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An Empirical Investigation of US Fiscal Expenditures and Macroeconomic Outcomes

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Abstract

In addition to containing stable information to explain inflation, state-local expenditures have also a larger share of the forecast error variance of US inflation than the Federal funds rate. Non-defense federal expenditures are useful in predicting real output variations and, starting from the early 1980s, present also a larger share of the forecast error variance of US real output than the Federal funds rate.

Keywords: Information value, state-local expenditures, forecast error variance decomposition.

JEL Classification: E31, E62.

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1. Introduction

While US output variations can be explained somewhat reliably with the use of a set of relevant variables such as Federal funds rate (FFR) 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. Even the FFR fails to provide statistically significant information content.[1] Aksoy and Melina (in press) study a wide range of fiscal indicators and find that certain fiscal variables contain statistically significant information for U.S. inflation and real output growth beyond the information contained in the FFR and autoregressive components of inflation and output.

Here, we focus on five expenditure aggregates, and (i) investigate their informational role for US inflation and real output both over a long post-WWII sample and a recent sub-sample, as it is widely accepted that change in the conduct of US monetary policy in the early 1980s have affected the transmission of shocks in the economy; and (ii) compute the share of the expenditure aggregates in explaining the forecast error variance (FEV) of US inflation and output growth.

2. Data

The quarterly seasonally adjusted data cover the period 1959:1-2008:2. We extract the following US macroeconomic variables from the database of the Bureau of Economic Analysis: (i) real output (GDP in chained 2000 US dollars); (ii) price level (GDP deflator); (iii) a set of expenditure indicators that excludes transfer payments (BEA Table 3.9.6): (a) government consumption expenditures and gross investment, (b) total federal expenditures, (c) federal non-defense expenditures, (d) defense expenditures, (e) state-local expenditures. We then use the FFR provided by the Federal Reserve Board of Governors.

[1] See for example Friedman and Kuttner (1992) and Stock and Watson (2003).

3. Granger non-causality tests

Our econometric specifications follow Friedman and Kuttner (1992). Instead of using an arbitrary number of lags, we rely on the Akaike Information Criterion (AIC) to select the lag structure every time we include a different expenditure indicator.[2]

The specification for real output changes is given by:

$$\Delta y_t = \alpha + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + \sum_{i=1}^{n} \lambda_i \Delta p_{t-i} + \sum_{i=1}^{q} \delta_i \Delta i_{t-i} + \sum_{i=1}^{r} \gamma_i \Delta g_{t-i} + \nu_t \quad (1)$$

where all variables represent annualized log differences, except for the change in the interest rate, which is simply the annualized first difference. The terms $\Delta y_t, \Delta p_t, \Delta i_t, \Delta g_t, \nu_t$ represent output growth, inflation, the change in the short-term interest rate, the change in an alternative expenditure indicator and an error term respectively. The inflation equation is:

$$\Delta p_t = \alpha + \sum_{i=1}^{n} \lambda_i \Delta p_{t-i} + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + \sum_{i=1}^{q} \delta_i \Delta i_{t-i} + \sum_{i=1}^{r} \gamma_i \Delta g_{t-i} + \nu_t \quad (2)$$

In Table 1, we report the lag structure for both equations.[3]

< Table 1 >

We run the above regressions over the full sample and over a restricted sample starting in 1983:1, as it is widely accepted that change in the conduct of US monetary policy in the 1980s may have affected the transmission of shocks in the economy. Then, we test for Granger non-causality of the expenditure indicators by imposing the null hypothesis that all the lags of each alternative indicator are jointly insignificant, i.e. $H_0 : \gamma_i = 0,\ i = 1, \ldots, r.$

< Table 2 >

In Table 2 we show that in the output equation, non-defense federal expenditures have significant information content both in the full and the recent sample. Moreover, while government expenditures have significant information content over the recent sample, defense expenditures only

[2] We run each regression with every combination of lags, from 1 to 12 for each regressor. Then we choose the combination that minimizes AIC.

