U.S. Fiscal Indicators, Inflation and Output

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Abstract

In this paper we explore the information content of a large set of fiscal indicators for US real output growth and inflation. We provide evidence that fluctuations in certain fiscal variables contain valuable information to predict fluctuations in output and prices. The distinction between federal and state-local fiscal indicators yields useful insights and helps define a new set of stylized facts for US macroeconomic conditions. First, we find that variations in state-local indirect taxes as well as state government surplus or deficit help predict output growth. Next, the federal counterparts of these indicators contain valuable information for inflation. Finally, state-local expenditures help predict US inflation. A set of formal and informal stability tests confirm that these relationships are stable. The fiscal indicators in questions are also among the ones that yield the best in-sample and out-of-sample performances.

Keywords: Information value; state-local finances; fiscal variables, Granger causality.
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1. Introduction

Macroeconomic theory is paying increasing attention to fiscal policy and the interaction between fiscal and monetary policymaking in stabilizing inflation, employment and the real output. Such mechanisms and their consequences for macro-fundamentals are usually studied within theoretical general equilibrium models that focus on aggregate spending and taxes. However, we believe that some government expenditure/revenues subcomponents may be better related with macroeconomic variables due to certain institutional features or preferences of policymakers. In the literature, there is already evidence that different institutional arrangements across US states yield different macroeconomic outcomes at least as far as business cycle fluctuations are concerned. For instance, Fatás and Mihov (2006) conduct a panel-data analysis with 48 US states to study the variation in the cross-state level of fiscal-policy restrictions and their effect on policy and output volatility at the state level. Sørensen and Yosha (2001) show that state fiscal policy has a stabilizing influence on output, but this influence differs across business cycles expansions and downturns. Such asymmetries appear to be associated with balanced budget rules or political conservatism that may in turn lead to constitutional balanced budget rules.

In this paper, we take a different perspective, i.e. we look at the information value of aggregate, federal and state-local fiscal variables for output growth and inflation at the national level and provide new stylized facts for the US economy that may motivate economic theory to explore new transmission channels of fiscal policymaking on macroeconomic outcomes. We borrow a non-structural, direct, statistical approach as suggested by Friedman and Kuttner (1992) and Sims (1972, 1980) and perform a systematic analysis on the informational role of a wide range of fiscal policy indicators to explain US inflation and real output movements. Reduced form/information value approach, as a preliminary test of statistical connection between certain variables, is immune to questions of causality, exogeneity or controllability of potential instruments.[1]

[1] The discretionary motive or the automatic stabilizers' role in fiscal policymaking is an important and complex topic, but is not the subject matter of this paper. For a recent survey of the macroeconometric literature on the identification of discretionary fiscal policy see for instance Caldara and Kamps (2008).

We find that certain fiscal indicators contain additional statistically significant information to explain US inflation and output growth next to the information contained in the Federal Funds rate and autoregressive components of inflation and real output. In particular, we find that changes in the federal budget, federal indirect taxes, as well as state-local expenditures contain valuable lead information for US inflation. Moreover, state-local budget and state-local indirect taxes are helpful in predicting US real output growth. Informal and formal statistical tests suggest that the information content present in these variables is stable over time.

To the best of our knowledge, there is neither a theoretical explanation nor other empirical contribution highlighting the different information content of state-local fiscal variables as opposed to the federal counterparts. We conjecture that one possible determinant has to do with the different institutional frameworks of the federal and state-local budgets, which we document, and the timing at which state-local data become available.

The remainder of the paper is organized as follows. Section 2 provides information on the conduct of US fiscal policy in postwar years and a review of the literature on state-fiscal policy. Section 3 presents the dataset used in the paper. Section 4 reports Granger-style regressions based on inflation and real output equations that include a set of alternative fiscal indicators together with the Federal Funds rate. Section 5 conducts stability tests. Finally, Section 6 concludes.

2. Fiscal conduct in the U.S.

As of 2007, state-local expenditures (including transfers) account for 15 percent of US GDP, while federal expenditures (including transfers) have reached more than 20 percent of GDP. In other words, both federal and state budgets represent large shares of the US economy. Table 1 reports the federal and state-local shares of revenue and spending components between 1955 and 2007. A fraction of around 40 percent of total receipt and expenditures is accounted for by the state and local government, while the remaining part is managed at the federal level. Defense is entirely

guaranteed by the federal government, while the state and local government is responsible for almost 70 percent of investment expenditures.

<Insert Table 1 here>

Federal and state fiscal policies are intrinsically different because institutional and constitutional arrangements foresee a different discipline for their conduct. While federal fiscal policies do not face institutional restrictions other than natural democratic processes, U.S. state and local fiscal policies are subject to constitutional balanced budget rules.

<Insert Figure 1 here>

As Figure 1 shows, over the postwar era, the sums of state-local budgets in percentage of GDP have been close to balanced budget. Although across the US there are disparities in the set of fiscal rules that governs a state's ability to raise and spend revenue, all states but Vermont having a more or less stringent fiscal discipline that foresees balanced budgets (Poterba, 1996). In 1987, the Advisory Council on Intergovernmental Relations (ACIR) constructed an index that characterizes fiscal discipline among state governments and ranges from 0 (lax) to 10 (stringent). Only eight states received ACIR scores of 5 or below, whereas 26 received a score of 10.

Some researchers investigated implications of these institutional arrangements, for key macroeconomic variables, particularly for real output, and for macroeconomic policy. Sørensen and Yosha (2001), for instance, use panel estimation to show that state fiscal policy has a stabilizing influence on output, but this influence differs across business cycles expansions and downturns. When state income rises, government revenue initially increases and then reverts to its initial level, while expenditure remains roughly constant. However, when state income falls, both revenue and expenditure decline with revenue remaining low for a sustained period. Such asymmetries appear to be associated with balanced budget rules or political conservatism (that may in turn lead to constitutional balanced budget rules). More precisely, the tighter the budget rules, the less effective is fiscal policy at stimulating the economy than it is at slowing it. On the contrary, in states with

relatively less strict budget rules, such as Massachusetts and New York, fiscal policy appears to mitigate economic slowdowns more than it mutes booms.

Traditionally fiscal policy has received less attention than monetary policy in the macroeconomic literature and with some exceptions state fiscal policy has almost been neglected. Among others, Poterba and Rueben (1999) evaluate the effects of state-level revenue and expenditure limits on borrowing costs; Bahl and Martinez-Vazquez (1990) estimate the impact of inflation on the real expenditures of US state-local government; and Sørensen et al. (2001) investigate the cyclical properties of US state-local government finances.

In sum both federal and state budgets represent large shares of the US economy. Moreover, federal and state fiscal policies are intrinsically different because institutional and constitutional arrangements foresee a different discipline for their conduct.[2]

In the remainder of this paper we distinguish among a large set of aggregate, federal and state-local fiscal indicators and perform a systematic evaluation of their information content role on US output growth and inflation.

3. Data

In the following empirical analysis we use quarterly seasonally-adjusted data covering the period 1955:1-2007:4.[3] We consider US macroeconomic variables, including (i) the real output, represented by GDP expressed in chained 2000 US dollars; (ii) the price level, represented by the GDP deflator; (iii) the interest rate, represented by the three-month federal funds rate (middle rate for each quarter); (iv) thirty-one fiscal indicators belonging to government current receipts and

[2] For instance, in a recent paper, Cogan and Taylor (2010) suggest that the countercyclical stimulus packages such as the American Economic Recovery Act (ARRA) of 2009 have had only marginal impact on real output because an increase in government purchases has occurred mainly at the federal level. While states and localities received substantial grants under ARRA, state and local governments have not increased their purchases of goods and services. Instead these reduced borrowing and increased transfer payments due to budget constraints at the state and local level. Such a large package failed to increase government consumption expenditures and infrastructure spending as many had predicted.

