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Brazil—Economic Activity

In Search of Lost Growth:

What Is the Extent of Spare Capacity in Brazil's Economy?

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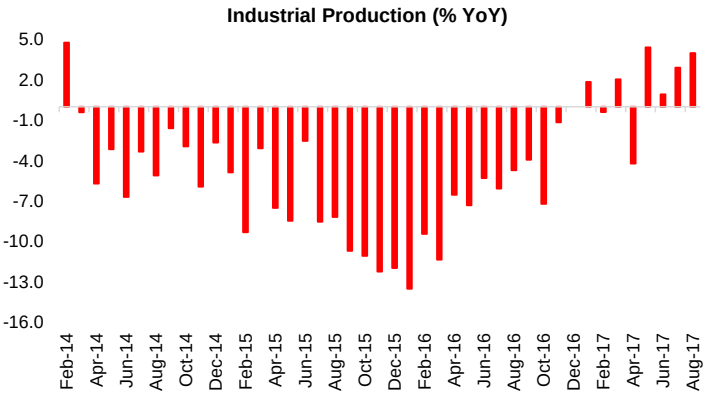
- **Since there seems to be no doubt that the Brazilian economy has resumed growth in 2017, the current economic debate focuses on the pace and sustainability of this ongoing recovery.**
- **To shed further light on this topic, this report attempts to answer the following questions: (i) What is the equilibrium (natural) unemployment rate of the Brazilian economy? (ii) How negative is the current output gap? (iii) When will inflation and monetary policy be affected by economic expansion?**
- **With respect to the first question, by applying a methodological framework that provides a Phillips Curve (trade-off between inflation and unemployment) with time-varying parameters and bounded trends, we calculate the current natural rate of unemployment (or NAIRU, the Non-Accelerating Inflation Rate of Unemployment) at around 9.5%, 3 percentage points below the actual unemployment rate.**
- **With respect to capital stock, capacity utilization rates have been significantly below equilibrium. The dismal performance of the industrial sector over the past few years probably accounted for most of the installed capacity gap, in our view.**
- **By using our own NAIRU and capacity utilization estimates, we have calculated a significant slowdown in the potential output growth since 2011. Accordingly, our base-case scenario points to potential GDP growing slightly below 2% in the next two years, much lower than the average increase experienced over the last decade (which we estimate at +3.2%).**
- **Despite slow potential GDP growth and our more optimistic view on the current pace of the economic recovery (we forecast that Brazil's GDP will grow 0.8% in 2017, 3.2% in 2018 and 3.0% in 2019, while the market expects 0.7%, 2.5% and 2.5%, respectively), we believe that excess capacity in the domestic economy will persist for an extended period. According to our estimates, the output gap (currently at -3.8%) will be closed at the end of 2019.**
- **Therefore, we believe that inflationary pressures from the economic activity (output gap) channel could emerge only from 2020 onward, reinforcing our expectation that interest rates are likely to remain low in the coming years.**
- **However, we would emphasize that other significant concerns continue to weigh on Brazil's economic environment, especially with regard to the structural reform agenda (pension reform plays a major role) and long-term fiscal sustainability. In our opinion, failure on these issues could severely damage the outlook for inflation and monetary policy.**

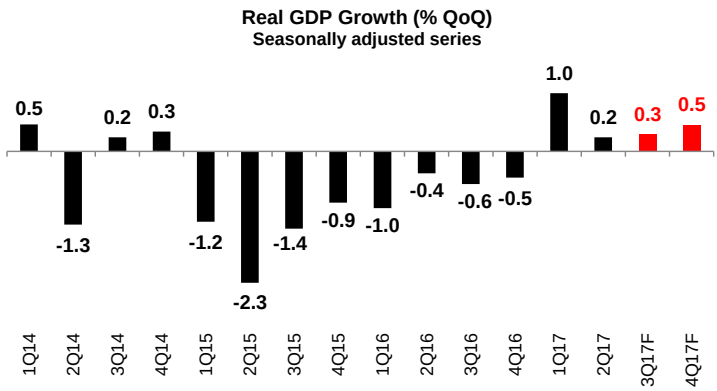
Certainties and Doubts about the Economic Recovery

We have increasingly seen signs that the Brazilian economy has recently resumed growth. Among these signs, we would highlight the (i) upward trend in industrial production and retail sales; (ii) expansion in Brazil's GDP over the first half of this year; and (iii) the unemployment rate peaking a few months ago. Hence, market expectations for Brazilian economic growth this year and next have been revised upward (it is worth noting that our numbers were already on the more optimistic side) and the lively debate at present concerns the pace and sustainability of the ongoing economic recovery.