[3] The Breusch-Pagan-Godfrey test and the White test reject the hypothesis of homoskedastic errors. The Breusch-Godfrey Lagrange-multiplier test fails to reject the null of uncorrelated errors. Therefore, we run all tests based on Wald-type chi-square statistics using White heteroskedasticity-consistent standard errors.

in the full sample. In the inflation equation, state-local expenditures have significant information content in both samples;[4] defense expenditures only in the full sample.[5] Consistent with previous studies while over the full sample the FFR has a significant predictive role on real output growth and inflation, over the more recent sample the FFR is not useful in explaining inflation.

4. Stability tests

Recursive p-values. We obtain recursive p-values in three different ways: (i) by fixing the endpoint (END) of the sample: the first p-value refers to sample 1980:2-2008:2, the last refers to 1962:1-2008:2; (ii) by fixing the starting point (STR): from sample 1962:1-1983:4 to 1962:1-2008:2; (iii) by rolling the sample: from 1962:1-1983:4 to 1983:3-2008:2. In Figure 1 we plot the recursive p-values of the Wald tests. The straight horizontal line represents the 10 percent significance level.

< Figure 1 >

Figure 1.A shows that changes in government expenditures have Granger caused changes in real output in more recent times. Changes in defense expenditures, while significant in the initial samples, have not been significant in many more recent ones. On the contrary, non-defense federal expenditures have been significant till the sample end.

Figure 1.B captures the stable information content of state-local expenditures for inflation. While changes in defense expenditures have not been significant in more recent times, non-defense federal expenditures have progressively gained significance.

Formal stability tests. We run stability tests for one or more unknown structural breakpoints in the constant term and the autoregressive coefficients of the expenditure variables using the Quandt

[4] In analyzing potential reverse causation, in both samples, we find that while output growth Granger causes state-local expenditures at a 10 percent significance level, inflation does not Granger cause state-local expenditures at any conventional significance level.
[5] See Poterba and Rueben (1999), Sørensen et al. (2001) and Aksoy and Melina (in press) for a discussion on state-local finances.

likelihood ratio statistic in Wald form (sup-Wald); the exponential average Wald statistic (exp-Wald); and the average Wald statistic (mean-Wald).[6]

< Table 3 >

Table 3 shows that we fail to reject the null hypothesis of parameter constancy in all cases.

5. Forecast error variance decompositions

Another criterion we use to assess the information value of the examined expenditure indicators is their ability to account for the FEV of real output growth and inflation over a ten-quarter horizon. We estimate unconstrained vector-autoregressive (VAR) representations for real output growth and inflation in which we include the alternative expenditure indicators one at a time.[7]

Figure 2 displays the shares of the FEV attributed to the alternative expenditure indicators and to the FFR for real output growth and inflation respectively.

< Figure 2>

Figure 2.A shows that, in all cases, FFR outperforms the expenditure indicators in the FEV decomposition of real output growth. However, in the recent subsample, the non-defense portion of federal expenditures has a larger share of FEV than the FFR, and federal and defense expenditures display a large contribution towards explaining the FEV of real output over at least a six-quarter forecast horizon. Figure 2.B shows that, in the full sample, in most cases expenditure indicators outperform FFR in the inflation equation. State-local expenditures outperform FFR both in the full sample and the more recent one.

Figure 3 allows us to compare the relative performance of the expenditure variables.

< Figure 3>

[6] To run the tests a 15-percent symmetric sample trimming is applied.

[7] Results are not significantly affected by variable orderings. Choleski ordering for output: output, inflation, FFR, expenditure indicator; for inflation: inflation, output, FFR, expenditure indicator. AIC selects 6, 7, 7, 5 and 6 lags when we include government, federal, defense, non-defense, and state-local expenditures, respectively.

Figure 3.A highlights the dominance of non-defense federal expenditures on all the other expenditure indicators in the FEV of output in the recent sub-sample. For the full sample, there is no conclusive evidence. Figure 3.B confirms the dominance of state-local expenditures over all the other expenditure indicators in the FEV of inflation.

