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Taylor rules, omitted variables, and interest rate smoothing in the US

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Abstract

We test for the presence of interest rate smoothing in forward looking Taylor rules in first differences. We also consider financial and asymmetric preferences indicators. We find that interest rate smoothing is not induced by an omitted variable bias.
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Keywords: Taylor rules; Interest rate smoothing; Serial correlation; Observational equivalence; Omitted variables

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1. Introduction

Conventional wisdom suggests that Central Bankers have historically implemented a smooth monetary policy rate. A large number of papers have investigated the rationale for this Central Bankers' gradualism[1]. Nevertheless, in a recent contribution Rudebusch (2002) claims that the monetary policy inertia at quarterly frequencies is just an illusion. He supports his claim with an indirect proof based on the term structure of interest rates. He also performs a direct test on the partial adjustment (i.e. interest rate smoothing) versus serial correlation hypotheses with a nested model in levels. However, this direct investigation does not lead to a definitive conclusion. This is due to an observational equivalence problem affecting the analysis performed with variables in levels[2]. In this case, a policy rate path triggered by a pure partial adjustment process with white noise errors is very

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[1] See recent surveys by Sack and Wieland (2000) and Srour (2001).
[2] See Castelnuovo (2003) for some numerical simulations regarding this problem.

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similar to the one implied by a Taylor rule without interest rate smoothing but with serially correlated policy shocks.

Interestingly, English et al. (2002, ENS hereafter) notice how this observational equivalence problem may be overcome with a model in first differences. The advantage of the latter is to give clear indications both in the case of a rejection of the null hypothesis and in the alternative one.

In this paper, we test for the presence of interest rate smoothing at quarterly frequencies in forward looking Taylor rules. To do so, we employ a model in first differences à la ENS. In our exercise, we generalize their approach. In particular, we consider a larger set of Taylor rates, taking into account also potentially important omitted variables such as the quadratic output gap and the credit spread. Our aim is to understand if the persistence of the federal funds rate typically registered in these kinds of empirical exercises is spurious and due to an omitted variable problem. Our results support the interest rate smoothing hypothesis.

Our paper is organized as follows. Section 2 presents ENS's empirical model. In the same section we explain how we take into account the potentially important omitted variables listed above. Section 3 describes the data. In Section 4 we analyze our empirical findings. Section 5 concludes.

2. The framework

In the context of simple Taylor (1993) rules, we identify a partial adjustment process with the following model:

$$i_t = (1-\rho)\tilde{i}_t + \rho i_{t-1} + \eta_t \tag{1}$$

where i_t is the federal funds rate, ρ is the smoothing parameter, $\tilde{i}_t$ is the Taylor rate, and η_t is a white noise process. Instead, the serial correlation specification reads as follows:

$$i_t = \tilde{i}_t + \varepsilon_t, \quad \varepsilon_t = \rho_\varepsilon \varepsilon_{t-1} + \eta_t \tag{2}$$

where ε_t is an AR(1) process, defined by the coefficient ρ_ε.

ENS notice that while the two different specifications (1) and (2) have similar implications for the behavior of the interest rate level, this similarity does not hold anymore when first differences are taken into account. To see this, consider Eq. (1). After some algebra, it is possible to arrive at the following formulation:

$$\Delta i_t = (1-\rho)\,\Delta\tilde{i}_t + (1-\rho)(\tilde{i}_{t-1} - i_{t-1}) + \eta_t \tag{3}$$

By contrast, the serial correlation specification (2) leads to this alternative equation:

$$\Delta i_t = \Delta\tilde{i}_t + (1-\rho_\varepsilon)(\tilde{i}_{t-1} - i_{t-1}) + \eta_t \tag{4}$$

Then, we can estimate the empirical model:

$$\Delta i_t = \gamma_1\,\Delta\tilde{i}_t + \gamma_2(\tilde{i}_{t-1} - i_{t-1}) + \eta_t \tag{5}$$

and test the null hypothesis:

$$H0_{SC}:\ \gamma_1 = 1 \tag{6}$$

Under the null (6), the serial correlation specification holds true. Otherwise, the interest rate smoothing conjecture is supported[3].

