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Current unemployment variance decomposition and consequences of using proxies

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CONTENTS

ABSTRACT

We offer a decomposition for the variance of the current unemployment rate that not only measures the contributions of labor market flows but also of the approximation error embedded in other decompositions that use surrogates for the current rate. Using data for the United States and Brazil, the results for the latter show significant differences in the flows' contributions and non-negligible distortions of approximation errors when the variance of the current (instead of the proxy) rate is decomposed; for the U.S., no substantial changes are detected.

Keywords: unemployment; labor market flows; decomposition.

SINOPSE

Decompor a variância da taxa de desemprego para medir a contribuição de cada fluxo do mercado de trabalho já se tornou uma prática recorrente na literatura especializada na análise dos ajustes do mercado de trabalho ao ciclo econômico. No entanto, a grande maioria dos estudos com esse propósito aproxima a variância da taxa de desemprego pela variância de uma *proxy* para a taxa de desemprego; em geral, a taxa de desemprego do estado estacionário. Neste texto, propõe-se uma decomposição para a variância da taxa de desemprego de fato, que, além de medir a contribuição de cada fluxo do mercado de trabalho, traz também uma medida da importância do erro de aproximação que se incorreria ao usar uma *proxy* em vez da própria taxa de desemprego. O procedimento é ilustrado usando dados para o Brasil e para os Estados Unidos. Os resultados sugerem que, para o Brasil, a importância do erro de aproximação não é desprezível e que a importância relativa de alguns fluxos muda consideravelmente quando se usa a variância da taxa de desemprego ou alguma das *proxies* para essa variável utilizadas na literatura. Por sua vez, os resultados para os Estados Unidos são bem menos afetados pelo uso das mesmas *proxies* consideradas.

Palavras-chave: desemprego; fluxos no marcado de trabalho; decomposição de variância.

1 INTRODUCTION

Shimer (2012) proposes an influential decomposition framework to measure the contributions of labor market flows to explain the fluctuations of the unemployment rate. A key feature of his framework is the use of the steady-state unemployment rate (u_t^*) as a proxy for the current rate (u_t). This is very convenient since u_t^* can be defined as a function only of the current labor market flows.

However, as pointed out by Elsby, Hobijn and Sahin (2013), while the use of u_t^* as proxy for u_t is a reasonable choice for the United States – a country known for its flexible labor market – it may not represent an accurate description of the current rate for countries with slower labor market dynamics. This limitation has motivated the development of alternative methodologies in the literature (Smith, 2011; Elsby, Hobijn and Sahin, 2013; Ahn and Hamilton, 2020; Moreira, Foguel and Corseuil, 2021).

In this article we propose to decompose the variance of the *current* unemployment rate as a function of the labor market flows and an additional element that captures the contribution of using proxies for the current rate. Apart from decomposing directly the variance of the current rate, one of the virtues of the proposed method is to unveil the adequacy of the chosen proxy for the variance decomposition of the actual rate.

We apply the proposed decomposition for a three-state labor market (unemployment, employment, and inactivity) using data from the U.S. and Brazil. The results show that, while there is no significant change for the U.S., for Brazil: i) the contributions of some labor market flows vary substantially when the current rate decomposition is used; and ii) the approximation error from using proxies is quite sizeable.

2 METHODOLOGY

2.1 Variance decomposition for the steady-state unemployment rate

Using the steady-state unemployment rate (u_t^*) as a proxy for the current unemployment rate (u_t), Shimer (2012)'s decomposition involves applying a first-order expansion to u_t^* around its sample average:[1]

$$u_t^* \cong \kappa^* + \sum_{i \neq j}[u_{ijt}^* - \kappa^*], \tag{1}$$

where κ^* is a constant and each u_{ijt}^* represents a transformation on the steady-state rate when all components of the transition matrix across the labor market states are held fixed except for the off-diagonal component "i, j". From expression (1) one can obtain the following variance decomposition of the steady-state unemployment rate:

$$\frac{V(u_t^*)}{V(u_t^*)} = 1 \cong \sum_{i \neq j} \frac{cov\langle u_t^*, u_{ijt}^* \rangle}{V(u_t^*)} = \sum_{i \neq j} \beta_{ij}^*, \tag{2}$$

where β_{ij}^* captures the contribution of the transition between state i to state $j \neq i$ to the variance of u_t^*.[2]

It is important to note that the quality of u_t^* as a proxy for u_t plays no role in this decomposition. This implies that this decomposition may point to some flows as important drivers of the steady-state unemployment dynamics when in fact the same flows are much less relevant to explain the actual unemployment rate dynamics.

