Potential output, output gap and inflation in Argentina*

Luciano Campos†

February 9, 2017

Abstract

I use the Blanchard-Quah decomposition to estimate potential output and output gap in Argentina and other Latinamerican countries. I find that, since 2007, Argentinian potential output grew slower, the output gap increased and monetary policy was too relaxed. These features can explain the high inflation Argentina had during the last years. Actually, the rest of Latinamerican countries analyzed here do not present these characteristics and did not suffer such an important inflationary pressure. However, I evidence business cycles to be significantly correlated among Argentina, Brazil, Chile and Peru, which might come from stronger trade and financial links developed in the last decades among these countries.

Keywords: Potential output; Output gap; Inflation; Argentina; Structural VARs; Long-run restrictions.

JEL Classification: C31; E22; E31.

---

*I thank Luca Benati for sharing his computer codes.

†Department of Economics, University College of Financial Studies (CUNEF), Leonardo Prieto Castro 2, Ciudad Universitaria, (28040) Madrid, Spain. E-mail address: lucianocampos@cunef.edu

1 Introduction

In the last years, Argentina has been experiencing an inflation way above 10% which contrasted with the lower and more stable inflation in most Latinamerican countries. In this article, I intend to explain the reasons for this by estimating the potential output and the output gap in Argentina and in other selected Latinamerican economies: Brazil, Chile, Colombia, Mexico and Peru. I find that high inflation in Argentina was related to the weakening of the growth in potential output, the increasing output gap and to an extremely loose monetary policy. These facts are not observed in the rest of the countries, where potential output grew stronger, output gap remained narrower and monetary policy was tighter. Nevertheless, I still evidence that Argentinian output gap was significantly correlated with the one of Brazil, Chile and Peru, which suggests that business cycles are highly related among these countries.

To obtain my results, I estimate potential output using a structural Vector Autoregression (VAR) identified with long run restrictions *à la* Blanchard and Quah [1989] (BQ henceforth). Since their original contribution, this method for estimating potential output has become very popular as it is based on a minimal set of restrictions derived from the neoclassical synthesis: i.e., that supply shocks have permanent effects on output while demand shocks have only transitory effects. As examples, the BQ decomposition is used by Benati [2012] to estimate the potential output drop in some developed economies after the 2008 financial crisis, and by Elosegui et al. [2006] to determine potential output in Argentina from 1980 to 2004.

The rest of the paper is structured as follows. Section 2 introduces the methodology used, Section 3 presents the evidence and discusses the policy implications and Section 4 concludes.

2 Methodology

I estimate for each country the following VAR(p) model:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + ... + A_p y_{t-p} + u_t \tag{1}$$

where, as in BQ, $y_t \equiv [\Delta X_t \quad U_t]'$, with ΔX_t and U_t being the log-difference of real GDP and the unemployment rate in levels, respectively. (See Data appendix on page 6 for sources and sample periods.) According to an augmented Dickey-Fuller test, non-stationarity in unemployment is present for all countries and, as noticed by Fernald [2007], not controlling for trend breaks in the mean can distort results. Therefore, I remove the trend *via* linear detrending. In order to select the lag order, I use a maximum lag of eight and I follow Ivanov and Kilian [2005], who recommend the Hannan-Quinn criterion for quarterly VARs with sample sizes bigger than 120 and the Schwarz Information for

smaller samples. The lag order is changed whenever residual autocorrelation is detected. I also verify non-normality to be present in most of the countries' VARs. However, as noted by Berkowitz and Kilian [2000], bootstrapping techniques, used here to characterize uncertainty around the estimates, reduce the risk of working with non-normal residuals.

