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# Literature Review of Empirical Studies on Okun's Law in Latin America and the Caribbean

Alessandra Pizzo

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Employment Policy Department

**EMPLOYMENT**

Working Paper No. 252

**2019**

# Literature Review of Empirical Studies on Okun's Law in Latin America and the Caribbean

Alessandra Pizzo

Employment  
Policy  
Department





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*Literature Review of Empirical Studies on Okun's Law  
in Latin America and the Caribbean*

Alessandra Pizzo

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## 1. Introduction

The empirical regularity highlighted by Arthur Okun in 1962, according to whom there is a solid statistical relation between unemployment and output, has become so important in macroeconomics that it is usually referred to as “Okun’s law”.

Okun estimated two versions of the relation between unemployment and production:

- The first one is called “difference” version and relates the change in production (expressed as changes in log of real GDP or percentage change of real GDP) to changes in the rate of unemployment:  $\Delta u_t = a + b \Delta y_t$ , with estimated values  $a = 0.3$  and  $b = -0.3$ .
- The second one is called “gap” version and relates the difference of actual unemployment with respect to its natural value to the production gap (difference between actual and long run output):  $u_t = c + d \cdot Output\ gap_t$ , with estimated values  $c = 3.72$  and  $d = -0.36$ .

Okun’s original estimation, therefore, using quarterly data for the US from 1947 to 1960, concluded that an increase in output of one percentage point decreased unemployment by around 0.3 percentage points.

Okun’s law has been in and out of fashion as an instrument in the standard macroeconomics toolbox. It was primarily intended as a tool to capture demand-driven fluctuations: in Sir Okun’s interpretation, when demand was low firms adapted their production by cutting total hours of work, which means both hours per worker as well as employment. Moreover, he found that productivity reacted too during demand shifts.

In recent years, after the 2008-2009 economic crises, demand-driven fluctuations came back to the attention of the public. This literature review starts from five recent papers,<sup>1</sup> both academic and policy oriented, that analyze the validity of Okun’s law for a large set of countries, including both developed and developing ones, witnessing the renewed interest in Okun’s law. It then considers other forty-four studies that focus only on estimating Okun’s law for Latin America and Caribbean countries (some of them consider subsets of Latin American countries, some of them focus only on one country).

The purpose of this literature review is to highlight the results of recent research about the validity of Okun’s law for developing countries, in particular for Latin America, and its quantitative importance. Moreover, it tries to summarize the factors that have been called as possible explanations for the “lower” responsiveness of unemployment to output growth usually observed in developing countries with respect to the benchmark given by the US.

The review is organized as follows: Section 2 contains a methodological reminder that summarizes the different methods and estimation techniques adopted in the papers. Section 3 reviews the evidence for developed and developing countries. Section 4 focuses on the research conducted on LAC countries. Sections 5 and 6 review the explanatory factors that have been proposed as driving the different estimates of Okun’s law, considering some of the potential sources of heterogeneity that are hidden behind the apparently simple Okun’s law. Finally, Section 7 concludes.

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<sup>1</sup> Huang, and Yeh (2013), An et al. (2017), Farole et al. (2017), Ball et al. (2016) and Bartolucci et al. (2018).





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## 2. Methodological focus

In this section we briefly revise the main methodologies adopted for estimating Okun's law. Okun's law has been expressed in two versions: the gap and the difference version, both relating unemployment and GDP.

### The gap version

The gap version of Okun's law relates changes in the cyclical component of unemployment to changes in the cyclical component of output, for each country  $i$  :

$$u_{i,t} - u_{i,t}^n = \beta^u (y_{i,t} - y_{i,t}^n) + \varepsilon_t \quad (1)$$

with  $\beta^u < 0$ , where  $u_t$  is the rate of unemployment and  $y_t$  is the log of real GDP. For estimating this equation, it is necessary to compute the unobserved value of the "natural rate of unemployment" ( $u_t^n$ ) and the "potential output" ( $y_t^n$ ).

To understand the theoretical link between unemployment and GDP, we can start from the relationship between employment and GDP, which is usually referred to as the Okun's law in terms of employment:

$$e_{i,t} - e_{i,t}^n = \beta^e (y_{i,t} - y_{i,t}^n) + \eta_t \quad (2)$$

with  $\beta^e > 0$ . The coefficient  $\beta^e$  sums up how firms adapt their labour force in order to respond to higher or lower desired levels of production. It includes therefore the costs of adjusting the employment level and the various other margins firms have, in addition to increase the number of employees, to increase production (for example, the possibility to adjust hours per worker, or effort).

The link between changes in employment and unemployment can be expressed as

$$u_{i,t} - u_{i,t}^n = \beta^l (e_{i,t} - e_{i,t}^n) + \zeta_t \quad (3)$$

with  $\beta^l < 0$ : if employment increases, the unemployment rate can decrease more or less according to how labour force participation reacts. If marginally attached workers or inactive people enter the labour force in good times, then the unemployment rate decreases less than the increase in the employment rate and vice versa.

Substituting equations (2) into equation (3), we obtain equation (4):

$$u_{i,t} - u_{i,t}^n = \beta^l [\beta^e (y_{i,t} - y_{i,t}^n) + \eta_t] + \zeta_t = \beta^l \beta^e (y_{i,t} - y_{i,t}^n) + (\beta^l \eta_t + \zeta_t)$$

The coefficient  $\beta^u$  which appears in equation (1) can be thus interpreted as the product between  $\beta^e$  and  $\beta^l$ : it includes both the effects of labour force participation and the costs of adjustments of the labour factor.

The gaps (or levels) version of Okun's law implies the need to estimate the natural rate of unemployment and the natural rate of GDP growth. While there is no agreement on which is the best suited technique, the most adopted ones in the literature include: the Hodrick-Prescott filter; a simple linear or quadratic time trend; the Kalman filter.

The Hodrick-Prescott filter is a widely used technique to estimate the trend and cyclical component of time series.

Considering a univariate time series ( $x$ ), it allows to decompose it by distinguishing a trend component ( $\tau$ ) and a cyclical component ( $c$ ) as following:

$$\min_{\tau} \left( \sum_{t=1}^T (x_t - \tau_t)^2 + \lambda \left[ \sum_{t=2}^T (\tau_{t+1} - \tau_t) + (\tau_t - \tau_{t-1}) \right]^2 \right)$$

where the parameter  $\lambda$  has to be set by the researcher, and as it varies it allows to obtain a more “linear” trend (when  $\lambda \rightarrow \infty$ ) or a trend which is closer to the original series (as  $\lambda \rightarrow 0$ ). The choice of the value of the parameter  $\lambda$  is arbitrary, however for quarterly data a common choice is  $\lambda = 1400$ .

This methodology, although widely used, is not immune to criticism, especially the fact that it does not work well at the end of the data period (the so called end-point bias). Gordon (2010) claims that even with higher values for the choice of the parameter the Hodrick Prescott filter generates a trend that is in fact too close to the original series. He thus strongly proposes to use another technique to identify the trend of a series, in particular the natural rate of growth for GDP and the natural rate of unemployment. The technique known as Kalman filter consists in estimating a time-varying trend  $a_t$  for a time series  $x_t$  as a state variable, considering the two following equations at the same time:

$$\begin{aligned} \Delta x_t &= a_t + \beta \Delta Z_t + \varepsilon_t \\ a_t &= a_{t-1} + \eta_t \end{aligned}$$

where  $\varepsilon_t \sim N(0, \sigma)$  and  $\eta_t \sim N(0, s)$ . The time-varying trend is thus modeled as a random walk process. This technique allows to consider some explanatory variables ( $Z_t$ ), but as a drawback it needs the researcher to specify also the parameters  $\sigma$  and  $s$ , thus making the estimation more “subjective”.

### The difference version

The gap version, by taking differences, can be rewritten as

$$(\Delta u_t - \Delta u_t^n) = \beta^u (\Delta y_t - \Delta y_t^n) + \Delta \varepsilon_t$$

Under the assumption that the natural rate of unemployment is constant ( $\Delta u_t^n = 0$ ) and that the rate of growth of potential output ( $g$ ) is constant, the equation becomes

$$\Delta u_t = \alpha + \beta^u \Delta y_t + e_t \quad (6)$$

where  $\alpha = -\beta^u g$  and  $\Delta \varepsilon_t = e_t$ .

The difference version can be therefore interpreted as a gap version in which the natural rate of growth of GDP is estimated as the intercept of the equation.

In order to correctly estimate both versions of Okun's law, as for every analysis implying time series, it is necessary to check if the variables of interest are stationary or not. Normally unemployment and output in levels are not stationary, but they can be stationary in first differences. If the series are I(1) (integrated of order one), and they are not cointegrated, then the difference equation can be estimated, or VAR models can be used, to include also lags (it is common to include lags for GDP when data are at quarterly frequency).

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If the series are cointegrated, the the correct model to use is the VECM, which can take into account the cointegration vector, i.e. the long run relationship between the variables. The gap version can be estimated with simple OLS techniques if the cyclical components of the two series are stationary.



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### 3. Okun's law: evidence from multi-countries studies

There has been a renewed interest in quantifying the relation between output and unemployment in the last years, as shown by five recent panel studies.<sup>2</sup> These studies use large sets of countries, distinguishing between “developed” and “developing” ones. In two cases,<sup>3</sup> the authors also provide estimates for individual countries.

All five studies assess the fact that the Okun's coefficient seems to be generally higher (in absolute value) in developed economies, i.e. GDP would have a stronger impact on unemployment in developed economies with respect to developing ones. Moreover, Okun's coefficients are more precisely estimated for developed than developing countries. For example, according to Ball et al. (2016), the average Okun's coefficient has a value of -0.2 for developing countries and -0.4 for developed ones. The measure of fit given by the  $R^2$  typically ranges between 0.2 and 0.3 for developing countries, being about a half of that one found for developed economies.

As a matter of general notation, all the graphs that follow in this Section show the estimated values of the variables of interest, the letters “Y” and “N” refer to the explicit information about a variable being significant (Yes) or not (No). When this information is not provided by the authors, the bar remains without letter. Huang and Yeh (2013) distinguish between OECD and non-OECD countries, Ball et al. (2016) consider advanced and developing countries (see Figure 1).

Farole et al. (2017) as well as Bartolucci et al. (2018) distinguish countries in terms of their GDP per capita in four categories (high income, upper middle income, lower middle income and low income), as it can be seen in Figure 2. They confirm the findings that unemployment seems to be more responsive to GDP in rich economies.

Except for Huang and Yeh (2013), they all estimate the difference and the gap versions of the Okun's law: Huang and Yeh (2013) estimate an Auto Regressive Distributed Lag (ARDL) model, which allows to distinguish between the long and the short run impact of GDP on unemployment; moreover, they do not need to pre-filter the data, as they use the so-called Pooled Mean Group (PMG) approach. An et al. (2017), instead, consider as dependent variable the employment rate, and not the unemployment rate. Their motive is that they consider the unemployment rate statistics as not reliable in developing countries.

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<sup>2</sup> Huang, and Yeh (2013), An et al. (2017), Farole et al. (2017), Ball et al. (2016) and Bartolucci et al. (2018).

<sup>3</sup> Ball et al. (2016) and Bartolucci et al. (2018).

Figure 1.

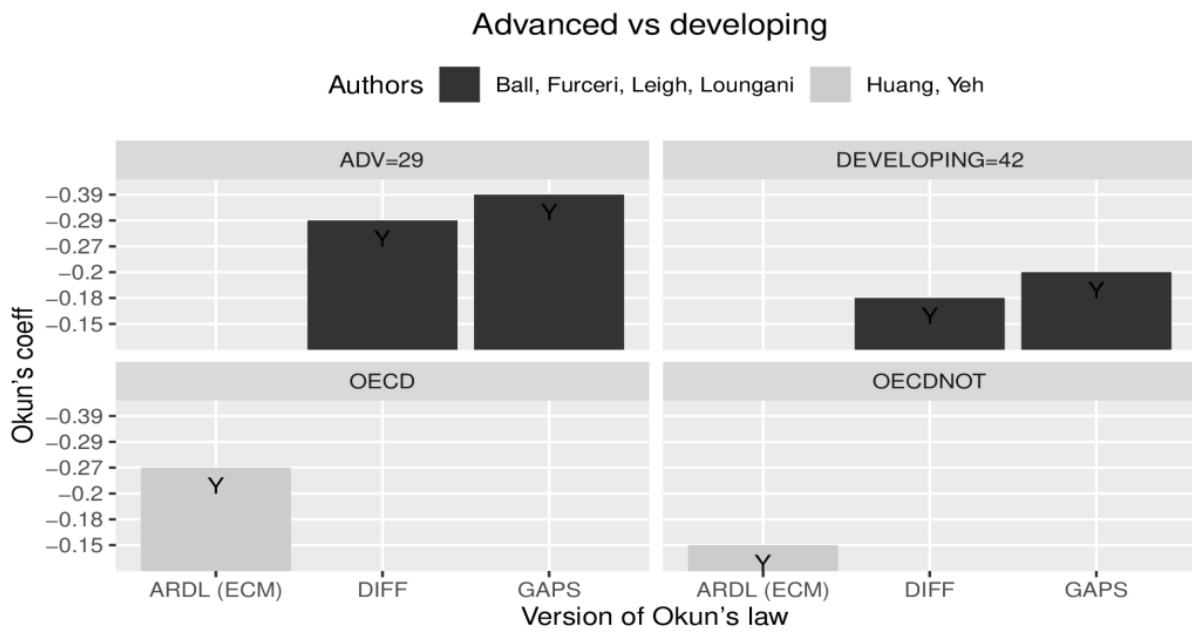
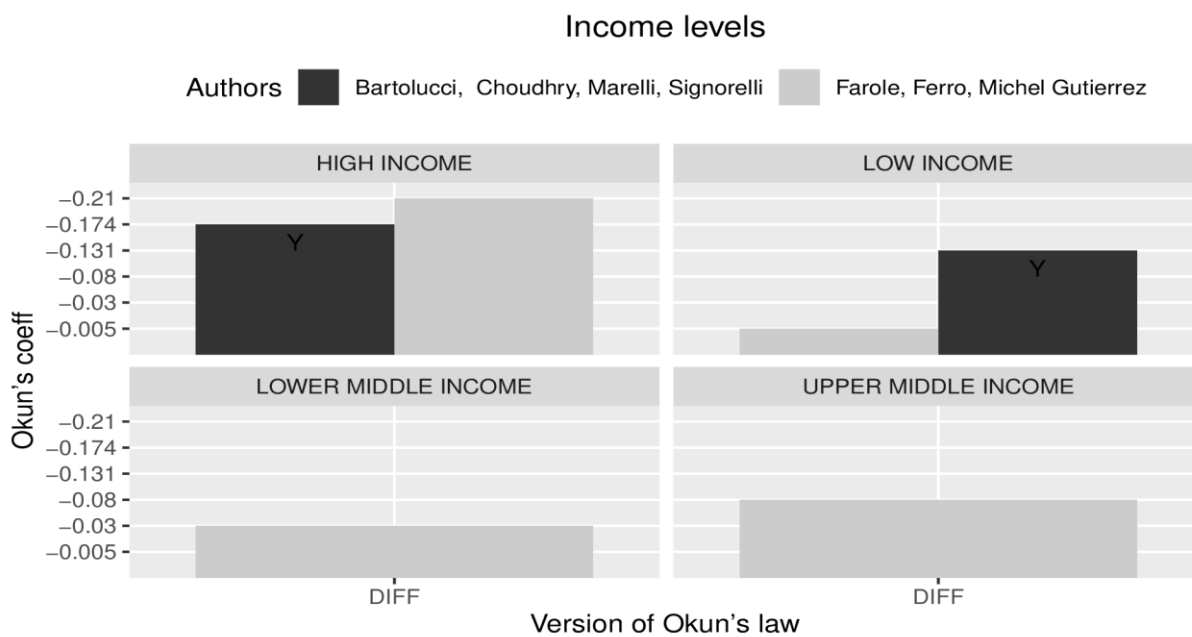


