Latin American natural rates of interest

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Abstract

This paper estimates the natural rate of interest for the six biggest Latin American economies. Considering the fact that money velocity is the permanent component of the nominal interest rate, both the nominal and real natural rates are estimated simply by running an OLS regression. It is evidenced a downward trend in the real natural rate since the 2010s, comparable with relative stagnation suffered by the region once the favorable conditions of the 2000s commodity boom were over. This result has direct implications for the monetary stance evaluation in the region, which are further analyzed in this work.

Keywords: Natural rate of interest; money velocity; Latin America.

JEL Classification Code: E58, N16.

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"There is a certain rate of interest which is neutral in respect to commodity prices, and tends neither to raise nor to lower them. It comes to much the same thing to describe it as the natural rate of interest"(Wicksell, 1898)

1 Introduction

The natural rate of interest has been in the center stage of policy discussions since the outbreak of the Great Recession in 2008 and the ulterior release of the Quantitative Easing in developed economies. Because of the secular stagnation and the Zero Lower Bound, monetary policy has been designed focusing on the real natural interest rate, which has been often negative. As for Latin America, the success in economic performance during the 2000s commodity boom, has been followed by low potential growth. Even more, the beginning of the 2020s with global tensions due to the pandemic and the Ukranian War, have further eroded economic perspectives in the region. Under these circumstances, an estimation of the Latin American natural rates of interest is of utmost importance in order to properly assess the monetary stance. Nevertheless, there are practically no works that discuss this, to my true knowledge[1].

In this paper, I use the novel methodology of Benati (2020, 2021) to estimate the natural rate for the six biggest Latin American economies: Argentina, Brazil, Chile, Colombia, Mexico and Peru. Benati (2020) builds on the fact that, under monetary regimes that make inflation stationary, money velocity, expressed as the ratio of nominal GDP over nominal M1, is the permanent component of the nominal short term interest rate. Henceforth, it is possible to estimate the nominal natural rate running an OLS of the latter over the former variable and, then, recover the real natural rate by subtracting mean inflation from it. Benati (2020) inspires in the case that velocity is the inverse of money demand as a fraction of GDP which, at the same time, only reacts to permanent shocks to the interest rate. Although this thought was already present in Hicks (1935), it was somehow sidestepped in modern monetary theory.

This approach is conceptually related to that of Cochrane (1994) who, following Friedman (1957)'s permanent income hypothesis, identifies consumption as the output trend. In other words, while Cochrane (1994) builds on the case that consumption is the I(1) component of output to obtain potential output and the output gap, Benati (2021) relies

[1]Most of the few works available are country specific estimates. These are Castillo et al. (2006); Fuentes and Gredig (2007); González et al. (2010) and Carrillo et al. (2018) for Peru, Chile, Colombia and Mexico, respectively. The only work I am aware of for a set of countries in Latin America is Gómez-Pineda (2019), who estimates the natural rate for Brazil, Chile, Colombia, Mexico and Peru following the model of Laubach and Williams (2003). His results are not too different from the ones presented here.

on M1 velocity as the low frequency component of the short-term interest rate to obtain the natural rate.

Compared to the traditional approach of Laubach and Williams (2003), who estimate jointly the natural rate of interest and trend output growth from a semi-structural model with the Kalman filter, or the fully structural DSGE model of DelNegro et al. (2017), the main advantage of Benati (2020)'s methodology is its simplicity, which allows to cover from any potential model misspecification that might exist.

The main results of this manuscript can be summarized as follows: (*i*) it is evidenced that money velocity generally stands as the stochastic trend of the short-term rate; (*ii*) the estimated nominal natural rate does indeed behave as the permanent (low-frequency) component of the short-term nominal rate; (*iii*) there is a negative correlation between nominal interest rates and aggregate activity, which endorses the existence of a Phillips Curve trade-off for most countries; (*iv*) the estimated real natural rate exhibits a downward trend, comparable to the decrease in potential output growth experienced in Latin America during the last decade or so; (*v*) a comparison between the estimated and *ex-post* real rate allows to identify periods when monetary policy has been expansionary, contractionary or neutral, in the Wicksellian sense.

The rest of the work is organized as follows: Section 2 describes the Latin American context under which the present study is realized. Particularly, presenting an estimation of the potential output growth, this section discusses how the region transited to a booming to a stagnant economy even before the pandemic impacted. Section 3 goes briefly through the methodology, Section 4 shows the main results and Section 5 concludes. Lastly, the Appendix presents comparable estimates of the natural rate for the US and the Euro Area, as well as an estimation of US potential output to show the resemblance of Benati (2021)'s methodology with that of Cochrane (1994)'s one.