[3] Seasonal adjustment is carried out by the source, the Bureau of Economic Analysis (BEA). The BEA conducts seasonal adjustment based on X-12-ARIMA seasonal adjustment procedures maintained by the U.S. Census Bureau, i.e. using the past seasonality of their source data. Hence, the issue of seasonal adjustment does not pose particular concerns for the Granger causality analysis presented below.

expenditures at the national, federal and state-local levels; (v) a set of price indices for government consumption expenditures and gross investment. Most series are extracted from the database of the Bureau of Economic Analysis (BEA). Federal funds rates are extracted from the database of the Federal Reserve Board of Governors. In Appendix A, we report full descriptions and sources of all the series. As the detailed fiscal variables under investigation are provided in nominal terms, we deflate them using some price indices.[4] Then, we compute percentage changes in the form of annualized log-differences.[5] Full details on data transformations are reported in Appendix B. In the remainder of the paper we rely on the stationarity of all transformed series, tested by means of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests (results available on requests).

4. Granger non-causality tests

Economists often rely on non-structural autoregressive econometric models such as unrestricted VARs, to explain or to forecast, in a parsimonious way, variations in key macroeconomic variables such as inflation and output. While US output variations can typically be explained somewhat reliably with the use of a set of relevant variables such as Federal Funds rate and certain monetary aggregates next to past variations in real output itself, empirical work confronts significant difficulties in assigning informative variables to explain US inflation movements. Even the Federal Funds rate typically fails to provide statistically significant information content to explain inflation variations in a stable way (see for example Friedman and Kuttner (1992); Stock and Watson (2003)).

In this section, we investigate the information content of fluctuations of fiscal indicators for output growth and inflation by means of Granger non-causality tests. By definition of Granger causality itself we are not looking for a proper causality relationship. Instead, we aim at detecting whether, in the fluctuations of some fiscal indicators, there is exploitable information that helps

[4] As the revenue indicators are available only in nominal terms in the BEA database we have deflated them by using deflators of the expenditure components. Our results are robust to the choice of CPI or GDP deflator as price deflators.
[5] Only in the cases of government deficits or surpluses we use proper percentage changes, as they may be negative numbers. We also express the real output growth and the rate of inflation as annualized log-differences. For the sake of comparability, we also annualize the interest rate.

predict fluctuations in output and prices, beyond those already predictable on the basis of fluctuations in output and prices themselves and other promptly observable variables, such as the interest rate.

Our specifications for real output changes and inflation follow closely Friedman and Kuttner (1992). However, while they try a number of alternative financial variables and monetary aggregates as a proxy of the monetary policy instrument, we simply use the short-term interest rate. This choice depends on the fact that we are interested in the information content of fiscal indicators and not in the comparative performance of alternative financial variables.

The specification for real output changes is given by the following equation:

$$\Delta y_t = \alpha + \sum_{i=1}^{4} \beta_i \Delta y_{t-i} + \sum_{i=1}^{4} \lambda_i \Delta p_{t-i} + \sum_{i=1}^{4} \delta_i i_{t-i} + \sum_{i=1}^{4} \gamma_i \Delta g_{t-i} + \nu_t \qquad (1)$$

The terms Δy_t, Δp_t, i_t, Δg_t, ν_t represent output growth, inflation, the short term interest rate, the change in an alternative fiscal indicator and an error term respectively.

The inflation equation takes the following specification:

$$\Delta p_t = \alpha + \sum_{i=1}^{4} \beta_i \Delta y_{t-i} + \sum_{i=1}^{4} \lambda_i \Delta p_{t-i} + \sum_{i=1}^{4} \delta_i i_{t-i} + \sum_{i=1}^{4} \gamma_i \Delta g_{t-i} + \nu_t \qquad (2)$$

where all variables are defined as in equation (1).[6]

<Insert Table 2 here>

We test for Granger non-causality of the fiscal indicators by imposing the null hypothesis that all the lags of each alternative indicator are jointly insignificant, i.e. $H_0 : \gamma_i = 0, \quad \forall i = 1,...,4$. In Table 2, we show that fluctuations in government indirect taxes (taxes on production and import) and in the government surplus/deficit have information content on both output growth and inflation. At a more disaggregated level, fluctuations in state-local indirect taxes and deficit contain useful information for output growth (at a 1 percent significance level); for inflation it is the federal

[6] We also run the tests described below using first differences of the Federal funds rate but differences in the results are negligible. With the exception of two cases, the Breusch-Pagan-Godfrey test and the White test always reject the null hypothesis of homoskedastic errors. The Breusch-Godfrey Lagrange-multiplier test fails to reject the null of uncorrelated errors. Therefore, throughout the paper we choose to run all tests based on Wald-type chi-square statistics computed by taking White heteroskedasticity-consistent standard errors. Finally, the Ramsey RESET test does not unveil further misspecification issues.

analogues to be informative (at 1 percent and 5 percent significance levels, respectively). Moreover, contributions for government social insurance at the national and federal level and the non-defense component of federal expenditures help predict output growth. However, as shown in Section 5.1, these do not turn out to be significant in a stable way across subsamples as their significance mainly depends on whether or not the 1970s are included in the sample. Finally, state-local total expenditures, and gross investment help predict inflation at a 10 percent significance level.[7]

Some previous studies have explored state-local finances. However, to our knowledge, there are no other contributions that find an information-content role for state-local expenditures on US inflation and state-local revenues or deficits on output growth. One possible narrative for the information contained in state and local expenditures for US inflation is the observation that data releases of state and local fiscal variables become available with a delay. In fact while the BEA incorporates information on federal accounts almost in real time, relying on the monthly statements of U.S. government receipts and outlays, which is usually published by the Treasury Department within a few weeks of the end of each month; for the state-local data, it typically takes more time for those to be collected. Hence, state and local expenditures are more likely to be initially estimated based on projections and revised when additional information is available. As a result, the Federal Reserve may incorporate imprecise information on state-local fiscal accounts when it takes the monetary policy decision and this may be translated in the fact that changes in the revised figures of state and local expenditures carry significant information content for inflation beyond that already contained in the Federal Funds rate.

<Insert Table 3 here>

As a robustness check of our results, in Table 3 we take the regressions in which the fiscal variable results to be informative in a Granger-causal sense and add four lags of an additional fiscal variable. In particular, firstly we include the federal and the state-local fractions of indirect taxes and budget (columns I and II of the output-growth and inflation equations) to find that (i) the

[7] For the sake of completeness, in Appendix C, we have reported the coefficients of the lagged fiscal variables in the regressions where those carry information content for either output growth or inflation. However, we did not detect any clear-cut pattern in the significance of specific lags.

information content of state-local indirect taxes and budget for output growth is not wiped out by the inclusion of the federal counterparts; and (ii) federal indirect taxes and the federal budget carry valuable information for inflation also in the presence of the state-local counterparts. Secondly, we verify that the information content of state-local indirect taxes and the state-local budget for output growth is preserved also in the presence of a federal fiscal variable that was significant if included alone (columns III and IV of the output-growth equation). Thirdly, we confirm that state-local expenditures and state-local investment expenditures maintain their information value for inflation also when a statistically significant federal fiscal variable, such as federal indirect taxes, is included.

We also report Granger causality tests run on the Federal funds rate. In all specifications, this is significant at a 1 percent level in the output growth equation and insignificant in the inflation equation.[8]

<Insert Table 4 here>

In Table 4, as a measure of comparative goodness of fit, we report the Akaike information criteria (AIC) of all the estimated specifications of equations (1) and (2) in ascending order. All the specifications in which we find information content in the fiscal variable are among the ones with the lowest AIC (top ten items in Table 4). According to AIC, the specifications including indirect taxes are the ones with the best fit.