Figure 2.



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## 4. Okun's law in Latin America

In order to study the validity of Okun's law in LAC countries, this review considered the five general multi-countries studies analyzed in the previous section, as well as forty-four other studies that specifically focused on one or more countries from the Latin America.<sup>4</sup> The summary results are given in Table 1. We report the totality of estimations and we distinguish between those provided by the general multi-countries studies revised in the previous section,<sup>5</sup> and the studies that instead focus on LAC countries. Each study can include information on one or multiple countries; moreover, each study generally proposes more than one estimation strategy. The results of the last column consider the estimated values for the Okun's coefficient coming from different regression strategies. Only cases in which the authors report a significant result (or omit to report explicitly the value of the t-test) are considered to compute the mean. A detailed description of each study can be found in the Annex of this review.

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<sup>4</sup> Among these 44 studies, Páez Cortés (2013) reports the estimation for a group of countries as well as for each individual country she analyses. All other studies only provide estimates for one country at the time.

<sup>5</sup> The general multi-countries studies who provide estimations for single countries are Ball et al. (2016) and Bartolucci et al. (2018); An et al. (2017) also provide estimates for single countries, but their dependent variable is employment (and not unemployment), so their results are not directly comparable.



**Table 1. Summary of information on LAC studies on Okun's law**

Country	# of studies	% of studies over total <sup>6</sup>	# of estimations	% of estimations over total	Total time-span covered	Okun's coefficient <sup>7</sup>		
						Min	Max	Mean
Argentina	8		14					-0.169
-multi-countries	2	16.3%	3	6.2%	1970-2015 <sup>8</sup>	-0.61	-0.065	-0.165
-LAC	6		11					-0.169
Bolivia	7		12					-0.391
-multi-countries	1	14.3%	11	5.3%	1970-2015	-1.71	-0.02	-0.306
-LAC	6		1					-0.405
Brazil	8		33					-0.155
-multi-countries	2	16.3%	3	14.5%	1970-2015	-0.385	-0.034	-0.194
-LAC	6		30					-0.147
Chile	6		22					-0.311
-multi-countries	2	12.2%	3	9.7%	1970-2015	-0.465	-0.0515	-0.316
-LAC	4		19					-0.301
Colombia	9		20					-0.377
-multi-countries	2	18.4%	3	8.8%	1953-2015	-0.518	-0.08	-0.376
-LAC	7		17					-0.377
Costa Rica	5		9					-0.236
-multi-countries	2	10.2%	3	4.0%	1970-2015	-0.35	-0.139	-0.199
-LAC	3		6					-0.255
Dominican Republic	2		3					-0.099
-multi-countries	2	4.1%	3	1.3%	1980-2015	-0.114	-0.084	-0.099
-LAC	0		0					NA
Ecuador	6		14					-0.302
-multi-countries	2	12.2%	3	6.2%	1970-2015	-0.77	-0.026	-0.180
-LAC	4		11					-0.335
El Salvador	3		5					0.134
-multi-countries	3	6.1%	5	2.2%	1980-2015	0.134	0.134	0.134
-LAC	0		0					NA
Guatemala	1		4					-0.735
-multi-countries	0	2.0%	0	1.8%	1970-2004	-0.75	-0.72	NA
-LAC	1		4					-0.735
Honduras	4		7					-0.109
-multi-countries	3	8.2%	2	3.1%	1980-2015	-0.122	-0.096	-0.109
-LAC	1		5					NS
Mexico	13		29					-0.176
-multi-countries	2	26.5%	3	12.8%	1970-2015	-0.385	-0.160	-0.177
-LAC	11		26					-0.176

<sup>6</sup> Since information on one country can appear in more than one study, the sum of the percentages does not have to be equal to 100%.

<sup>7</sup> Calculated using only estimated values that are significant, or for which there is not explicit information about the t-test.

<sup>8</sup> Data disclaimer: there have been concerns over the quality of the official data provided by Argentina on inflation and GDP during the last decade.

Country	# of studies	% of studies over total <sup>6</sup>	# of estimations	% of estimations over total	Total time-span covered	Okun's coefficient <sup>7</sup>		
						Min	Max	Mean
Nicaragua	5		8					-0.160
-multi-countries	3	10.2%	1	3.5%	1980-2015	-0.192	-0.133	-0.160
-LAC	1		7					NS
Panama	5		10					-0.751
-multi-countries	2	10.2%	3	4.4%	1970-2015	-3.24	-0.168	-0.211
-LAC	3		7					-1.112
Peru	9		14					-0.120
-multi-countries	3	18.4%	3	6.2%	1979-2015	-0.25	-0.012	-0.121
-LAC	6		11					-0.120
Trinidad and Tobago	2		3					-0.119
-multi-countries	1	4.1%	1	1.3%	1980-2012	-0.16	-0.088	-0.088
-LAC	1		2					-0.135
Uruguay	4		7					-0.421
-multi-countries	2	8.2%	3	3.1%	1970-2015	-1.04	-0.15	-0.199
-LAC	2		4					-0.588
Venezuela	4		7					-0.181
-multi-countries	2	8.2%	3	3.1%	1970-2010	-0.24	-0.07	-0.207
-LAC	2		4					-0.177
Arg, Bol, Bra, Chl, Col, Mx, Par, Pe, Uy, Ve <sup>9</sup>	1	2.0%	4	1.8%	1995-2009	-0.064	-0.034	-0.046
<b>Total</b>	49		227					-0.260
<b>-multi-countries</b>	5		3	100.0%				-0.188
<b>-LAC</b>	44		224					-0.277

The total average of the Okun's coefficient estimates shows that unemployment is not very reactive to the economic cycle (in terms of GDP), as it is expected from the fact that Latin American countries fall in the category of "developing", or at least in the lower categories in terms of income per capita.

The conclusions about some countries can be considered as "stable", being the results of many different estimations, such as in the cases of Bolivia, Brazil, Chile, Colombia, and Mexico. In terms of the magnitude, it seems it can be confirmed what stated by Ball et al. (2016) when they say that the higher Okun's coefficients are found for Colombia and Chile. Brazil and Mexico present lower coefficients, while the coefficient for Bolivia should be considered with more caution, since it is driven from the results of Páez Cortés (2013), who finds a value of -1.71.

In the following, for each country we report the estimates obtained in all the studies that contain relevant information, in order to highlight the heterogeneity that characterizes the results of the estimations.

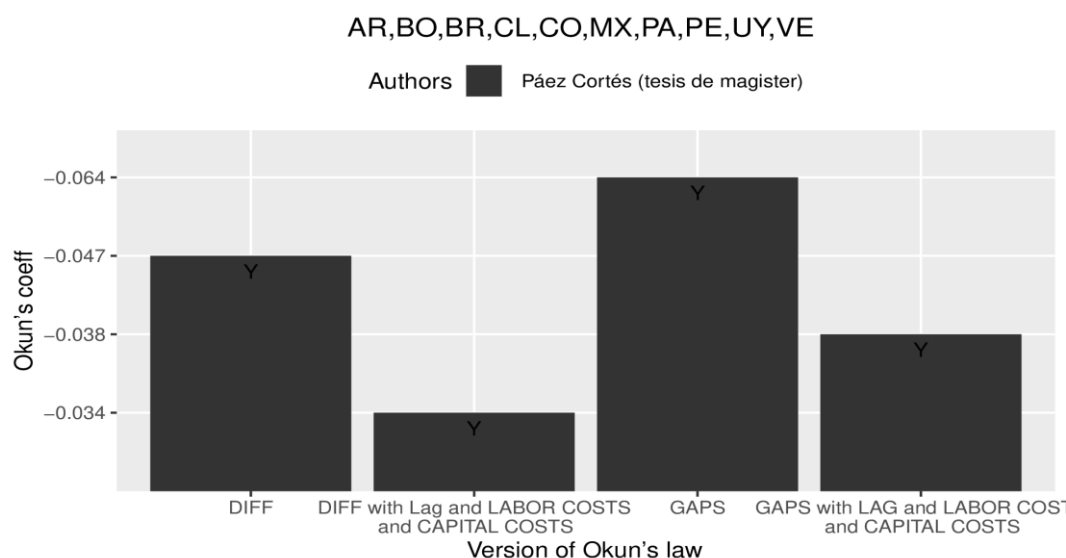
<sup>9</sup> In Páez Cortés (2013).

In the study by An et al. (2017), the authors consider the employment rate as dependent variable, and not the unemployment rate. Although the results are not symmetric for employment and unemployment, the information is reported for the sake of completeness.

Considering ten LAC countries (Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Panama, Peru Uruguay and Venezuela), Páez Cortés (2013) estimate the standard versions of Okun's law in terms of differences and gaps; the author estimates Okun's law both in a panel model, as well as for each country.

In terms of the panel estimation, she finds Okun's coefficients that are significant but small in terms of magnitudes (comparing to the traditional values assumed for the US, as well as for those countries, such as Japan, that show a lower connection between unemployment and GDP),<sup>10</sup> as it can be seen in Figure 3. She also estimates the gaps version adding two more explanatory variables: a measure of labour costs and a measure of capital costs. Adding one lag and the prices of factors (in terms of gaps with respect to their long run values) slightly decreases the magnitude of the Okun's coefficient; and an increase in the price of labour or of capital has a positive effect on the unemployment rate.

Figure 3.



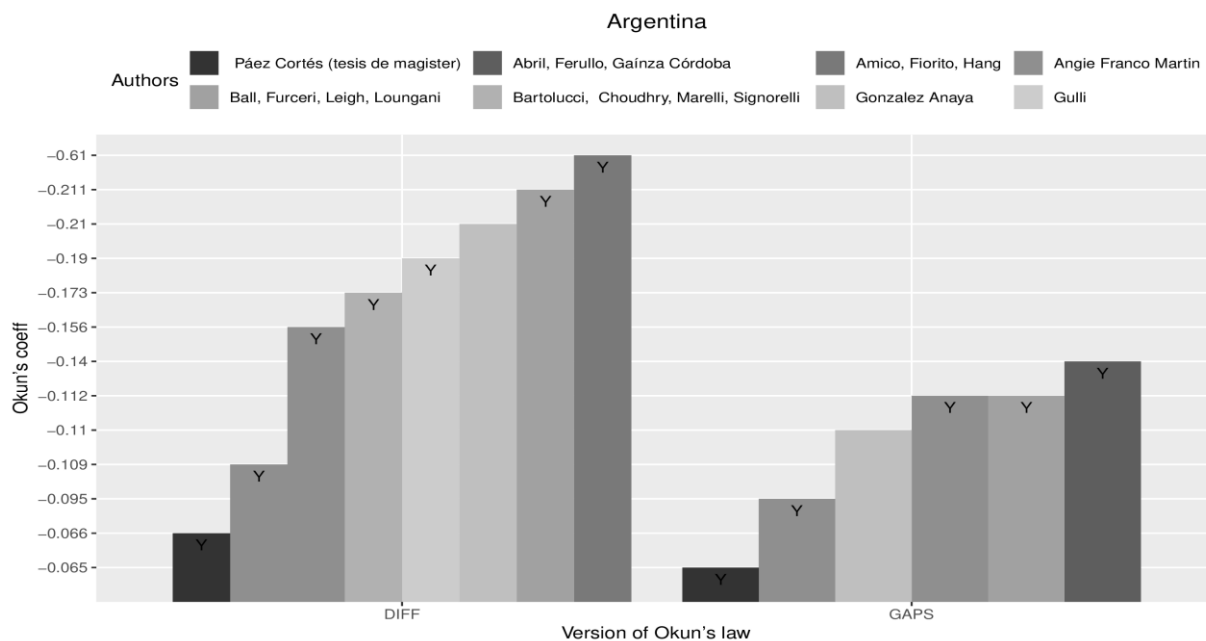
<sup>10</sup> Blanchard (2000) reports a value of 0.39 for the US but only 0.1 for Japan, considering the period 1960-1980.

