The correlation between unemployment and economic growth in Latin America – Okun's law estimates by country

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Abstract. *The authors question the validity of Okun's law in Latin America in this paper. Based on several econometric models, they show that fluctuations in economic activity have a lesser impact on unemployment rates in Latin American countries than in other, more advanced economies. Instead of stimulus policies focused on reducing unemployment in general, these countries need targeted policies that encourage job creation in specific sectors. That being said, the unemployment–output ratio differs from one Latin American country to another. Where the ratio is weak or non-existent, cyclical variations adversely affect the quality of employment – another aspect that must also be addressed by economic policy.*

Keywords: *Okun's law, unemployment, economic growth.*

1. Introduction

Okun's law is a relevant empirical regularity from the perspective of economic policy, insofar as it provides information on the impact of cyclical variations in economic activity on the unemployment rate, indicating in particular the gap between a country's total and potential production of goods and services (its output) when there are idle resources in the economy.

Understanding of the law and its scope has become even more important in the current context of crisis, in which countries are suffering the devastating effects of the COVID-19 pandemic on world economic activity. In a report issued in

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late March 2020,[1] the Economic Commission for Latin America and the Caribbean (ECLAC) noted that "[t]he pandemic is affecting the economies of Latin America and the Caribbean through external and domestic factors whose combined impact will lead to the most severe contraction that the region has experienced since records began in 1900" (2020, 10). In addition, there is evidence that the real output of an economy is an essential factor for understanding future changes in the unemployment rate (Karfakis, Katrakilidis and Tsanana 2014). The question thus arises: what is the anticipated effect of the current economic crisis on the level of employment and, consequently, on the unemployment rate in Latin American countries? The answer will depend on whether the link between GDP and unemployment is relatively strong, weak or non-existent in each country.

Although the unemployment–output ratio has been extensively studied since Okun first stated his law in 1962, almost all of that research relates to developed countries (Ball, Leigh and Loungani 2017; Blanchard 1997; Gil-Alana, Skare and Buric 2020; Ismihan 2010; Kaufman 1988; Moosa 1997; Paldam 1987; Perman and Tavera 2005 and 2007; Schnabel 2002; Sögner and Stiassny 2002, among others), while empirical evidence remains scarce in the case of Latin American countries. What information is available (Ball et al. 2019 and Pizzo 2020, among others) seems to indicate that the link between the two variables is less significant in Latin America than in the developed world. In other words, in Latin American countries growth must be higher to achieve substantial reductions in the unemployment rate. It also appears that Okun's law applies differently depending on the country. In Peru, for example, the reaction of the unemployment rate to variations in output is barely perceptible, in Ecuador it is of dubious validity, and in Argentina, Brazil and Uruguay it is at levels similar to the lower coefficients of developed countries; in Colombia, on the other hand, the reaction seems stronger, comparable to the average level in more advanced countries. Why is the pattern in several Latin American countries different from the norm?

Any analysis of Okun's ratio must bear in mind that unemployment is the synthetic labour market variable that reflects the impact of changes in labour demand and supply. Thus, the impact of cyclical variations in economic activity on unemployment will change depending on how those variations affect labour supply and demand, and the latter's response will depend on the labour market's contexts and characteristics.

In terms of demand, the reaction of the unemployment rate to changes in output will depend, among other things, on the economy's sectoral specialization, given that some productive activities are more labour-intensive than others (Herwartz and Niebuhr 2011). Specifically, agricultural activities are less labour-intensive than services.[2] This means that, if the relative weight of the agricultural

[1] Study prepared at the request of the Government of Mexico in its capacity as Pro Tempore Chair of ECLAC at the virtual ministerial meeting on health matters for response and follow-up to the COVID-19 pandemic in Latin America and the Caribbean, held on 26 March 2020.

