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An Estimate of the Orphanides-Wieland Rule for Brazil

Adonias Evaristo†
†Autor correspondente: adoniasevaristo@hotmail.com

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ABSTRACT

This paper estimates the Orphanides-Wieland rule for Brazil, using data from 2001 to 2024. Despite statistically significant reactions of Selic changes to the difference of inflation expectations from its target and expected output growth from potential, the estimated coefficients and explanatory power are lower than obtained for advanced economies in the literature.

1. Introduction

The study of reaction functions has always attracted the attention of economists, since it is possible to describe interest rate setting with few variables.

The most famous reaction function is the Taylor rule (Taylor, 1993), which relates the policy rate to deviations of inflation from its target and the output gap. Later the rule was expressed in deviations of expected inflation from its target by Galí (1998) and Clarida et al. (2000).

The goal of this paper is to estimate the Orphanides-Wieland (Orphanides and Wieland, 2013) rule for Brazil. This rule has a good track record in describing European Central Bank (ECB) decisions and has not been studied in the context of Brazil. The main question addressed is how well it explains Brazilian monetary policy.

The rest of this paper is organized as follows. Section 2 discusses the Orphanides-Wieland rule. Section 3 presents the data used in the estimations. Section 4 shows the results. Section 5 concludes.

2. Orphanides-Wieland rule

The Orphanides and Wieland (2013) rule is given by the following equation:

$$\Delta i_t = \alpha \left(E\pi_t - \pi^* \right) + \beta \left(E\Delta y_t - \Delta y^* \right) + \varepsilon_t \tag{1}$$

where α and β are the coefficients of interest, interpreted as the sensitivity of interest rates to the deviation of inflation ($E\pi_t$) from its target (π^*) and output growth ($E\Delta y_t$) from potential output growth (Δy^*).

The origins of the rule can be traced back to Orphanides (2003), in which he labels it as natural-growth targeting rules, in order to highlight that these rules rely on the estimation of the economy's natural growth rate for guidance, instead of the output gap (p. 10).

The main advantage of the rule is that it does not include the equilibrium real rate and the output gap, two unobservable variables. Arguably policymakers have more reliable information in real time about the potential output growth rather than the output gap. Usually, Taylor rules are estimated with output gaps, but these variables are difficult to measure and tend to be revised substantially over time (Walsh, 2003).

The rule is expressed in differences because if inflation is at its target ($E\pi_t = \pi^*$) and the economy is growing at its potential ($E\Delta y_t = \Delta y^*$), the rule predicts that the Central Bank would not change interest rates ($\Delta i_t = 0$). Hence the absence of a constant in the rule.

There is evidence that the Orphanides-Wieland rule describes interest-rate setting well, both in the United States and the Euro area. Setting $\alpha = \beta = 1$, Orphanides (2003, p. 23) argues that the rule describes well monetary policy in the U.S. since the 1990s, and even better than the Taylor rule. Likewise, Orphanides and Wieland (2013) show that the European Central Bank (ECB) policy rate is characterized quite well with a rule with the same coefficients. Belke (2019) estimates the rule for the Euro area from 1999 to 2019 and finds coefficients of $\alpha = 0.46$ and $\beta = 0.38$, a bit lower than the originally proposed ones. The results show that the rule tracks ECB policy rates quite well, with the regression showing a high explanatory power. By the same token, Bletzinger and Wieland (2017) show a high explanatory power — R^2 of 0.69 — for the Orphanides-Wieland rule when using professional forecasts data for the Euro Area, but this figure drops to 0.35 when forecasts from the ECB staff are used in the estimations. Finally, Hartmann and Smets (2018) estimate the rule for the ECB, finding coefficients below 0.5 for α and β, but with a high explanatory power — R^2 above 0.5 — for all specifications, regardless of the sources of the forecasts used in the models.

3. Data

Data on Selic changes (Δi_t) come from the website of the Central Bank of Brazil. In order to estimate the Orphanides-Wieland reaction functions, data were collected from the SGS database of the Central Bank of Brazil, available since 2001.

Expectations for the IPCA inflation rate and output growth are available on a daily basis, for subsequent years. I built constant maturity Selic interest rate, GDP growth and inflation expectations with the following equation:

$$\exp_{tj} = \frac{12-j}{12}\exp_t + \frac{j}{12}\exp_{t+1} \tag{2}$$

where j refers to the month for which the expectations were collected and $t = 1, 2, 3$ refers to the year ahead considered, and exp denotes expectations for the inflation or GDP growth. The next step was to transform the resulting series to the monthly frequency, by taking monthly averages of the daily series. Inflation expectations and GDP growth expectations for 1-year ahead were used as the explanatory variables $E\pi_t$ and $E\Delta y_t$, respectively.