2.2 Variance decomposition for the current unemployment rate

Shimer (2012)'s framework can be easily modified to deliver a decomposition of the current unemployment rate. Adding u_t on both sides of expression (1), it can be rewritten as:

1. See Moreira, Foguel and Corseuil (2021) for the details of the derivation.

2. As it is well known, the contributions of the components of the decompositions can be obtained by regressing the time series of each component against the time series of the unemployment rate of interest.

$$u_t \cong \kappa^* + \sum_{i \neq j}[u^*_{ijt} - \kappa^*] + (u_t - u^*_t), \quad (3)$$

where the last term in the right-hand side captures the deviation between the current and the steady-state unemployment rates. Expression (4) below spells out the associated variance decomposition:

$$\frac{V(u_t)}{V(u_t)} = 1 \cong \{\sum_{i \neq j} \frac{cov\langle u_t, u^*_{ijt}\rangle}{V(u_t)}\} + \frac{cov\langle u_t, (u_t - u^*_t)\rangle}{V(u_t)} = \sum_{i \neq j} \gamma^*_{ij} + \gamma^*_p. \quad (4)$$

Note that, differently from β^*_{ij} in expression (2), γ^*_{ij} measures the relative importance of each labor market flow to the variance of the current rate. The last term in the right-hand side, γ^*_p, is an additional term that captures the contribution of the steady-state approximation error to the variance decomposition of the actual rate.

2.3 Empirical application

Empirical results of the decomposition methods described in the subsections 2.1 and 2.2 were obtained for the United States and Brazil. For the former country, we use the monthly gross flow data from the Current Population Survey (CPS) released by the Bureau of Labor Statistics for the period from January 1990 to December 2015. For the latter country, we compute the monthly gross flows from February 2003 to January 2016 using data from the Pesquisa Mensal de Emprego (PME), a monthly household survey whose sampling design is similar to that of the CPS and which was conducted by the Instituto Brasileiro de Geografia e Estatística (IBGE, the Brazilian Census Bureau) in the six major metropolitan areas in the country. The monthly gross flow data for each country were subjected to standard filters following Shimer (2012).[3]

Table 1 reports the decomposition results for Brazil (left panel) and the U.S. (right panel). In the first two columns for each country we report the contribution of each labor market flow (indicated in the first six rows) to explain the variance of the current and the steady-state unemployment rates respectively. The last column for each country reports the p-value for the hypothesis of equality of contributions between the two decompositions for each flow.

3. First, the monthly series were seasonally adjusted using the US Census Bureau's X13 software. Second, we take the quarterly averages of the resulting monthly series. The last step was to detrend the quarterly data through the HP filter with the same smoothing parameter used by Shimer (2012), 105.

The last row exhibits the contribution of the steady-state approximation error and the associated p-value for its statistical significance (first and third columns for each country).

TABLE 1
Decomposition estimates for the current and the steady-state unemployment rates

	Brazil			United States		
	γ_{ij}	β_{ij}	p-value	γ_{ij}	β_{ij}	p-value
ie	0.04	0.03	0.45	0.08	0.09	0.47
ue	0.08	0.04	0.18	0.34	0.35	0.07
iu	0.39	0.35	0.06	0.19	0.19	0.41
eu	0.46	0.36	0.05	0.24	0.26	0.08
ui	0.09	0.03	0.10	0.11	0.11	0.37
ei	0.13	0.12	0.41	-0.05	-0.05	0.37
γ_p	-0.26	-	0.01	0.04	-	0.02

Sources: *Pesquisa Mensal do Emprego* for Brazil; and Current Population Survey for USA.
Obs.: γ_{ij} and β_{ij} refer to the contribution of the flow from state i to state j respectively for the current and steady-state decompositions methods; γ_p is the contribution of the steady-state approximation error to the current unemployment rate. The p-values refer to the tests: $\gamma_{ij} = \beta_{ij}$ (first six rows) and $\gamma_p = 0$ (last row). The letters (u,e,i) correspond respectively to the states of (unemployment, employment, inactivity).