[2] In Kapsos (2005), table 3.10 shows negative mean employment–output elasticity in the agricultural sector in Latin American countries (1991–2003), while that of the services sector is around 1, meaning that the level of employment drops in the agricultural sector, even in periods of growth in the sector. Consequently, the agricultural sector of Latin American countries trends downwards in terms of its share of total employment, owing to increases in labour productivity in the sector (Weller 2016).

sector in the economy is high, stimulating aggregate demand will not have a substantial impact on total employment and, consequently, unemployment will not be strongly affected. However, the agricultural sector varies in terms of labour intensity, in that it involves both high- and low-labour-productivity activities. Weller (2016, 39–40 and 64) designates these as "business agriculture" and "family agriculture", respectively, and provides data pointing to a positive correlation between the proportion of family farming in agricultural employment and the share of agriculture in total employment in Latin American countries. Countries with a predominantly smallholder economy tend to have low labour productivity and occupations whose characteristics differ greatly from those of business agriculture. Consequently, employment in the smallholder or family farming segment seems to behave anti-cyclically, featuring migration in search of more productive activities when the economy expands and labour force retention when it contracts, with the consequent reception of family members who return for want of other job opportunities. Therefore, when employment in agricultural activities has a greater relative weight, the economy will tend to present less significant Okun's ratios.

The references listed at the end document many cases in which employment protection legislation (EPL) rigidifies labour demand and makes it less responsive, because it entails hiring and firing costs for companies that have an impact on the unemployment–output ratio (Balakrishnan, Das and Kannan 2010; Blanchard 1997; Cazes, Verick and Al Hussami 2013; Sögner and Stiassny 2002). If costs are high, companies may opt to hoard labour, i.e. to keep their employees on staff, during downturns. When this occurs in countries where such rigidities exist, the reaction of the unemployment rate to variations in output will not be very pronounced. Ball et al. (2019, 865–866) nonetheless observe that the variable used to measure the degree of employment protection (the EPL indicators) fails to explain the estimated differences in Okun's ratio between countries.

In terms of demand, it must not be forgotten that employers in developing countries, faced with the need to reduce labour costs, frequently hire some of their workers off payroll, depriving them of social security coverage, contrary to the legislation in force (Neffa 2008), and that this has an impact on labour participation decisions and, therefore, on the link between unemployment and output.

On the other hand, on the supply side there are also effects that influence the cyclical sensitivity between unemployment and output, namely those affecting labour participation throughout the economic cycle and usually called, during a downturn, the "added worker effect" and the "discouraged worker effect".[3] The first predicts anti-cyclical behaviour of the labour supply in its extensive margin (labour participation) and the second, procyclical behaviour. A simple theoretical formalization of both effects may be found in two recent publications: Martín-Román, Cuéllar-Martín and Moral (2020) and Martín-Román (2022).

[3] During economic upticks, these are usually called the "inverse added worker effect" and the "encouraged worker effect".

More specifically, loss of employment during downturns deprives the workers concerned of their income – a luxury that few of them can afford. In such cases, the search for survival strategies is the predominant factor in labour participation decisions, and this encourages self-employment and employment in the informal economy. On the other hand, inactivity also rises, given the lack of job opportunities and the non-existence of unemployment insurance obliging the worker to remain active. This is the theoretical effect documented in Martín-Román (2022).

These supply-side decisions explain the low impact of changes in output on unemployment. Okun's ratio will therefore tend to be less evident in economies with a high percentage of employed persons without social security. Added to this is the fact that, although all Latin American countries are governed by legislation that guarantees severance pay, few have an unemployment insurance system (Velásquez Pinto 2014, 18) and this has a similar impact on the link between unemployment and output.

Another factor influencing labour participation decisions is the relative importance of employment in the informal sector.[4] The informal economy tends to operate with low levels of organization, on a small scale and with little or no division between labour and capital as factors of production. In addition, employment relations in the sector are based mostly on casual employment, kinship, or personal and social relationships (ILO 1993, 2). These are activities with low productivity levels that generate, in many cases, subsistence occupations that are poorly paid and require minimal or no qualifications. Neffa (2008, 31), citing Tokman (2004), recalls that informal employment has behaved anti-cyclically in most Latin American countries, and that this slows the rise in unemployment during downturns, owing in part, as we have already pointed out, to the non-existence of general unemployment insurance. In addition, the low qualifications of most informal workers makes it difficult for them to transition to formal employment when the economy expands. Therefore, the greater the weight of informal occupations, the lower the anticipated impact of changes in output on unemployment. This is confirmed by studies prepared with data from Mexico (Liquitaya Briceño 2005; Islas-Camargo and Cortez 2018) and from a group of countries (Ball et al. 2019, 863).

