# A detailed overview of monetary policy rules in Modelbase

For model comparison exercises the MMB 2.0 offers seven pre-programmed monetary policy rules. They are taken from Taylor (1993), Gerdesmeier and Roffia (2004), Levin, Wieland, and Williams (2003), Smets and Wouters (2007), Christiano, Eichenbaum, and Evans (2005), Orphanides and Wieland (2008) and Orphanides and Wieland (2013), respectively. In addition, we allow users to specify their own rule. The specific formulas of each policy rule, expressed in terms of common modelbase variables, are shown below.

Table 1: MONETARY POLICY RULES IN MODELBASE

| | |
|---|---|
| Taylor (1993) | $i_t^z = \sum_{j=0}^{3} 0.375 p_{t-j}^z + 0.50 q_t^z + \eta_t^i$ |
| Gerdesmeier and Roffia (2004) | $i_t^z = 0.66 i_{t-1}^z + \sum_{j=0}^{3} 0.17 p_{t-j}^z + 0.10 q_t^z + \eta_t^i$ |
| Levin et al. (2003) | $i_t^z = 0.76 i_{t-1}^z + \sum_{j=0}^{3} 0.15 p_{t-j}^z + 1.18 q_t^z - 0.97 q_{t-1}^z + \eta_t^i$ |
| Smets and Wouters (2007) | $i_t^z = 0.81 i_{t-1}^z + 0.39 p_t^z + 0.97 q_t^z - 0.90 q_{t-1}^z + \eta_t^i$ |
| Christiano et al. (2005) | $i_t^z = 0.8 i_{t-1}^z + 0.3 E_t p_{t+1}^z + 0.08 q_t^z + \eta_t^i$ |
| Orphanides and Wieland (2008) | $i_t^z = 2.34 E_t \pi_{t+3}^z + 0.765 E_t q_{t+3}^z + \eta_t^i$ |
| Orphanides and Wieland (2013) | $i_t^z = i_{t-1}^z + 0.5 \pi_t^z + 0.5(q_t^z - q_{t-4}^z) + \eta_t^i$ |
| User-specified rule | $i_t^z = \sum_{j=0}^{j=4} \rho_i i_{t-j}^z + \sum_{j=-4}^{j=4} \rho_{\pi,j} p_{t+j}^z + \sum_{j=-4}^{j=4} \rho_{q,j} q_{t+j}^z + \sum_{j=-4}^{j=4} \rho_{y,j} y_{t+j}^z + \eta_t^i$ |

In all rules, $i_t^z$ denotes the annualized quarterly money market rate, $\pi_t^z$ refers to the year-on-year rate of inflation, $p_t^z$ denotes the annualized quarter-to-quarter rate of inflation, $y_t^z$ is the quarterly real GDP, $q_t^z$ is the quarterly output gap which is defined as the deviation of actual output from the level of output that would be realized if prices were flexible. $\eta_t^i$ refers to the common monetary policy shock.

In the following we provide a brief description for each rule.

- The rule proposed by Taylor (1993) is a well-known monetary policy rule. In the 1990s Taylor's rule received much attention because it described the interest rate decisions of the Federal Reserve surprisingly well. Since then, a great number of Taylor-type rules have been used in the literature.
- The rule of Gerdesmeier and Roffia (2004) was estimated on euro area data and was used for model comparison exercises in Kuester and Wieland (2010) with four euro area economy

models that are included in the Modelbase. This rule is a variant of the Taylor rule, augmented with the interest-rate smoothing term.

- The rule used by Levin et al. (2003) was originally estimated with U.S. data by Orphanides and Wieland (1998). Levin et al. (2003) employs this rule to simulate five models of the U.S. economy for model comparison. All five U.S. models are also contained in the Modelbase. This rule allows for interest-rate smoothing and reacts to the lagged output gap in addition to the current output gap and current inflation.

- The rule of the model of Smets and Wouters (2007), one of the best-known medium-scale new-Keynesian models, was estimated together with other structural parameters in the model using Bayesian techniques. This rule includes the lagged interest rate, the current inflation as well as the lagged and current output gap like the rule of Levin et al. (2003).

- Unlike the rules so far, the rule used by Christiano et al. (2005) is forward-looking and responds to the one-period ahead forecast of inflation. They ascribe this estimated rule to Clarida, Gali, and Gertler (1999).