The first point to note is that the estimates for the contributions of some flows are quite distinct for Brazil when the current rate decomposition is used instead of the steady-state one. For instance, considering only the comparisons that are statistically significant (at the 10% level), there are substantial changes in the contributions of three transitions: employment to unemployment (eu), inactivity to unemployment (iu), and unemployment to inactivity (ui), the latter even changing its ranking from the lowest contributor to the variance of the steady-state rate to the fourth most important in the decomposition of the current rate. In the case of the U.S., though there are two changes in contributions that are statistically significant (at the 10% level) – specifically the ue and the eu transitions –, the difference for any given flow does not surpass 2 percentage points.

The lower sensitivity of the contributions of the labor market flows in the U.S. relatively to Brazil may reflect a better quality of the proxy based on the steady-state rate for the former country than for the latter. This is confirmed in the last row of table 1: the estimates, which are statistically different from zero at the 5% level for both countries, point to a contribution of

the steady-state approximation error of -0.26 for Brazil and 0.04 for the U.S.[4] These numbers indicate that while for the U.S. good approximations of the contributions of labor market flows can be attained using the variance decomposition of steady-state unemployment, the same cannot be said for the case of Brazil.

3 EXTENSIONS TO OTHER PROXIES FOR CURRENT UNEMPLOYMENT

Moreira, Foguel and Corseuil (2021) departure from the same Markovian representation of the labor market as in Shimer (2012) and demonstrate that a variance decomposition can be performed for any chosen projected unemployment rate, denoted u_{t+h}, $h = 1,2$. Analogous to the steady-state context, the contribution of each component to the variance of u_{t+h} can be calculated from:

$$\frac{V(u_{t+h})}{V(u_{t+h})} = 1 \cong \frac{cov\langle u_{t+h}, u_{0t+h}\rangle}{V(u_{t+h})} + \sum_{i\neq j} \frac{cov\langle u_{t+h}, u_{ijt+h}\rangle}{V(u_{t+h})} = \beta_0^h + \sum_{i\neq j} \beta_{ij}^h, \quad (5)$$

where β_0^h captures the contribution of the initial conditions and β_{ij}^h the contribution of the transition from state i to state $j \neq i$ for time horizons $h = 1,2$. In fact, the variance decomposition for the steady-state unemployment rate corresponds to the particular case when $h \to \infty$.

Moreira, Foguel and Corseuil (2021) implemented this variance decomposition for many different time horizons using data from the U.S. and Brazil. They report that the relative importance of some labor market flows can change substantially according to the time horizon of the projected rate.

Analogous to (3), one can depart from an expression for u_{t+h} to derive an expression for the current rate:

$$u_t \cong \kappa_h + u_{0t+h} + \sum_{i\neq j}[u_{ijt+h} - \kappa_h] + (u_t - u_{ijt+h}),\ h = 1,2,\ldots. \quad (6)$$

4. As shown in expressions (2) and (4), the sum of all contributions must be the same in both specifications. So, a higher magnitude of γ_p should be compensated by higher differences for the contribution of at least one labor market flow across the two specifications considered in table 1. That is why we use changes in rank to highlight these differences for Brazil, as opposed to compare estimated values of such contributions across specifications.

The corresponding variance decomposition for the current rate is given by:

$$\frac{V(u_t)}{V(u_t)} = 1 \cong \frac{cov\langle u_t, u_{0t+h}\rangle}{V(u_t)} + \{\sum_{i\neq j} \frac{cov\langle u_t, u_{ijt+h}\rangle}{V(u_t)}\} + \frac{cov\langle u_t, (u_t - u_{ijt+h})\rangle}{V(u_t)} = \gamma_0^h + \sum_{i\neq j} \gamma_{ij}^h + \gamma_p^h, \quad (7)$$

$h = 1,2, \ldots,$

where γ_0^h captures the contribution of the initial conditions and γ_{ij}^h measures the contribution of the transition from state i to state $j \neq i$. The term γ_p^h quantifies the approximation error from using the projected rate as a proxy for the current rate.