In short, we have a more optimistic view on the performance of the local economy compared with the market consensus. **We forecast that Brazil's GDP will grow 0.8% in 2017, 3.2% in 2018 and 3.0% in 2019, while the market expects 0.7%, 2.5% and 2.5%, respectively.** In our opinion, the improvement seen in household consumption will be accompanied by a resurgence in investment in the coming year (albeit moderately in the face of their pronounced fall over the last three years), in the wake of the significant reduction in real interest rates, rising business confidence, and some impulse from infrastructure concessions and privatizations programs. For more information about the impact of loosening monetary policy on domestic activity (we have calculated that the benchmark overnight interest rate will reach the lowest level in 60 years in the coming months), please see our October 10 report, *"Coming… The Lowest Interest Rates Ever?"*.



Source: IBGE



Source: IBGE and Santander forecasts

GDP Breakdown - Annual Change (%)						
Components	Weights (%)	2014	2015	2016	2017F	2018F
Total GDP	100.0	**0.5**	**-3.8**	**-3.6**	**0.8**	**3.2**
Agriculture & Livestock	5.6	2.7	3.2	-6.6	11.6	1.5
Industry	21.4	-1.5	-6.3	-3.8	0.2	3.7
Services	73.0	1.0	-2.7	-2.7	0.1	2.9
Household Consumption	63.5	2.3	-3.9	-4.2	0.9	3.4
Government Consumption	20.3	0.8	-1.1	-0.6	-1.5	0.3
Investments	15.7	-4.2	-13.9	-10.2	-2.2	6.0
Exports	12.2	-0.9	6.2	1.9	4.2	2.8
Imports (-)	11.7	-1.9	-14.1	-10.3	3.7	3.6

Source: IBGE and Santander forecasts

Nevertheless, we believe that the more auspicious development of the Brazilian economy will not quickly offset the sharp contraction of activity seen from mid-2014 to end-2016, when per capita GDP tumbled nearly 9.5 percentage points. In other words, **Brazil's GDP has grown far below its potential in recent years, implying substantial spare capacity in the local economy. The record highs hit by the unemployment rate this year and low capacity utilization in industry are the main examples of this. Thus, in our view, the cyclical recovery that the domestic economy has already been experiencing should not put pressure on inflation for a long period**, and this is reflected in current market expectations, which combine an acceleration of economic growth with below-target inflation over the coming years. In fact, in contrast to the recent past, the top risks to inflation in the short term are not related to the economic activity (demand) channel, but rather to the concerns about the progress of the fiscal reform agenda.

Although there seems to be a consensus about that diagnosis, there are different opinions and estimates for the following questions: (i) What is the equilibrium (natural) unemployment rate of the Brazilian economy? (ii) How negative is the output gap (difference between actual GDP and potential GDP) currently? (iii) When will inflation and monetary policy be affected by economic expansion?

While acknowledging the high degree of difficulty in obtaining accurate answers to the questions listed above (especially with regard to the estimation of unobservable economic variables), we present our assessment, opinions and calculations on the subject in this study.

