The Natural Rate of Unemployment in Brazil

Among the variables closely followed by central banks, those aimed at measuring the degree of slackness of the economy are, in principle, valuable leading inflation indicators. In the set of such indicators, the natural rate of unemployment or, more precisely, the unemployment gap – which seeks to measure how tight the labor market is – is a very important one. It should be noted that, besides its intrinsic relevance, the natural rate of unemployment is a key factor in the estimation of the potential output of the economy.

In spite of its great theoretical and practical importance, there are considerable difficulties in estimating the natural rate of unemployment. On the one hand, because it is an unobservable variable, it is usually estimated with great imprecision (see Staiger et al., 1996). On the other hand, there is no consensus among economists about its meaning and, therefore, about the best estimation strategy. Despite those obstacles, this box, largely based on da Silva Filho (2008a, b), discusses estimation methods of the natural rate of unemployment, as well as presents some results for the Brazilian economy.

The natural rate of unemployment concept was concomitantly developed by Friedman (1968) and Phelps (1968). Despite the fact that the inflation rate had not been explicitly mentioned in the definition of the natural rate of unemployment proposed by Friedman – which highlights its structural

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1/ In order to have an idea of the degree of uncertainty involved in the natural rate of unemployment estimates, it is worth mentioning the confidence intervals found by Staiger et al. (1996) for the U.S. They estimated that the 95% confidence interval for the Nairu, in 1994, reached almost four percentage points (3.9%–7.6%). Moreover, the intervals found in the literature (including Staiger et al.’s) are based on parameter uncertainty only. Should model uncertainty also be taken into consideration they would be much larger.

2/ Phelps (1968) named it the steady state unemployment equilibrium rate.
determinants – it could be inferred from it that when real wages (adjusted by productivity) are changing the labor market cannot be in equilibrium. In fact, the link between the (natural) rate of unemployment and the inflation rate were emphasized by Friedman while arguing that, in the long run, the Phillips curve is vertical, although there is a trade-off between inflation and unemployment in the short run. In this way, while the Philips Curve emphasizes the role of nominal wage rigidity and inflation expectations, the above definition highlights the structural – essentially microeconomic – determinants of the natural rate of unemployment. According to the economic theory, among the factors that affect the natural rate of unemployment, demographic and legal variables stand out. For example, as the labor force composition changes, it is likely that the natural rate of unemployment will also change, since the groups that comprise it are not homogeneous. The natural rate may also reflect changes in labor legislation, for example, in laws regulating the cost of hiring and firing, unemployment insurance and minimum wage.

A variety of methods have been used to estimate the natural rate of unemployment, and they can be divided into three groups: structural methods, which seeks to model explicitly the determinants of demand and supply of labor; reduced form methods, which model directly – in one equation (in general the Philips Curve) – the link between inflation and unemployment; univariate methods, which only uses the information contained in the unemployment rate to determine its natural rate. Among them the so-called univariate filters stand out, especially the Hodrick-Prescott (HP) filter.

The most used multivariate method to estimate the natural rate of unemployment is the Philips Curve (PC), which relates directly inflation to the unemployment gap.³ This framework, besides representing a very interesting alternative between a-theoretical methods – such as the univariate methods – and structural methods, is quite flexible.

³ Some economists argue that this method does not estimate the natural rate of unemployment (e.g. Tobin, 1998), but rather the Nairu (non accelerating inflation rate of unemployment). However, given that several economists consider both terms as being synonyms, here they are used interchangeably. For more details on this debate, see da Silva Filho (2008b).
In fact, in its general specification, the Philips Curve can be defined as:

\[ \Delta \pi_t = \alpha(L) \Delta \pi_{t-1} + \beta(L)(u_t - u^\alpha_t) + \gamma(L) x_t + \epsilon_t, \quad \epsilon_t \sim \text{NID}(0, \sigma^2_{\epsilon}) \]

Where \( \alpha(L) \), \( \beta(L) \) and \( \gamma(L) \) are lag polynomials, \( \pi_t = \Delta \ln IPCA \) is the inflation rate, \( u_t \) is the (seasonally adjusted) unemployment rate, \( u^\alpha_t \) is the natural rate of unemployment (unobservable, and possibly time-varying) and \( x_t \) is the vector of other inflation determinants, among which supply shocks are an essential part.