6. Conclusion

In addition to containing information to explain inflation, state-local expenditures have a larger share of the FEV of US inflation than the FFR. Non-defense federal expenditures are useful in predicting real output variations and, starting from early 1980s, have a larger share of the FEV of US real output than the FFR.

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Table 1

Lag selection in output growth and inflation equations

(Akaike Information Criterion)

	Output growth				Inflation			
Expenditure variable	*m*	*n*	*q*	*r*	*n*	*m*	*q*	*r*
Government	4	1	4	6	4	10	10	1
Federal	4	3	6	6	4	10	10	1
Defense	4	3	6	6	4	10	10	4
Non-defense	2	3	6	1	4	10	10	1
State-local	4	1	4	3	8	10	9	11

m = output; *n* = inflation; *q* = interest rate; *r* = expenditure variable

Table 2

Granger non-causality chi-square statistics

p-values in parentheses

Tests on the joint insignificance of lags of alternative expenditure variables

	Output growth equation		Inflation equation	
Expenditure variable	1959:2-2008:2	1983:1-2008:2	1959:2-2008:2	1983:1-2008:2
Government	8.4855	11.8686	0.4496	0.2825
	(0.2046)	(0.0650)	(0.5025)	(0.5951)
Federal	7.7149	6.0499	0.3380	1.0239
	(0.2597)	(0.4176)	(0.5610)	(0.3116)
Defense	10.9989	8.2844	8.7752	6.1635
	(0.0884)	(0.2180)	(0.0670)	(0.1873)
Non-defense	4.8522	4.4656	0.8226	1.4191
	(0.0276)	(0.0123)	(0.3644)	(0.2335)
State-local	4.2110	4.1256	36.1422	21.9459
	(0.2396)	(0.4959)	(0.0002)	(0.0248)

Tests on the joint insignificance of lags of FFR
in the presence of alternative expenditure variables

	Output growth equation		Inflation equation	
Expenditure variable	1959:2-2008:2	1983:1-2008:2	1959:2-2008:2	1983:1-2008:2
Government	29.6680	9.4077	21.5520	8.3249
	(0.0000)	(0.0517)	(0.0176)	(0.5971)
Federal	41.5778	19.4234	23.4114	18.0540
	(0.0000)	(0.0035)	(0.0093)	(0.0541)
Defense	40.5959	21.1657	24.9646	16.0990
	(0.0000)	(0.0017)	(0.0054)	(0.0968)
Non-defense	39.8776	25.6392	21.5278	8.6701
	(0.0000)	(0.0003)	(0.0177)	(0.5637)
State-local	32.8103	7.3617	25.3451	8.3923
	(0.0000)	(0.0612)	(0.0026)	(0.4951)

Table 3

Tests for one or more unknown structural breakpoints

Null hypothesis: no structural breaks in the constant and in the expenditure variables