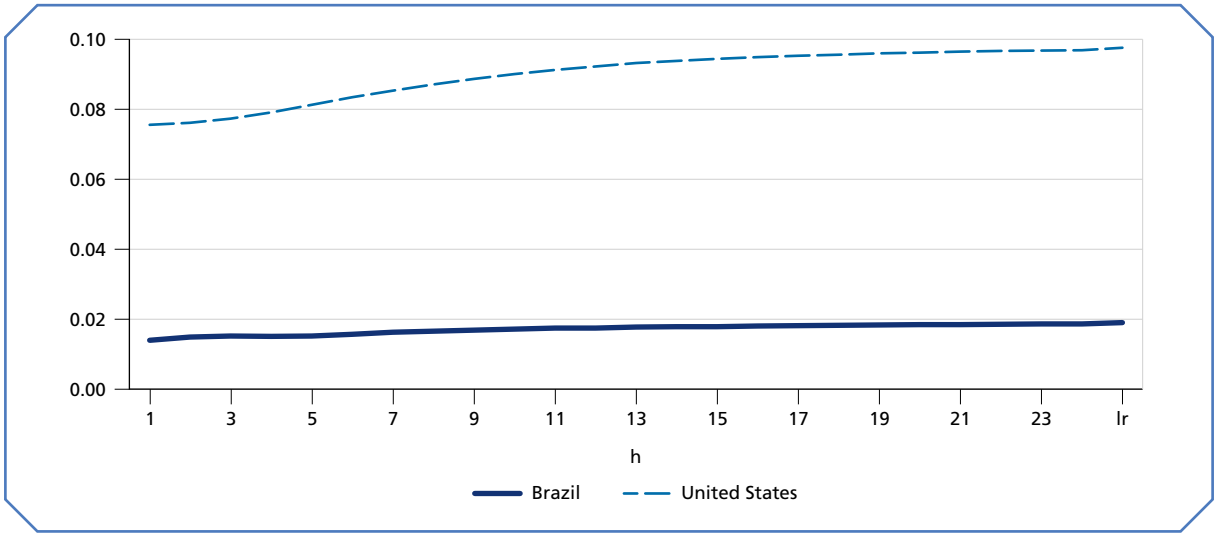
One can check how much proxying the actual rate by the projected rate distorts the relative importance of each labor market flow to the variance of the actual rate. This can be done by comparing the estimated contribution of a particular flow for the variance of the projected rate – the β_{ij}^h in expression (5) – with the estimated contribution of the same flow for the variance of the current rate – the γ_{ij}^h in expression (7).

Using the same data described in subsection 2.3 for the U.S. and Brazil, we implement this comparison for each of the six labor market flows for various time horizons, including the long-run one (i.e., for large h). As these comparisons convey too many figures, we simplify the exposition by displaying only the estimated contribution of the flow whose difference (in absolute value) between β_{ij}^h and γ_{ij}^h is the largest for each h. The results, which are displayed in graph 1, reveal an important difference between the two countries. While the maximum difference is never greater than 2 percentage points (pp) for the U.S., it is always greater than 7 pp for Brazil and can reach as much as 10 pp.[5]

5. It is worth mentioning that the contributions of the initial conditions (β_0^h and γ_0^h) decline monotonically with h. All results presented in this subsection are normalized with respect to β_0^h and γ_0^h. Results without the normalization exhibit the same pattern. Full results are presented in an online Appendix.