Given that own-account jobs tend to be found in the informal sector,[5] it can be assumed that economies with a high proportion of self-employment tend to have a weaker unemployment–output ratio. Porras-Arena and Martín-Román (2019) collect data on this in a study on regional differences in Spain and conclude that people compare the relevant costs and benefits when considering the possibility of being self-employed. The study makes a distinction between "opportunity" and "necessity" entrepreneurs. The former become autonomous because of the pull factor, that is, because they want to explore business opportunities;

[4] The ILO distinguishes between employment in the informal sector and informal employment. The first includes basically all those employed in unregistered and/or small private companies that produce goods or services for sale or barter, while the second also includes unregistered workers employed in formal companies (2013, 42).

[5] The informal sector does not include self-employed professionals and technicians.

for the latter, on the other hand, self-employment is the only option available (push factor). The push factor dominates over the pull factor in Spain, because self-employment operates to a large extent as "safe haven employment" and is therefore anti-cyclical or only slightly procyclical.

In the case of Latin America, the activity of unpaid family workers plays a central role in the economy of several countries. Occupations of this type do not conform to the labour demand theory and consequently tend to exhibit countercyclical behaviour as well. Changes in output will therefore affect unemployment much less in countries in which these occupations account for a significant proportion of economic activity. Given that the relative weight of this type of employment differs greatly among Latin American countries, this factor will have to be considered when analysing the differences in Okun's law.

Consequently, cyclical variations in output, which in developed countries are very significantly correlated with unemployment rates, seem milder in developing countries, but have a very notable influence on the quality of occupations. In developing countries, jobs in the informal sector abound, without social coverage, without unemployment insurance, on an own-account basis or in an unpaid family work relationship. Several of these characteristics are correlated. In other words, part of agricultural employment presents characteristics typical of the informal sector, such as self-employment or unpaid family work, or combines informality with the lack of social security coverage. These points should be taken into account when using these variables to explain the different reactions of unemployment to fluctuations in output.

The contribution of this study to research in this field is twofold. On the one hand, it documents the behaviour of Okun's ratio in 15 Latin American countries during the same time interval, using a compatible database and various models that make the results more robust. Its sequential estimates of the coefficients serve to visualize problems of stability and significance throughout the entire period. On the other hand, it uses the estimate results to compare country-specific outcomes, analysing the differences between countries and endeavouring to discover the underlying factors, taking into account the aforementioned variables characterizing the labour markets concerned.

The rest of the article is structured as follows. Section 2 describes the reference framework, Okun's law, and reviews earlier research that estimated Okun's coefficient in developed and developing economies, particularly studies focused on Latin America, in order to formulate initial hypotheses. In section 3 we explain the analysis methodology, the estimation models and the explanatory variables used; the data series used is set out in section 4. Section 5 contains the detailed results of the analysis; we estimate the Okun coefficients in Latin American economies to try to explain the differences observed between countries, looking for possible correlations with different variables. The data obtained allow us to formulate policy recommendations (section 6) and draw conclusions about the general behaviour of Okun's law in Latin American countries (section 7).

2. Reference framework: Okun's law

In a study based on United States data, Okun (1962) observed an inverse and statistically significant ratio between the unemployment rate and the level of output. He concluded that for each percentage point of growth in output above its normal or potential level in an economy, the unemployment rate was reduced by approximately 0.3 percentage points.

This observation had major repercussions: it provided not only a rough measure of the cost of high unemployment on a country's output, but also a tool for assessing the impact of policies on changes in the unemployment rate. It has since been incorporated into economic policy debates and become the subject of academic study.