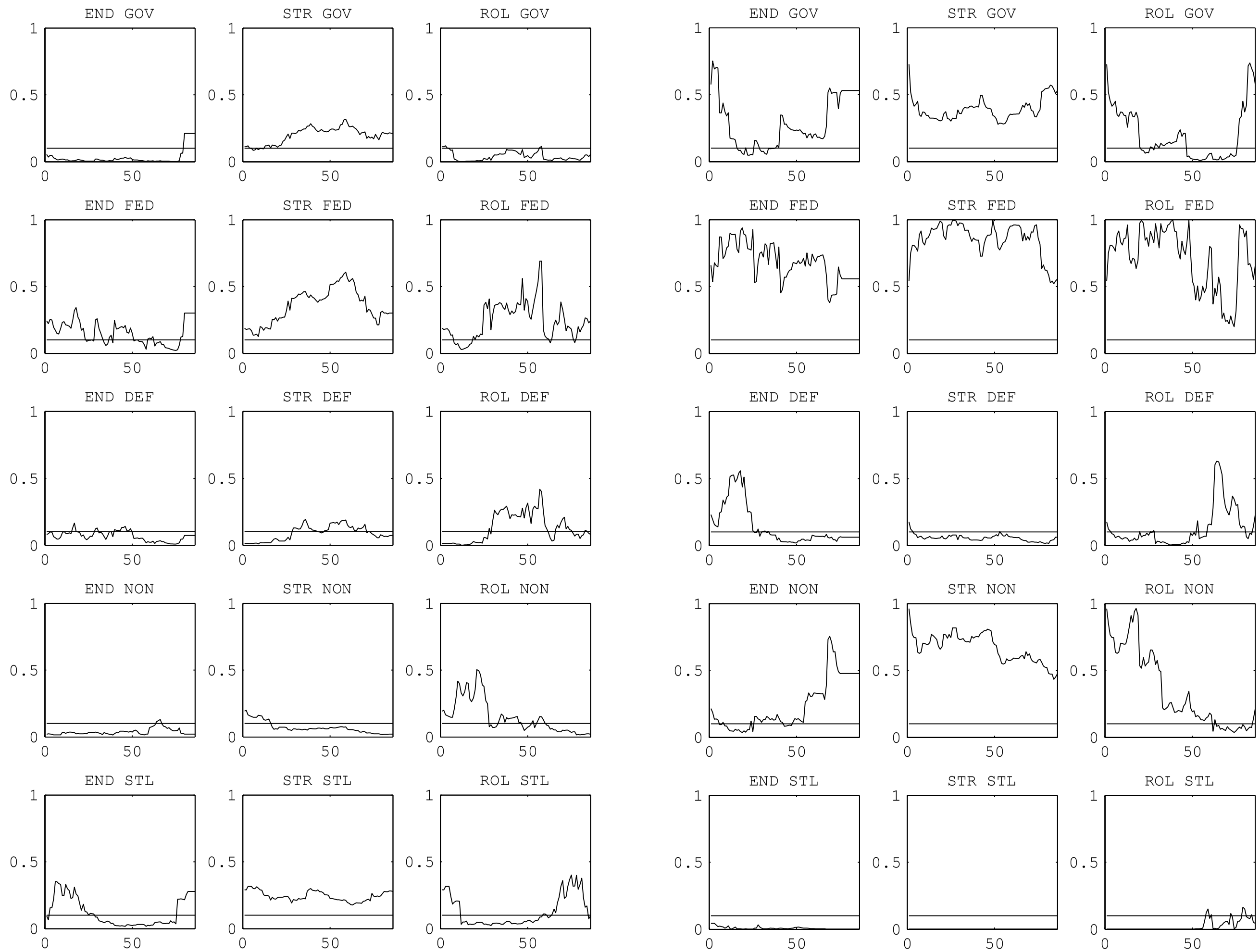
Asymptotic p-values (Hansen, 1997) in parentheses

Expenditure variable	sup-Wald	exp-Wald	mean-Wald	sup-Wald	exp-Wald	mean-Wald
Government	3.3956	1.0550	1.9692	2.7994	0.6554	1.2388
	(1.0000)	(1.0000)	(1.0000)	(0.9157)	(0.7458)	(0.6702)
Federal	5.9370	1.1948	2.1435	3.3009	0.5673	1.0029
	(0.9980)	(1.0000)	(1.0000)	(0.8430)	(0.8104)	(0.7797)
Defense	4.0274	1.0528	1.9192	2.4341	0.8158	1.5393
	(1.0000)	(1.0000)	(1.0000)	(1.0000)	(1.0000)	(0.9992)
Non-defense	4.5750	1.4171	2.5946	3.3034	0.5696	0.9621
	(0.6289)	(0.3379)	(0.2433)	(0.8426)	(0.8086)	(0.7991)
State-local	3.7739	0.6828	1.2093	2.7791	0.8460	1.5994
	(0.9894)	(0.9997)	(0.9998)	(1.0000)	(1.0000)	(1.0000)