GRAPH 1

Maximal difference between the projected and the current unemployment rate decompositions among the contributions of the flow rates for different time horizons

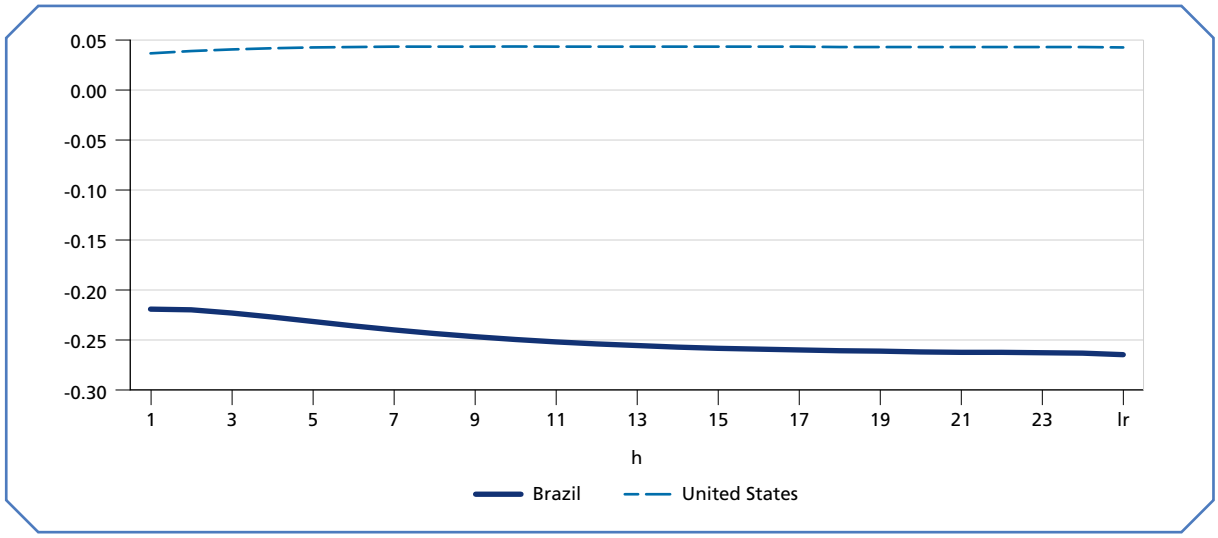


Sources: *Pesquisa Mensal do Emprego* for Brazil; and Current Population Survey for USA.
Obs.: Time horizon measured in quarters. The last point in the horizontal axis (lr) corresponds to the steady-state (large *h*).

From the estimates of one can evaluate the relevance of the approximation error in explaining the variance of unemployment across distinct time horizons. The estimates, shown in graph 2, reveal two interesting results. First, the contribution of the approximation error is much lower (in absolute value) for the U.S. than for Brazil. We had seen in the last row of table 1 that this was the case when using steady-state unemployment as a proxy for the unemployment rate. Graph 2 reveals that this is not a peculiar result for the proxy based on steady-state unemployment.

Second, the contribution of the approximation error tends to be smaller (in absolute value) in the shorter than in the longer run for both countries. This indicates that among all proxies considered, the steady-state unemployment rate may be the one whose approximation error tends to distort the most the variance decomposition of the actual rate.

GRAPH 2
Estimates of the approximation error for different time horizons



Sources: *Pesquisa Mensal do Emprego* for Brazil; and Current Population Survey for USA.
Obs.: Time horizon measured in quarters. The last point in the horizontal axis (lr) corresponds to the steady-state (large *h*).

REFERENCES

AHN, H. J.; HAMILTON, J. D. Heterogeneity and unemployment dynamics. **Journal of Business and Economic Statistics**, v. 38, n. 3, p. 554-569, 2020.

ELSBY, M. W. L.; HOBIJN, B.; SAHIN, A. Unemployment dynamics in the OECD. **The Review of Economics and Statistics**, v. 95, n. 2, p. 530-548, 2013.

MOREIRA, A.; FOGUEL, M. N.; CORSEUIL, C. H. The ins and outs of unemployment over different time horizons. **Empirical Economics**, v. 60, n. 5, p. 2533-2556, 2021.

SHIMER, R. Reassessing the ins and outs of unemployment. **Review of Economic Dynamics**, v. 15, n. 2, p. 127-148, 2012.

SMITH, J. C. The ins and outs of UK unemployment. **The Economic Journal**, v. 121, n. 552, p. 402-444, 2011.

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