>Govt. Purchases / GDP</b>	0.0028	0.1393	0.0028	0.1136
<b>Transfers / GDP</b>	0.0021	0.2290	0.0021	0.2115
<b>Revenues / GDP</b>	0.0045	0.1159	0.0045	0.1138
<b>Primary Deficit / GDP</b>	<b>0.0055</b>	<b>0.3272</b>	<b>0.0055</b>	<b>0.3271</b>

**Table 3 – Estimates of Response Coefficients from Fiscal Taylor Rule with Own Lags, Full Sample**

Dependent Variable	2SLS, 1952-2006		
	<i>Coeff. on u</i>	<i>Coeff. on b</i>	<i>Coeff. on <math>x_{it-1}</math></i>
<b>Govt. Purchases / GDP</b> (Std. Err.)	<b>0.1627</b> 0.0955	<b>-0.0186</b> 0.0079	<b>-0.0006</b> 0.0730
<b>Transfers / GDP</b> (Std. Err.)	<b>0.4898</b> 0.0697	<b>-0.0036</b> 0.0062	<b>-0.1847</b> 0.0669
<b>Revenues / GDP</b> (Std. Err.)	<b>-0.6590</b> 0.1377	<b>0.0059</b> 0.0123	<b>-0.2875</b> 0.0669

**Table 4 – Properties of Residuals from Fiscal Taylor Rule with Own Lags, Full Sample**

Dependent Variable	2SLS, 1952-2006	
	<i>Std (<math>\eta_{it}</math>)</i>	<i>R<sup>2</sup></i>
<b>Govt. Purchases / GDP</b>	0.0028	0.1138
<b>Transfers / GDP</b>	0.0022	0.1969
<b>Revenues / GDP</b>	0.0043	0.1694