## Argentina

There are eight studies that consider data from Argentina, spanning a time period from 1970s till 2015,<sup>11</sup> estimating the difference and the gaps version.

The average value for the Okun's coefficient, for the cases in which it is significant, is -0.216 for the difference version, and -0.105 for the gaps version.

Figure 4.

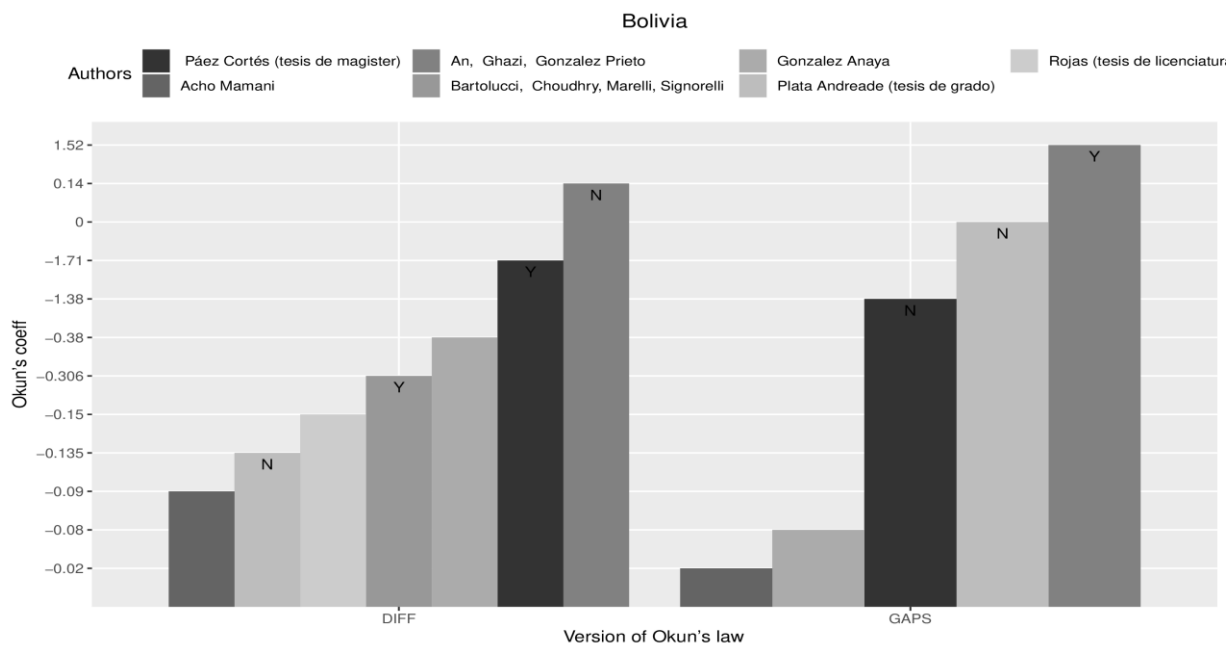


<sup>11</sup> See footnote 8 on Argentinian data for the last decade.

## Bolivia

There are seven studies that use Bolivian data, however the evidence is much less clear: only two studies give an Okun's coefficient that is significant when estimated using the difference equation, its mean value is -1.008.

Figure 5.

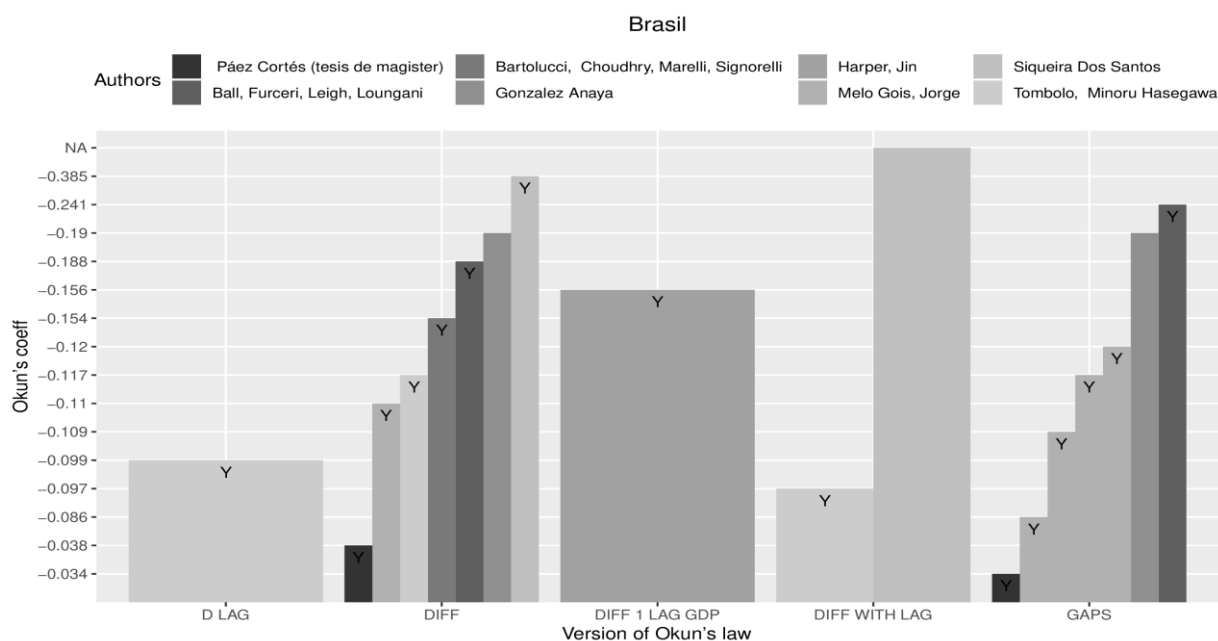


## Brazil

There are eight studies with Brazilian data, the estimations using the standard difference and gaps versions are almost all significant, giving an average value of, respectively, -0.165 and -0.118; the total average gives -0.137.

Apart from the two standard versions of Okun's law, Tombolo and Hasewaga (2014) also add lags of GDP or unemployment; they also estimate a version with distributed lags (D LAG). Adding lags allows them to distinguish between the short run, or Okun's coefficient on impact (equal to -0.097) and the long run Okun's coefficient, which they find equal to -0.21.

Figure 6.

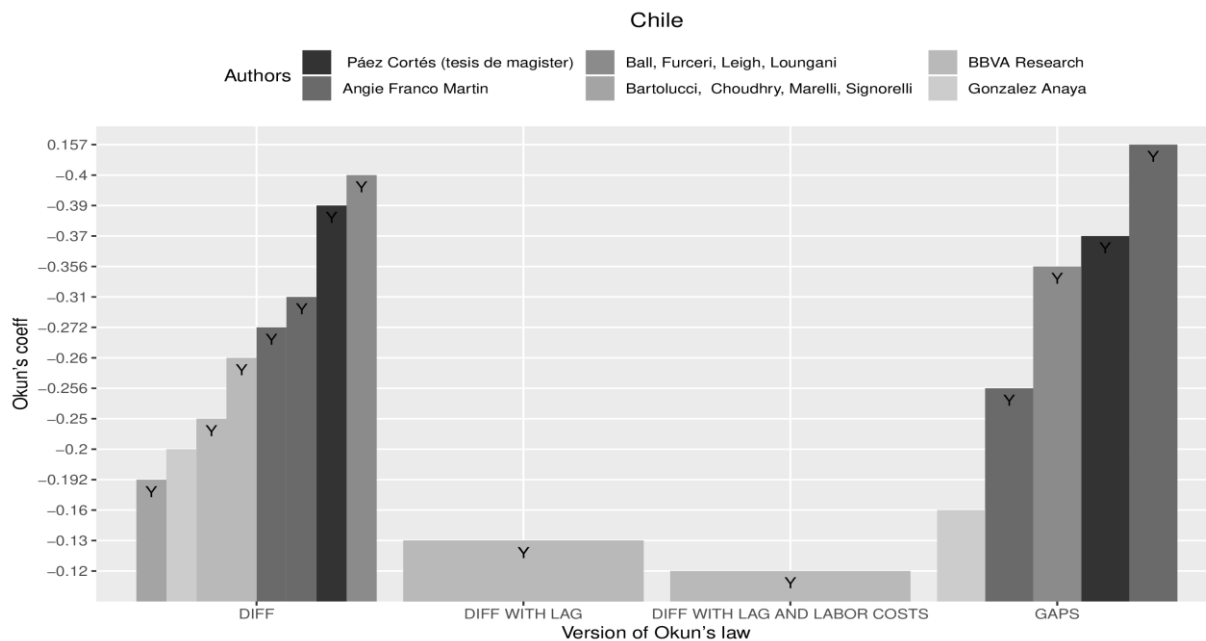


## Chile

There are six studies that use Chilean data; the estimations using the standard difference and gaps versions are almost all significant, giving an average value of, respectively, -0.296 and -0.206; the total average gives -0.234.

The research notes by BBVA in 2014 and 2016 provide estimations in which they add lags for the independent variables as well as labour costs as an additional explanatory variable. They obtain lower values for the Okun's coefficients in this case.

Figure 7.



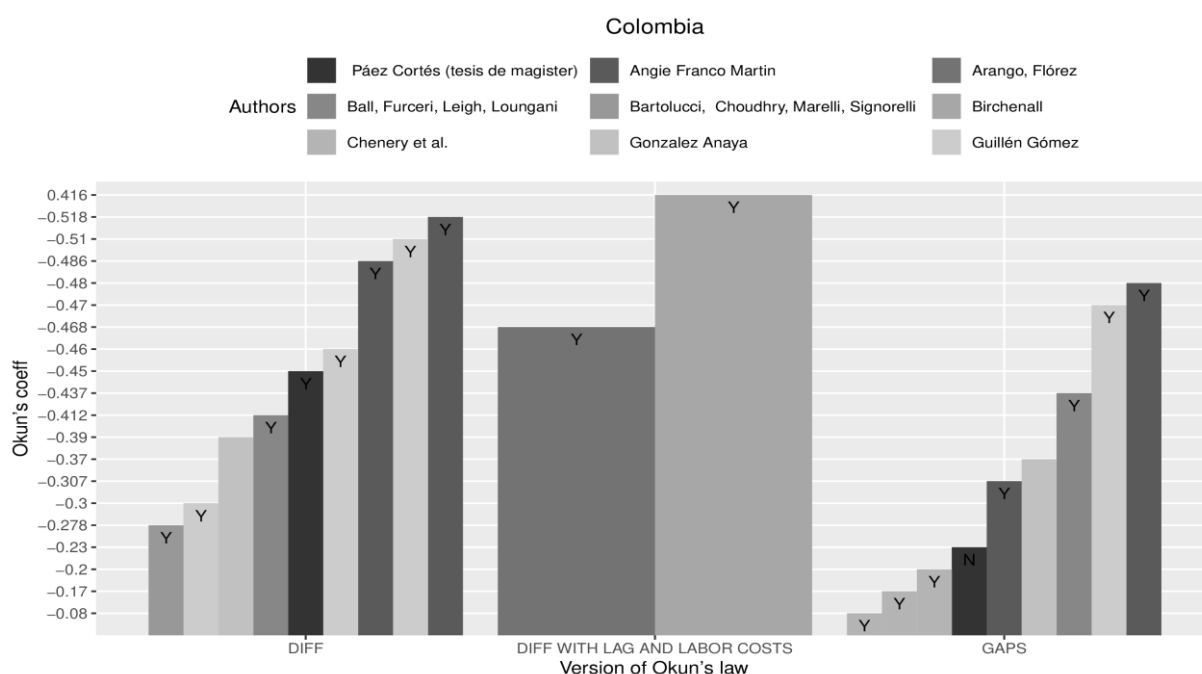
## Colombia

The nine studies that use Colombian data seem to find some robust results about the fact that in this country the unemployment rate is quite sensitive to economic activity: the average Okun's coefficient resulting from the difference equation is equal to -0.427, for the gaps version -0.306, for a total average of -0.377.

Birchenall (1997) considers a version of Okun's law in which employment is the dependent variable (the estimated coefficient is thus positive). Both Birchenall (1997) and Arango and Flórez (2017) estimate a version of Okun's law in which they add lags and labour costs as an independent variable.

Arango and Flórez (2017) distinguish between the short run Okun's coefficient, equal to -0.468, and the long run one, equal to -0.314 (both are significant).

Figure 8.