The Natural Rate of Unemployment (NAIRU)

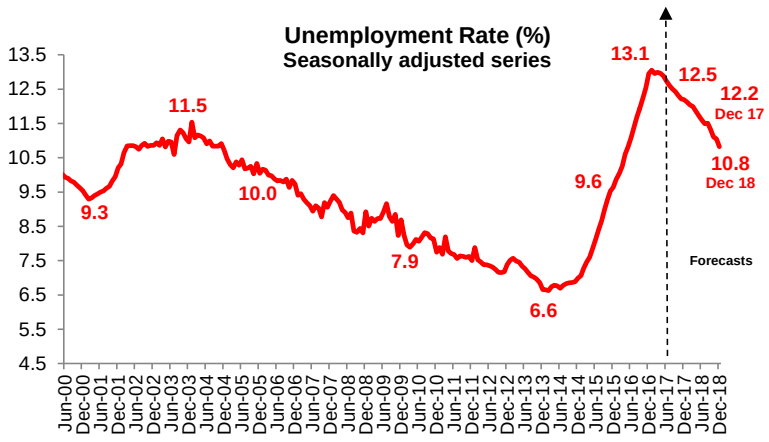
Alban William Phillips pointed out the famous trade-off between inflation and the unemployment rate for the first time in 1958[1]. This relationship, expressed in the economic concept worldwide known as the Phillips Curve, implies the existence of the Non-Accelerating Inflation Rate of Unemployment (NAIRU). In simple terms, NAIRU can be defined as the unemployment rate that is consistent with a stationary (constant) inflation rate. That is, if the unemployment rate remains above NAIRU, inflation is expected to decrease; but if NAIRU is higher than the unemployment rate, the inflation rate is expected to increase. Therefore, the NAIRU is a key variable in the analysis of stages of the business cycle, potential output, inflation forecasting, and monetary policy decisions.

Despite the great relevance of NAIRU, the empirical literature for the Brazilian economy is not vast, which could be partially explained by the changes in official surveys for the local labor market (and their relatively short time series) and by the aforementioned difficult task of estimating unobservable variables.

This report then aims to provide updated estimates for the natural unemployment rate in the Brazilian economy based on the Continuous National Household Sample Survey (PNAD), which currently publishes the official data on the local labor market, on a monthly basis. As presented in our April 8 study, *Deterioration in the Labor Market: The Worst Consequence of the Economic Downturn*, PNAD is considered much more representative of the Brazilian labor market compared to the previous survey (The Monthly Employment Survey – PME), mainly due to its wider coverage and the use of more modern concepts aligned to international patterns[2].

However, the PNAD historical data series began in March 2012, hindering the development of long-term analysis and forecasts. Hence, we estimated the data series of some PNAD variables (unemployment rate, employed population, labor force, average real wage, and aggregate real wages) backward through econometric models, considering the period from early 2000 to early 2012[3].

Using a longer series of the unemployment rate (see below our estimated curve), we applied the framework proposed by Chan, Koop & Potter (2015)[4] that provides a bivariate model for inflation and the unemployment rate (Phillips Curve) with time-varying parameters and bounded trends.



Source: PNAD Contínua (IBGE) and Santander forecasts

With regard to NAIRU (taken as the unobserved trend of the unemployment rate in the model), the adoption of bounds is appropriate for providing a smooth behavior over the sample period, not having the variable toward levels near zero or above rates seen during recessions. Similarly, the adoption of bounds is also consistent with the inflation-targeting regime that guides

[1] Phillips, A.W. (1958) The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957.

[2] PNAD data series cover the entire national territory (around 211,000 households in 3,500 municipalities), while PME's historical data series – which began in 2002 – covered only six metropolitan areas in Brazil, totaling 44,000 households in 142 municipalities.

[3] We used information contained in other Brazilian labor market surveys with longer historical data series, namely: (1) Labor Ministry Register for Employed and Unemployed - (CAGED); (2) SEADE/DIEESE's Employment and Unemployment Report (PED); (3) IBGE's Monthly Employment Survey (PME); and (4) Annual National Household Sample Survey (Annual PNAD).