5. Stability tests

5.1. Stability of recursive p-values

To gain initial guidance about the stability of the Granger-causality relationships above, we plot the recursive p-values of the Wald tests on the joint insignificance of the lags of each alternative fiscal indicator. The methodology consists in computing the p-values of the Wald tests above by recursively changing the sample in the estimation. The resulting plots, using the alternative fiscal

[8] In the inflation equation, using four lags, the Federal funds rate is insignificant also in the absence of any fiscal variables. However, adding more lags of the interest rate (results not reported) helps retrieve significance also in the inflation equation. Thus, in the cases in which we find an information-content role for the fiscal variable, the latter does not substitute but adds further information to that already contained in past values of the interest rate.

indicators, are depicted in figures 2 and 3. From top to bottom we report stability of p-values at: (a) the national government level; (b) the federal government level; and (c) the state-local government level.[9] The straight horizontal line in each quadrant of figures 2 and 3 represents the 10 percent significance level. Thus, anything below the line represents rejection of the Granger non-causality null hypothesis.

<Insert Figure 2 here>

Figure 2 shows that, in the output growth equation, recursive p-values of indirect taxes are stable at the national level and less stable at the state-local level. For government surplus/deficit, we find that both at the national and the state-local level, they are statistically significant in most subsample though not in all of them. The p-values of the non-defense part of federal expenditures and contributions for government social insurance are not stable.

<Insert Figure 3 here>

Figure 3 shows that, apart from some subsamples for government deficit and state-local investment expenditures, the remaining recursive p-values of the fiscal components for which we find an information-content role for inflation are stable.

5.2. Formal Stability Tests

To formally evaluate the stability of coefficients in the Granger-style specifications, we run stability tests for one or more unknown structural breakpoints in the autoregressive coefficients of the fiscal variables. We compute three different statistics: the Quandt likelihood ratio statistic in Wald form (sup-Wald) as in Andrews (1993); the Andrews and Ploberger (1994) exponential average Wald statistic (exp-Wald); and the Andrews and Ploberger average Wald statistic (mean-

[9] We obtain recursive p-values in three different ways: first, by fixing the endpoint (end) of the sample and making the starting point shift quarter by quarter from an intermediate point in the sample up to the initial observation. The first p-value reported refers to the sample 1980:3-2007:4; the second p-value refers to the sample 1980:2-2007:4 and so on. The last considered sample is the full sample 1955:1-2007:4. Second, by fixing the starting point (str) of the sample and making the end point shift quarter by quarter from an intermediate point of the sample up to the last available observation. The first considered sample is 1955:1-1979:4. The second sample we consider is 1955:1-1980:1 and so on up to 1955:1-2007:4. Finally, by rolling the sample (rol), i.e. by shifting the starting point and the endpoint of the sample quarter by quarter. Hence the initial sample is 1955:1-1979:4, the second sample is 1955:2-1980:1 and so on up to 1980:3-2007:4.

Wald). We apply a 15 percent symmetric sample trimming, which allows us to check whether a breakpoint has occurred in the interval 1963:1-1998:4.

<Insert Table 5 here>

Table 5 displays the results of the tests. They fail to reject the null hypothesis of parameter constancy in all cases.[10]

5.3. Out-of-sample Analysis

To evaluate the out-of-sample performances of the estimated equations, we use recursive least squares. For each equation specification, we compute all feasible cases, starting from the smallest possible sample size and adding one observation at a time. At each step, we save the one-step ahead forecast error to obtain a series of recursive residuals. We then use each series of recursive residuals to compute the correspondent root mean squared errors (RMSE), which we report in Table 6 in ascending order.

<Insert Table 6 here>

A relatively low RMSE can be interpreted as a further indicator of stability of the specification in question in comparative terms. The ordering obtained in Table 6 is virtually coincident to the ordering implied by AIC in Table 4. The specifications where fiscal variables have stable information content for output growth or inflation are also the ones with the best out-of-sample performances. Indirect taxes yield the lowest RMSE both in the output growth and in the inflation equation.

6. Concluding Remarks

We provide evidence that fluctuations in certain fiscal variables contain valuable information to predict fluctuations in output and prices. Our analysis also shows that the distinction between federal and state-local fiscal indicators provides useful insights.

[10] The approximate asymptotic p-values are provided by Hansen (1997).

First, we find that variations in state-local indirect taxes as well as state government surplus or deficit help predict output growth. Next, the federal counterparts of these indicators contain valuable information for inflation. Finally, state-local expenditures help predict US inflation.

A set of formal and informal stability tests confirm that these relationships are stable. The fiscal indicators in questions are also among the ones that yield the best in-sample and out-of-sample performances.

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Appendix A. Data sources and description

Variables	Measurement unit	Type	Freq.	Sample	Source		
Gross domestic product	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	1.1.5
Real Gross Domestic Product	Billions of 2000 dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	1.1.6
Implicit GDP deflator	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	1.1.9
Three-month federal funds rate	Percentage	MR	Q.ly	1955:1-2007:4	Federal Reserve Board		
Government Current Receipts and Expenditures:							
Current tax receipts	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.1
Personal current taxes	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.1
Taxes on production and imports	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.1
Taxes on corporate income	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.1
Contributions for government social insurance	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.1
Total expenditures	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.1
Current expenditures	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.1
Gross government investment	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.1
Net lending or net borrowing (-)	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.1
Federal Government Current Receipts and Expenditures:							
Total receipts	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
Current tax receipts	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
Personal current taxes	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
Taxes on production and imports	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
Taxes on corporate income	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
Contributions for government social insurance	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
Total expenditures	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
Current expenditures	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
Gross government investment	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
Federal defense expenditures	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	1.1.5
Federal nondefense expenditures	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	1.1.5
Net lending or net borrowing (-)	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.2
State and Local Government Current Receipts and Expenditures:							
Total receipts	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Current tax receipts	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Personal current taxes	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Taxes on production and imports	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Taxes on corporate income	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Current transfer receipts	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Total expenditures	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Current expenditures	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Gross government investment	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Net lending or net borrowing (-)	Billions of current dollars	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.3
Price Indices for Government Consumption Expenditures and Gross Investment:							
Government expenditures	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
Government consumption expenditures	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
Government gross investment	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
Federal expenditures	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
Federal consumption expenditures	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
Federal gross investment	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
National defense	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
Federal nondefense expenditures	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
State and local expenditures	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
State and local consumption expenditures	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4
State and local gross investment	Index numbers 2000=100	SA	Q.ly	1955:1-2007:4	BEA	NIPA Table	3.9.4

SA = seasonally adjusted; MR = middle rate; Q.ly = quarterly;