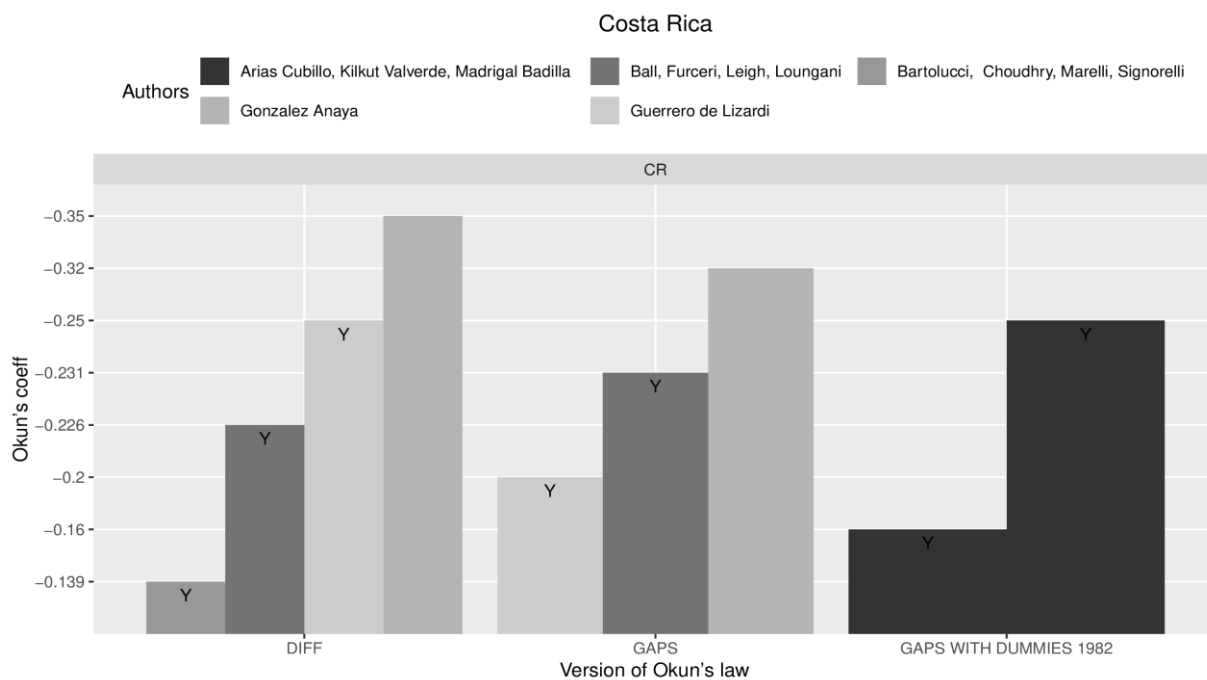


## Costa Rica

The six studies that provide information on Costa Rica give estimates for the Okun's coefficients that are significant, with an average value of -0.205 for the difference version and -0.216 for the gaps version, for a total average of -0.208.

Arías et al. (2002) estimate two versions of Okun's law in terms of gaps (using the HP filter and the Baxter-King filter) and add the time dummies to take into account the crisis of 1982.

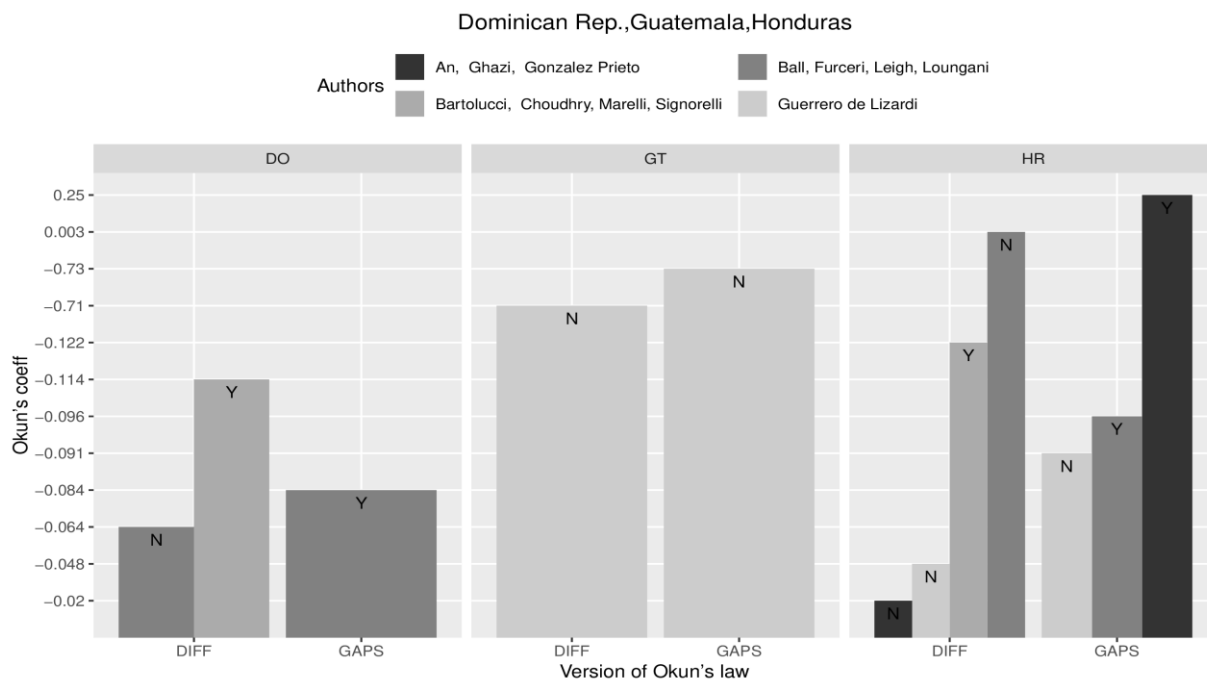
Figure 9.



## Dominican Republic, Guatemala and Honduras

There are fewer studies on Caribbean countries, and they also give less clear results about the magnitude of Okun's coefficients: for Guatemala, for example, both estimates in terms of the difference and gaps versions are not significant; the average values for Dominican Republic and Honduras are -0.099 and -0.109.

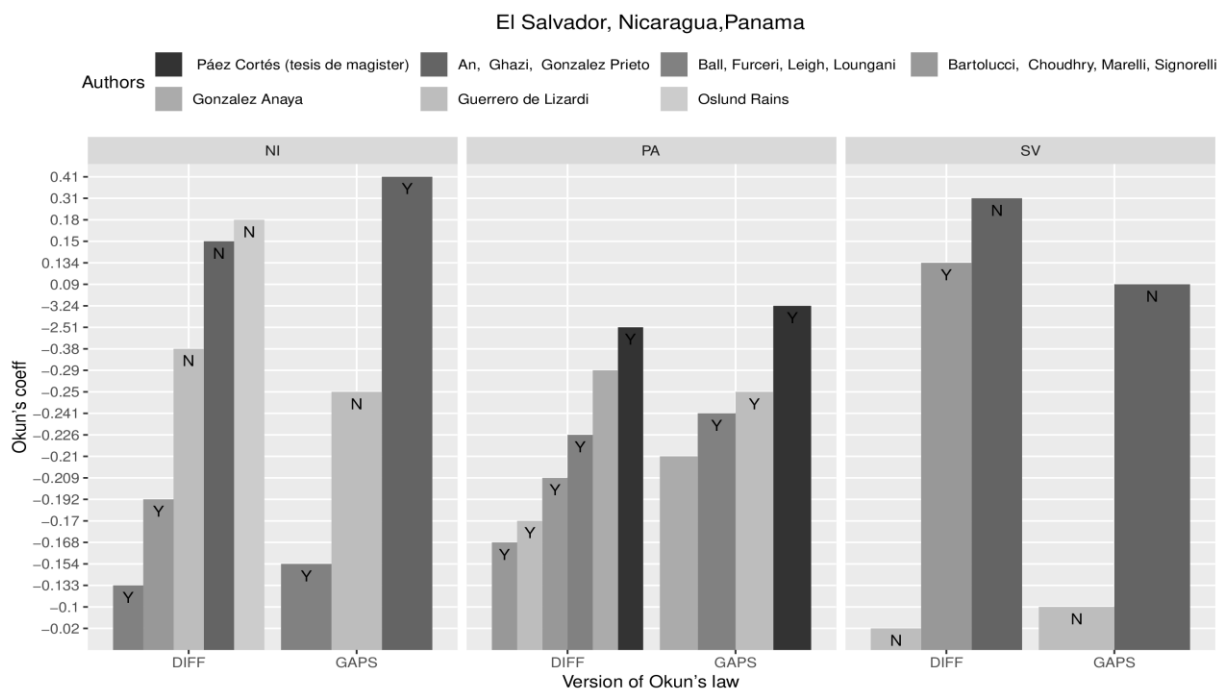
Figure 10.



## El Salvador, Nicaragua, Panama

While information on El Salvador does not seem to give conclusive results, the results for Nicaragua and Panama are clearer. For Nicaragua, the average values for Okun's coefficients for the difference and the gaps versions are, respectively, -0.163 and -0.154, for Panama they are -0.657 and -1.244.

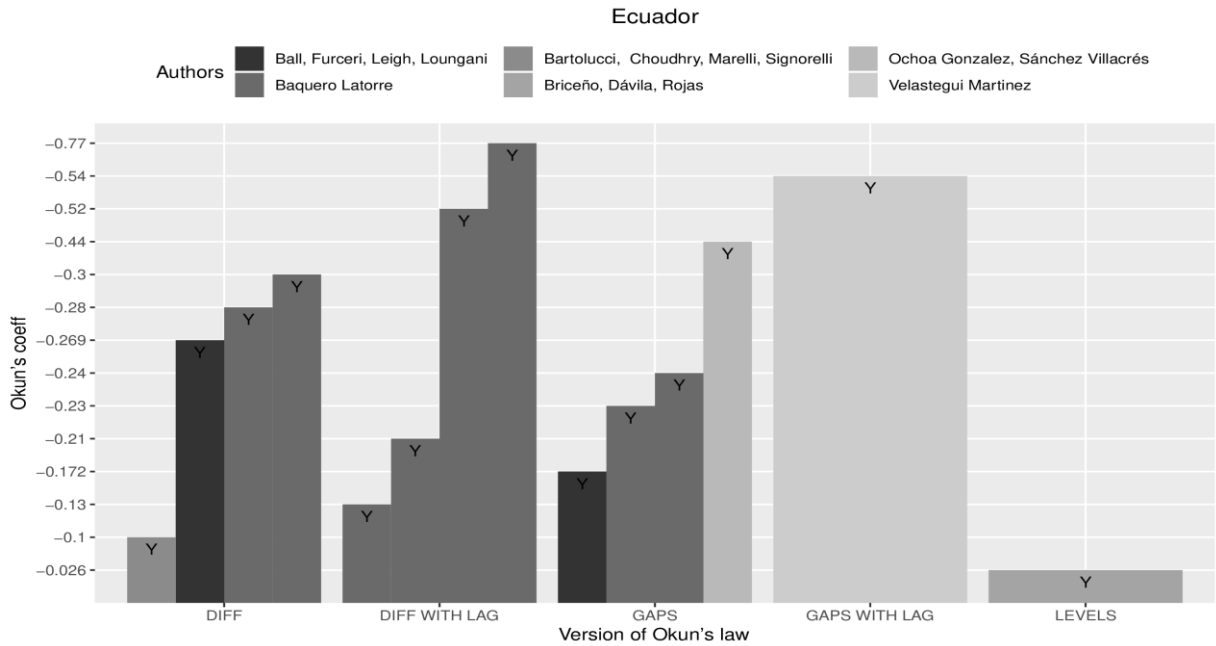
Figure 11.



## Ecuador

There are six studies on Ecuador, they all give significant results. Apart from the two standard regressions in terms of first differences and gaps, we also find the presence of (different numbers of lags). Briceño et al. (2016) estimate the equation using log-levels, and not first differences.

Figure 12.



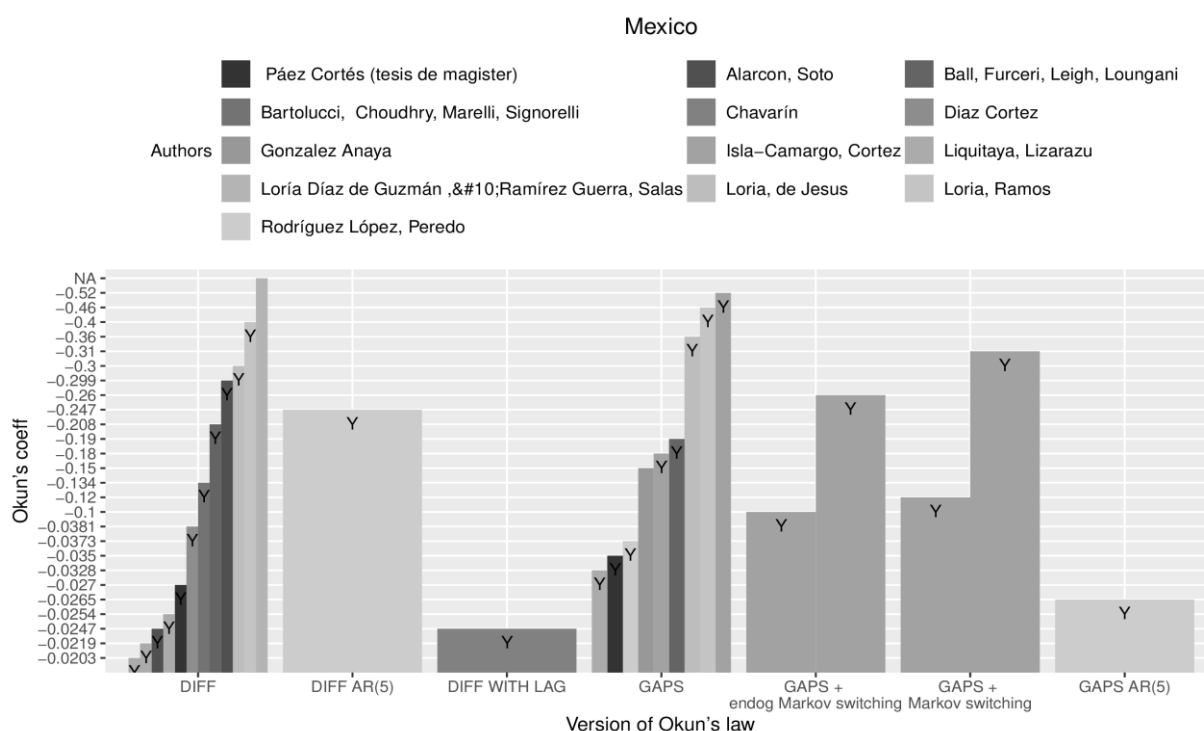
## Mexico

There are thirteen studies on Mexican data, the majority of them focus on the two standard versions of Okun's law: in terms of difference, the average value for the Okun's coefficient is -0.11, while the gaps version gives -0.194.