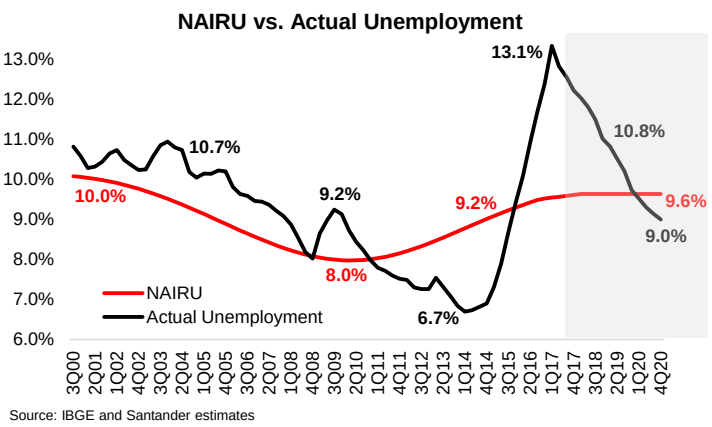
[4] Chan, J.; Koop, G.; Potter, S.M.A. (2015) A Bounded Model of Time Variation in Trend Inflation, Nairu and the Phillips Curve.

the monetary authority, since inflation does not follow an unlimited growth trajectory. The study developed by Palma & Ferreira (2017)[5] is noteworthy, as it first applied the method proposed by Chan, Koop & Potter (2015) to the Brazilian economy – in this case, the sample period ranged from March 2002 to October 2015, and the authors used PME's unemployment rate series, which was discontinued in March 2016. The methodological framework presented in Chan, Koop & Potter (2015) can be found in the *Appendix*.

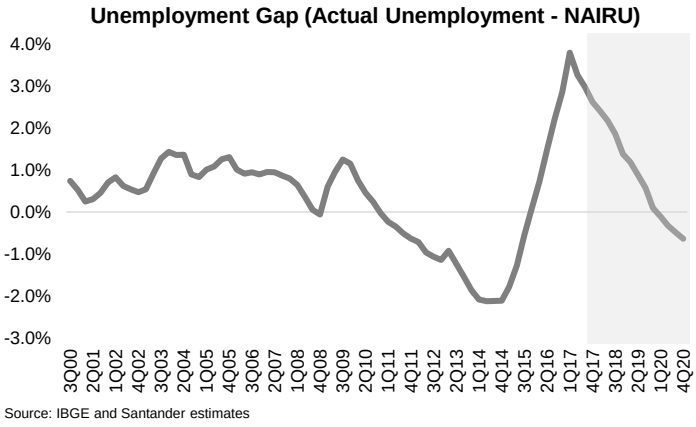
We used the following databases to run the econometric model: Broad National Consumer Price Index (IPCA) and PNAD's unemployment rate (seasonally adjusted series). The Brazilian Institute of Geography and Statistics (IBGE) publishes both series on a monthly basis. Our estimates covered the period from January 2000 to August 2017.

According to our model outcomes, the unemployment gap – the difference between the actual unemployment rate and NAIRU – showed a downward trend from 2004 to 2008. Although that trajectory was interrupted in 2009, the gap remained in positive territory until early 2011, in line with the slowdown in inflation seen in the period. After that, however, NAIRU was higher than the actual unemployment rate, which lasted until the end of 2015 (inflation increased from about 6% to nearly 11% in this time interval). Finally, the unemployment gap has been in positive territory since early 2016, as the unemployed population has skyrocketed (the unemployment rate jumped to 13.1% in 1Q17 from 6.7% in 1Q14, marking the highest and lowest levels of the sample period, respectively). This significant spare capacity in the Brazilian labor market has likely contributed to the widespread decline in domestic inflation in the recent period.

We calculate that NAIRU is currently around 9.5%, 3 percentage points below the actual unemployment rate. In our view, the Brazilian unemployment rate will decline gradually in the coming years, which should not be sufficient to close the labor market gap before 2020.



Source: IBGE and Santander estimates



Source: IBGE and Santander estimates

Output Gap: How Deep Is the Well?