BEA = Bureau of Economic Analysis; NIPA = National Income and Product Accounts

Appendix B. Data transformations

Keywords	Variables	Transformations
gdp	Real GDP growth rate	Annualized log-difference in real GDP
inf	Inflation rate	Annualized log-difference of the Implicit GDP deflator
int	Interest rate	Annualized three-month Federal funds rate
	Government Current Receipts and Expenditures:	
gov.cur.tax	Current tax receipts	Annualized log-difference (deflated using government expenditures price index)
gov.per.tax	Personal current taxes	Annualized log-difference (deflated using government expenditures price index)
gov.pro.tax	Taxes on production and imports	Annualized log-difference (deflated using government expenditures price index)
gov.cor.tax	Taxes on corporate income	Annualized log-difference (deflated using government expenditures price index)
gov.soc.con	Contributions for government social insurance	Annualized log-difference (deflated using government expenditures price index)
gov.tot.exp	Total expenditures	Annualized log-difference (deflated using government expenditures price index)
gov.cur.exp	Current expenditures	Annualized log-difference (deflated using government consumption expenditures price index)
gov.inv.exp	Gross government investment	Annualized log-difference (deflated using government gross investment expenditures price index)
gov.sur.def	Net lending or net borrowing (-)	Annualized growth rate (deflated using government expenditures price index)
	Federal Government Current Receipts and Expenditures:	
fed.tot.rec	Total receipts	Annualized log-difference (deflated using federal expenditures price index)
fed.cur.tax	Current tax receipts	Annualized log-difference (deflated using federal expenditures price index)
fed.per.tax	Personal current taxes	Annualized log-difference (deflated using federal expenditures price index)
fed.pro.tax	Taxes on production and imports	Annualized log-difference (deflated using federal expenditures price index)
fed.cor.tax	Taxes on corporate income	Annualized log-difference (deflated using federal expenditures price index)
fed.soc.con	Contributions for government social insurance	Annualized log-difference (deflated using federal expenditures price index)
fed.tot.exp	Total expenditures	Annualized log-difference (deflated using federal expenditures price index)
fed.cur.exp	Current expenditures	Annualized log-difference (deflated using federal consumption expenditures price index)
fed.inv.exp	Gross government investment	Annualized log-difference (deflated using federal gross investment expenditures price index)
fed.def.exp	Federal defense expenditures	Annualized log-difference (deflated using national defense expenditures price index)
fed.non.exp	Federal nondefense expenditures	Annualized log-difference (deflated using federal nondefense expenditures price index)
fed.sur.def	Net lending or net borrowing (-)	Annualized growth rate (deflated using federal expenditures price index)
	State and Local Government Current Receipts and Expenditures:	
stl.tot.rec	Total receipts	Annualized log-difference (deflated using state and local expenditures price index)
stl.cur.tax	Current tax receipts	Annualized log-difference (deflated using state and local expenditures price index)
stl.per.tax.	Personal current taxes	Annualized log-difference (deflated using state and local expenditures price index)
stl.pro.tax	Taxes on production and imports	Annualized log-difference (deflated using state and local expenditures price index)
stl.cor.tax	Taxes on corporate income	Annualized log-difference (deflated using state and local expenditures price index)
stl.cur.tra	Current transfer receipts	Annualized log-difference (deflated using state and local expenditures price index)
stl.tot.exp	Total expenditures	Annualized log-difference (deflated using state and local expenditures price index)
stl.cur.exp	Current expenditures	Annualized log-difference (deflated using state and local consumption expenditures price index)
stl.inv.exp.	Gross government investment	Annualized log-difference (deflated using state and local investment expenditures price index)
stl.sur.def	Net lending or net borrowing (-)	Annualized growth rate (deflated using state and local expenditures price index)

Appendix C. Coefficients on lagged fiscal variables. Selected regressions.

Fiscal variables	Output growth equation				Fiscal variables	Inflation equation			
	Δg_{t-1}	Δg_{t-2}	Δg_{t-3}	Δg_{t-4}		Δg_{t-1}	Δg_{t-2}	Δg_{t-3}	Δg_{t-4}
gov.pro.tax	0.1003	0.1644	-0.0645	-0.1113	gov.pro.tax	0.0333	0.0170	-0.0644	-0.0308
	(0.1318)	(0.0131)	(0.2760)	(0.0391)		(0.1576)	(0.4756)	(0.0010)	(0.1561)
gov.soc.con	-0.0235	-0.0523	-0.0461	-0.0248	gov.sur.def	0.0002	-0.0001	0.0002	0.0002
	(0.4085)	(0.0041)	(0.0411)	(0.3890)		(0.0536)	(0.3076)	(0.0053)	(0.0132)
gov.sur.def	-0.0002	0.0007	-0.0004	0.0006	fed.pro.tax	0.0086	0.0051	-0.0084	-0.0121
	(0.7617)	(0.0017)	(0.4377)	(0.1915)		(0.0932)	(0.4404)	(0.1308)	(0.0117)
fed.soc.con	-0.0204	-0.0520	-0.0444	-0.0254	fed.sur.def	-0.0002	0.0000	0.0002	0.0000
	(0.4483)	(0.0022)	(0.0369)	(0.3566)		(0.0286)	(0.7859)	(0.0720)	(0.9517)
fed.non.exp	-0.0161	0.0200	0.0385	0.0113	stl.tot.exp	-0.0474	-0.0236	0.0304	0.0285
	(0.3253)	(0.1878)	(0.0168)	(0.4276)		(0.0492)	(0.2389)	(0.0836)	(0.1651)
stl.pro.tax	0.1326	0.1957	-0.0147	-0.1720	stl.inv.exp	-0.0107	-0.0023	0.0101	0.0069
	(0.0675)	(0.0153)	(0.8560)	(0.0181)		(0.1553)	(0.7322)	(0.0804)	(0.2733)
stl.sur.def	-0.0008	-0.0002	0.0007	-0.0003					
	(0.0002)	(0.5255)	(0.0092)	(0.3331)					

Note: p-values in parentheses.

Table 1. Federal and state-local shares of revenue and spending components

Fiscal variables	Federal Government	State and Local Government
	(Percentages of total values Sample: 1955-2007)	
Total receipts	58.4	41.6
Current tax receipts	57.0	43.0
Personal current taxes	81.0	19.0
Taxes on production and imports	15.3	84.7
Taxes on corporate income	86.1	13.9
Contributions for government social insurance	100.0	0.0
Current transfer receipts	0.0	100.0
Total expenditures	60.1	39.9
Current expenditures	62.5	37.5
Gross government investment	32.1	67.9
Federal defense expenditures	100.0	0.0
Federal nondefense expenditures	100.0	0.0
Net lending or net borrowing (-)	81.6	18.4

Table 2. Granger non-causality tests

Fiscal variables	Output growth equation				Inflation equation			
	Fiscal variables		Federal funds rate		Fiscal variables		Federal funds rate	
	χ-square	p-values	χ-square	p-values	χ-square	p-values	χ-square	p-values
gov.cur.tax	3.5462	(0.4709)	19.0550	(0.0008)	2.1616	(0.7061)	1.4633	(0.8331)
gov.per.tax	3.0623	(0.5475)	18.4839	(0.0010)	2.0391	(0.7286)	1.4795	(0.8303)
gov.pro.tax	14.9401	(0.0048)	23.0491	(0.0001)	20.5659	(0.0004)	1.7041	(0.7900)
gov.cor.tax	1.8696	(0.7597)	17.5770	(0.0015)	5.5539	(0.2350)	1.7759	(0.7769)
gov.soc.con	10.4189	(0.0339)	15.3063	(0.0041)	2.1430	(0.7095)	1.3928	(0.8454)
gov.tot.exp	0.1661	(0.9967)	15.5148	(0.0037)	1.9437	(0.7461)	0.9218	(0.9214)
gov.cur.exp	3.8270	(0.4299)	18.5037	(0.0010)	4.3615	(0.3593)	1.3653	(0.8502)
gov.inv.exp	6.7417	(0.1502)	19.1063	(0.0007)	6.1831	(0.1859)	1.4585	(0.8340)
gov.sur.def	11.6294	(0.0203)	19.4145	(0.0007)	29.7478	(0.0000)	1.3872	(0.8464)
fed.tot.rec	2.7049	(0.6084)	15.7454	(0.0034)	1.9299	(0.7486)	1.3772	(0.8481)
fed.cur.tax	2.3115	(0.6787)	17.8673	(0.0013)	1.7567	(0.7804)	1.3025	(0.8609)
fed.per.tax	3.0183	(0.5548)	18.1214	(0.0012)	0.8239	(0.9352)	1.4074	(0.8429)
fed.pro.tax	6.1482	(0.1883)	20.1472	(0.0005)	17.4563	(0.0016)	1.4264	(0.8396)
fed.cor.tax	2.2163	(0.6960)	18.1791	(0.0011)	5.5229	(0.2377)	1.7569	(0.7804)
fed.soc.con	11.9526	(0.0177)	14.0641	(0.0071)	3.2944	(0.5098)	1.5173	(0.8236)
fed.tot.exp	0.6503	(0.9573)	15.7254	(0.0034)	4.4439	(0.3493)	1.3198	(0.8580)
fed.cur.exp	2.7462	(0.6011)	17.5932	(0.0015)	5.0941	(0.2778)	1.4917	(0.8281)
fed.inv.exp	2.1053	(0.7164)	18.0301	(0.0012)	7.3973	(0.1163)	1.4480	(0.8358)
fed.def.exp	2.8284	(0.5869)	16.6178	(0.0023)	4.4005	(0.3545)	1.3658	(0.8501)
fed.non.exp	8.3429	(0.0798)	15.2296	(0.0042)	0.8795	(0.9275)	1.4301	(0.8390)
fed.sur.def	2.4737	(0.6494)	15.8904	(0.0032)	10.0731	(0.0392)	1.6371	(0.8021)
stl.tot.rec	7.6172	(0.1066)	14.2508	(0.0065)	7.2555	(0.1230)	1.6687	(0.7964)
stl.cur.tax	6.7594	(0.1492)	16.6685	(0.0022)	5.8524	(0.2104)	1.4378	(0.8376)
stl.per.tax.	4.8029	(0.3081)	16.8764	(0.0020)	6.4619	(0.1672)	1.5752	(0.8133)
stl.pro.tax	17.6625	(0.0014)	15.8133	(0.0033)	7.1507	(0.1281)	1.2723	(0.8661)
stl.cor.tax	5.3520	(0.2530)	17.0132	(0.0019)	3.2190	(0.5219)	1.4893	(0.8285)
stl.cur.tra	0.5540	(0.9680)	16.0980	(0.0029)	4.2655	(0.3713)	1.6877	(0.7930)
stl.tot.exp	1.8923	(0.7556)	17.3636	(0.0016)	7.8744	(0.0963)	1.6760	(0.7951)
stl.cur.exp	1.2100	(0.8765)	17.3008	(0.0017)	1.3549	(0.8520)	1.4468	(0.8360)
stl.inv.exp.	7.3464	(0.1187)	16.8990	(0.0020)	8.8755	(0.0643)	1.7774	(0.7766)
stl.sur.def	29.7698	(0.0000)	16.3544	(0.0026)	7.6090	(0.1070)	1.2648	(0.8673)