Most of the research on Okun's ratio relates to more advanced economies. Several conclusions can be drawn from the results: (a) with few exceptions, the law is borne out in most countries and periods; (b) generally speaking, unemployment has reacted more strongly to changes affecting output in more recent periods; (c) in most of the analyses, except in the case of the United States, the estimated coefficients are sensitive to the methodology used for their estimation; and (d) Okun's coefficient[6] presents significant differences between countries (for example, according to Ball et al. (2019), the values oscillate between –0.17 in Japan and almost –1 in Spain, which means that cyclical variations in output have a slight impact on unemployment in Japan, while in Spain the ratio is practically 1:1, that is, an increase of 1 per cent in GDP above its natural or potential level reduces the unemployment rate by 1 percentage point).

According to the empirical evidence, labour markets in developing countries are on average less sensitive to fluctuations in output than those in advanced economies. Ball et al. (2019, 845) estimate that Okun's coefficient has an average value of –0.2 in developing countries and –0.4 in advanced economies.[7] Therefore, as Pizzo (2020) explains in a review of the literature, smaller Okun's coefficients in absolute value are predicted for Latin American economies compared to the average for more advanced economies. Pizzo finds, in general, lower Okun's coefficients (between 0.1 and 0.2 in absolute value) than those estimated for the United States and similar coefficients to those of some European countries

[6] Okun's coefficient is obtained by estimating a regression in which unemployment is the dependent variable and output is the explanatory variable. In the difference version, both unemployment and output are described as first differences. The coefficient therefore indicates how many percentage points unemployment changes when output varies by 1 per cent above or below "normal" growth, which is the situation in which unemployment remains unchanged. In the gap version, both unemployment and output are expressed as the differential with respect to their natural or potential levels. That is, the coefficient indicates how many percentage points unemployment moves away from its natural level when output varies by 1 per cent above or below its potential level (Belmonte and Polo 2004). The coefficient is usually negative and ranges in most cases between 0 and –1. For this reason, to simplify the analysis, we have generally commented on and compared only the absolute values of the coefficients, without specifying the corresponding sign.

[7] According to the same study, the adjustment of Okun's ratio also turns out to be lower in developing countries than in advanced countries: the median value of the coefficient of determination (R2) of the models in less developed countries ranges between 0.2 and 0.3, while it is about 0.5 in more advanced economies.

Table 1. Earlier Okun's law estimates for Latin American countries

Country or region	Ball et al. (2019)[1]	González Anaya, (2002)[2]	Franco Martín (2017)[3]	Various authors
Argentina	–0.11**	–0.17	from –0.10 to –0.16	–0.14[4]
				–0.12 to –0.36***[5]
Bolivia		–0.01		
Brazil	–0.24***	–0.18		–0.18 and –0.2***[6]
Chile	–0.36***	–0.36	–0.31 and –0.16***	
Colombia	–0.44***	–0.52	–0.5 and –0.3***	
Costa Rica	–0.23***	–0.22		–0.19 a –0.29***[7]
Ecuador	–0.17**			0.48[8]
Honduras	–0.10*			
Mexico	–0.19***	–0.12		0.10***[9]
				0.13***[10]
Nicaragua	–0.15***			
Panama	–0.24***	–0.17		
Paraguay	–0.11*	–0.06		
Peru	–0.12***	–0.13		–0.08***[11]
Uruguay	–0.22***	–0.29		
Venezuela		–0.32		
Latin America				between –0.1 and –0.2[12]
				–0.034 to –0.06*** [13]
Developing countries	–0.20			
Developed countries	–0.40			

Note: *, **, *** Significant at 10, 5 and 1 per cent, respectively.