Taking into account the time-varying NAIRU estimates, we now focus our analysis on calculating the Brazilian output gap. We assume that GDP (Y_t) follows a typical Cobb-Douglas production function, $Y_t = A_t(K_t\omega_t)^{1-\alpha}[L_t(1-\mu_t)]^{\alpha}$, where: A_t corresponds to the exogenous technology shock; K_t is the capital stock; ω_t denotes the capacity utilization level; L_t is the labor force; and μ_t is the unemployment rate. Accordingly, the potential output can be expressed as: $Y_t^* = A_t(K_t\omega_t^*)^{1-\alpha}.[L_t(1-\gamma_t^{\mu})]^{\alpha}$, where ω_t^* represents the NAICU (Non-Accelerating Inflation Capacity Utilization) and γ_t^{μ} stands for NAIRU (Non-Accelerating Inflation Rate of Unemployment, as presented before)[6].

In addition to PNAD's unemployment rate (which we estimated backward through the econometric model), we used the following data series to calculate Brazil's potential output: (i) Actual GDP published by IBGE in its Quarterly National Accounts; (ii) Capital Stock estimated by the Institute for Applied Economic Research (IPEA) – it discounts the capital depreciation; (iii) Labor force released by IBGE in its National Household Sample Survey (PNAD) – we estimated it backward (from January 2000 to February 2012) by adopting the same procedure already discussed in this report; and (iv) Capacity utilization rate for the whole economy estimated by IPEA[7]. All these data series were seasonally adjusted and taken on a quarterly basis.

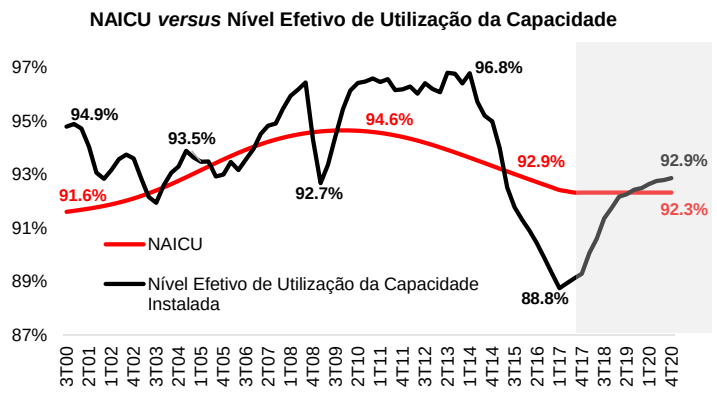
[5] Palma, A.A.; Ferreira, D. (2017) NAIRU, Inflação e Curva de Phillips no Brasil: novas evidências a partir de um modelo tempo-variante.

[6] We assumed $\alpha = 0.65$ (participation of labor in total output) and $(1-\alpha) = 0.35$ (participation of capital in total output).

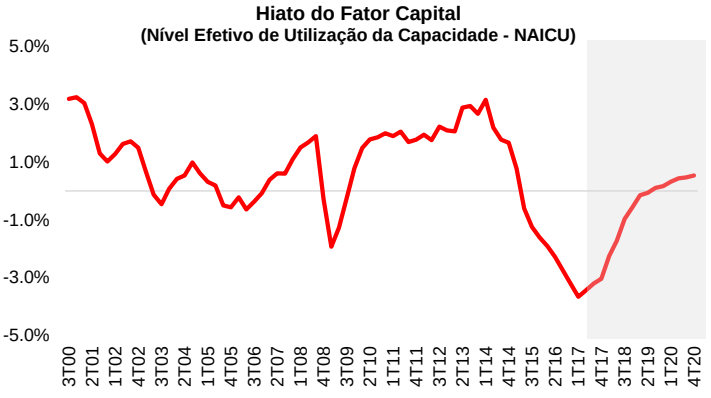
[7] We also performed calculations using the capacity utilization rates in the industrial sector measured by the National Confederation of Industry (CNI) and Fundação Getúlio Vargas. The three data series present similar dynamics and our estimates did not change qualitatively.

Moreover, we applied the Hodrick-Prescott (HP) statistical filter for obtaining the NAICU (natural rate of capacity utilization) estimates. Although we recognize that HP filtering does not have any economic reasoning (i.e., it does not consider any economic structure), its results for NAICU do not seem to substantially diverge from estimates obtained by the use of more complex methodologies. Concerning the NAIRU estimates, nevertheless, the economic literature – for Brazil – tends to present larger differences[8].