Note: Wald-type chi-square statistics computed by taking White heteroskedasticity-consistent standard errors.

Table 3. Granger non-causality tests for selected fiscal variables in the presence of two fiscal variables.

Fiscal variables	Output growth equation				Inflation equation			
	I	II	III	IV	I	II	III	IV
fed.non.exp			6.3609	7.4373				
			(0.1738)	(0.1145)				
fed.pro.tax	8.4711				18.0225		14.7476	14.6768
	(0.0758)				(0.0012)		(0.0053)	(0.0054)
fed.sur.def		3.1131				9.4621		
		(0.5391)				(0.0505)		
stl.pro.tax	20.3336		14.8092		6.5878			
	(0.0004)		(0.0051)		(0.1593)			
stl.tot.exp							8.1610	
							(0.0859)	
stl.inv.exp								9.3521
								(0.0529)
stl.sur.def		32.4127		23.9819		10.3410		
		(0.0000)		(0.0001)		(0.0351)		

Note: Wald-type chi-square statistics computed by taking White heteroskedasticity-consistent standard errors. Regressions specified as in equations (1) and (2) plus 4 lags of an additional fiscal variable. Null hypothesis: 4 lags of each fiscal variable are jointly zero in the presence of 4 lags of the additional fiscal variable. P-values in parentheses.

Table 4. Akaike information criteria (AIC)

Output growth equation				Inflation equation			
AIC	Fiscal variable	AIC	Fiscal variable	AIC	Fiscal variable	AIC	Fiscal variable
5.2164	gov.pro.tax	5.2732	stl.cor.tax	3.1024	gov.pro.tax	3.1529	gov.cor.tax
5.2260	stl.pro.tax	5.2772	gov.cur.tax	3.1126	fed.pro.tax	3.1541	stl.sur.def
5.2266	fed.non.exp	5.2786	fed.def.exp	3.1129	gov.sur.def	3.1546	stl.tot.rec
5.2370	fed.soc.con	5.2793	fed.inv.exp	3.1315	fed.sur.def	3.1556	fed.soc.con
5.2420	gov.soc.con	5.2811	fed.sur.def	3.1319	stl.pro.tax	3.1588	stl.cur.tra
5.2424	stl.sur.def	5.2814	stl.tot.exp	3.1339	fed.cur.exp	3.1629	gov.tot.exp
5.2480	gov.sur.def	5.2816	fed.cur.tax	3.1343	fed.inv.exp	3.1634	gov.soc.con
5.2525	stl.inv.exp.	5.2824	fed.per.tax	3.1363	stl.inv.exp.	3.1646	stl.cor.tax
5.2558	stl.tot.rec	5.2827	gov.per.tax	3.1381	stl.tot.exp	3.1663	gov.per.tax
5.2583	fed.pro.tax	5.2832	fed.cor.tax	3.1382	fed.tot.exp	3.1669	gov.cur.tax
5.2605	stl.cur.tax	5.2851	gov.cor.tax	3.1412	gov.cur.exp	3.1677	fed.tot.rec
5.2626	gov.inv.exp	5.2862	stl.cur.exp	3.1425	stl.cur.tax	3.1699	fed.cur.tax
5.2659	gov.cur.exp	5.2873	fed.tot.exp	3.1429	gov.inv.exp	3.1724	stl.cur.exp
5.2715	stl.per.tax.	5.2878	stl.cur.tra	3.1447	stl.per.tax.	3.1725	fed.non.exp
5.2716	fed.cur.exp	5.2904	gov.tot.exp	3.1500	fed.cor.tax	3.1727	fed.per.tax
5.2723	fed.tot.rec			3.1514	fed.def.exp		