The BQ decomposition implies that demand disturbances have no permanent effects in output growth. As in Lutkepohl [2005], this can be implemented by restricting the long-run impact matrix

$$\Xi_\infty = (I_K - A_1 - \ldots - A_p)^{-1} A_0 \tag{2}$$

to be lower triangular. In 2, K is the VAR dimension,

$$A_0 = (I_K - A_1 - \ldots - A_p) * chol\left[(I_K - A_1 - \ldots - A_p)^{-1} \Sigma_u (I_K - A_1' - \ldots - A_p')^{-1}\right]$$

is the structural shocks' impact matrix, Σ_u is the reduced form residuals variance covariance matrix and *chol* is the 'lower' Cholesky operator. Once the impact matrix A_0 is estimated, I can obtain the structural residuals:

$$e_t = A_0^{-1} u_t$$

I then rerun history conditional only on the transitory shocks. That is, setting the supply shocks (the first element of e_t) to 0. By doing this, I am left with the cyclical component of output, i.e., the output gap. So, I can get an estimate of the logarithm of potential output by subtracting the cyclical component from the original log of output. This estimation is repeated 10,000 times by doing bootstrapping from the original VAR residuals' estimates. Hence, I can build a distribution of potential output and output gap from the original estimated series.

3 Evidence

Figure 1 shows the logarithms of real GDP and of the estimated median of potential output with the 95% and 68% confidence bands, Figure 2 presents the inflation rate and the output gap median estimate together with the 68% confidence band and in Figure 3 I plot the actual interest rate together with the one derived from the monetary rule used by Lubik and Schorfheide [2007]:

$$R_t^* = \pi^* + \rho_R R_{t-1} + (1 - \rho_R)[\phi_\pi(\pi_t - \pi^*) + \phi_y \tilde{y}_t + \phi_e \Delta e_t] \tag{3}$$

where R^* is the rule's rate, $\pi^* = 5$ is the inflation target, $\rho_R = 0.5$ is a smoothing parameter, R is the actual interest rate, $\phi_\pi = 1.5$ is the inflation policy coefficient, π is the inflation rate, $\tilde{y}$ is the median estimation of the output gap, Δe is the nominal exchange rate depreciation and $\phi_y = \phi_e = 0.25$ are the corresponding policy coefficients. The values

of ρ_R, ϕ_π, ϕ_y and ϕ_e are the benchmark prior values used by the aforementioned authors in their Bayesian estimation of (3).

Fig. 1: Actual output (—), potential output (—), 68% ($\cdots$) and 95% ($--$) CI

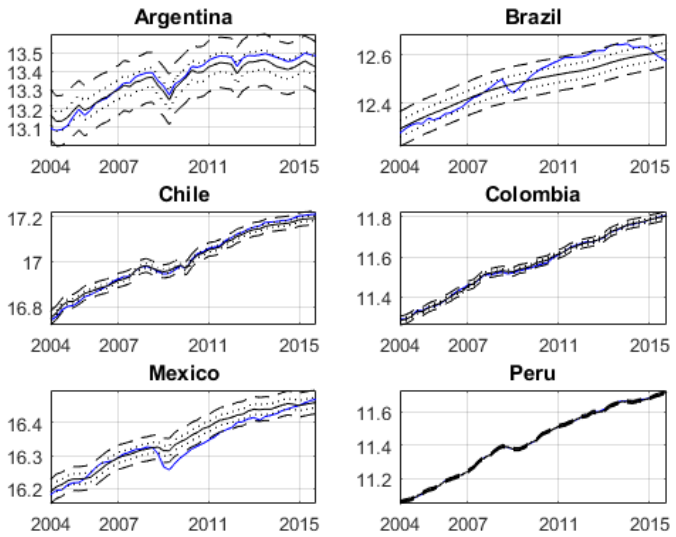


Fig. 2: Inflation (‖), output gap (—) and 68 % CI ($--$)