[1] In general, the period is 1980–2015. According to the authors, however, lack of data means that for several countries the period is shorter. [2] 1980–1996, with no significance in terms of the estimates. [3] 1980–2015. [4] Abril, Ferullo and Córdoba (1998). 1980–1997. Insignificant coefficient. [5] Magariños (2018). 1980–2013. [6] Tombolo and Hasegawa (2014). 1980–2013. [7] Arias Cubillo, Kikut Valverde and Madrigal Badilla (2002). 1976–2001. [8] Briceño, Dávila and Rojas (2016). 1991–2014. Positive, statistically insignificant coefficient. [9] Loría Díaz de Guzmán, Ramírez Guerra and Salas (2015). 1997–2004. [10] Rojas Manzo (2019). 2005–2016. [11] Garavito (2003). 1970–2000. [12] Pizzo (2020). Literature review. Corresponds to the conclusions of the study but does not specify a period or coefficient significance. [13] Páez Cortés (2013). 1995–2009.

and Japan, with the exception of Colombia and Chile, which present somewhat higher values.

One of the studies reviewed by Pizzo is that of Páez Cortés (2013), who investigated the validity of Okun's law in ten Latin American economies between 1995 and 2009 using panel methodology and by individual country. In her panel estimates, Páez Cortés obtained significant but small coefficients. However, some of her results by country differed greatly from those estimated by other authors, such as Ball et al. (2019), González Anaya (2002) and Franco Martín (2017).[8]

[8] The results for Uruguay, Bolivia and Paraguay estimated by Páez Cortés (2013) are –1.04, –2.5 and –1.7, and those for Brazil and Argentina are –0.038 and –0.065, respectively. In addition, those results do not match the observations for those countries set out in the main body of her research.

Table 1, which contains previous point estimates for various Latin American countries, shows the following:

- Some estimates indicate that unemployment reacts very slightly (below 0.1 in absolute value) or not at all (not significant) to variations in output in Bolivia, Paraguay and Peru (González Anaya 2002; Briceño, Dávila and Rojas 2016; Garavito 2003);
- Colombia is the only country for which the estimates attain absolute values equal to or greater than 0.3 (Ball et al. 2019; González Anaya 2002; Franco Martín 2017) and is therefore the Latin American country in which the unemployment rate is most sensitive to changes in output, reacting on a par with rates in developed countries;
- For several countries (Brazil, Chile, Costa Rica, Panama, Uruguay and Venezuela), the estimates are between –0.2 and –0.36 (Ball et al. 2019; González Anaya 2002; Franco Martín 2017; Tombolo and Hasegawa 2014; Arias Cubillo, Kikut Valverde and Madrigal Badilla 2002);
- For some countries (Honduras, Nicaragua, Paraguay and Peru) the estimated coefficient was between –0.1 and –0.15 (Ball et al. 2019; González Anaya 2002);
- The estimates for Argentina show dissimilar values (between –0.10 and –0.36), perhaps because the periods, methods or data sources were different (Ball et al. 2019; González Anaya 2002; Franco Martín 2017; Abril, Ferullo and Gaínza Córdoba 1998; Magariños 2018);
- Most of the estimates for Mexico (between –0.1 and –0.13) indicate that unemployment reacted slightly to variations in output (González Anaya 2002; Loría Díaz de Guzmán, Ramírez Guerra and Salas 2015; Rojas Manzo 2019), while the study by Ball et al. (2019) of many countries estimates a coefficient that is somewhat higher in absolute value (0.19).

In short, in light of the results set out in the references consulted, it can be predicted that the unemployment–output ratio is less robust in Latin American countries than in more developed countries, that Okun's ratio is, with few exceptions, significant in most Latin American countries, and that the coefficients differ between countries, indicating in some cases a greater sensitivity of unemployment to variations in output.

3. Analysis of the methodology

In our analysis, Okun's ratio was estimated using static versions of the difference and gap versions (Belmonte and Polo 2004), which fit well with the annual data analysed.

The difference version was formulated using the following equation:

$$u_t - u_{t-1} = \alpha_1 + \alpha_1(y_t - y_{t-1}) + \varepsilon_t, \quad (1)$$

where u_t is the unemployment rate, y_t is the GDP logarithm and ε_t represents residual white noise.