**Table 5 – Estimates of Response Coefficients from  
Fiscal Taylor Rule, Split Sample at 1981.Q4**

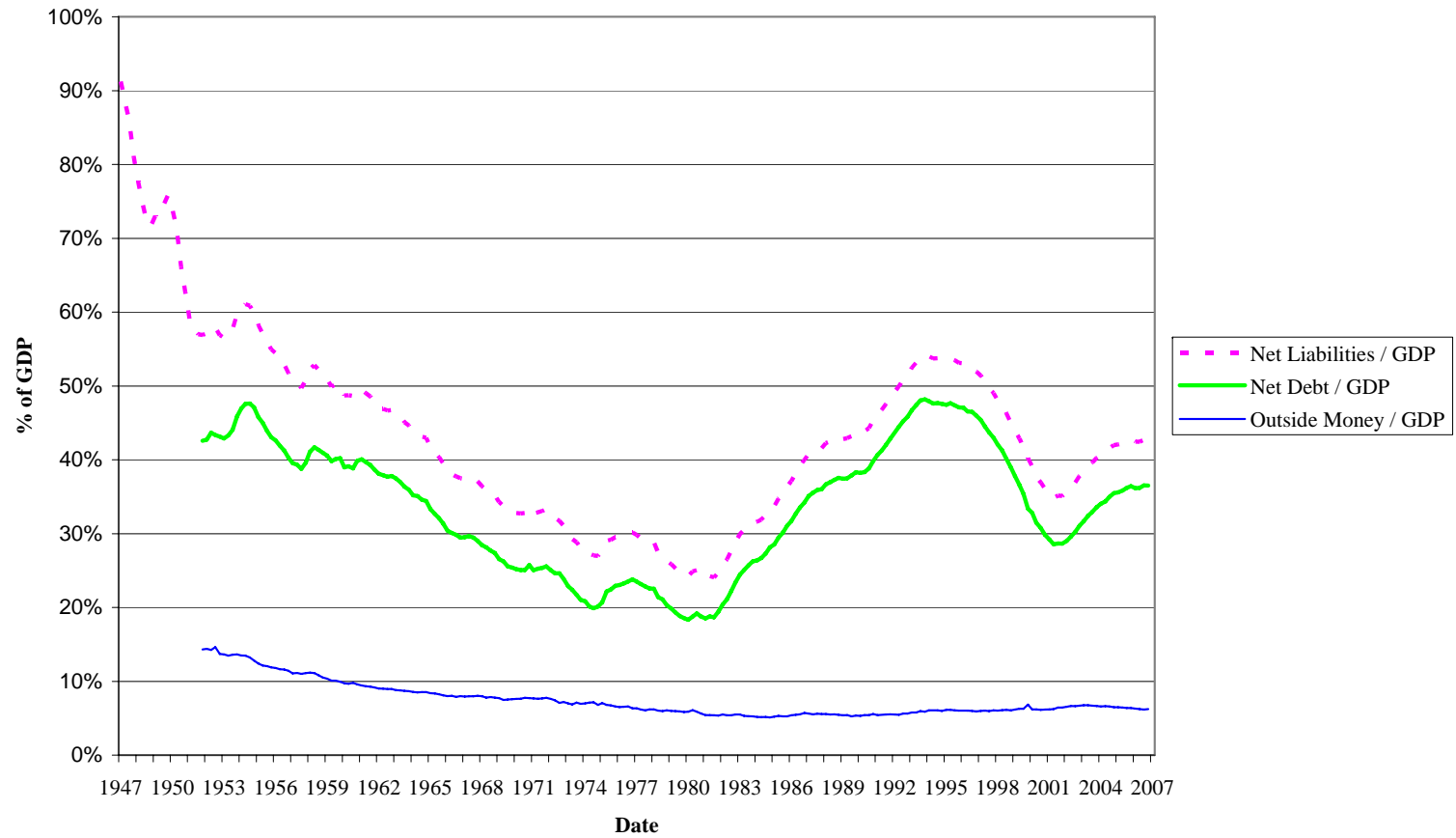
Dependent Variable	2SLS, 1952 – 1981.Q3		2SLS, 1981.Q4 – 2006	
	<i>Coeff. on u</i>	<i>Coeff. on b</i>	<i>Coeff. on u</i>	<i>Coeff. on b</i>
<b>Govt. Purchases / GDP</b> (Std. Err.)	<b>0.2882</b> 0.1374	<b>-0.0528</b> 0.0169	<b>0.3928</b> 0.1119	<b>-0.0061</b> 0.0073
<b>Transfers / GDP</b> (Std. Err.)	<b>0.4910</b> 0.0984	<b>-0.0254</b> 0.0121	<b>0.4252</b> 0.1160	<b>0.0056</b> 0.0076
<b>Revenues / GDP</b> (Std. Err.)	<b>-0.6701</b> 0.1737	<b>0.0420</b> 0.0214	<b>-0.5817</b> 0.2895	<b>0.0084</b> 0.0190
<b>Primary Deficit / GDP</b> (Std. Err.)	<b>1.4493</b> 0.2232	<b>-0.1203</b> 0.0275	<b>1.3997</b> 0.3312	<b>-0.0089</b> 0.0217

**Table 6 – Properties of Residuals from  
Fiscal Taylor Rule, Split Sample at 1981.Q4**

Dependent Variable	2SLS, 1952 – 1981.Q3		2SLS, 1981.Q4 – 2006	
	<i>Std (<math>\eta_{it}</math>)</i>	<i>R<sup>2</sup></i>	<i>Std (<math>\eta_{it}</math>)</i>	<i>R<sup>2</sup></i>
<b>Govt. Purchases / GDP</b>	0.0032	0.1956	0.0019	0.0880
<b>Transfers / GDP</b>	0.0023	0.2293	0.0020	0.1657
<b>Revenues / GDP</b>	0.0041	0.2055	0.0050	0.0207
<b>Primary Deficit / GDP</b>	<b>0.0052</b>	<b>0.4661</b>	<b>0.0057</b>	<b>0.1314</b>