In addition to the two standard versions of Okun's law, some estimations included lags.

Isla-Camargo and Cortez (2018) estimate a more sophisticated version of the gaps version: in order to investigate the potential differences in Okun's coefficients during recessions or booms, they consider a Markov switching model across two states. In one version the transition probabilities are estimated but fixed, in a second version they allow for time-varying transition probabilities; the variable used to estimate these transition probabilities is the share of informal employment. The authors find that the Okun's coefficients are lower (in absolute value) in expansion than in recessions; moreover, using the share of informal employment as a variable to explain the transition probabilities implies lower (in absolute value) Okun's coefficients than the ones obtained in the model with fixed transition probabilities.

Figure 13.

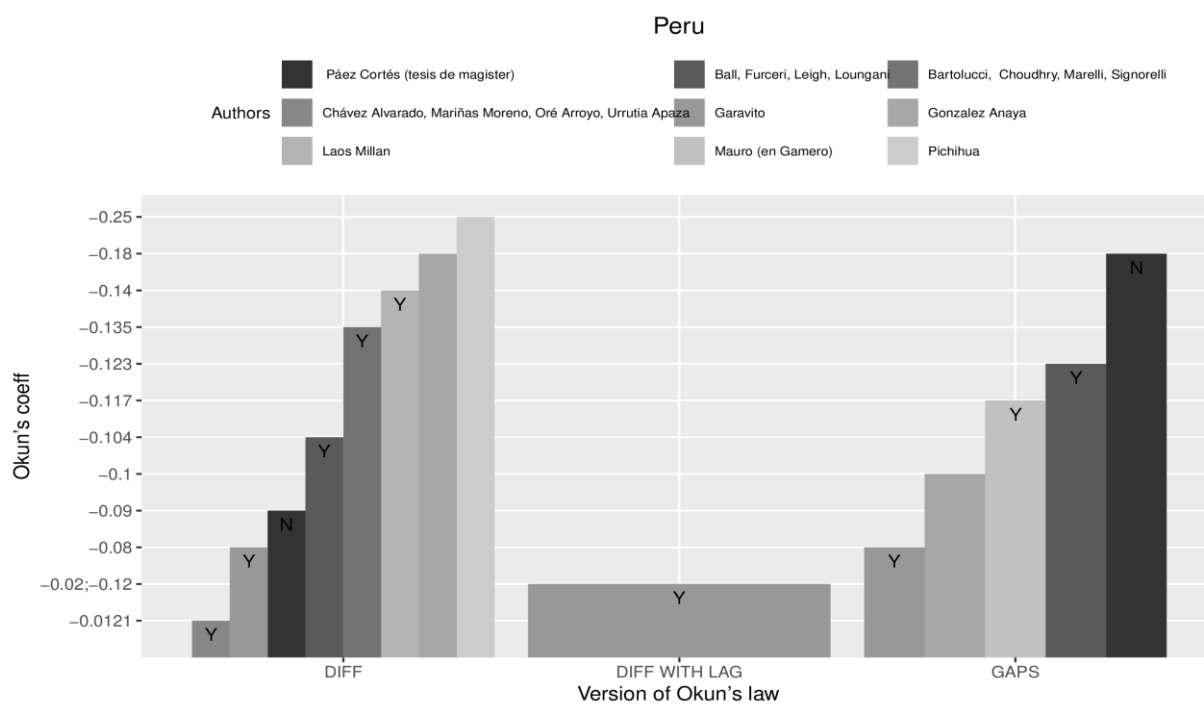


## Peru

Evidence for Peru comes from nine studies, the Okun's coefficients average values, when significant, in terms of the difference and gaps equations, are respectively -0.094 and -0.108.

Garavito (2002) estimates the Okun's law in terms of gaps, differences and she also adds lags. She performs a ten year rolling window estimation, to explore the stability across time of Okun's coefficient. She finds that the coefficients, estimated over the period 1970-2000, vary between -0.02 (en 1980) and -0.12 (en 1986). According to the author, the coefficients decrease (in absolute value) during the 1990s, after the labour market reform that was intended to bring flexibility to the labour market. The author explains this apparently counter-intuitive result considering that the informal sector grew in importance and potentially "absorbed" the workers who were displaced as a result of the reform, thus dampening the effect of growth on unemployment. However, it has also to be recognized that Okun's coefficients are higher at the end of the period than in the 1980s, when the labour market was more rigid.

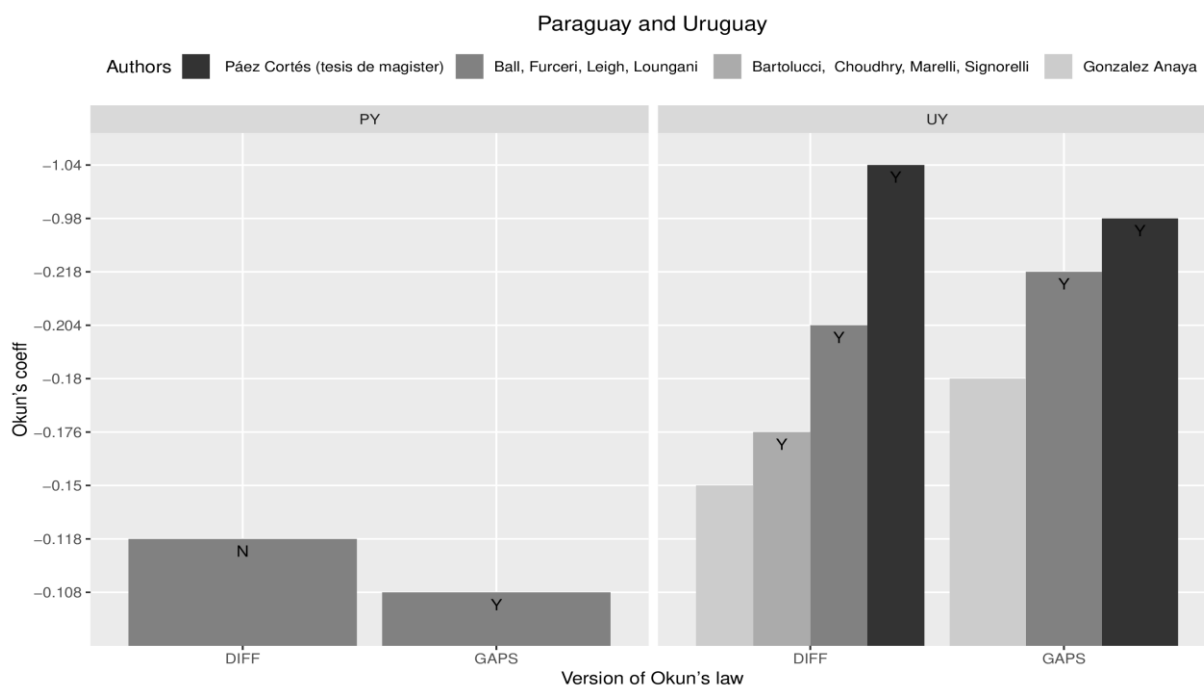
Figure 14.



## Paraguay and Uruguay

There is only one study with Paraguayan data, and its results are significant only in terms of the gaps equation, giving a value of -0.108. For Uruguay there are four studies, the average values for Okun's coefficients, in terms of the difference and gaps equations, are -0.473 and -0.599.

Figure 15.

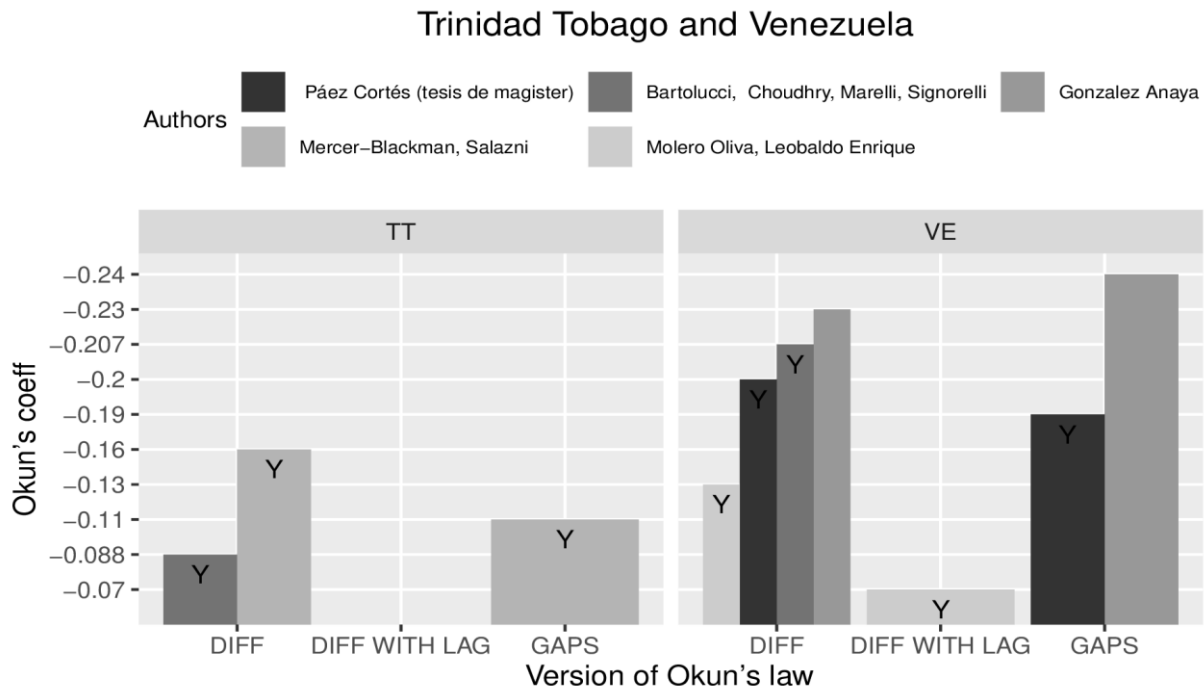


## Trinidad and Tobago and Venezuela

The only available study, that we found with data for Trinidad and Tobago gives an estimation of Okun's coefficients of -0.124 and -0.11 when estimated using the difference and gaps versions.

For Venezuela, there are four studies, the average values for Okun's coefficients, when significant, are -0.179 (difference version) and -0.19 (gaps version).

Figure 16.







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## 5. Determinants of Okun's coefficients

Considering the factors that can explain the variability in the magnitude of Okun's coefficients across countries, we firstly gathered some information from the five multi-countries studies that have been reviewed at the beginning of this document.

Among the proposed explanatory variables that could influence the responsiveness of unemployment to production, we found:

- the importance of shadow economy (or informal sector);
- labour markets regulation, measured as labour market flexibility by the OECD or by some disaggregated measures, such as the importance of severance pay or the length of the probation period;
- business regulation, measured by the product market flexibility index or the Economic Freedom of the World Index;
- the structure of the economy or its sophistication;
- the share of services/GDP;
- the skill mismatch index (computed by the Frasier Institute);
- the poverty rate;
- the goodness of institutions measured by a rule of law index.

Labour market informality or the presence of rigidities in the markets, measured both as business and labour market regulation, which are normally thought as potential explanatory factors, do not seem to be significant in the five multi-countries studies we analyzed. A strong informal sector can be interpreted as providing "flexibility" circumventing law provisions, and it can also absorb some of the flows that would otherwise be between employment and unemployment.

Economic structure is important, considering that employment creation is concentrated in some sectors: countries relying more on "traditional" sectors, typically agriculture, would have a lower effect of output movements on employment and unemployment.

We will analyze all these elements more in detail in the following.

It has been pointed, for example by Kapsos (2006), that the service sector has been, in general, creating employment faster than the industry or the agriculture sector, so a more service-oriented economy would observe larger movements in employment and unemployment.

Skill mismatch appears to have a role in two of the studies,<sup>12</sup> and can be linked to the effects of economic sophistication: if the pool of unemployed does not possess the characteristics required by the firms that are creating jobs (typically those in the "modern" sector), labour market dynamism is damped.

Considering the studies in details, Ball et al. (2016) analyze some potential explanatory variables, such as business and labour market regulation, the share of services over GDP, the size of the shadow economy, as well as a skill mismatch index, the mean unemployment rate and the level of GDP per capita. When evaluating correlations between each of these variables and the Okun's coefficients there seems to be a negative effect of skill mismatch

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<sup>12</sup> Ball et al. (2016) and An et al. (2017).

index on Okun's coefficients for developed economies and a positive one for developing countries, as we can see in Figure 17. However, in the regression the only significant variables appear to be the mean unemployment rate and the level of GDP per capita, which are not per se informative (see Figure 18).

Figure 17.