The gap version was formulated using the following equation:

$$u_t - u_t^* = \beta_0 + \beta_1(y_t - y_t^*) + \mu_t, \quad (2)$$

where u_t^* is the natural unemployment rate, y_t^* is the potential GDP logarithm and μ_t is residual white noise.

The cyclical components of the gap version variables were obtained using the Hodrick–Prescott (HP) filter, applying different values of the multiplier penalty parameter (λ), and the Hamilton filter (HF) (Hamilton 2017; Schüler 2018), in order to contrast sensitivity to the chosen filter. According to Del Rio (1999), it is fairly common to assign a value of 1,600 to λ when dealing with quarterly data, but not other periodicities. For annual series, various values of λ were used (10, 100 and 400), but the value 6.65 also fits the annual series. This is why the unemployment and GDP cycle series were estimated using three values of λ, namely 6.65, 10 and 100. Since the variables in differences and the cyclical components are stationary, the ratio can also be estimated using ordinary least squares.

In a second step, sequential or rolling window estimates were calculated in order to observe the changes over time in Okun's coefficient, as in Balakrishnan, Das and Kannan (2010) and Knotek (2007). The procedure consists in estimating the ratio by windows, in order to identify moments of major changes in the ratio or temporal stability problems. The estimates were made at 20-year windows for all the models (the difference model, the gap model using the Hodrick–Prescott filter and assigning the values of 6.65, 10 and 100 to λ, and the gap model using the Hamilton filter). Nineteen consecutive estimates of Okun's coefficient were obtained for each model and for each country (the first estimate is for the period 1980–1999 and the last one for 1998–2017).[9]

The explanatory factors for the differences in Okun's coefficient were first analysed by visualizing the ratios graphically and calculating the linear correlation between the variables, following the criteria applied by Ball, Leigh and Loungani (2017) and Ball et al. (2019). Various explanatory models were also estimated using ordinary least squares, but the corresponding results should be viewed with caution, given the limited data availability.

4. Description of the data

The annual series for the unemployment rate and GDP for the period 1980–2017, which are available in the ECLAC database, were used for the following 15 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. Only a few countries were excluded from the analysis owing to the short duration of their series.

[9] Owing to differences in the availability of the data, for Uruguay the first period is 1986–2005 and for Venezuela the last period is 1995–2014.

The following explanatory variables were used:

- Employment in the agricultural sector: percentage of total employment (ECLAC database;[10] average of available data (2000–2017); no information available on Argentina);
- Employment protection legislation (EPL indicators): indicators prepared by the Organisation for Economic Co-operation and Development (OECD) and the Inter-American Development Bank (IDB)[11] (for most countries only the estimated indictors for 2014 are available; the higher the value of the indicators, the greater the job protection);
- Wage earners without social security coverage: percentage of total wage earners (ECLAC database; average of available data (2000–2017); no information available for Bolivia, Ecuador and Panama);
- Employment in the informal sector: percentage of total employment (ECLAC database; average of available data (2000–2017); includes microenterprise workers, domestic workers and unskilled own-account workers; no information available for Nicaragua);
- Self-employment: percentage of total employment (World Bank database;[12] average of available data (1991–2017));
- Unpaid family workers: percentage of total employment (ECLAC database; average of available data (2000–2017)).

5. Discussion of the findings

5.1. Okun's law estimate

Regarding the estimates of Okun's law, the first notable aspect of the findings is that the negative ratio between unemployment and economic activity is true, regardless of the version applied, in all countries except four: Bolivia , Ecuador, Honduras and Nicaragua (table 2). The findings for these four countries could have been predicted based on the analysis of previous estimates (table 1), which might have forecast such a result (insignificant coefficients) or values indicating a slight change in the unemployment rate with respect to output.