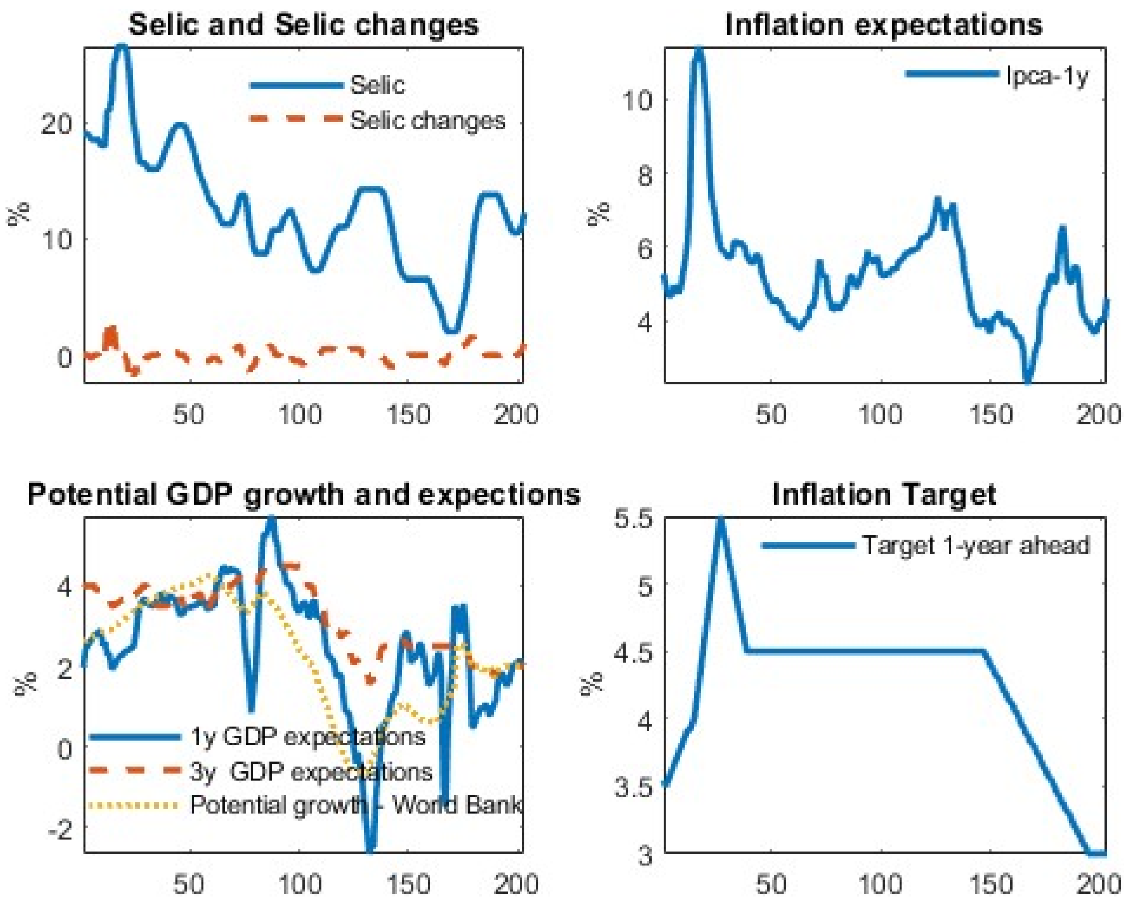
For the potential output growth variable Δy^*, the data comes from two sources.

The first one is the 3-year ahead output growth from the SGS database. This variable conveys information about the output growth in the long run, which can be used as a proxy for the potential output growth. After all, it is expected that 3-year ahead the cyclical fluctuations and shocks that hit the economy in the short run will dissipate, and the economy will return to its potential growth.

The second source is the cross-country database of potential growth from the World Bank (Kilic Celik et al., 2023). I use the median of the measures, and interpolate the data in the same way as in Equation 2, in order to obtain a constant 1-year ahead potential growth variable. Due to data availability, from 2021 onwards it was not possible to interpolate, so the figures are equal to the 3-year ahead growth rate from the SGS database.

The series used in the estimations are depicted in Figure 1. The sample period runs from November 2001 to December 2024, encompassing 203 monetary policy meetings.

Figure 1. Data



Source: own elaboration.

4. Results

4.1. Results for the period 2001–2024

Table 1 shows the results for the estimation of the Orphanides-Wieland rule for the overall sample period, based on Equation 1. The independent variables are the difference between the expected inflation and the corresponding inflation target for the same period, and the difference between GDP growth and the proxy for the potential GDP growth, either the expected GDP growth for 3-years ahead (specification 1) or the potential GDP growth from the World Bank database (specification 2).