About the Taylor rate $\tilde{i}_t$, we concentrate on its forward looking version popularized by Clarida et al. (2000, CGG henceforth). We do so because we believe that Central Banks tend to be forward looking in setting their policy rates given that lags are present in the monetary policy transmission mechanism. CGG's approach is captured by the following Taylor rate definition:

$$\tilde{i}_t = c + b_\pi E_{t-1}\bar{\pi}_{t+4} + b_y E_{t-1} y_t \tag{7}$$

where c is a constant, $\bar{\pi}_t$ is the four-quarter average inflation rate, y_t is a measure of the gap, and E_{t-1} is the expectation operator conditional to the information available at time $t-1$.

Rudebusch (2002) claims that the high estimated figures for the interest rate smoothing parameter ρ might also be caused by serially correlated omitted variables. Which ones? Gerlach-Kristen (2002) empirically shows that a measure of credit spread is statistically significant in a backward looking Taylor rule estimated with US data. This may be due to the fact that this spread is a good leading indicator of the business cycle, as shown by Guha and Hiris (2002). Another variable we want to consider is the squared value of the output gap, which can be related to Central Bankers' asymmetric preferences (Surico, 2002; Gerlach, 2000; Cukierman and Muscatelli, 2002)[4]. To introduce the omitted variable z_t in our analysis, we just add the term $E_{t-1}z_t$ to Eq. (7).

3. The data

The variables employed in this exercise have been constructed as follows: π_t is the four-quarter inflation rate constructed on the basis of the GDP chainweighted price index P_t, i.e. $\pi_t \equiv 4(p_t - p_{t-1})$, where $p_t = 100 \ln P_t$. y_t is the output gap, which has been defined as $q_t - q_t^*$, where $q_t \equiv 100 \ln Q_t$, while $q_t^* \equiv 100 \ln Q_t^*$. Q_t is the real GDP level, while Q_t^* is the potential output estimated by the Congressional Budget Office. In Gerlach-Kristen (2002) paper, the credit spread is defined as the difference between the Moody's BAA corporate index yield and the 10 year US treasury note yield. We employ the same definition here. Finally, the upper-barred variables indicate simple averages taken over the contemporaneous observation and the previous three lags of the variables considered. All the series listed above are downloadable from the web-site of the Federal Reserve Bank of St. Louis, i.e. http://research.stlouisfed.org/fred2/.

[3] We are here assuming that the federal funds rate has been driven either by a partial adjustment mechanism or by serially correlated policy shocks. Indeed, we may think of a hybrid process, as well. However, the rejection of the null (6) would still support the partial adjustment mechanism.

[4] See Surico (2002) for a detailed derivation of the first-order conditions of a problem with a general (i.e. Linex) loss function and a New Keynesian structure of the economy.

Table 1
Test on partial adjustment vs. serial correlation

Forward looking Taylor rates	Standard	With spread	With quadr. gap
b_π	1.59** (0.49)	1.44** (0.28)	1.47** (0.43)
b_y	0.70** (0.25)	0.79** (0.12)	0.43* (0.19)
b_z	–	−2.98** (0.89)	−0.30* (0.13)
γ_1	0.37* (0.17)	0.21** (0.07)	0.32 (0.19)
γ_2	0.18** (0.06)	0.27** (0.04)	0.27** (0.08)
Adj. R^2	0.93	0.97	0.93
σ_η^2	0.45	0.32	0.47
$H0_{SC}$: $\gamma_1 = 1$ (F-stat, P-value)	0.001**	0.000**	0.001**

Sample, 1987:3Q1–2002:Q3. */** = 95%/99% statistical confidence. t-Statistics (in brackets) corrected for heteroskedasticity and serial correlation. Adj. R^2 refers to the federal funds rate level. Constants omitted for brevity.