Except in a few cases, the estimates made using the different models for each country do not differ significantly, meaning that we could analyse and compare their averages as an approximation of the real value of the coefficients. Once the countries with an insignificant Okun's coefficient are eliminated, Peru presents the lowest coefficient (0.13 in absolute value), followed by Mexico (0.17) and Paraguay (0.19). Thus, according to these estimates for the entire period, and in line with the earlier estimates, those are the three countries in which the unemployment rate reacts less intensely to changes in economic activity. The

[10] CEPALSTAT, Statistical Databases and Publications, "Statistics and indicators". https://statistics.cepal.org/portal/cepalstat/index.html?lang=en.

[11] See www.oecd.org/employment/emp/oecd-idbdatabaseonsummaryindicatorsofemployment protectionlegislationeplinlatinamericanadthecaribbean.htm.

[12] See https://data.worldbank.org/indicator/SL.EMP.SELF.ZS.

Table 2. Okun coefficient estimates for Latin American countries (1980–2017)

Country	Differential model	Gap model				Mean estimates[2]
		Hodrick–Prescott			Hamilton[1]	
		λ = 6.65	λ = 10	λ = 100[1]		
Argentina	–0.21***	–0.24***	–0.24***	–0.23***	–0.18***	–0.22
Bolivia	–0.15	–0.12	–0.10	–0.09	–0.08	*–0.11*
Brazil	–0.24***	–0.22***	–0.20***	–0.25***	–0.20***	–0.22
Chile	–0.35***	–0.30***	–0.31***	–0.26***	–0.22***	–0.29
Colombia	–0.38***	–0.34***	–0.33***	–0.35***	–0.41***	–0.36
Costa Rica	–0.25***	–0.33***	–0.33***	–0.25***	–0.34***	–0.30
Ecuador	–0.27***	–0.02	–0.10	–0.11	–0.15	*–0.13*
Honduras	–0.02	–0.09	–0.11	–0.21**	–0.16**	*–0.12*
Mexico	–0.17***	–0.19***	–0.17***	–0.17***	–0.17***	–0.17
Nicaragua	–0.16	–0.15	–0.13	–0.10	–0.08	*–0.12*
Panama	–0.28***	–0.29***	–0.27***	–0.28***	–0.30***	–0.28
Paraguay	–0.23***	–0.17**	–0.17**	–0.15***	–0.22***	–0.19
Peru	–0.14***	–0.15***	–0.15***	–0.12***	–0.08***	–0.13
Uruguay[3]	–0.20***	–0.20***	–0.20***	–0.22***	–0.18***	–0.20
Venezuela[4]	–0.24***	–0.25***	–0.25***	–0.28***	–0.22***	–0.25

Note: *, **, *** Significant at 10, 5 and 1 per cent, respectively.

[1] The Newey–West estimator was used; it corrects autocorrelation issues using the Hodrick–Prescott filter λ=100 for Colombia, Mexico and Uruguay, and the Hamilton filter for Argentina, Colombia, Mexico, Nicaragua and Paraguay. [2] Values in italics are mean results of dubious validity. [3] 1986–2017. [4] 1980–2014.

Source: Compiled by the authors.

coefficients obtained indicate that, for each percentage point of output growth above its potential or natural level, the unemployment rate is reduced by 0.13 (Peru), 0.17 (Mexico) and 0.19 (Paraguay) percentage points.

Colombia is at the opposite end of the scale and has the most sensitive unemployment rate among Latin American countries, with a level of reaction to output (–0.36) similar to that of several developed countries (Ball et al. 2019). Okun's coefficients for the other countries range between –0.2 and –0.3 in absolute value, again in line with several of the earlier estimates.

In general, this is confirmation that, except in the case of Colombia, Okun's ratio is relatively weaker in this group of countries than in developed countries. In line with the information that we had obtained from the earlier research, there is a group of countries in which the unemployment rate reacts weakly or not at all to variations in output, and another group in which the ratio is somewhat more robust.

Point estimates of the coefficients, taking into account the entire period, can hide unstable behaviour in the ratio over time. As Knotek (2007, 81) points out in a study of Okun's law with respect to the United States, the problem with time-series models is that history can hide changes in ratio. Consequently, in order to provide additional information, sequential estimates of Okun's ratio were obtained, and they give an idea of how the coefficients changed over time.