Table 1. Estimation of the Orphanides-Wieland Rule

Variables	**(1)**	**(2)**
$E\pi_t - \pi^*$ (α)	0.19***	0.11***
	(0.040)	(0.035)
$E\Delta y_t - \Delta y^*$ (β)	0.20***	0.082**
	(0.031)	(0.034)
Observations	203	203
R-squared	0.202	0.105

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Results from the estimation of the Orphanides-Wieland rule presented in Table 1 show that changes in the Selic rate respond to the difference between expected inflation and its target, as well as to the difference in expected output growth and its natural rate. All explanatory variables are statistically significant at the 1% level.

The responsiveness of Selic changes to inflation expectations and deviations of output growth from its potential rate is larger in the first specification than in the second. For instance, $\alpha = 0.19$ and $\beta = 0.20$ in the first specification, while in the second specification the coefficients are estimated at $\alpha = 0.11$ and $\beta = 0.082$. Despite the significant sensitivity to inflation and output in both models, the explanatory power is very low in both regressions, 0.20 and 0.10 respectively. These figures are low relative to the more recent estimates obtained for the ECB, for instance in Orphanides and Wieland, Belke (2019), Bletzinger and Wieland (2017) and Hartmann and Smets (2018).

The conclusion is that in general the Orphanides-Wieland rule is not a good model to explain expected changes in interest rates in Brazil. This might be due to the fact that emerging countries are more prone to different shocks and more variables are at play in interest rate setting in Brazil. Alternatively, interest-smoothing may play a greater role in Brazil.

4.2. Results for different chairs

This section shows the results of the Orphanides-Wieland rule for different chairmanships over the sample period. Table 2 presents the results for the first specification, with the expected 3-year ahead growth rate as a proxy for potential GDP growth rate.

Table 2. Estimation of the Orphanides-Wieland Rule (3-year ahead growth proxy)

Variables	**(1) Armínio**	**(2) Meirelles**	**(3) Tombini**	**(4) Goldfajn**	**(5) RCN**
$E\pi_t - \pi^*$ (α)	0.42***	0.10***	0.26***	0.72***	0.26***
	(0.11)	(0.035)	(0.051)	(0.077)	(0.052)
$E\Delta y_t - \Delta y^*$ (β)	0.36*	0.49***	0.17***	0.43***	0.094*
	(0.19)	(0.076)	(0.036)	(0.034)	(0.051)
Observations	15	76	44	21	47
Adjusted R-squared	0.454	0.343	0.210	0.853	0.321

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Despite the lower number of observations, the Orphanides-Wieland rule describes monetary policy better during the Ilan Goldfajn and Armínio Fraga chairmanships (adjusted R^2 of 0.85 and 0.45, respectively). The results show a strong reaction to inflation in these two periods, with $\alpha = 0.72$ and $\alpha = 0.42$ respectively. For economic activity, the models show a strong reaction during the Meirelles chairmanship ($\beta = 0.49$), followed by the Goldfajn administration ($\beta = 0.43$). Overall, the explanatory variables explain interest-rate setting across all chairmanships.

Finally, Table 3 presents the results considering the potential output growth from the World Bank database. The results differ from those in Table 2. Both variables are not statistically significant for the Armínio Fraga chairmanship. For the Meirelles administration, only the difference between output growth and its potential is significant. For the Tombini and Campos Neto chairmanships, only the difference from inflation expectations and its target is statistically significant. The largest response to inflation is estimated to be during the Roberto Campos Neto (RCN) chairmanship ($\alpha = 0.26$). The explanatory power is lower than in the models in Table 2.

Table 3. Estimation of the Orphanides-Wieland Rule (World Bank potential growth)

Variables	(1) Armínio	(2) Meirelles	(3) Tombini	(4) Goldfajn	(5) RCN
$E\pi_t - \pi^*$ (α)	0.067	0.046	0.080***	0.18	0.26***
	(0.24)	(0.038)	(0.023)	(0.18)	(0.053)
$E\Delta y_t - \Delta y^*$ (β)	-1.35	0.40***	0.016	-0.10	0.031
	(1.57)	(0.061)	(0.035)	(0.058)	(0.065)
Observations	15	76	44	21	47
Adjusted R-squared	0.423	0.270	0.086	0.056	0.296

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5. Conclusion

This paper estimated the Orphanides-Wieland rule using Brazilian data for the period 2001–2024. The results show in general a lower explanatory power and lower estimated coefficients than those obtained for the ECB. Therefore, there is evidence that more variables are at play when it comes to describing monetary policy in Brazil.

Despite this, there is evidence that monetary policy reacted to deviations of expected inflation from the inflation target as well as to deviations of expectations of output growth from its potential rate.

This paper fits into the literature that uses monetary rules and historical data to analyze monetary policy (Orphanides, 2003), and it sought to assess the suitability of the Orphanides-Wieland rule to describe monetary policy in emerging markets such as Brazil.

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