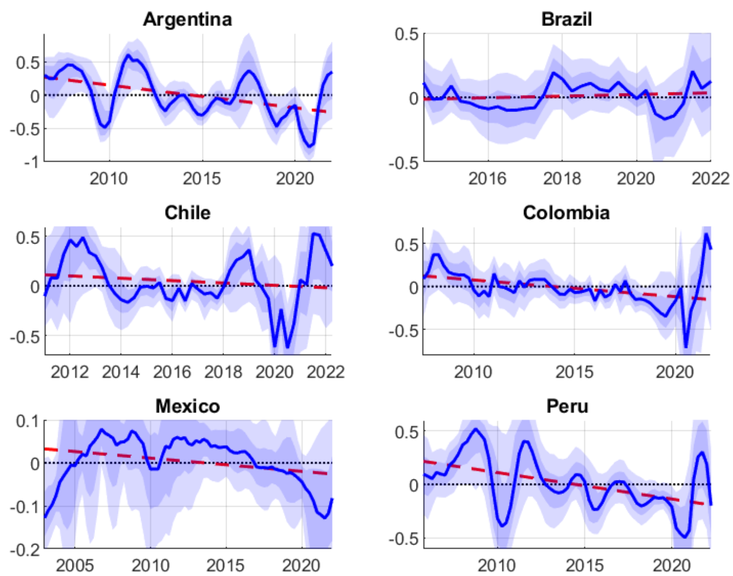
2 Latin American context

At the turn of the century, Latin American countries experienced and outstanding performance boosted by favorable commodity prices, though this was not the only reason. As noted by Campos (2019, 2020), the region generally benefited as well from an improved macroeconomic management that reduced output volatility and the level of inflation, when compared to its own past.

However, this promising beginning of the 21st century started to fade away in the 2010s. Several events can explain this dismay, ranging from the end of the so-called commodity boom, to macroeconomic unbalances in Argentina, or even social unrest in countries like

Brazil, Chile or Colombia. Whatever the reasons might have been, the fact is that, by the middle of the 2010s, Latin America economic strength seemed declining. To make matters worse, the pandemic, the Ukranian War and the world turmoil which came after it have hit hard on the region. A picture of this phenomena is displayed in Figure 1, where it can be verified that potential output for the analyzed countries has been stagnant, if not shrinking, during the last decade or so.

Figure 1: **Potential output growth and its trend**



Note: Potential output was estimated with a structural VAR, using real output and unemployment as in Blanchard and Quah (1989) and running a counterfactual as in Benati (2012). The trend was obtained with a linear fit. Source: National Statistics Institutes (see the Appendix for details).

Potential output is estimated as in Benati (2012), who uses the Blanchard and Quah (1989)'s decomposition to estimate supply and demand shocks and runs then a counterfactual by setting demand shocks to zero. In this way, an estimate of the output's permanent component can be obtained. While Benati (2012) estimates a multivariate VAR, I use the bivariate VAR with unemployment and real output, as originally done by Blanchard and Quah (1989). Figure 1 presents the yearly growth rate of the estimated potential output.

As originally noted by Wicksell (1898), and latter subscribed by Woodford (2003), there is a strong relationship between the real natural rate of interest and (potential) output growth. This was eventually verified empirically by Laubach and Williams (2003), who found a "close link between the natural rate of interest and the trend growth rate, as predicted by theory". Henceforth, the evidence shown in Figure 1 suggests that the real interest rate might have fallen lately. Indeed, the results exposed in the following section are in line with this evidence.

3 Methodology

The works of Lucas and Nicolini (2015) and Benati et al. (2021) presented evidence in favor of a stable money demand-interest rate relation in US and a wide sample of countries, respectively. Furthermore, these works proposed that the best fit for this relation was, what they called, the "Selden-Latané" functional form: a linear model capturing the interaction among these variables. Leaning on these proposals, Benati (2020, 2021) suggested that, whenever money velocity was the permanent component of the short-term nominal interest rate, a simple OLS regression can be used to estimate the nominal natural interest rate:

$$R_t = \alpha + \beta V_t + \eta_t \tag{1}$$

where R_t is the nominal short-term interest rate and V_t is M1 velocity, i.e, the ratio of nominal GDP over nominal M1. If η_t is small and stationary, this estimation provides the nominal natural rate:

$$\hat{R}_t^n = \hat{\alpha}_{ols} + \hat{\beta}_{ols} V_t$$

As mentioned in the introduction, this methodology is conceptually similar to the estimation of potential output and the output gap performed by Cochrane (1994), which is explained in the Appendix.

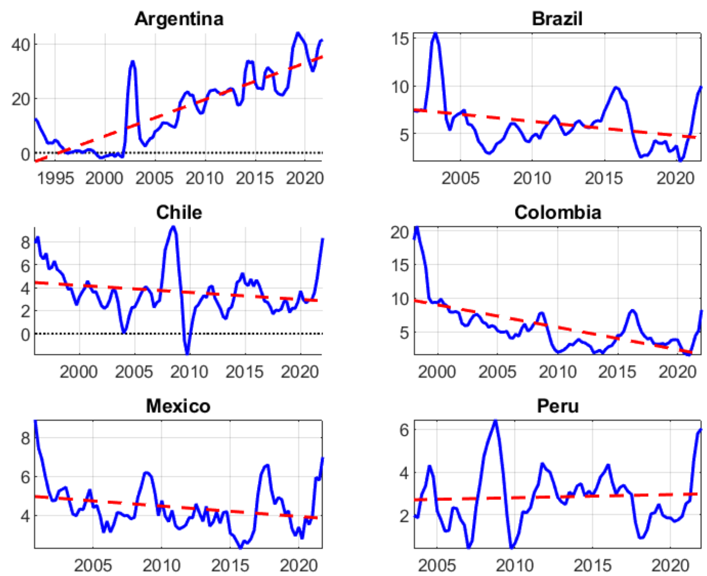
Once the nominal natural interest rate is estimated, it can be used to obtain the real natural interest rate with:

$$r_t^n = R_t^n - \bar{\pi} \tag{2}$$

where $\bar{\pi}$ stands for the mean of sampled inflation. Nevertheless, the whole methodology is conditional on inflation being stationary. Which, as shown in Figure 2 might have not been always the case. As a matter of fact, a visual inspection of the figure suggests that in Argentina inflation has clearly been non-stationary during the analyzed period. So, the results derived in the following section need to be taken with a bit of caution[2].

[2] In fact, the augmented Dickey-Fuller test can only reject the null of unit root for a high enough confidence level only in the case of Colombia, which can always be due to the specific sampled period. However, as the reader will see in the following section, the results obtained are by no means incongruous. So, I shall have confidence in them, though not without some skepticism.

Figure 2: **Inflation and its trend**



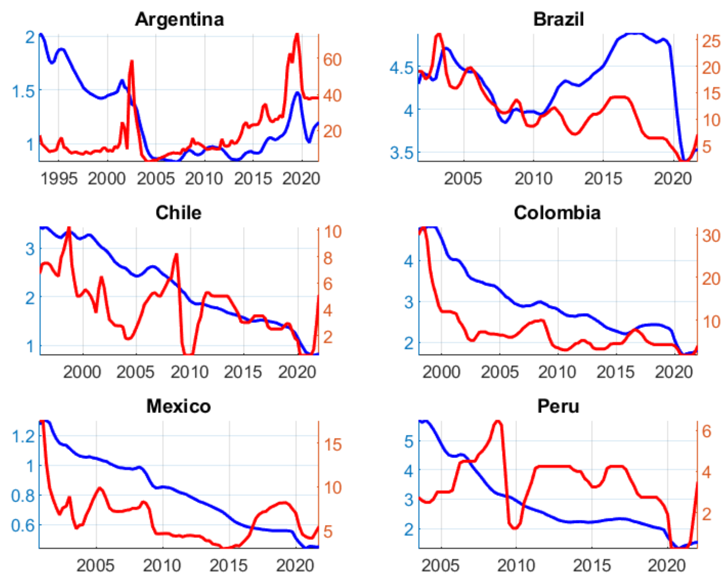
Note: Inflation represents the annual variation of the CPI index. The trend was obtained with a linear fit. Source: National Statistics Institutes. For Argentina the source for the period 2007-15 is Cavallo (2013) because official estimates were unreliable then. See the Appendix for details.

Data To estimate (1), data on money velocity, calculated as the ratio of nominal GDP over nominal M1, and the short-term natural rate were collected from the countries' respective National Statistics Institutes and Central Banks. The nominal rate is either the monetary policy rate or, when it is unavailable, the one that corresponds to the comparable short-maturity yield government bond (typically, the 3-months bond).

The periods under study were limited by data availability. These include from 1993:Q1 to 2021:Q4 for Argentina, from 2001:Q4 to 2021:Q4 for Brazil, from 1996:Q1 to 2022:Q1 for Chile, from 1998:Q1 to 2022:Q1 for Colombia, from 2000:Q4 to 2021:Q4 for Mexico and from 2003:Q3 to 2022:Q1 for Peru. A detail on the data used in this manuscript can be found in the Appendix.

Figure 3 shows the short-term nominal rate and money velocity for the sampled countries where, to remove high frequency noise in money velocity, the figure plots its centered four-quarters moving average. Several features can be observed in this figure. First, velocity and the nominal rate are cointegrated, which indicates the existence of a long-run relation among them. In fact, another specification of model (1) can be a VECM with a cointegration vector reflecting this relation and where long-run restrictions can be used to identify permanent and transitory shocks. Then, re-running history with a counterfactual conditional on transitory shocks being zero can deliver the permanent component of the nominal rate, which can be interpreted as the natural rate.

Figure 3: **Nominal rate** and **money velocity**



Note: Money velocity is calculated as the ratio between nominal GDP and nominal M1 and it is represented in the left axis. The nominal rate correspond to either the monetary policy rate or the shortest maturity government bond and it is plotted in the right axis. Source: National Statistics Institutes and countries' Central Banks (see the Appendix for details).