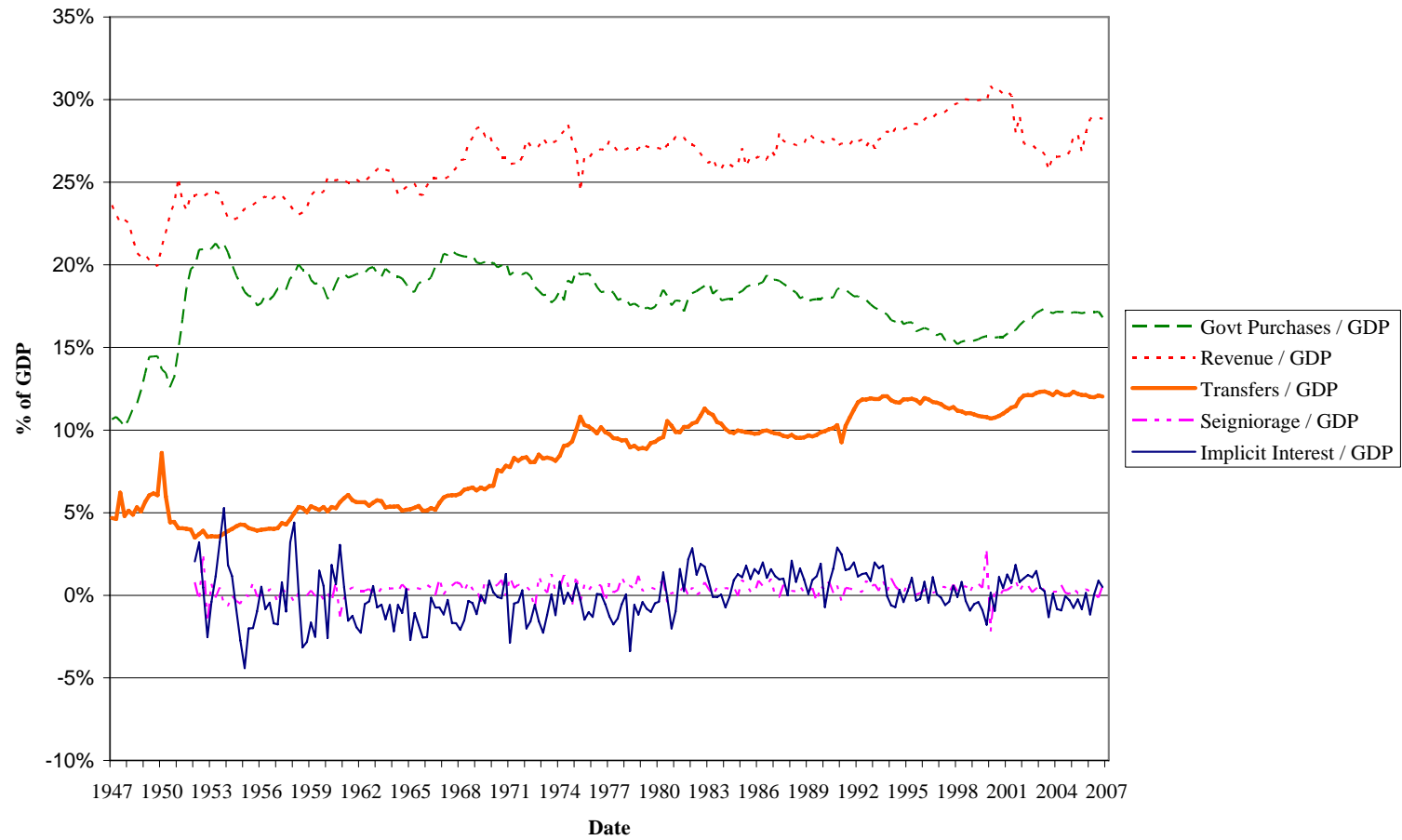
# Figure 1 – Net Liabilities for the Government Sector

Seasonally Adjusted Net Government Liabilities  
(End of Quarter, % of GDP Based on Par Value)



# Figure 2 – Deficit Items as a Percent of GDP

Government Flows (% of GDP)



# Figure 3 – Deficits as a Percent of GDP

## Three Measures of Deficits (% of GDP)