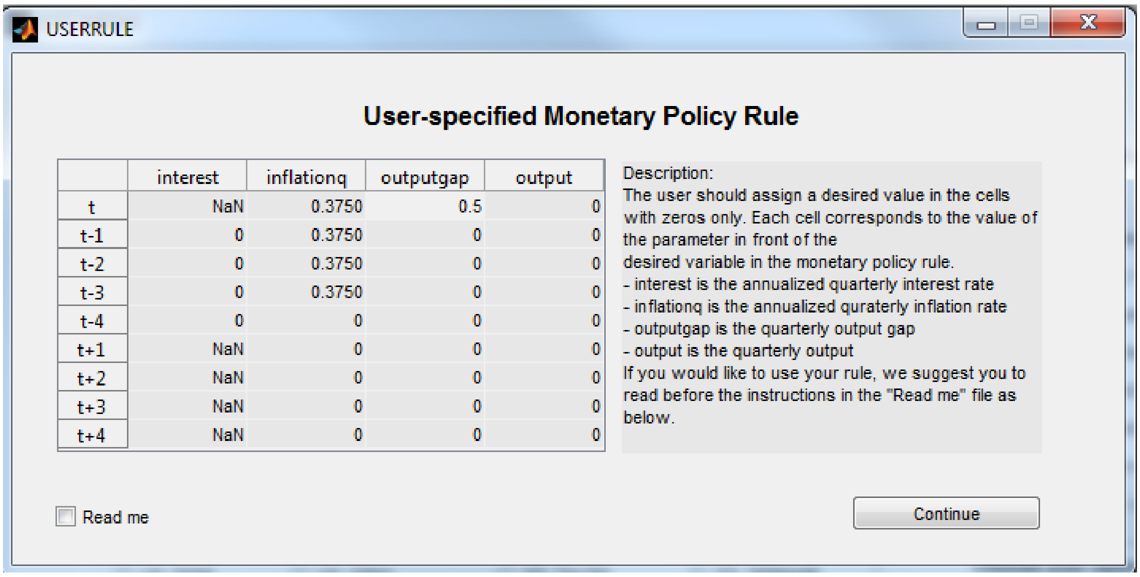
- Orphanides and Wieland (2008) estimated monetary policy rules with the publicly-available FOMC's projections for inflation and unemployment rate, while carefully considering the timing of releasing the semiannual monetary policy report to the Congress. The rule is forward-looking in the sense that it contains three quarters-ahead forecasts for inflation and unemployment rate. We have implemented a rule without the interest-rate smoothing (the fourth column in Table 3 in Orphanides and Wieland (2008)). Furthermore, the unemployment rate in the original rule is replaced with the output gap using Okun's law, $-2(u - \bar{u}) \approx (y - \bar{y})$.

- Orphanides and Wieland (2013) propose an outcome-based simple policy rule with the change in policy rate responding equally to the current inflation and output gap growth over the last four quarters. They find that this simple rule delivers quite robust stabilization performance across eleven euro area macroeconomic models from the Modelbase.

- Users can simulate models with their own rule by choosing "User-specified rule". To allow for richer rule specification, a generalized interest rate rule is presented in terms of common Modelbase variables. Users can specify desired values for the coefficients of variables in the rule. For example, suppose that you implement the Taylor (1993) rule, the first rule in Table 1, using the option for "User-specified rule". The coefficients should be set as follows: $\rho_{\pi,0} = \rho_{\pi,-1} = \rho_{\pi,-2} = \rho_{\pi,-3} = 0.375, \rho_{q,0} = 0.5$, with the rest of coefficients being set to zero. The Figure 1 shows the pop-up menu for a user-specified rule with the example of Taylor (1993) rule. Note that with certain rule parametrization, a model might not be simulated.

The system of a proposed monetary policy rule and other model equations may violate the Blanchard-Kahn condition so that they do not yield a unique stationary rational expectations equilibrium. There is no hard guideline for determinacy conditions, but Levin et al. (2003) suggest several characteristics of rules that deliver a unique equilibrium. They include a relatively short inflation forecast horizon, a moderate degree of responsiveness to the inflation forecast, an explicit response to the current output gap, and a substantial degree of policy inertia.

Figure 1: TAYLOR (1993) RULE USING THE OPTION OF USER-SPECIFIC RULE




In the menu for *One model, many policy rules*, the rules menu also includes the model-specific rule used by the original model authors, in addition to the list of rules and the user-specified rule. If the model-specific rule can be written in terms of common variables, the choice of this rule is activated. Currently, the model-specific rule is available for forty models. One can find the exact specification for each model-specific rule in the file "MSR_COEFFS.m". The list of models are presented below with its abbreviated model name in the MMB:

- Small calibrated models: NK_LWW03, NK_CGG99, NK_CGG02, NK_MCN99cr, NK_IR04, NK_BGG99, NK_GK11, NK_CK08, NK_CKL09, NK_MM10, NK_KRS12
- Estimated US models: US_OW98, US_SW07, US_ACELm, US_ACELswm, US_OR03, US_PM08, US_PM08fl, US_DG08, US_IAC05, US_RA07, US_CCTW10, US_IR11, US_IN10, US_VMDno, US_VMDop
- Estimated euro area models: EA_CW05ta, EA_CW05fm, EA_SW03, EA_QUEST3, EA_CKL09, EA_GE10, EA_GNSS10

- The rest of the models: G7_TAY93, G3_CW03, G2_SIGMA08, EAUS_NAWM08, EAUS_NAWMctww, EAES_RA09, BRA_SAMBA08

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