A robustness test of this alternative specification is performed in the online Appendix of Benati (2021). This being said, the present work only displays the evidenced obtained with the OLS regression (1) because it is much simpler than the VECM representation. In fact, thanks to its simplicity, the model is less sensible to model misspecification, like lag order selection or cointegration vector imposition. Of course, relying on the OLS specification is ultimately sensitive to the size of the residuals. But, as noted below in Figure 4, the estimated natural rate, though not perfect, is generally similar to money velocity and, hence, proves to be a good fit for the low frequency component of the short rate.

Second, with the exceptions of Argentina in the 1990s and Brazil in the 2010s, velocity seems to be the stochastic trend along which the short-term rate fluctuates. Therefore, velocity can be interpreted as the permanent component of the nominal interest rate. As mentioned above and shown in detail in the following section, the methodology applied in this manuscript to estimate the natural rate is based on this piece of evidence.

Third, with the exception of Argentina, there is a downward trend in money velocity that resembles remarkably that of potential output growth, previously shown in Figure 1. Similarly, Benati (2020) estimates an almost perfect correlation among these two variables for a group of developed countries. This downward trend in velocity might respond to the higher level of development reached by Latin American countries since the 1990s. As pointed out by Friedman and Schwartz (1963) for US, "velocity is a relative stable magnitude that has declined secularly as real income has risen". So, the same argument might explain this evidence for Latin America.

It is convenient to briefly discuss Argentinean data. This country is a special case because it went from an hyperinflationary period until 1992 to a low-inflationary regime in the 1990s. Although this trajectory is not too different from the rest of Latin American economies, it is the only country in the region where inflation has been rising since the 2000s, as Figure 2 has previously shown[3]. Nevertheless, Figure 3 displays some patterns which are not entirely surprising. Actually, the drop in velocity observed in the 1990s is consistent with a country transiting from a high to a low inflationary regime. A similar pattern was observed by Friedman and Schwartz (1963) when US ended the Civil War at the mid 19th century, a period characterized by high inflation. Naturally, velocity tended to rise again when Argentina went back to a high inflationary regime in the 2000s.

4 Results

As explained above, the OLS regression (1) would deliver a perfect fit to the natural rate if velocity were completely in line with it. Though not perfect, Figure 4 shows that this is approximately the case for most countries. Henceforth, the main features displayed in Figure 4 are very much related to those commented when analyzing Figure 3. Firstly, that the natural nominal rate behaves as the low frequency component around which the short-term interest rate fluctuates, with the exception of Argentina. Secondly, again disregarding Argentina and, probably, Brazil, there was a decreasing trend in the nominal natural rate during the sampled period, which is consistent with macroeconomic moderation and an improved policy management observed in most countries in the region (Campos, 2020).

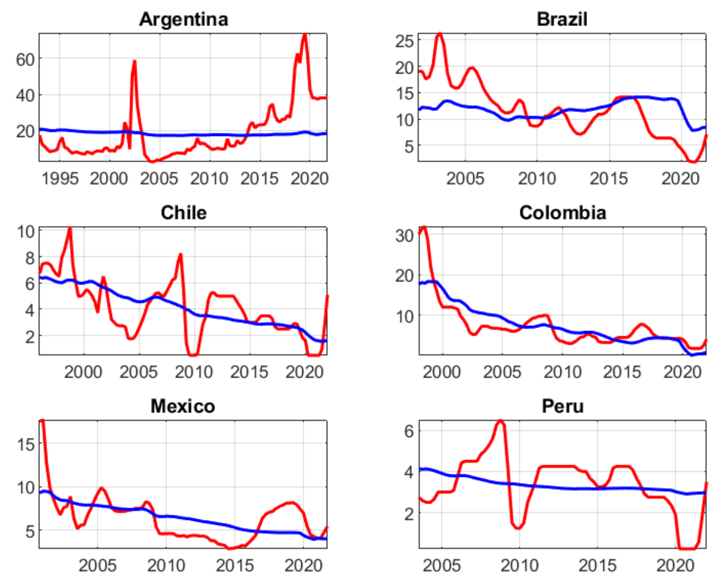
Next, the residuals in (1) can be interpreted as the transitory component of the short-term rate, i.e, the nominal interest rate gap[4]. Conveniently, I pretend to verify whether the interest rate gap is negatively related to aggregate activity and, hence, evokes the existence of a Phillips curve trade-off. As in Benati (2021), I use the unemployment rate detrended

[3] The other exception is, of course, Venezuela. Which is not analyzed here because of lack of reliable data.

[4] In effect, this is very much the same as obtaining the output gap with the residuals of (3) following Cochrane (1994), as described in the Appendix.

with the Band Pass filter setting as cut-off frequency domain a minimum of zero and a maximum of fifteen years. Both, the interest rate gap and the detrended unemployment are plotted in Figure 5.

Figure 4: **Nominal rate** and **natural nominal rate**



Note: The nominal rate correspond to either the monetary policy rate or the shortest maturity government bond. The natural nominal rate is estimated projecting the short-term interest rate onto M1 velocity, as described in (1). Source: National Statistics Institutes and countries' Central Banks (see the Appendix for details).