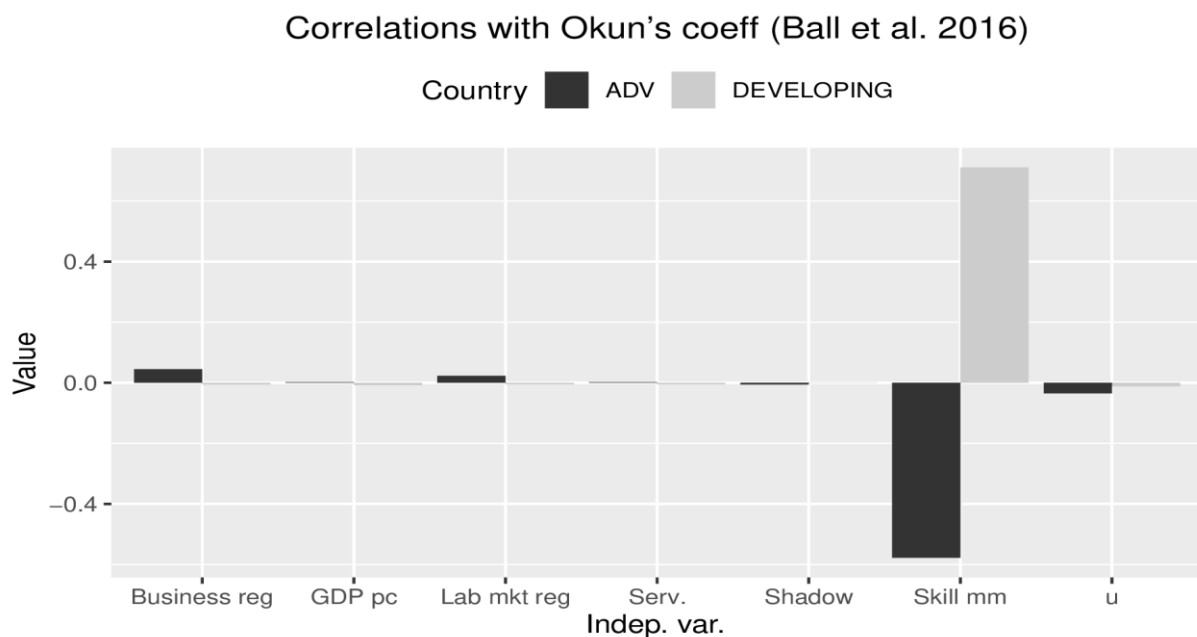
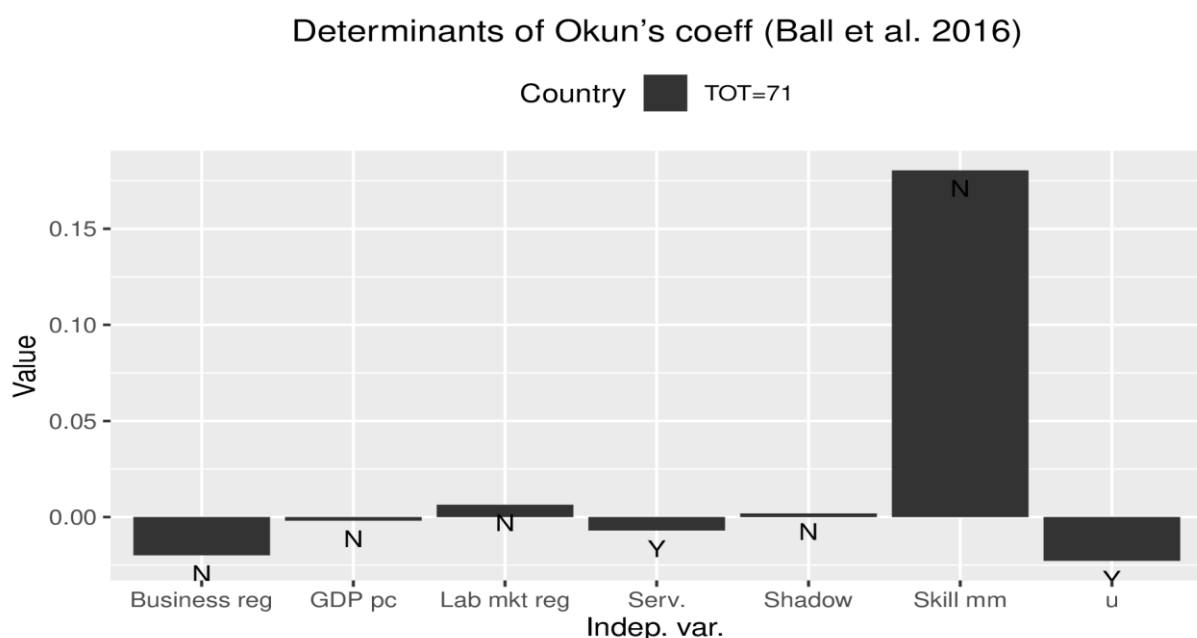


Figure 18.



Farole et al. (2017) perform a panel regression with time fixed effects in which labour market outcomes, including Okun's coefficients, are regressed on a series of potential explanatory variables. They find that higher employment growth is linked to lower levels of informality, higher flows of FDI and more closeness.

The magnitude of Okun's coefficients is influenced by better institutions (measured through the rule of law). Labour market flexibility, as measured by the maximum time for a probation period during the hiring process and the severance pay for redundancy dismissal for 1 year of service) does not appear to have an impact, as it can be seen in Figure 19.

An et al. (2017) consider as potential explanatory variables the poverty rate, the informality rate, as well as business regulation and the skill mismatch index. Their sample includes low and lower middle income countries (LLMICs) and they find that there seems to be a negative relation between poverty rate and the responsiveness of employment to growth, meaning that employment is less reactive in poor countries, where the skill mismatch is worse and business regulation more stringent; informality does not seem to have an impact (see Figure 20). When they perform a formal regression, the poverty rate and the skill mismatch do remain significant (see Figure 21).

Figure 19.

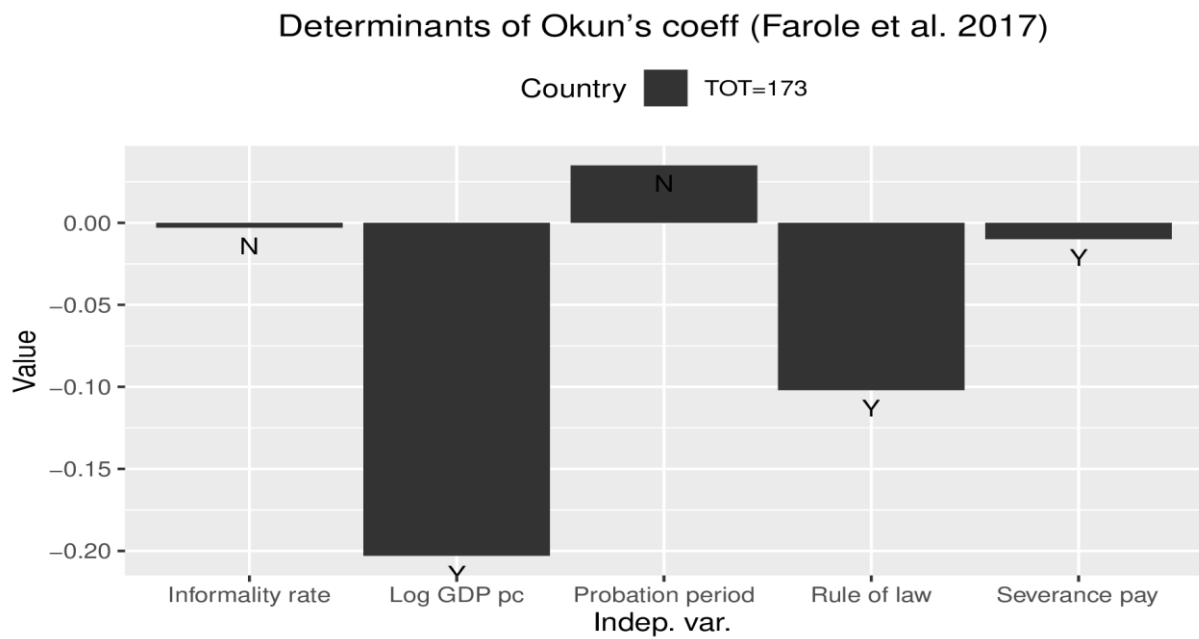




Figure 20.

Correlations with Okun's Employment coeff (An et al. 2017)

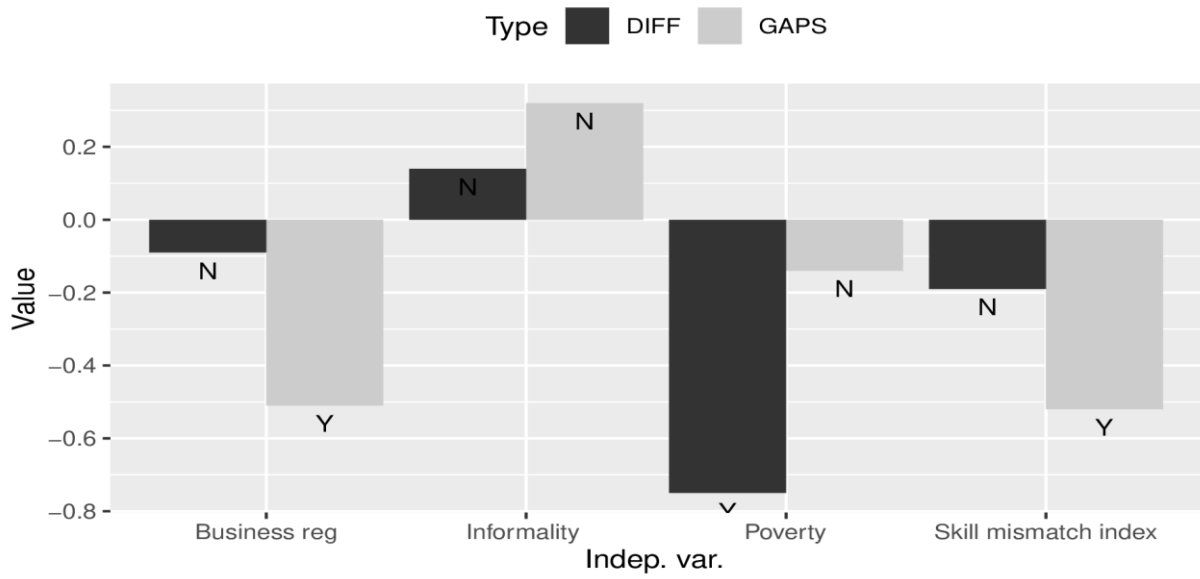
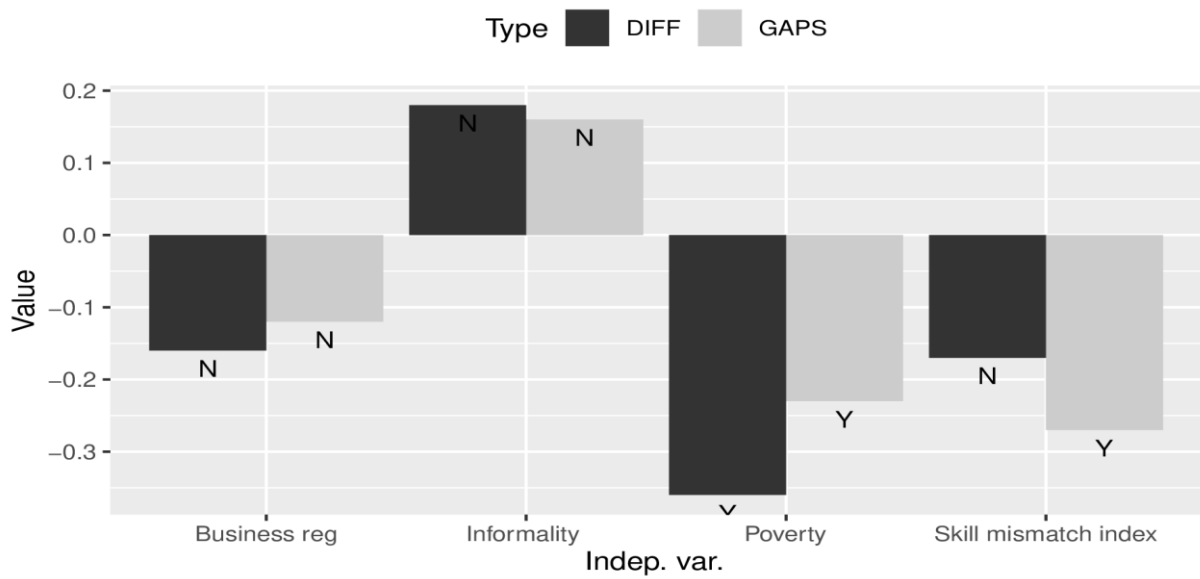


Figure 21.

Determinants of Okun's Employment coeff (An et al. 2017)



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## Economic structure

Farole et al. (2017) provide a qualitative analysis of the correlations between the “sophistication” of the economy<sup>13</sup> and the Okun’s coefficients. They stress that “The negative relationship between unemployment rates and GDP growth is stronger in industrial, service intensive, tourism intensive, and high tech product intensive economies. In contrast, economies, which depend on natural resources and agriculture, have a regression line with a slope that is nearly zero”.<sup>14</sup>

Economies with stronger agricultural sector and higher share of self-employment would see more adjustment through prices (wages and salaries) than quantities of employment or unemployment.

However, Kapsos (2006) noted that, with respect to the positive relationship between employment elasticities and share of the service sector, it is not clear if this represents a greater dynamism of the sector or if instead “the jobs created in services tend to be of lower quality (and hence lower productivity)”.<sup>15</sup>

These findings are confirmed in those countries for which it is possible to estimate Okun’s coefficients at the national, as well as regional level:<sup>16</sup> if the region considered is the metropolitan area of the capital, where normally the formal employment in the more modern sectors is concentrated, we expect the Okun’s coefficient to be higher.

## Labour market flexibility

In the five multi-countries analysis, the information on “labour market flexibility” did not seem to be significant. However, it is necessary to analyze this variable more in detail. First of all, it is necessary to distinguish what it is meant by labour market “flexibility”: following Loría Díaz de Guzmán et al. (2015), one can distinguish between:

- measures of “nominal” labour market flexibility, referring to the laws and norms regulating the functioning of labour markets;
- measures of “factual” labour market flexibility, including information about wages, unionization, as well as the importance of temporary contracts;
- the importance of informal sector: informal employment can be interpreted as a de facto flexible alternative to formal employment.