As presented in the charts below, capacity utilization rates have been below equilibrium (NAICU) since mid-2014, also contributing to the significant spare capacity in the Brazilian economy. **Industry's dismal performance over the past few years – manufacturing production plunged around 20pp from mid-2013 to end-2016 – likely accounted for most of the installed capacity gap, in our view.** While the recovery in domestic production (especially in industry) has become increasingly consistent, it should not close the capital factor gap anytime soon.



Fonte: FGV e estimativas do Santander

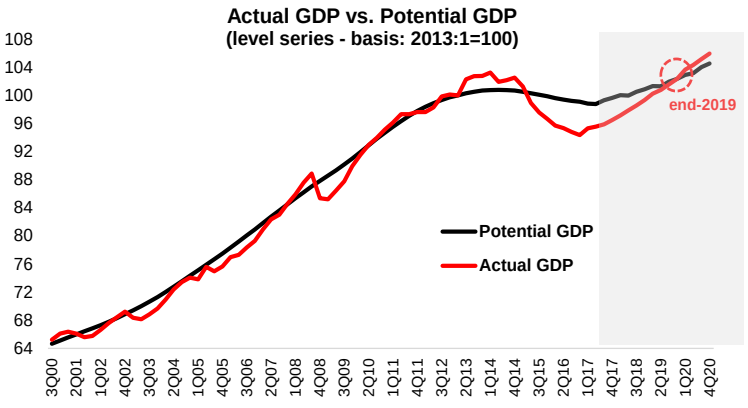


Fonte: FGV e estimativas do Santander

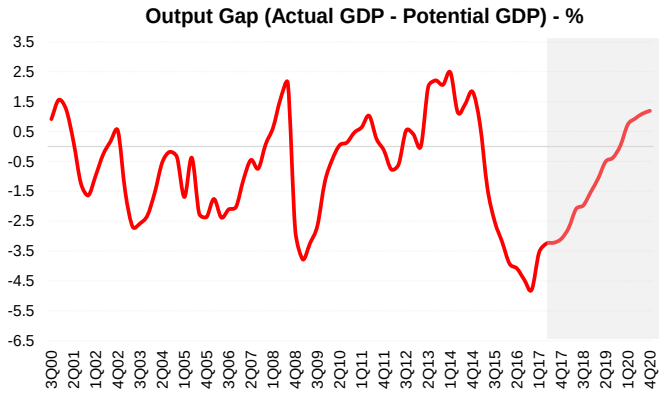
The estimates obtained from the production function revealed a significant slowdown in potential output growth since 2011. All components showed a weaker performance over this period, but we highlight the sharp contraction of total factor productivity, reflecting imbalances in the macroeconomic environment and scarce technological progress.

Our base-case scenario points to Brazilian potential GDP growing slightly below 2% in the next two years, significantly lower than the average increase experienced over the last decade (which we estimate at +3.2%). However, we see plenty of room for improvement in this indicator over a longer time horizon, in the wake of the infrastructure concessions/privatizations programs and microeconomic reform agenda that have been implemented in the Brazilian economy. In our opinion, potential output growth could be nearly 3.0% within three or four years.

Despite slow growth in potential GDP and our more optimistic view on the pace of economic recovery, excess capacity in the domestic economy should persist for an extended period. According to our estimates, output gap (currently at -3.8%) will be closed at the end of 2019.



Source: IBGE, FGV, IPEA and Santander estimates



Source: IBGE, FGV, IPEA and Santander estimates

[8] For example, we highlight the results presented in Alves, S.A.L.; Correa, A.S. (2014) A Tale of Three Gaps: Unemployment, Capacity Utilization and Output.

Therefore, we believe that inflationary pressures from the economic activity (output gap) channel could emerge only from 2020 onward, reinforcing our expectation that interest rates are likely to remain low in the coming years. (For more information, please see our October 10 report *Coming…The Lowest Interest Rates Ever?).*

However, we would emphasize that other major concerns continue to weigh on the Brazilian economic environment, especially with regard to the structural reform agenda (pension reform plays a major role) and long-term fiscal sustainability. In our opinion, failure on these issues could severely damage the outlook for inflation and monetary policy.