Table 5. Tests for structural breaks

Fiscal variables	Output growth equation						Inflation equation					
	sup-Wald	p-values	exp-Wald	p-values	mean-Wald	p-values	sup-Wald	p-values	exp-Wald	p-values	mean-Wald	p-values
gov.cur.tax	3.4857	(0.9949)	0.8313	(0.9893)	1.6046	(0.9743)	2.0068	(1.0000)	0.4355	(1.0000)	0.8182	(1.0000)
gov.per.tax	6.2488	(0.8163)	0.7653	(0.9959)	1.1998	(0.9998)	2.1585	(1.0000)	0.4797	(1.0000)	0.9192	(1.0000)
gov.pro.tax	3.6859	(0.9913)	0.6293	(1.0000)	1.1685	(1.0000)	2.1380	(1.0000)	0.3874	(1.0000)	0.7272	(1.0000)
gov.cor.tax	3.9246	(0.9854)	1.1305	(0.9264)	2.0496	(0.8976)	3.9605	(0.9844)	0.9977	(0.9602)	1.6846	(0.9638)
gov.soc.con	2.9049	(0.9995)	0.4370	(1.0000)	0.8135	(1.0000)	3.2725	(0.9974)	0.9894	(0.9621)	1.7891	(0.9477)
gov.tot.exp	4.6004	(0.9571)	1.1852	(0.9103)	1.9160	(0.9249)	9.2532	(0.4563)	1.8696	(0.6615)	1.3541	(0.9956)
gov.cur.exp	6.7665	(0.7569)	1.4605	(0.8167)	2.0970	(0.8872)	6.7172	(0.7627)	1.2083	(0.9032)	1.2773	(0.9985)
gov.inv.exp	3.2391	(0.9977)	0.6918	(0.9995)	1.2691	(0.9987)	1.7932	(1.0000)	0.5309	(1.0000)	1.0441	(1.0000)
gov.sur.def	3.2011	(0.9980)	0.8185	(0.9908)	1.5689	(0.9784)	1.8732	(1.0000)	0.5818	(1.0000)	1.1377	(1.0000)
fed.tot.rec	2.9396	(0.9994)	0.8770	(0.9830)	1.6759	(0.9650)	1.8589	(1.0000)	0.4965	(1.0000)	0.9580	(1.0000)
fed.cur.tax	3.8175	(0.9883)	0.9805	(0.9640)	1.8820	(0.9313)	1.9801	(1.0000)	0.4813	(1.0000)	0.9186	(1.0000)
fed.per.tax	6.7575	(0.7579)	0.8831	(0.9821)	1.3377	(0.9964)	2.3799	(1.0000)	0.5696	(1.0000)	1.0754	(1.0000)
fed.pro.tax	3.2919	(0.9972)	0.9468	(0.9709)	1.7714	(0.9506)	2.9089	(0.9995)	0.5796	(1.0000)	1.0213	(1.0000)
fed.cor.tax	4.9948	(0.9321)	1.4144	(0.8335)	2.5471	(0.7764)	4.2364	(0.9746)	1.0575	(0.9460)	1.7772	(0.9497)
fed.soc.con	1.7895	(1.0000)	0.3882	(1.0000)	0.7444	(1.0000)	4.4583	(0.9645)	1.1141	(0.9310)	1.8468	(0.9377)
fed.tot.exp	5.4252	(0.8980)	1.3873	(0.8431)	2.1949	(0.8648)	5.9551	(0.8476)	1.0870	(0.9384)	1.3764	(0.9945)
fed.cur.exp	4.4282	(0.9660)	1.0324	(0.9522)	1.7572	(0.9529)	6.6859	(0.7664)	1.2330	(0.8954)	1.2821	(0.9984)
fed.inv.exp	4.3572	(0.9693)	0.8000	(0.9928)	1.4212	(0.9917)	2.5260	(1.0000)	0.5754	(1.0000)	1.0984	(1.0000)
fed.def.exp	1.3084	(1.0000)	0.3354	(1.0000)	0.6496	(1.0000)	2.6108	(1.0000)	0.6329	(1.0000)	1.1891	(0.9999)
fed.non.exp	5.7323	(0.8698)	1.3001	(0.8734)	2.0469	(0.8982)	5.3024	(0.9084)	1.5980	(0.7652)	2.6954	(0.7371)
fed.sur.def	5.2423	(0.9133)	1.6000	(0.7644)	3.0506	(0.6424)	3.9108	(0.9858)	1.5412	(0.7867)	2.9150	(0.6784)
stl.tot.rec	7.3565	(0.6850)	1.8982	(0.6507)	2.4108	(0.8117)	2.8370	(0.9997)	0.6660	(0.9999)	1.1650	(1.0000)
stl.cur.tax	11.3773	(0.2562)	2.8785	(0.3364)	3.0954	(0.6306)	2.4432	(1.0000)	0.6453	(1.0000)	1.2460	(0.9992)
stl.per.tax.	1.1555	(1.0000)	0.2440	(1.0000)	0.4732	(1.0000)	1.4235	(1.0000)	0.4413	(1.0000)	0.8608	(1.0000)
stl.pro.tax	3.7543	(0.9898)	0.7135	(0.9989)	1.3026	(0.9978)	1.2685	(1.0000)	0.2859	(1.0000)	0.5498	(1.0000)
stl.cor.tax	3.5535	(0.9938)	0.6951	(0.9995)	1.2068	(0.9998)	2.1726	(1.0000)	0.5280	(1.0000)	0.9489	(1.0000)
stl.cur.tra	4.0669	(0.9809)	1.1044	(0.9337)	2.1496	(0.8753)	2.5392	(1.0000)	0.6009	(1.0000)	1.1094	(1.0000)
stl.tot.exp	3.2288	(0.9978)	0.6450	(1.0000)	1.1940	(0.9999)	4.3080	(0.9715)	0.8107	(0.9917)	1.3322	(0.9966)
stl.cur.exp	2.1365	(1.0000)	0.4470	(1.0000)	0.8506	(1.0000)	1.1580	(1.0000)	0.3278	(1.0000)	0.6441	(1.0000)
stl.inv.exp.	2.9690	(0.9993)	0.4454	(1.0000)	0.7940	(1.0000)	3.2065	(0.9980)	0.9298	(0.9741)	1.6834	(0.9640)
stl.sur.def	4.4729	(0.9638)	1.1119	(0.9316)	1.8026	(0.9454)	3.4985	(0.9947)	0.7313	(0.9981)	1.3772	(0.9944)

15 percent symmetric trimming; Test sample: 1963:1-1998:4; Null hypothesis: no structural breaks in the fiscal variables;
Hansen (1997) asymptotic p-values.

Table 6. Root mean squared errors of recursive residuals (RMSE)

Output growth equation				Inflation equation			
RMSE	Fiscal variable	RMSE	Fiscal variable	RMSE	Fiscal variable	RMSE	Fiscal variable
3.1586	gov.pro.tax	3.2498	stl.cor.tax	1.0977	gov.pro.tax	1.1257	gov.cor.tax
3.1740	stl.pro.tax	3.2563	gov.cur.tax	1.1032	fed.pro.tax	1.1264	stl.sur.def
3.1748	fed.non.exp	3.2585	fed.def.exp	1.1034	gov.sur.def	1.1266	stl.tot.rec
3.1913	fed.soc.con	3.2597	fed.inv.exp	1.1137	fed.sur.def	1.1272	fed.soc.con
3.1994	gov.soc.con	3.2625	fed.sur.def	1.1139	stl.pro.tax	1.1290	stl.cur.tra
3.2000	stl.sur.def	3.2631	stl.tot.exp	1.1150	fed.cur.exp	1.1314	gov.tot.exp
3.2090	gov.sur.def	3.2634	fed.cur.tax	1.1153	fed.inv.exp	1.1317	gov.soc.con
3.2163	stl.inv.exp.	3.2646	fed.per.tax	1.1164	stl.inv.exp.	1.1323	stl.cor.tax
3.2216	stl.tot.rec	3.2653	gov.per.tax	1.1174	stl.tot.exp	1.1333	gov.per.tax
3.2255	fed.pro.tax	3.2659	fed.cor.tax	1.1175	fed.tot.exp	1.1336	gov.cur.tax
3.2291	stl.cur.tax	3.2691	gov.cor.tax	1.1191	gov.cur.exp	1.1341	fed.tot.rec
3.2325	gov.inv.exp	3.2709	stl.cur.exp	1.1199	stl.cur.tax	1.1353	fed.cur.tax
3.2378	gov.cur.exp	3.2727	fed.tot.exp	1.1201	gov.inv.exp	1.1367	stl.cur.exp
3.2470	stl.per.tax.	3.2735	stl.cur.tra	1.1211	stl.per.tax.	1.1368	fed.non.exp
3.2471	fed.cur.exp	3.2778	gov.tot.exp	1.1241	fed.cor.tax	1.1369	fed.per.tax
3.2483	fed.tot.rec			1.1249	fed.def.exp		

Figure 1. US government surplus as fractions of GDP
(Source: our computations using BEA data)