Figure 1. Recursive p-values of Granger non-causality tests

A. Output growth

B. Inflation



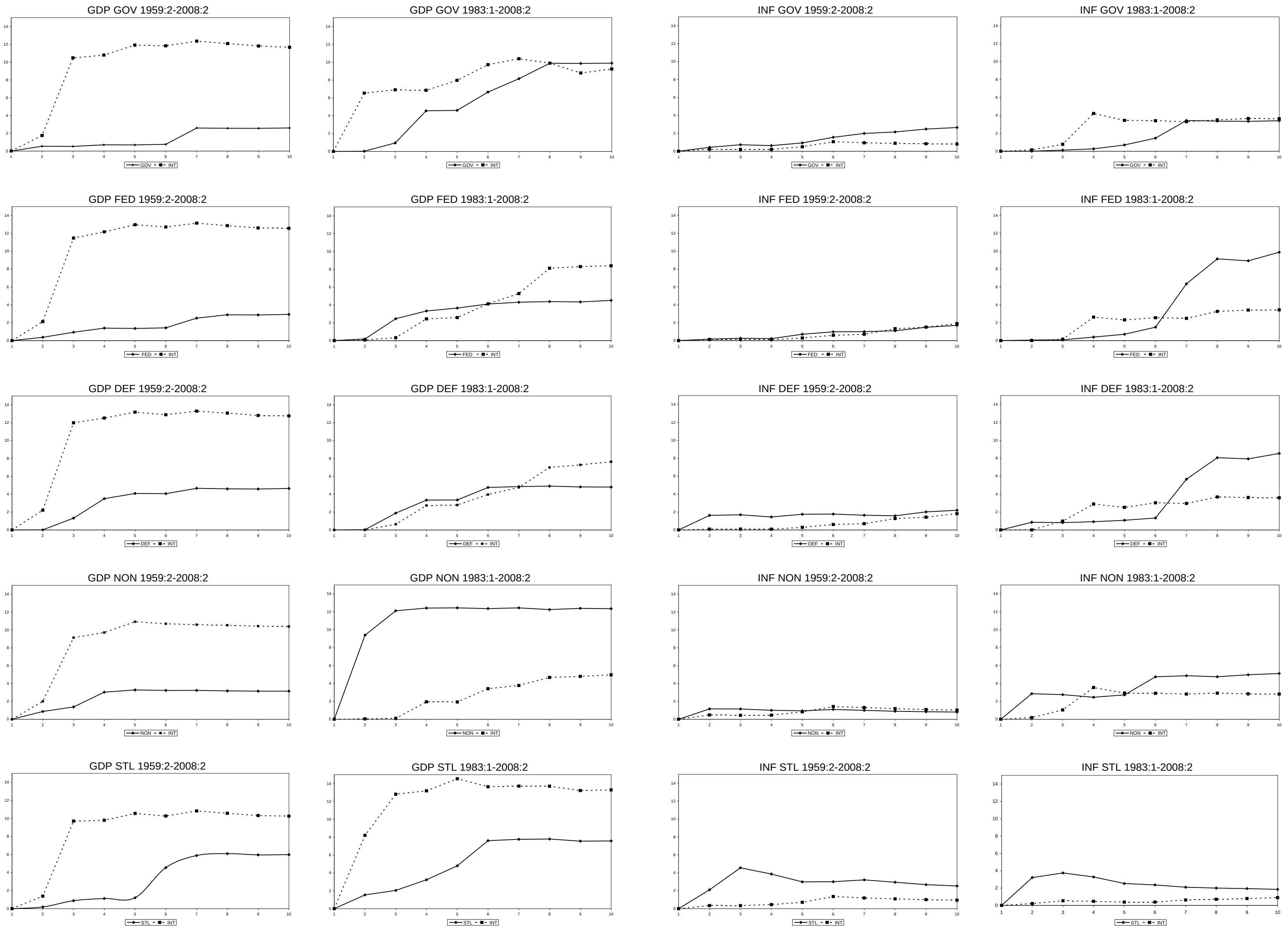
GOV = government; FED = federal; DEF = defense; NON = non-defense; STL = state-local

END = fixing the endpoint of the sample; STR = fixing the starting point of the sample; ROL = rolling the sample