Appendix

Econometric Model: Phillips Curve with time-varying parameters and bounded trends

$$(\pi_t - \gamma_t^{\pi}) = \theta_t^{\pi}(\pi_{t-1} - \gamma_{t-1}^{\pi}) + \beta_t(\mu_t - \gamma_t^{\mu}) + \varepsilon_t^{\pi} \quad (1)$$

$$(\mu_t - \gamma_t^{\mu}) = \alpha_1^{\mu}(\mu_{t-1} - \gamma_{t-1}^{\mu}) + \alpha_2^{\mu}(\mu_{t-2} - \gamma_{t-2}^{\mu}) + \varepsilon_t^{\mu} \quad (2)$$

$$\gamma_t^{\pi} = \gamma_{t-1}^{\pi} + \varepsilon_t^{\gamma\pi} \quad (3)$$

$$\gamma_t^{\mu} = \gamma_{t-1}^{\mu} + \varepsilon_t^{\gamma\mu} \quad (4)$$

$$\theta_t^{\pi} = \theta_{t-1}^{\pi} + \varepsilon_t^{\theta\pi} \quad (5)$$

$$\beta_t = \beta_{t-1} + \varepsilon_t^{\beta} \quad (6)$$

$$\varepsilon_t^{\pi} \sim N(0, e^{h_t}) \quad (7)$$

$$h_t = h_{t-1} + \varepsilon_t^{h} \quad (8)$$

$$\varepsilon_t^{h} \sim N(0, \sigma_h^2) \quad (9)$$

$$\varepsilon_t^{\mu} \sim N(0, \sigma_{\mu}^2) \quad (10)$$

$$\varepsilon_t^{\gamma\pi} \sim TN(a_{\pi} - \gamma_{t-1}^{\pi}, b_{\pi} - \gamma_{t-1}^{\pi}; 0, \sigma_{\gamma\pi}^2) \quad (11)$$

$$\varepsilon_t^{\gamma\mu} \sim TN(a_{\mu} - \gamma_{t-1}^{\mu}, b_{\mu} - \gamma_{t-1}^{\mu}; 0, \sigma_{\gamma\mu}^2) \quad (12)$$

$$\varepsilon_t^{\theta\pi} \sim TN(-\theta_{t-1}^{\pi}, 1 - \theta_{t-1}^{\pi}; 0, \sigma_{\theta\pi}^2) \quad (13)$$

$$\varepsilon_t^{\beta} \sim TN(-1 - \beta_{t-1}, 0 - \beta_{t-1}; 0, \sigma_{\beta}^2) \quad (14)$$

Equation (1) refers to the Phillips Curve, which relates inflation (π_t) to the unemployment rate (μ_t). In this equation, the inflation trend (γ_t^{π}) could mean the implicit inflation target of the Central Bank or market inflation expectations. Furthermore, it is worth noting that both AR(1) and slope parameters (θ^{π}, β, respectively) are time varying, being determined by a random walk process [Equations (5) and (6)].

Equation (2) presents an AR(2) process for the unemployment rate gap, with time-invariant parameters (α_1^{μ} and α_2^{μ}). The variable γ_t^{μ} represents the NAIRU, the most important component in the estimation process of our study. In fact, the four main latent variables (or states) of the methodological approach are: (i) γ_t^{π} (inflation trend); (ii) γ_t^{μ} (NAIRU); (iii) θ_t^{π} (inflation inertia); and (iv) β_t (Phillips Curve slope).

The model defines the errors as independent and uncorrelated, except with regard to the equation for inflation (1), since its error term shows stochastic volatility [as described by the Equations (7), (8) and (9)].

Finally, as shown in Equations (11), (12), (13) and (14), we adopt a truncated Normal distribution for the errors of the latent variables. The notation $TN(a, b; \mu, \sigma^2)$ corresponds to the Normal distribution with mean μ and variance σ^2, truncated in the interval (a, b).

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