Note that equation (1) implicitly assumes a vertical Philips Curve in the long-run and random-walk expectations (i.e. \( \pi_t = \pi_{t-1} \)). A particular case of interest is that when the natural rate is assumed to be constant along the sample, so that equation (1) can be rewritten as:

\[ \Delta \pi_t = c + \tilde{\alpha}(L) \Delta \pi_{t-1} + \tilde{\alpha}(L) u_t + \tilde{\alpha}(L) x_t + \epsilon_t \]

In equation (2) the natural rate can be estimated by ordinary least squares (OLS) and equals the ratio between the constant and the sum of coefficients attached to the unemployment lags.

\[ \bar{\alpha} = \frac{c}{\tilde{\beta}(1)} \]

As mentioned above, an attractive feature of the Philips Curve framework is its flexibility. Indeed, it can be used, for example, along with the unobservable components (UC) method, when one wants to allow for the possibility of a time-varying natural rate. In this case, instead of carrying out a non-linear estimation in (1), one can express the model in the space-state format and estimate it by maximum likelihood, using the Kalman Filter. An advantage of this framework is that it allows for the possibility of a time-varying natural rate without the need of specifying what is behind such changes (i.e. its determinants). Nevertheless, one needs to specify a statistical model for the natural rate.

A widely used assumption is that the natural rate behaves like a random walk, according to which the best prediction for period \( t + 1 \) is the rate observed in period \( t \). Equations (4) and (5) illustrate this approach using the random walk hypothesis. It should be noted
that \( \text{var}(\xi_t) = 0 \), so that model (4)–(5) reduces to the model (2)–(3).

\[
\Delta \pi_t = \alpha(L) \Delta \pi_{t-1} + \beta(L)(u_t - n_t) + \gamma(L)x_t + \epsilon_t, \quad \epsilon_t \sim \text{NID}(0, \sigma^2_{\epsilon})
\]

\[
u_t^n = \pi_t^n + \xi_t, \quad \xi_t \sim \text{NID}(0, \sigma^2_{\xi}) , \quad E(\epsilon_t, \xi_t) = 0
\]

Figure 1 shows how the quarterly unemployment rate evolved in Brazil in the 1985.1-2007.4 period.\(^4\) The sharp rise in unemployment during that period is noteworthy, as well as the fact that it stood at high levels since the second half of 1990. However, note that the long upward trend was broken at some point between 2006 and 2007 and, since then, the unemployment rate has been showing a downward trend. It is essential, therefore, to have some estimate of where the natural rate of unemployment in Brazil stands now.

Figure 2 shows preliminary evidence on the relation between inflation and unemployment in Brazil, in the 1986-2006 period.\(^5\) Some points deserve attention. First, although the regression line shows a negative slope, that slope is not statistically significant. Second, this exercise suggests that the natural rate probably lie around 7.4%. Third, the large dispersion around the regression line reflects the great uncertainty behind that estimate. Indeed, when the year of 1994 – a year when inflation was sharply reduced due to the Real Plan – is discarded the estimate jumps to 9.9%.

Finally, as Figure 3 indicates, when the sample is divided in two sub-periods, a structural break in the link between inflation and unemployment after the Real Plan is revealed. In the first period (1986-1995) not only the regression line remains negatively sloped, but the slope is more statistically significant. On the other hand, in the second period (1996-2006), the slope becomes positive. This change suggests that in the last period there was an incidence of large supply shocks in the Brazilian economy. Building on that evidence – and constructing various supply shock proxies – da Silva Filho (2008) estimates the natural

\(^4\) The plotted series extrapolates backward the actual PME series. For more details about its construction see da Silva Filho (2008a). The series shown in the Figure 1 is not seasonally adjusted, while the one used in estimation was seasonally adjusted using the Kalman Filter.

\(^5\) The vertical axis refers to annual changes in inflation – measured by the IPCA – while the horizontal axis refers to the unemployment series lagged one period.
rate of unemployment for Brazil – for the second period only – using a Phillips Curve framework. The point estimates vary from 7.5% to 8.5%, values well below the unemployment average for the period under analysis and estimates using the HP Filter.6

References


_____. (2008b). The Natural Rate of Unemployment in Brazil, Chile, Colombia and Venezuela: Some Results and Challenges. CEMLA (to be published).


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6/ Note that even using the Kalman Filter – models (4) and (5) above – the evidence was favorable to a constant NAIRU during the analyzed period.