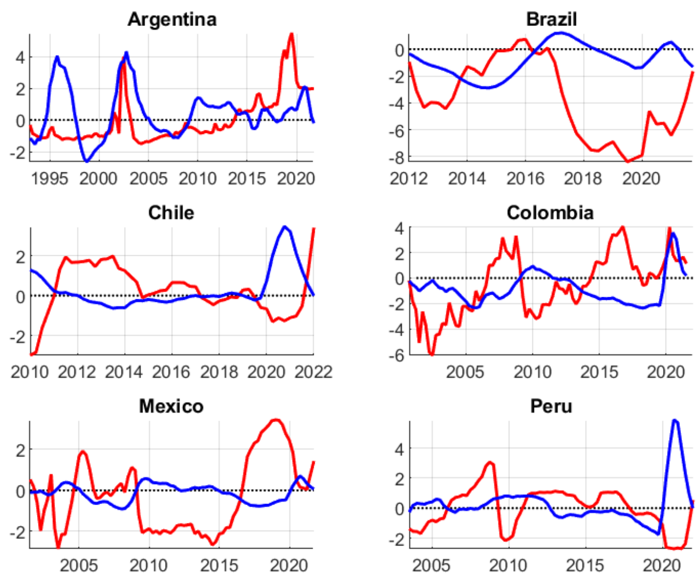
Indeed, the evidence plotted in Figure 5 points towards a negative contemporaneous correlation between the interest rate gap and detrended unemployment. Most notably, at the aftermath of the Global Financial Crisis and at the outbreak of the pandemic during 2010 and 2020, respectively. Again the exception is Argentina which, probably due to its high inflationary outcome, has lost its capability of exploiting the Phillips curve trade-off.

Finally, Figure 6 shows the *ex-post* real rate plotted together with the natural real interest rate, as estimated with (2). This figure contains probably the most interesting piece of evidence in this manuscript and can be summarized as follows: first, the real natural rate behaves as the very low-frequency component of the *ex-post* real rate.

Second, in line with the evidence of money velocity and the estimated nominal natural rate presented in Figures 3 and 4, respectively, the real natural rate displays a downward trend. Within the factors that can explain this decline, this paper has presented evidence on the stagnant, and even decreasing, potential growth, as previously described in Figure

1. This salient feature is by no means exclusive to Latin America. It is a well known fact that developed countries share this pattern, as proved by Holston et al. (2017), among others. In the Appendix, the interested reader can find the estimations of the nominal and interest rate for US and the Euro area, following the same procedure applied here. It is there manifestly clear the analogy between these developed countries' and Latin American estimates.

Figure 5: **Nominal rate gap and detrended unemployment**

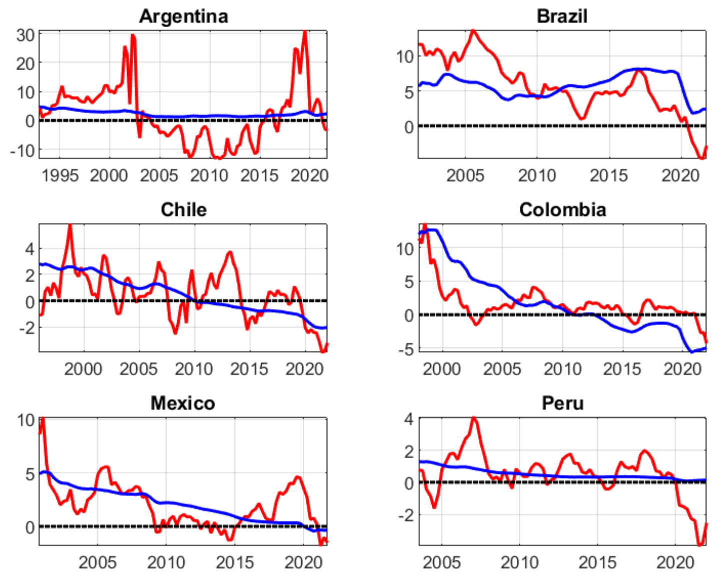


Note: The nominal rate gap is the transitory component of the short-term rate, estimated with the residuals in (1). Detrended unemployment is the cyclical component obtained with the Band Pass filter for a fifteen year period domain. Source: National Statistics Institutes and countries' Central Banks (see the Appendix for details).

Third, differently from the nominal interest rate estimates presented in Figure (4), the natural real rate might have even turned negative at the end of the 2010s or the beginning of the 2020s in some countries. The estimates indicate that this might have been specially the case in Chile and Colombia. These countries represent, then, perfect examples of economies that went from poster children to basket cases, amid rising social tensions probably derived from historic inequalities.