As Loría Díaz de Guzmán et al. (2015) stress, it is particularly important to distinguish between the *de iure* flexibility as opposed to the *de facto* flexibility: in between there is the consideration that law implementation is often imperfect in developing countries.

While the multi-countries studies that we reviewed at the beginning of this document used mainly the *de iure* concept of flexibility,<sup>17</sup> Loría Díaz de Guzmán et al. (2015) consider as an indicator of flexibility the fraction of temporary contracts over formal employment,

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<sup>13</sup> To define the level of sophistication, they use the percentage of natural resources, agriculture, industry and services as a percentage of GDP, as well as tourism and high-tech exports as percentage of total exports.

<sup>14</sup> See Farole et al. (2017), p. 16.

<sup>15</sup> See Kapsos (2006), p. 28.

<sup>16</sup> See the following section for more details.

<sup>17</sup> An et al. (2017), for example, use a measure that mixes labour and product market regulations, as well as the ease of business.

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which in itself can be interpreted as a consequence of a certain legislative way of introducing labour market flexibility (through a two-tier system). The authors consider the fraction of temporary contracts as a variable in their Vector Error Correction Model (VECM), and find it has a value of 1.28, meaning that higher flexibility implies in fact a higher unemployment rate.

This result is not counter-intuitive: frictional labour markets literature has highlighted that, at a theoretical level, the effect of formal labour market flexibility, measured by employment protection legislation, on unemployment is not unambiguous: stronger protection discourages employment destruction (the flows from employment to unemployment). However, it can also have a negative effect on job creation, and so on the flow from unemployment to employment, leaving the total effect on unemployment unclear.

Plata Andrade (2010) estimates time-varying Okun's coefficients for Bolivia, using data from 1999 to 2009. This author develops a measure of labour market flexibility aggregating information on labour costs, underemployment and social security coverage, thus focusing on a comprehensive de facto labour market flexibility measure. The estimated Okun's coefficients are not significant, however when he regresses the Okun's coefficients over a measure of labour market flexibility, he finds that the independent variables significant and has a negative effect, meaning that higher flexibility implies lower values for the Okun's coefficients. He justifies these findings considering the importance of informal employment.

## Informal economy and self-employment

When analyzing the importance of the shadow economy, few considerations have to be made:

1. Measurement and definition: according to the ILO, "Employment in the informal sector includes all jobs in informal sector enterprises or all persons who, during a given reference period, were employed in at least one informal sector enterprise" and it comprises:
  - "Own-account workers and employers employed in their own informal sector enterprises;
  - Contributing family workers;
  - Employees holding informal jobs;
  - Members of informal producers' cooperatives;
  - Own-account workers engaged in the production of goods exclusively for own final use by their household".

A big part of informal employment includes thus self-employed people, who can have or not employed workers.

2. Similarly, self-employment also presents a large and overlapping definition with informal employment. According to Porrás-Arena, Martín-Román (2018), "Self-employment embraces a range of heterogeneous workers with diverse degrees of working conditions and economic self-sufficiency. The majority of the group comprises self-employed workers without employees (i.e. 'own-account workers', from highly skilled professional to low-skilled workers). In second place are business people who run firms and employ others (i.e. 'employers'). The minor groups (3% of all self-employed workers in Spain, in 2017) comprise the members of cooperatives and so-called 'family help'".



- 
3. When employment is measured with data coming from National Surveys, it normally refers only to urban employment, and it also usually includes informal employment. If part of the flow from employment to unemployment is absorbed by informal employment (and this flow cannot be observed if employment measures the sum of formal and informal jobs), the resulting unemployment rate would be thus less reactive.<sup>18</sup>
  4. The presence of an important informal sector can be linked to the pro-cyclicality of labour force. In countries in which the social security safety net is not well developed, income effects are more likely to prevail on substitution effects in labour supply during cycles, causing the labour force to be pro-cyclical: during a recession, if the breadwinner member of the family gets fired, it is likely that the other members of the family enter the labour force and look for a job; often the job is found in the informal rather than the formal sector.

Isla-Camargo, Cortéz (2018) for example estimate an endogenous Markov switching model for the Okun's law, allowing for the Okun's coefficients to be different in recessions or expansions. When they allow the share of informal employment as a variable that can predict the switching probabilities, they find that the resulting Okun's coefficients are in fact lower (in absolute value) than when they are estimated using a standard difference or gap version, or a Markov switching model with fixed transition probabilities.

Porras-Arena, Martín-Román (2018) study the heterogeneity of Okun's coefficients in Spanish regions and the impact of self-employment. They clarify that behind the definition of self-employment there are in fact two distinct economic concepts: one is self-employment as "refuge employment" (very much similar to informal employment), which shows weakly anti-cyclicality or even pro-cyclical behavior; the other is self-employment as that of "opportunity entrepreneurs" (as opposed to "necessity entrepreneurs", who are in fact employed people pushed to self-employment by necessity).

If the majority of self-employment is in fact refuge employment, i.e. equivalent to informal employment, then the higher the share of self-employment, the lower the magnitude of Okun's coefficients.

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<sup>18</sup> See the discussion in Gonzalez Anaya (2002) as well as Garavito (2002).

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## 6. Sources of heterogeneity within countries

Okun's coefficients can be characterized by within-county variability; some aspects across which they show heterogeneity are:

- time;
- regions;
- gender and age;
- phase of the economic cycle (recession or expansion).

Few studies among the ones that have been reviewed in this document addressed the question of the stability over time of Okun's coefficients. While there is evidence of the instability of Okun's coefficients across time, it is much less clear why so.

Gonzalez Anaya (2002) claims that in countries that underwent a period of stabilization in terms of inflation, quantities (unemployment) started to react more to GDP shocks since real wages could not absorb them anymore, once inflation was brought under control. However, among the six countries he considers, two cases actually fit well his explanation (Chile and Costa Rica), Mexico is considered as a counter-example and for the other three countries evidence does not seem to be compelling.

Considering Peru, Garavito (2002) shows that Okun's coefficients decreased in the 1990s, after a labour market reform that introduced more labour market flexibility. She claims this can be linked to the increased quantitative importance of informal employment, since the flows from employment to informal employment and vice versa damped those between employment and unemployment.

In terms of the heterogeneity of Okun's coefficients across regions, there is evidence that regions where employment in the "modern" (formal) economy is higher also show higher (in absolute value) Okun's coefficients: for example in the metropolitan area of Santiago (Chile) and Sao Paolo (Brazil).<sup>19</sup>

In terms of age and gender, a study for OECD countries (including thus Chile) shows that in general unemployment of young cohorts is more sensitive to GDP fluctuations, and that the unemployment rate of men reacts more than the one of women (probably because of a composition effect in terms of sectors).

Finally, there is a quite strong evidence that unemployment is more reactive in recessions than in expansions, meaning that Okun's coefficient is not symmetric, although the explanation behind this fact does not seem to be clear.

We now proceed to analyze each of these factor in more detail.

### Heterogeneity across time

Gonzalez Anaya (2002) uses data till 2000 for thirteen LAC countries; he identifies at least three macroeconomic regimes for the majority of LAC countries: a period of relative stability and growth in the 1980s and beginning of 1970s; a period of instability following

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<sup>19</sup> This statement has to be put in relation with the fact that in most cases unemployment is measured through national surveys that consider only urban areas.

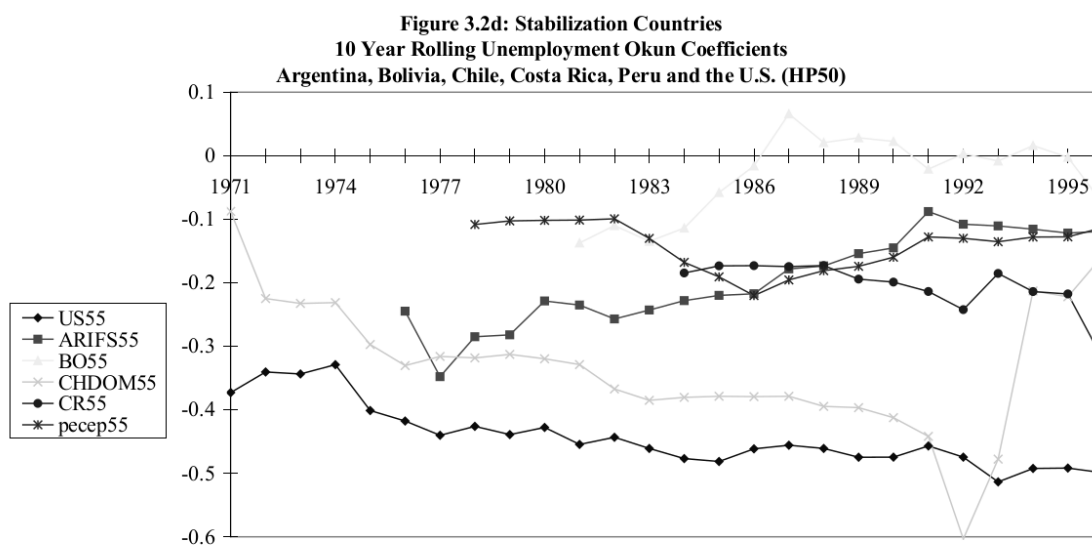
the debt and currency crises of the beginning of the 1980s; the relative stability and growth of 1990s.

He then studies the change across time of Okun's coefficients (performing a ten-year rolling estimation), focusing on countries that experienced stabilization policies in terms of inflation (Argentina in 1991, Bolivia in 1985-1986, Chile in 1974 and 1982, Costa Rica in 1983-1984, Mexico in 1988 and Peru in 1992). In two of the six countries (Chile and Costa Rica), Okun's unemployment coefficients increased (in absolute value), meaning that unemployment became more sensitive to output growth, as it can be seen in Figure 22: From Gonzalez Anaya (2002) p. 20 ). The claim of the author is that when inflation is high, macroeconomic shocks can be absorbed through changes in real wages (since nominal wages do not adjust fast enough); once the price channel is shut down, when inflation is under control, the adjustment has to pass through quantities, in particular unemployment and employment. The unemployment's Okun coefficient would react, meaning that fluctuations in output are reflected in unemployment, if there are not counteracting movements in terms of labour force participation: according to Gonzalez Anaya (2002), for example, in Peru “Unemployment Okun ratios have not increased. The result indicates vigorous cyclical employment creation dampened by labour force participation fluctuation.”

In Argentina, according to the author, quantities could not react due to rigidities coming from in labour markets regulation.

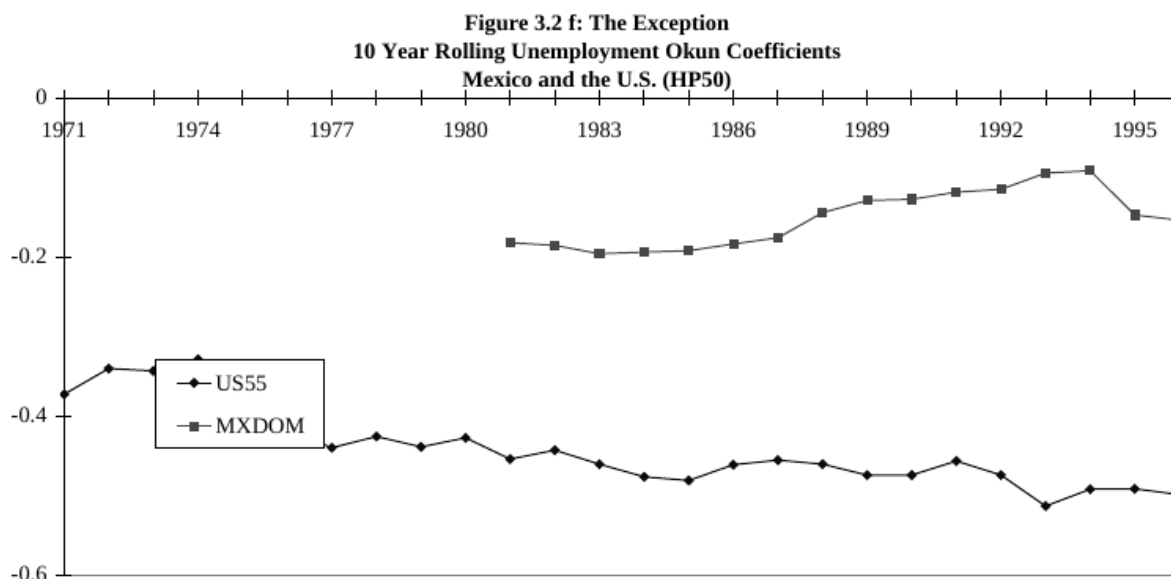
Mexico is considered as an “exception”, because its Okun's coefficients remained quite stable across the period, as it can be seen in Figure 23: From Gonzalez Anaya (2002), p. 22.

Figure 22.



Source:Gonzalez Anaya (2002), p. 20

Figure 23.



Source: Gonzales Anaya (2002), p. 22

Guillén Gomez (2010) checks the stability of Okun's coefficient for Colombia performing two different sets of estimations: first he reports the values obtained using data starting from 1985 till 2009, adding one year at a time; secondly he considers only the period from 2000 to 2009. As we can see in Table 2, he finds that Okun's coefficient decreased across time.

Table 2.