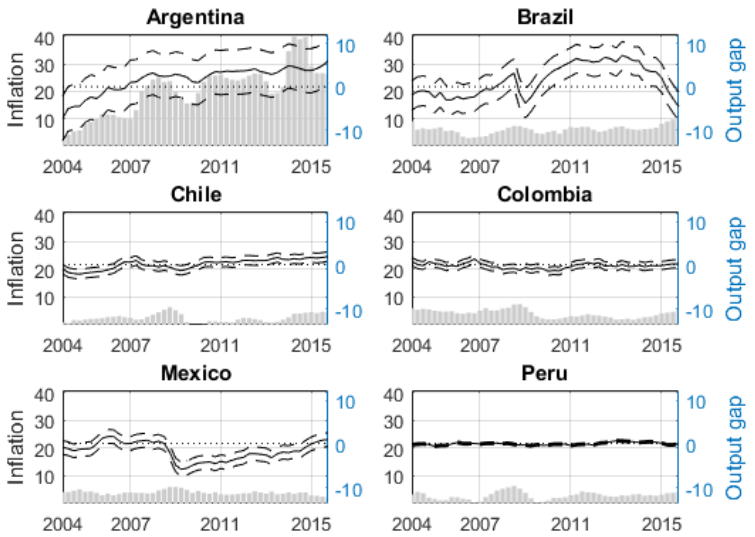
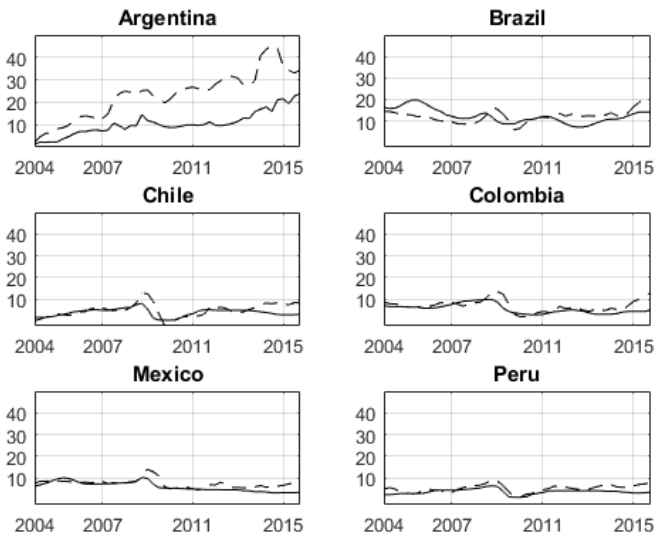


Fig. 3: Actual interest rate (—) and monetary rule's rate (−−)



The main results that are derived from these figures are: firstly, Argentinian potential output became weak since 2007 and reached a *plateau* from 2011 on. Secondly, the country's slowdown in potential output coincided with the gradual widening of its output gap. Thirdly, output gap and inflation are highly correlated in Argentina during the inflationary years ($\rho_{\tilde{y},\pi} = 0.9$). Lastly, if we compare the actual interest rate of Argentina with the one derived from the monetary rule (3), we verify that monetary policy was way too loose in the country. More specifically, the rule indicates that the interest rate should have been around 13 basis points higher on average to meet a 5% inflation target.

At the same time, the rest of the countries share the same patterns, which are very different from the ones just mentioned for Argentina. In particular, there is no such weakening in the potential output, nor is there a clear widening of the output gap, nor a systematical deviation from the monetary rule. The only exception is Brazil, where output gap does increase between 2010 and 2015 but there is no significant deviation from the monetary rule.

In summary, Argentina has a country specific behavior characterized by potential output stagnation, rising output gap and deviation from a standard monetary rule that can explain the high inflation of the country during the period 2007 to 2015. In fact, the rest of the Latinamerican countries analyzed here do not present these patterns and managed to keep inflation below 10%.