Figure 2. Shares of expenditure indicators and FFR in the FEV

A. Output growth

B. Inflation

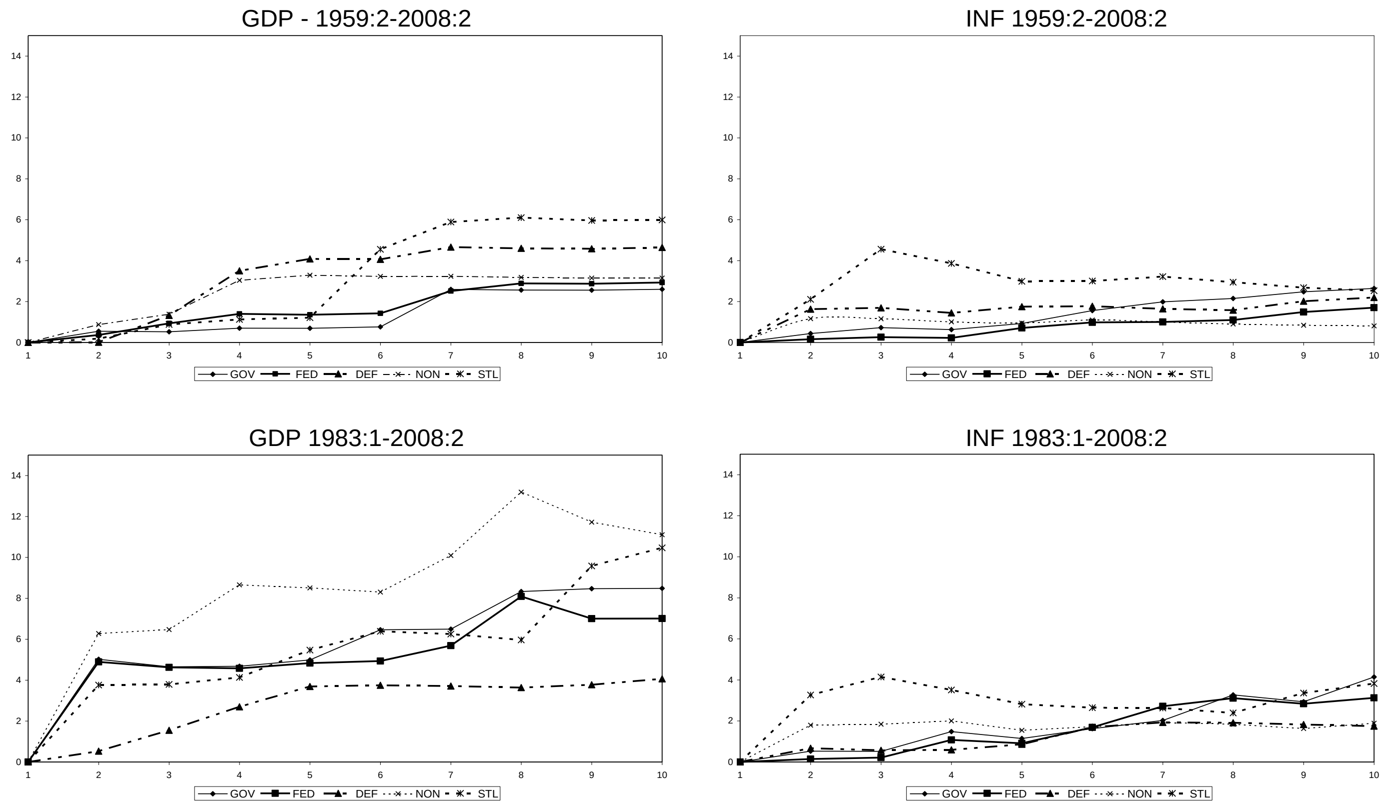


GOV = government; FED = federal; DEF = defense; NON = non-defense; STL = state-local; INT = Federal funds rate

Figure 3. Shares of expenditure indicators in the FEV

A. Output growth

B. Inflation



GOV = government; FED = federal; DEF = defense; NON = non-defense; STL = state-local.