4. The empirical model and results

By plugging Eq. (7) in (5) and taking into account the omitted variable $E_{t-1}z_t$, we obtain the following empirical model:

$$\Delta i_t = \gamma_1(b_\pi E_{t-1}\,\Delta\bar{\pi}_{t+1} + b_y E_{t-1}\,\Delta y_t + b_z E_{t-1}\,\Delta z_t) + \gamma_2(c + b_\pi E_{t-1}\bar{\pi}_{t+3} + b_y E_{t-1} y_{t-1} + b_z E_{t-1} z_{t-1} - i_{t-1}) + \eta_t \tag{8}$$

We estimate the empirical model (8) with 2SLS[5]. We use American data, and focus on Greenspan's regime, i.e. 1987:Q3–2002:Q3. Our estimates are presented in Table 1.

Table 1 reports P-values of the Wald-test on the null hypothesis (6). Notably, the null hypothesis is rejected, thus discarding serial correlation as the unique reason for the observed policy rate persistence. Hence, the data seem to suggest that the partial adjustment process is an important element for tracking the federal funds rate path. This result is robust to the introduction of some omitted variables in the Taylor rate. This finding supports the English et al. (2002) one. Notably, it is based on a larger set of Taylor rates.

As a by product of our empirical test we also obtain estimates for the parameters of the Taylor rule (7). Our figures are fairly in line with those in the literature. In particular, the Taylor principle (i.e. $b_\pi > 1$) seems to have been respected by Greenspan's conduct, while the output gap coefficient is positive and significant. Interestingly enough, both the credit spread and the quadratic gap turns out to be significant and have the expected signs. We take these results as evidence in favor of a richer specification of the Taylor rule than the Standard one, at least for the US.

[5]In all our regressions we exploit the following set of intruments: [c, $\bar{\pi}_{t-2}, \ldots, \bar{\pi}_{t-5}$, $\bar{\pi}^{PPI}_{t-2}, \ldots, \bar{\pi}^{PPI}_{t-5}$, $y_{t-2}, \ldots, y_{t-5}$, $i_{t-2}, \ldots, i_{t-5}$], where $\bar{\pi}_t^{PPI}$ is the four-quarter average inflation rate computed on the basis of the Producer Price Index (Finished Goods).

5. Conclusions

In this paper we employed the English et al. (2002) empirical model to test for the significance of interest rate smoothing at quarterly frequencies in simple Taylor rules. Our results suggest that the estimated interest rate smoothing degree is not due to an omitted variable bias. Moreover, our evidence indicates that financial indicators and asymmetric preferences may have played a significant role in the determination of the monetary policy in the US.

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References

Castelnuovo, E., 2003. Describing Greenspan's conduct with simple taylor rules: is interest rate smoothing important? Mimeo.

Clarida, R., Gali, J., Gertler, M., 2000. Monetary policy rules and macroeconomic stability: evidence and some theory. Quarterly Journal of Economics 115, 147–180.

Cukierman, A., Muscatelli, V.A., 2002. Do central banks have precautionary demands for expansions and for price stability? Theory and Evidence, mimeo.

English, W.B., Nelson, W.R., Sack, B., 2002. Interpreting the significance of the lagged interest rate in estimated monetary policy rules. Federal Reserve Bank of Washington, Finance and Economics Discussion Series Working Paper, No. 2002-24.

Gerlach, S., 2000. Asymmetric policy reactions and inflation. Bank for International Settlements, mimeo.

Gerlach-Kristen, P., 2002. Interest rate smoothing: monetary policy inertia or unobserved variables? A comment on Rudebusch's ''term structure evidence on interest-rate smoothing and monetary policy inertia''. Mimeo.

Guha, D., Hiris, L., 2002. The aggregate credit spread and the business cycle. International Review of Financial Analysis 11, 219–227.

Rudebusch, G.D., 2002. Term structure evidence on interest rate smoothing and monetary policy inertia. Journal of Monetary Economics 49, 1161–1187.

Sack, B., Wieland, V., 2000. Interest-rate smoothing and optimal monetary policy: a review of recent empirical evidence. Journal of Economics and Business 52, 205–228.

Srour, G., 2001. Why do central banks smooth interest rates? Bank of Canada Working Paper No. 2001-17.

Surico, P., 2002. US monetary policy rules: the case for asymmetric preferences. FEEM Working Paper No. 66-2002.

Taylor, J.B., 1993. Discretion versus policy rules in practice. Carnegie-Rochester Conference Series on Public Policy 39, 195–214.