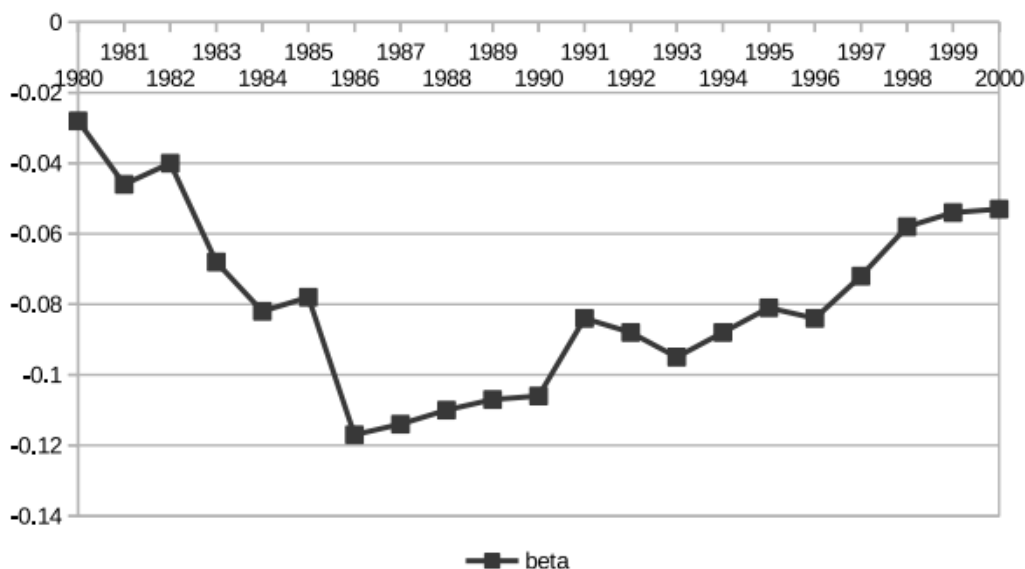
Period 1985-2000		Period 2001-2009	
	$\beta$		$\beta$
1985-1999	-0.5064	2000-2009	-0.3023
1985-2000	-0.5075	2001-2009	-0.2714
1985-2001	-0.4726	2002-2009	-0.359
1985-2002	-0.4627	2003-2009	-0.3887
1985-2003	-0.474	2004-2009	-0.3886
1985-2004	-0.4848	2005-2009	-0.3875
1985-2005	-0.4947		
1985-2006	-0.4745		
1985-2007	-0.4645		
1985-2008	-0.4617		
1985-2009	-0.4587		

From Guillén Gomez (2010)

Using older data for Colombia, Chenery et al. (1986) show that while the Okun's coefficient estimated using data for the whole period 1963-1985 has a value of -0.17 and an  $R^2$  of 0.42, in the period 1965-1974 the structural unemployment was higher and the Okun's coefficient lower in absolute value (equal to -0.08), while in the decade 1975-1985 the structural level of employment decreased and the Okun's coefficient increased (in absolute value) to -0.20; the fit of the regression improved too.

As we saw when analyzing Peru, Garavito (2002) performs a ten year rolling window estimation, to explore the stability across time of Okun's coefficient. She finds that the coefficients vary between -0.02 (en 1980) and -0.12 (en 1986) over the period 1970-2000, as it can be seen in Figure 24. Overall, the coefficients decreased (in absolute value) during the 1990s, after the labour market reform that was intended to bring flexibility to the labour market.

**Figure 24. Peru: Okun's coefficient, 1980-2000**



Source: Data from Garavito (2002)

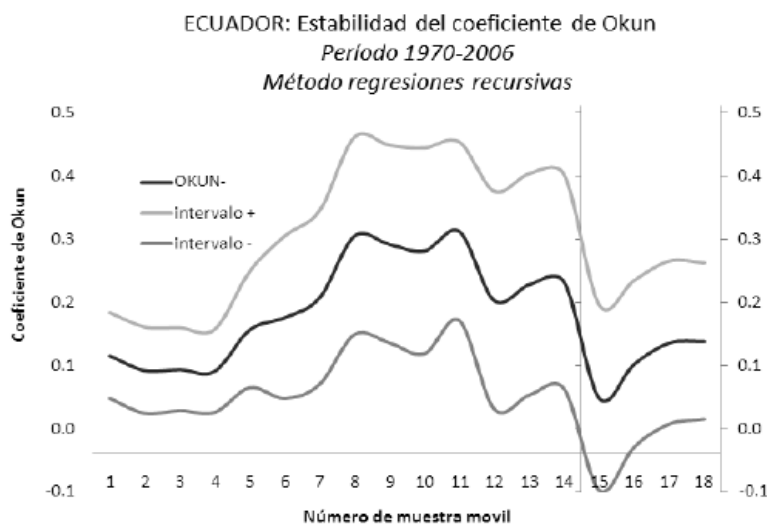
The main conclusions of the author are:

- the informal sector grew in importance and potentially “absorbed” the workers who were displaced as a result of the reform, thus dampening the effect of growth on unemployment.
- Okun's coefficients are higher at the end of the analyzed period than in the 1980s, when the labour market was more rigid.

Baquero Latorre (2009) studies the Okun's relation for Ecuador using data from 1970 to 2009. Apart from the standard estimation, he also performs a set of rolling regressions<sup>20</sup> in order to assess the stability of the Okun's coefficient. In the first set, he uses annual data from 1970 to 2006, in the second set he uses quarterly data from 2000 to 2009.

<sup>20</sup> The author uses a number of n=20 observation, so that the first regression is performed using annual data from 1970 to 1989, the second one using data from 1971 to 1990 and so on.

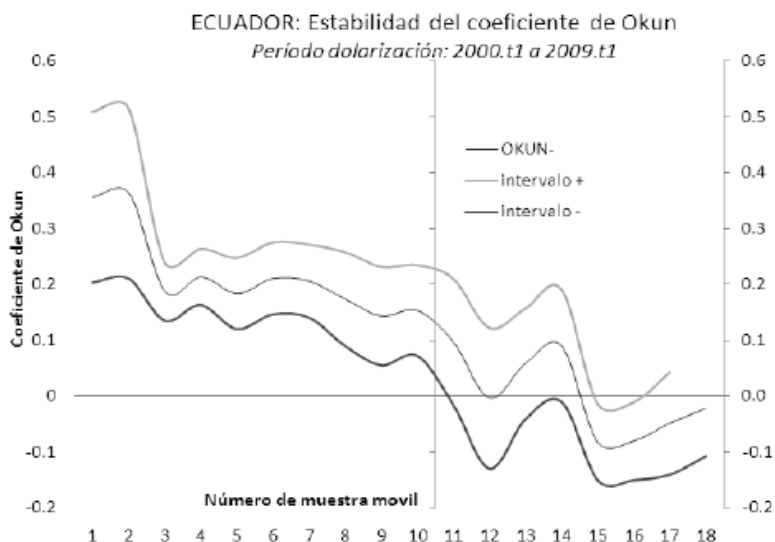
Figure 25.



The author stresses that the estimated Okun's coefficient using annual data fluctuated between -0.13 and -0.35.<sup>21</sup> Including the data from 2000 (regression number 12 in Figure 25: From Baquero Latorre (2009), p. 16), when Ecuador went through a period of “dollarization”, Okun's coefficient stopped being significant.

Considering quarterly data, the author stresses that, after the period of dollarization, when the economy showed some stability, Okun's coefficient remained stable around -0.18. Starting from 2006q1, the Okun's law lost its significance and the coefficient also changed sign (see Figure 26: From Baquero Latorre (2009), p. 19).

Figure 26.



<sup>21</sup> The author reports the estimated Okun's coefficients, in his graphs, in absolute value.

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## Heterogeneity across regions

The main idea behind the fact that Okun's coefficient can potentially be very different inside a country, across its regions, is linked to the heterogeneity in terms of economic structure and the importance of informal labour markets across regions. If the bulk of “modern sector” is concentrated in the capital and its region, while in the rest of the country the “traditional” sectors prevail (including agriculture), where informality and self-employment are important, then we should expect that Okun's law holds more evidently in the capital region than elsewhere.

Considering the studies that we reviewed, these conclusions are mostly evident for Chile and Brazil.

Melo Gois (2017) estimates Okun's law using both data for whole Brazil as well as data for three metropolitan regions (Sao Paulo, Belo Horizonte and Porto Alegre), and he finds that labour market is more responsive to growth in the MA of Sao Paulo, while Okun's coefficients are not even significant in the other two regions.

The research notes of BBVA in 2014 and 2016 for Chile consider two different data sources for unemployment: the national survey ENE and the survey conducted by the Universidad de Chile, that covers only the so called “Gran Santiago”, i.e. the metropolitan area of the capital. The estimations show that the Okun's coefficient is higher in the metropolitan area (-0.53 using data from 1997 to 2014 and -0.51 using data till 2015) than in the whole country (-0.26 using data from 1987 to 2014 and -0.25 adding the data from 2015).

Alarcón and Soto (2017) consider a panel data set for Mexican states, they show that when they estimate Okun's coefficients using fixed effects (thus taking into account states' heterogeneity), they obtain a slightly stronger reaction of unemployment to growth (-2.99% instead of -2.47%). When they estimate the coefficients state by state, they stress that the higher results are found in some areas in the North and North-East, characterized, according to the authors, by a higher level of labour market flexibility.<sup>22</sup>

## Heterogeneity across age and gender

In his paper, Zanin (2015) studies Okun's coefficients in OECD countries across age cohorts and sex. The only Latin American country that belongs to the OECD is Chile, what can be seen is that Okun's coefficient is higher for men than for women (-0.50 and -0.34), and that for both sexes the youngest cohort (15-24 years) have the highest coefficients (-0.90 for men and -0.74 for women).

These results are common across all the countries included in the sample. The author suggests that on the one hand, men are more represented in sectors that are more subject to the economic cycle, such as manufacture and construction; on the other, young people just entering in the labour market are more likely to have temporary contracts, as well as more likely to suffer a “mismatch” between their skills (acquired during their studies) and the skills required by the employers.

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<sup>22</sup> The states the authors refer to are Baja California, Sonora and Chihuahua, which are at the border with the US. We can think that their labour market is therefore strongly affected by its closeness to the border.

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## Heterogeneity across the phase of the economic cycle

The literature on Okun's coefficients has emphasized the possibility that Okun's law could hold with asymmetries according to the phase of the economic cycle: a widely cited paper, Silvapulle et al. (2004), using quarterly data for the US from 1947 to 1999, strongly makes the point that “The response of unemployment to output is found to be stronger when there is a negative rather than a positive output gap”.

Their preferred explanation for this result is linked to the importance of expectations and pessimism; in their words “The proposition that employers tend to be more pessimistic on the downturn than optimistic on the upturn seems to be consistent with risk aversion. Not only is this explanation more appealing, but it is also supported by our empirical results”.

Among the studies that we reviewed, Bartolucci et al. (2018) allow for asymmetric Okun's coefficients considering dummy variables during financial crises;<sup>23</sup> they find that while for high income countries banking and currency crises have a positive additional impact on the magnitude of Okun's coefficient (with one year lag), for low income countries currency crises have the opposite effect. They rationalize their findings considering that while in general a financial crisis adds a considerable level of uncertainty to the economy (even more than a crisis without a financial origin), for low income countries, already characterized by high levels of uncertainty, this effect would not be so important.

Liquitaya and Lizarazu (2004) using data for Mexico from 1980 to 2002 estimate an Error Correction Model allowing for asymmetries between the short run impact of the rate of change of GDP during expansions or recessions. They find that the coefficient during recessions is higher (in absolute value) than the one during expansions (-2.54% versus -2.033%).

Baquero Latorre (2009) for Ecuador estimates an asymmetric Okun's law (in terms of first differences adding two lags for unemployment) and finds that while a reduction of 1% in GDP implies that unemployment increases by 0.52%, while an increase of 1% in GDP decreases unemployment of 0.21%.

Isla-Camargo, Cortéz (2018) estimate for Mexico a standard Okun's law in terms of gaps, as well as two versions of a Markov switching model, allowing for two regimes (expansion and recessions): in the first case the transition probabilities are estimated but fixed, while in the second case they are allowed to depend on a measure of labour market flexibility that is given by the share of informal employment over total employment. They find evidence that unemployment is more responsive to growth in recession than expansion: a decrease of 1% in cyclical output implies an increase of 0.31% in unemployment, while an increase of 1% implies a decrease of cyclical unemployment of 0.12% in the model with fixed transition probabilities; the values are respectively 0.26% and 0.12% in the model that allows for variable transition probabilities.

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<sup>23</sup> They distinguish between three types of financial crises: banking crises, currency crises and sovereign debt crises.





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## 7. Conclusions

In this literature review, we analyzed forty-nine studies on Okun's law, five multi-countries studies and forty-four that specifically focus on Latin American countries.

The two main methodological approaches to estimate Okun's law, in terms of differences (or growth rates) and in terms of gaps of unemployment and GDP have been revised, together with more specific estimation strategies, country by country.

Okun's coefficients for Latin American countries show typically lower values than what found for the US, but quantitatively in line with the evidence for some European countries or Japan (values typically range between -0.10 and -0.20).<sup>24</sup> Two countries for which most estimations give better results in terms of fit and in terms of magnitude of the coefficients are Colombia and Chile. In accordance to what found for developed countries, Okun's coefficients seem to be asymmetric: unemployment would increase more in recession than decrease in expansions.

Some specific economic characteristics of LAC countries can explain the lower responsiveness of unemployment to cycle: the large informal sector and the importance of self-employed, together with weak safety nets provided by social security; the relative importance of the agricultural sector, the overall relatively low level of sophistication of the economy, reflected in the limited share of services in GDP.

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<sup>24</sup> The fact that the values appear to be quantitatively similar with some European countries or Japan does not imply that the underlying economic structures are similar, or that the driving factors are the same. As we will see more in detail in the following, for LAC countries one of the most important element to be considered is the importance of the informal sector, a characteristic that is in common with some European countries, as for example Italy or Greece, but not with other, such as the Continental or the Northern countries.



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