Fourth, the observed difference between the *ex-post* real rate and the estimated natural real rate in Figure (6) can help to evaluate how accurate the policy stance has been. On one hand, whenever the *ex-post* real rate was higher than the natural rate, it can be assumed that monetary policy was too tight. On the other hand, when the *ex-post* real rate was lower than the natural rate, it might have been too lose. Correspondingly, whenever they were equal, it can be presumed that policy was neutral, in the Wicksellian sense. Although a general picture of Figure (6) exhibits that countries' real rates did not tend to deviate much from their natural estimates, it might be suitable to do a more detailed analysis, to which I devote the last following paragraphs.

Figure 6: ***Ex-post* real rate** and **natural real rate**



Note: The *ex-post* real rate is the short-term nominal rate minus inflation. The natural real rate is obtained subtracting sampled mean inflation from the estimated nominal natural rate as described in (2). Source: National Statistics Institutes and countries' Central Banks (see the Appendix for details).

By far, Argentina displays the strongest policy deviations, according to my estimates: monetary policy appeared to have been to tight in the 1990s. This is not surprising as the country had lost then its monetary independence by imposing a strict hard peg, known as the *Convertibilidad*. The country was then completely dependent on its balance of payments to set its policy rate. Later on, Argentina regain monetary sovereignty but implemented a policy extremely loose until 2015, according to the estimates. This can probably explain the high inflation Argentina has been suffering from those years on, as shown previously in Figure (2). At the end of the 2010s, monetary policy was too tight, most certainly to put a halt on high inflation. Nevertheless, the last years in the sample, during the early 2020s show once more a relaxation in the monetary stance which can be related to inflation accelerating again by the time of writing this paper.

Regarding Brazil, the monetary policy appeared to have been tight in the 2000s and loose in the 2010s. In the 2020s the natural real rate is estimated to have fallen notoriously. But policy still remained too loose, most certainly to alleviate the economic consequences of the pandemic lockdown. However, this expansionary stance seems to be reverting by the end of the sample, probably to halt rising inflation as the economic activity returns to normality.

As for Chile, there is no clear pattern that allow to identify a certain period with monetary tightness or looseness, other than the monetary expansion to counterweight the lockdown effects during the 2020 pandemic. A similar observation can be made for Peru. So, according to my estimates, these two countries had a fairly neutral policy stance.

Colombia seemed to have displayed a loose policy in the early 2000s, probably to counterweight the financial crisis suffered by this country in 1999. However, this expansiveness was soon compensated with a modestly tight policy until the end of the sample.

As for Mexico, two distinct periods can be identified: subtly loose at the early 2010s and increasingly tight from 2015 on. Though this tightening appears to have been suddenly reversed at 2020, when countercyclical policy was implemented.

5 Conclusions

This work provides estimates of the natural rate of interest for the biggest Latin American economies: Argentina, Brazil, Chile, Colombia, Mexico and Peru. The methodology implemented is based on Benati (2020, 2021), who builds on the fact that money velocity, i.e, the inverse of M1 demand as a fraction of GDP, is the permanent component of the short-term nominal interest rate. Based on this case, a simple OLS regression of the latter over the former variable can deliver, whenever inflation is I(0), an estimate of the natural nominal interest rate. And, by subtracting mean inflation from it, the natural real interest rate can be obtained.

The results presented in this manuscript reveal that the natural real rate in Latin America has had a downward trend since the 2000s, which is compatible with two stylized facts observed in the region: on one hand, the higher level of development achieved by Latin America countries and, on the other hand, the decline in potential output growth.

It is also verified that there is generally a negative correlation between the interest rate gap and unemployment, which suggests the existence of a Phillips Curve trade-off. It can be argued that this might have been the consequence of an improved macroeconomic management in the region, when compared to its own past.

Finally, when measured against the *ex-post* real rate, the estimated natural real rate can be used to assess the accuracy of monetary policy, in the Wicksellian sense. On this, it is evidenced that Latin American countries have not generally tended to have persistent unbalanced policy stances, with the exception of Argentina. This result further endorses the argument that the region has consistently improved its policy design in the last decades.

Appendix

A Obtaining the potential output and the output gap as in Cochrane (1994)

The methodology used in this work follows Benati (2020), who approaches the estimation very much like Cochrane (1994). While the former counts on the fact that money velocity is the permanent component of the short-term nominal rate to estimate the natural rate of interest, the latter relies on the well-known claim that real consumption is the permanent component of real output to obtain estimates of potential output and the output gap. This is easily done by running the following OLS regression:

$$\ln Y_t = a + b \ln C_t + u_t \tag{3}$$

where Y_t is real output, C_t is real consumption and the residuals u_t can be interpreted as the transitory component of output, i.e, the output gap. The potential output is obtained with:

$$Y_t^p = \bar{c} + \ln C \tag{4}$$

where $\bar{c} = \text{mean}[\ln(C_t/Y_t)]$.