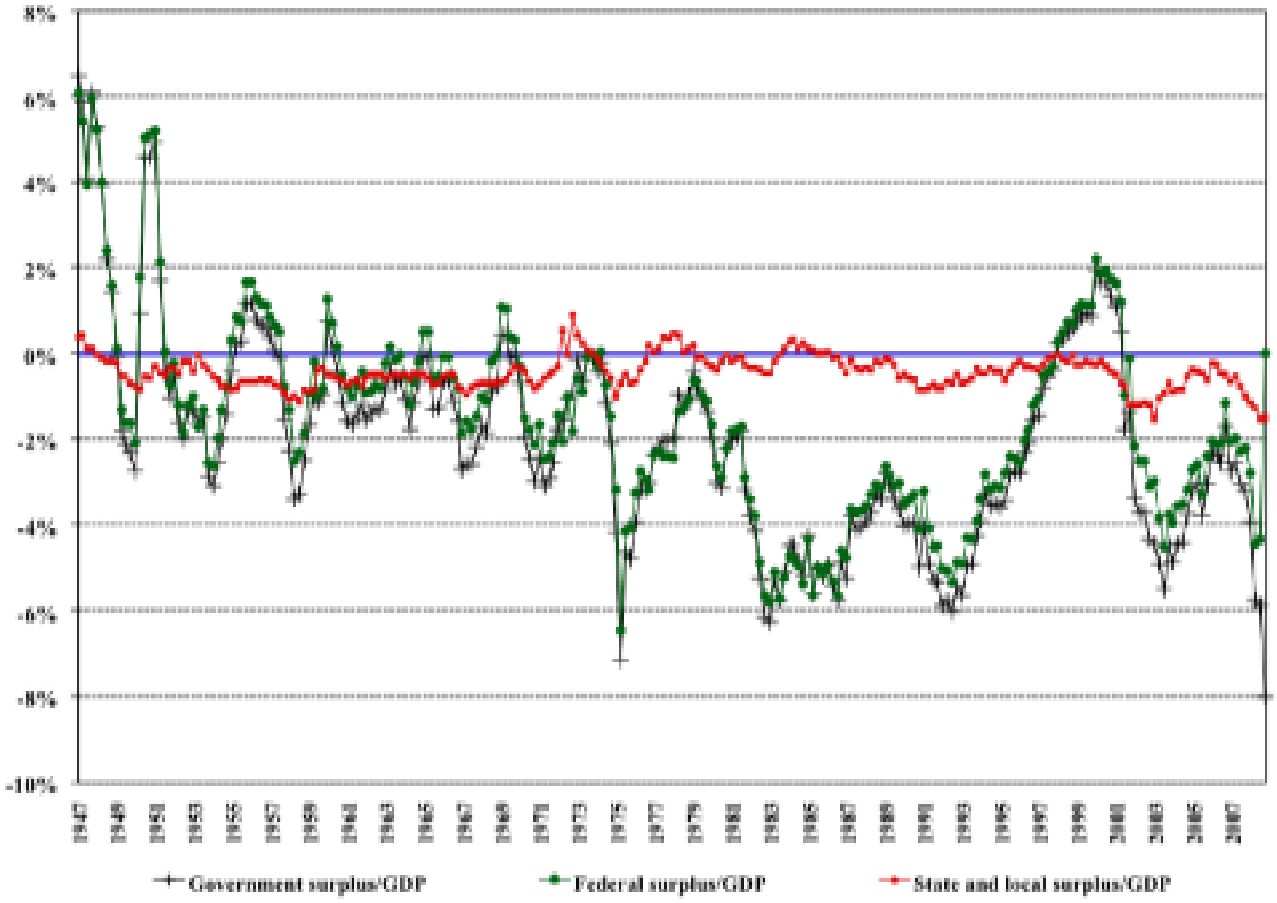
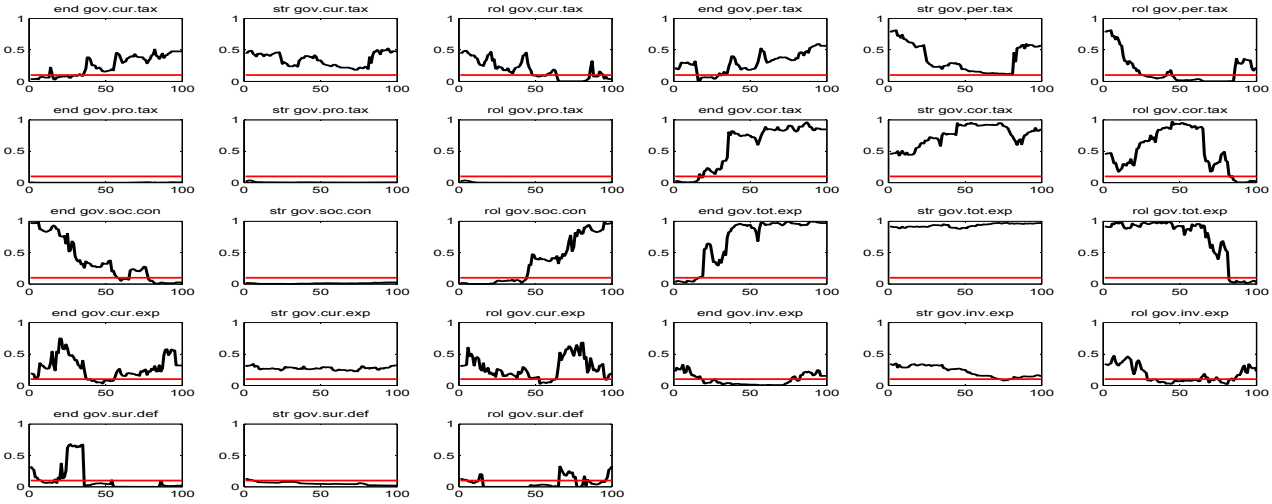
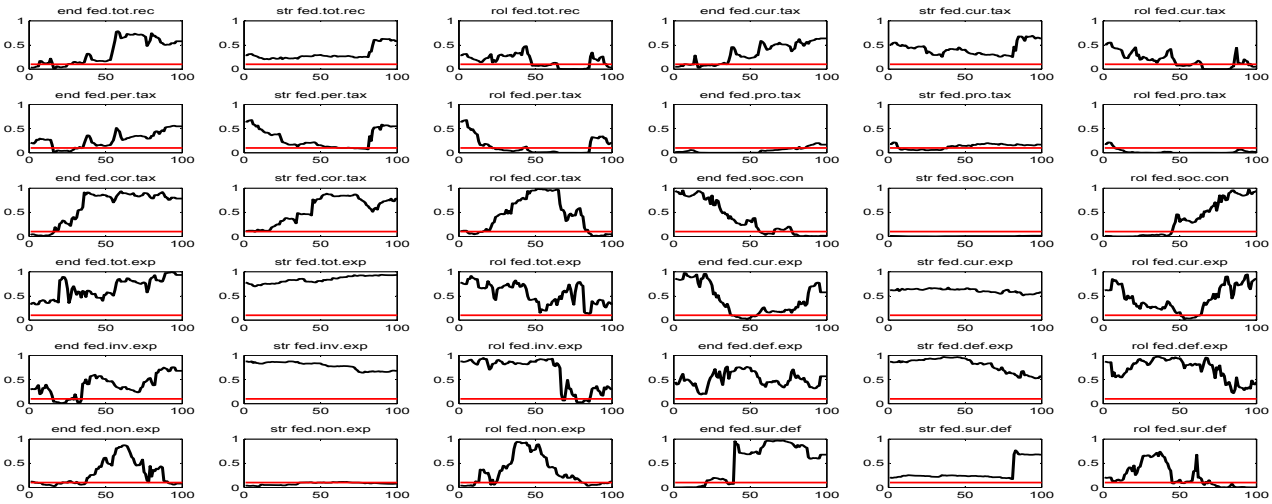