Additionally, the Table 1 shows the correlation matrix for the median output gap estimations among the analyzed countries, together with their p-values. It can be concluded

Table 1: Output gap correlation among countries

	Argentina	Brazil	Chile	Colombia	Mexico	Peru
Argentina	1.0	0.5***	0.8***	-0.3**	-0.2	0.3**
Brazil	0.5***	1.0	0.6***	-0.2	-0.5***	0.5***
Chile	0.8***	0.6***	1.0	0.1	-0.0	0.5***
Colombia	-0.3**	-0.2	0.1	1.0	0.4***	0.1
Mexico	-0.2	-0.5***	-0.0	0.4***	1.0	0.2
Peru	0.3**	0.5***	0.5***	0.1	0.2	1.0

$^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$

that business cycles are significantly correlated for Argentina, Brazil, Chile and Peru, on one side, and Mexico and Colombia on the other. These results might come from stronger trade and financial links that grew among both groups of countries during the last years.

4 Conclusions

In this work I estimate potential output and output gap in Argentina and other Latinamerican countries using a structural VAR identified with the BQ long run restrictions. My intention is to see whether this estimation can be useful to investigate the causes of high inflation the country suffered from 2007 to 2015. Actually, I find that there is a slowdown in potential output together with an increase in the output gap during those years. In addition, I verify that the monetary policy was extremely loose during the inflationary period. All these facts are absent in the rest of the analyzed countries where inflation was kept in much lower levels. It can be concluded that high inflation in Argentina was due to a wakening in potential output, the widening of the output gap and a way too relaxed monetary policy.

5 Data appendix

To estimate (1) I use quarterly series for real GDP and monthly series of unemployment. The data samples are: Argentina (1980Q1-2015Q4), Brazil (1991Q1-2016Q2), Chile (1986Q1-2016Q2), Colombia (1994Q1-2016Q2), Mexico (1996Q1-2016Q2) and Peru (2001Q1-2015Q4). To estimate (3) I use monthly series of CPI, nominal interest rate and nominal exchange rate with a data sample from 2004Q1 to 2015Q4 for all countries. Data sources are: Argentina (INDEC, BCRA, Cavallo [2012] for CPI and the newspaper Ámbito Financiero for the exchange rate since 2012), Brazil (IBGE and BCB), Chile (INE and central bank), Colombia (central bank), Mexico (INEGI and central bank) and Peru

(central bank). I do seasonal adjustment using the X-13ARIMA-SEATS method when necessary and I convert to quarterly frequency by taking averages when the original frequency is higher. Inflation and the depreciation rate are yearly changes in the CPI index and the nominal exchange rate, respectively.

References

Luca Benati. Estimating the financial crisis' impact on potential output. *Economics Letters*, 114(1):113–119, 2012.

J. Berkowitz and L. Kilian. Recent developments in bootstrapping time series. *Econometric Reviews*, 19(1):1–48, 2000.

O. J. Blanchard and D. Quah. The dynamic effects of aggregate demand and supply disturbances,. *American Economic Review*, 79(4):655–673, 1989.

A. Cavallo. Online and official price indexes: measuring Argentina's inflation. *Journal of Monetary Economics*, http://dx.doi.org/10.1016/j.jmoneco.2012.10.002, 2012.

Pedro Elosegui, Lorena Garegnani, Luis Lanteri, Francisco Lepone, and Juan Sotes Paladino. Estimaciones alternativas de la brecha del producto para la economía argentina. *Banco Central de la República Argentina*, Ensayos Económicos(45), 2006.

J. Fernald. Trend breaks, long run restrictions, and contractionary technology improvements. *Journal of Monetary Economics*, 54(8):2467–2485, 2007.

V. Ivanov and L. Kilian. A practitioners guide to lag order selection for VAR impulse response analysis. *Studies in Nonlinear Dynamics and Econometrics*, 9(1):Article 2, 2005.

T. Lubik and F. Schorfheide. Do central banks respond to exchange rate movements? A structural investigation. *Journal of Monetary Economics*, 54(4):1069–1087, 2007.

H. Lutkepohl. *New introduction to multiple time series analysis*. Springer-Verlag, 2005.