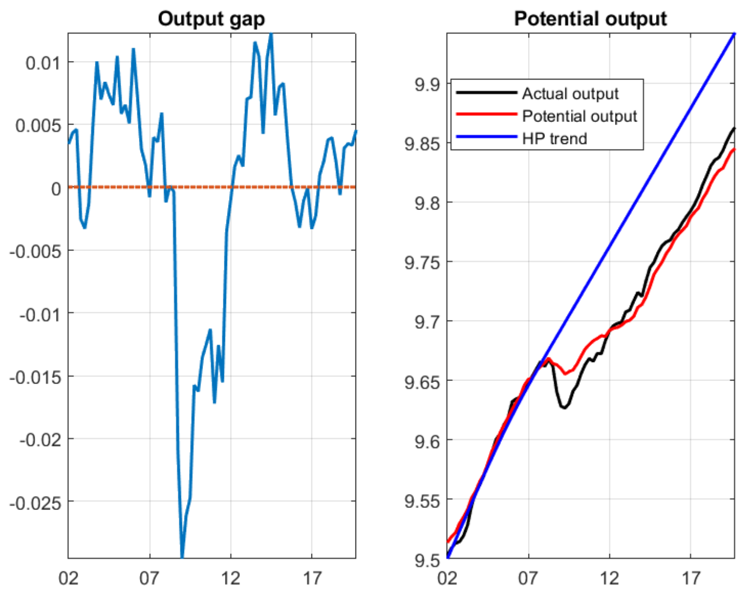
Figure A1 shows the estimation for US, together with the actual HP trend until the collapse of Lehman Brothers in the third quarter of 2008 and the projected one calculated as in Benati (2021) with:

$$\tau_t = 2\tau_{t-1} - \tau_{t-2} + \epsilon_t$$

where τ_t is the HP trend and ϵ_t is a white noise disturbance.

Figure A1 clearly depicts how hard the Subprime crisis hit US in 2008, displaying a tremendous fall in output gap and a permanent decrease in potential output, which has not yet return to its previous trend. For the purpose of the present work, its important to highlight how rescaled ratio of real consumption over output (i.e, the potential output in red in the right hand side plot) behaves as the permanent component of real output, with actual GDP fluctuating around it.

Figure A1: Using consumption to get potential output & the output gap



Note: The output gap is obtained as the residual in (3), while the potential output is calculated by rescaling consumption ratio as in (4). Source: Federal Reserve Bank of St. Louis (FRED).

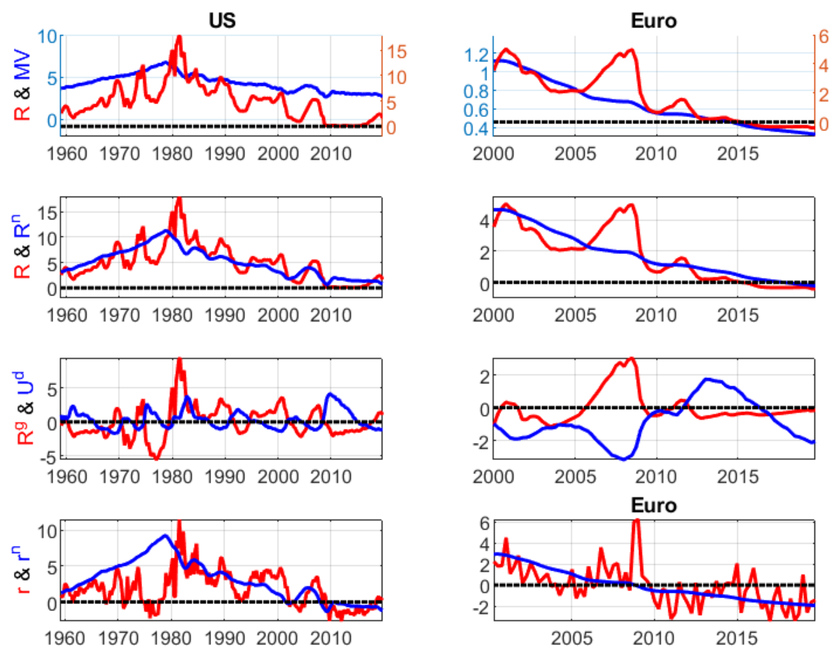
B Natural rate estimates for US and the Euro area

The interested reader can verify in this section that the estimates performed for Latin America in the main body of the article resemble those of the ones of two selected developed countries: US and the Euro area. As shown in the first row of Figure A2, money velocity and the nominal short-term rate seem to be cointegrated, deploying a long-run relation.

The second row of Figure A2 suggests that the estimated nominal natural rate behaves as the stochastic trend of the nominal short-term rate for both countries. The third row of the Figure depicts a strong negative contemporaneous correlation between the nominal rate gap and detrended unemployment, though this relation seems interrupted during the High Volatility period of the 1970s and 1980s in US. Finally, the fourth row of Figure A2 shows the downward trend in the natural real rate evidenced in both countries during the last decades. This estimation might be also used to assess how tight, loose or neutral has monetary policy been, in the Wicksellian sense.

As a whole, this evidence exhibits consistent links to the Latin American estimates presented in the main body of the manuscript and it is reassuring of the methodology undertaken here to estimate the natural rate of interest in this region.