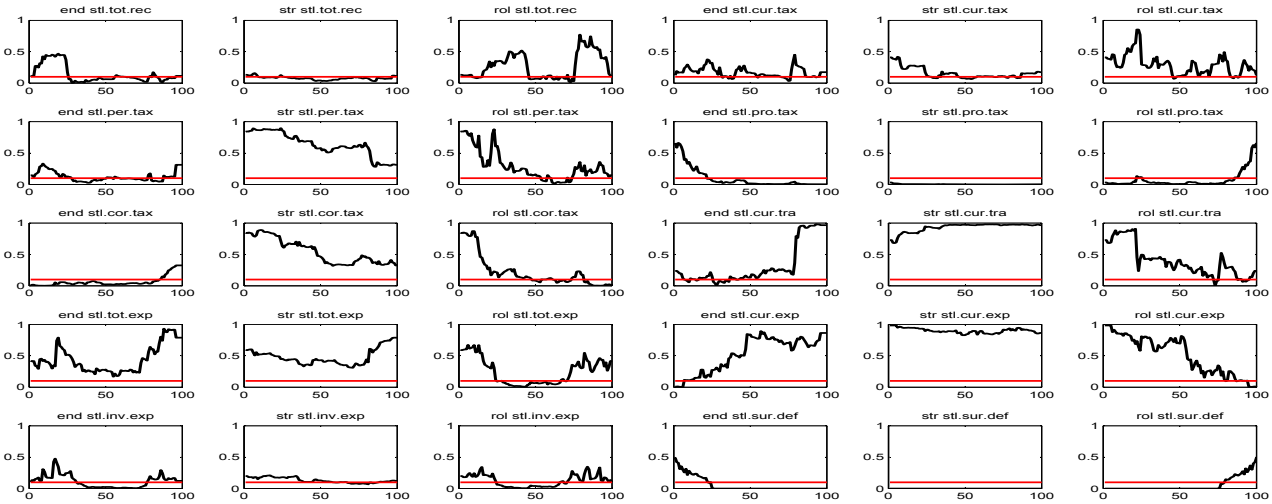
Figure 2. Recursive p-values of Granger non-causality tests on fiscal indicators in the output growth equation



(a) Government current receipt and expenditures.

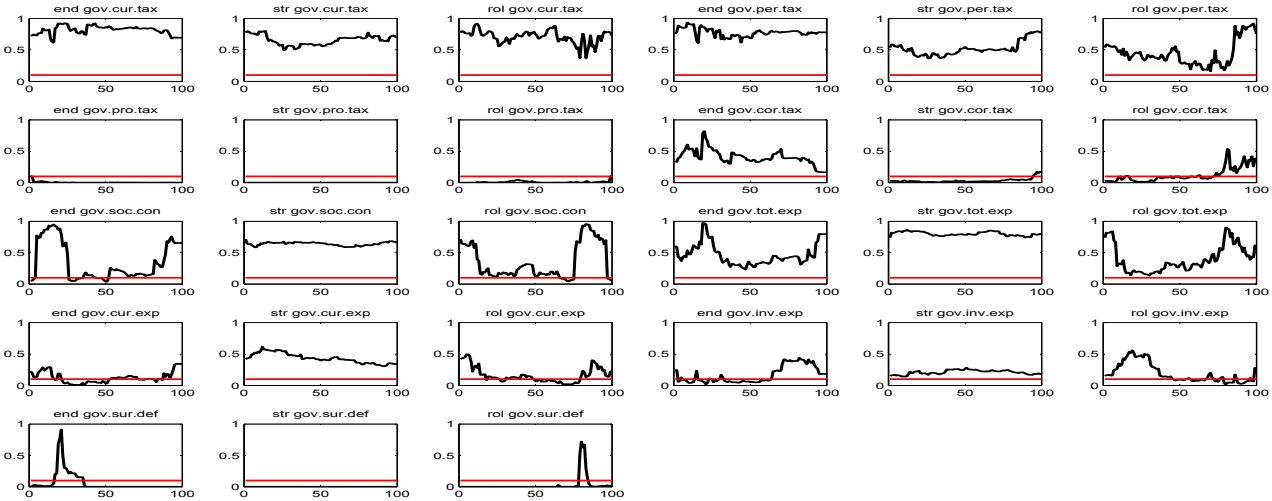


(b) Federal government current receipts and expenditures.

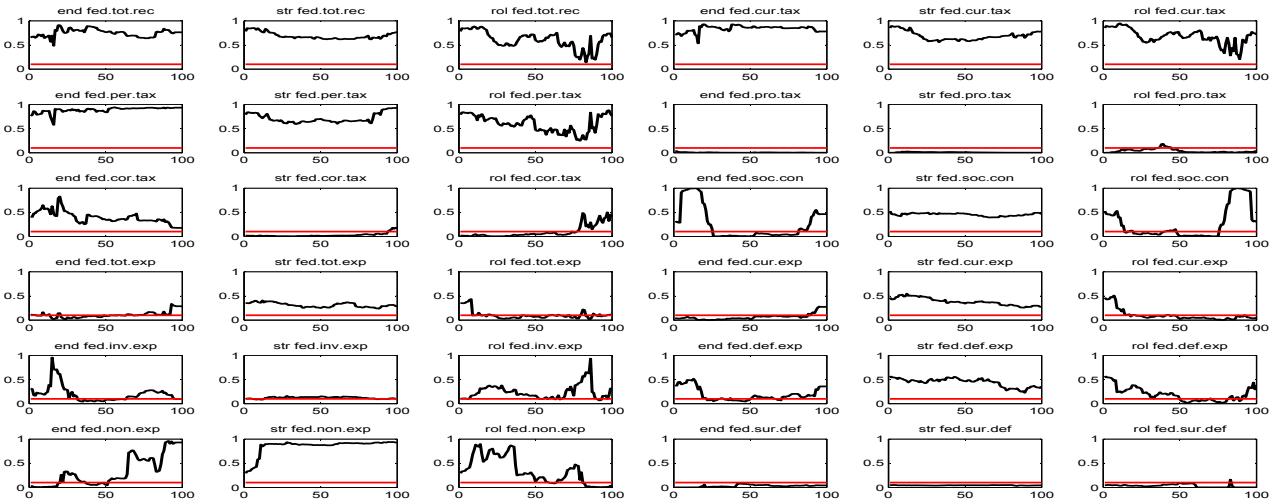


(c) State-local government current receipts and expenditures.

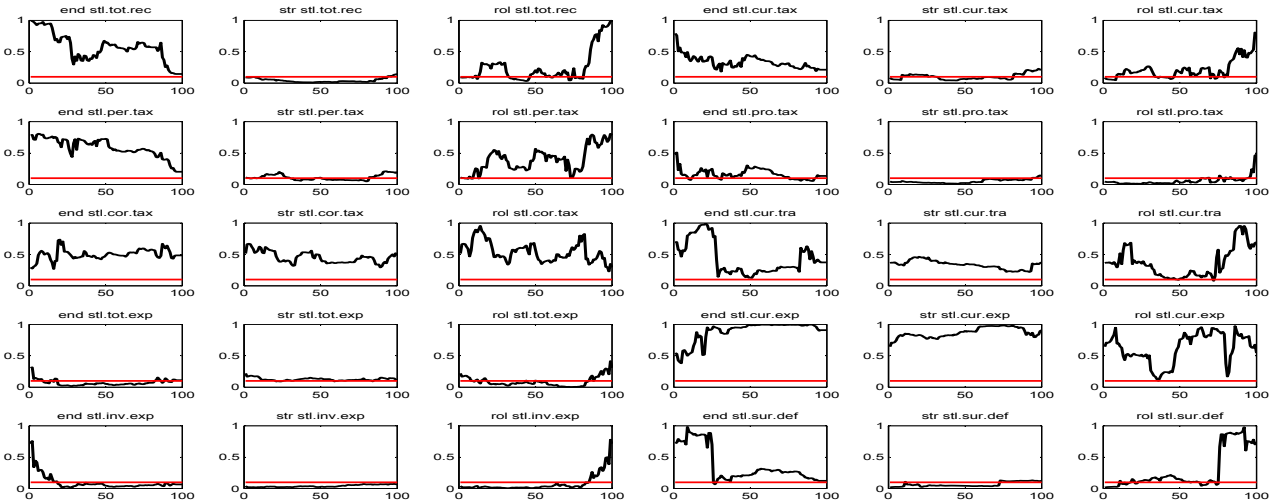
Figure 3. Recursive p-values of Granger non-causality tests on fiscal indicators in the inflation equation



(a) Government current receipt and expenditures.



(b) Federal government current receipts and expenditures.



(c) State-local government current receipts and expenditures.