Figure A2: US and Euro area estimates



First row: money velocity (left axis) and the nominal rate (right axis). Second row: the nominal rate and its natural estimate with (1). Third row: the nominal rate gap estimated with the residuals in (1) and detrended unemployment. Fourth row: the *ex-post* real rate and its natural estimate with (2). Source: FRED and the European Central Bank.

C Data

Argentina: Nominal GDP goes from 1993:Q1 to 2021:Q4 and real GDP from 2004:Q1 to 2021:Q4. CPI index monthly is used to compute annual inflation and taken to quarterly frequency by calculating averages within each quarter. It goes from 1992:M1 to 2021:M12. Unemployment goes from 1993:Q1 to 2021:Q4. However, this variable is available in quarterly frequency since 2003:Q3 and only in biannual frequency before that date. When this is the case, the quarterly frequency is computed with averages among the previous and subsequent semester. The source for these variables is the National Statistics Institute

(INDEC), except for the CPI between 2007 and 2015 for which Cavallo (2013) is used as source because the official estimates are known to have been manipulated.

M1 and the interest rate go from 1993:Q1 to 2021:Q4 and were obtained in the Central Bank of Argentina (BCRA) database. The monetary policy rate was implemented in 2015:M12. Before that date, the 3-month deposit rate (*plazo fijo*) is used. These variables are taken to quarterly frequency by calculating averages within each quarter.

Brazil: Nominal GDP goes from 2001:Q4 to 2021:Q4 and real GDP from 2011:Q4 to 2021:Q4. CPI index monthly is used to compute annual inflation and it is taken from 2000:M12 to 2021:M12, while unemployment goes from 2012:M3 to 2021:M12. The source for these variables is the National Statistics Institute (IBGE). M1 and the interest rate go from 2001:M12 to 2021:M12 and were obtained in the Central Bank of Brazil (BCB) database. For the interest rate, the overnight Selic rate is used. Monthly variables are taken to quarterly frequency by calculating averages within each quarter.

Chile: Nominal GDP goes from 1996:Q1 to 2022:Q1 and real GDP from 2008:Q3 to 2022:Q1. The CPI index is used to compute annual inflation and it is taken from 1995:M1 to 2022:M3, whereas M1 and the interest rate go from 1996:M11 to 2022:M3 and unemployment goes from 2008:M12 to 2022:M3. For the interest rate, the monetary policy rate is used. Monthly variables are taken to quarterly frequency by calculating averages within each quarter. The source for all the variables is the Central Bank of Chile database.

Colombia: Nominal GDP is taken from 1998:Q1 to 2022:Q1 and real GDP from 2005:Q1 to 2021:Q4. Annual CPI inflation, M1 and the monetary policy interest rate go from 1998:M2 to 2022:M3, whereas unemployment goes from 2000:M12 to 2021:M10. Monthly variables are taken to quarterly frequency by calculating averages within each quarter. The source for all the variables is the Central Bank of Colombia (Banco de la República) database.

Mexico: Nominal GDP is taken from 2000:Q4 to 2021:Q4 and real GDP from 2000:Q3 to 2021:Q4. Annual CPI inflation and unemployment go from 2000:M1 to 2021:M12. These four variables were taken from the National Statistics Institute (INEGI). M1 and the interest rate go from 2000:M2 to 2021:M12. The 3-months Treasury bills rate (CETES 91) is used as interest rate. The source for these two variables is the Central Bank of Mexico (BANXICO) database. Monthly variables are taken to quarterly frequency by calculating averages within each quarter.

Peru: Nominal and real GDP go from 2003:Q3 to 2022:Q1. The CPI index is used to compute annual inflation and it is taken from 2002:M9 to 2022:M3, whereas M1, the interest rate and unemployment go from 2003:M9 to 2022:M3. For the interest rate, the monetary policy rate is used. Monthly variables are taken to quarterly frequency by calculating averages within each quarter. The source for all the variables is the Central Bank of Peru (BCRP) database.

Euro area: Nominal GDP goes from 2000:Q1 to 2019:Q4. The CPI index is used to compute annual inflation and it is taken, together with M1, the interest rate and the unemployment rate from 2000:M1 to 2019:M12. For the interest rate, the Euribor 3-month rate is used. Monthly variables are taken to quarterly frequency by calculating averages within each quarter. The source for all the variables is the European Central Bank (ECB) database.

US: Nominal GDP goes from 1959:Q1 to 2019:Q4. The CPI index is used to compute annual inflation and and it is taken, together with M1, the interest rate and the unemployment rate from 1959:M1 to 2019:M12. For the interest rate, the Federal Funds Effective rate is used. As in Benati (2020, 2021), augmented M1 is obtained by adding Money Market Deposits Accounts (MMDA) to M1 when calculating money velocity. Monthly variables are taken to quarterly frequency by calculating averages within each quarter. To obtain potential output and output gap estimates of Figure A1, real GDP and real non-durable consumption is used from 2002:Q2 to 2019:Q4. The source for all the variables is the Federal Reserve Bank of St. Louis (FRED) database.

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