Figure 1. Sequential estimates of Okun's coefficient for Latin American countries

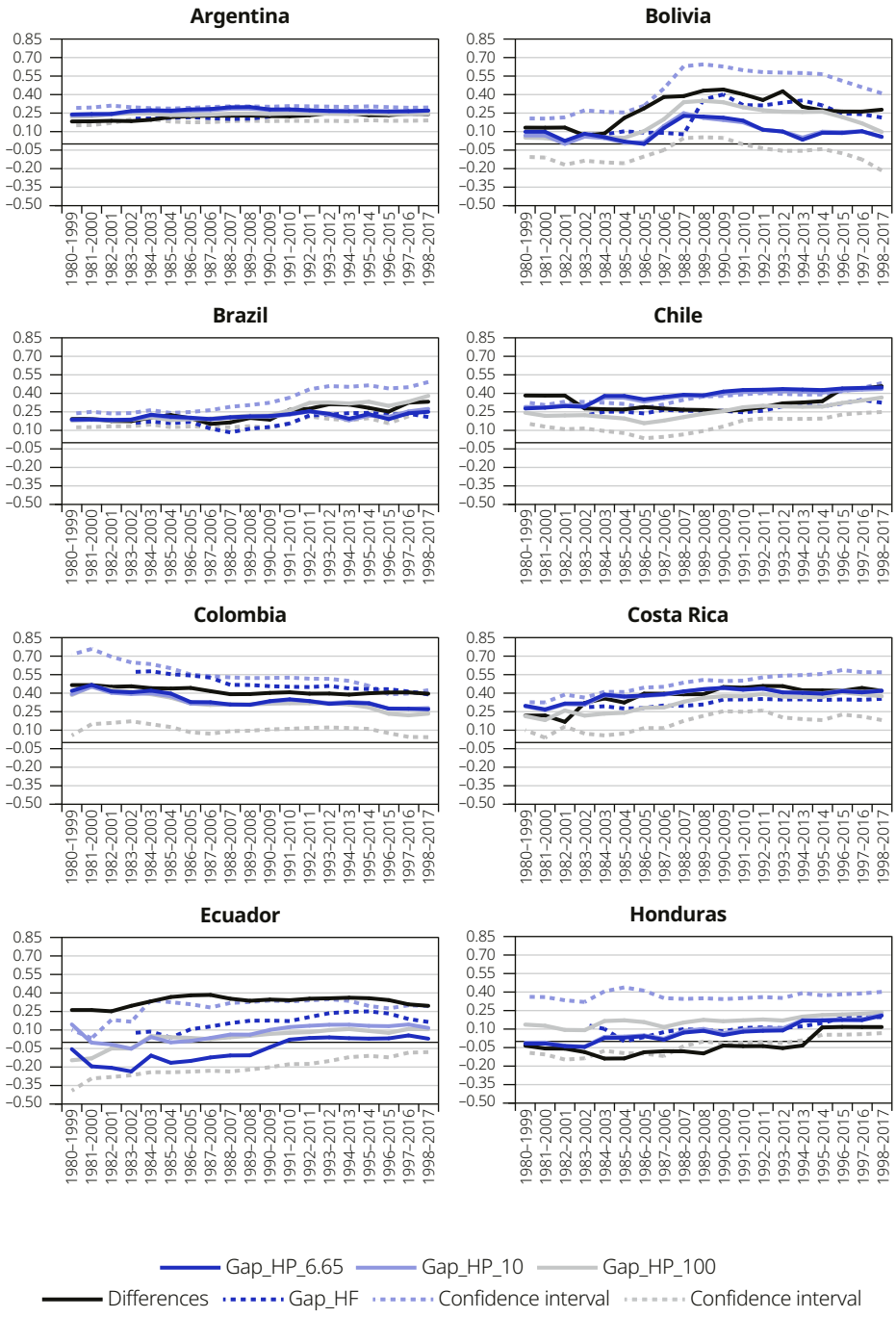
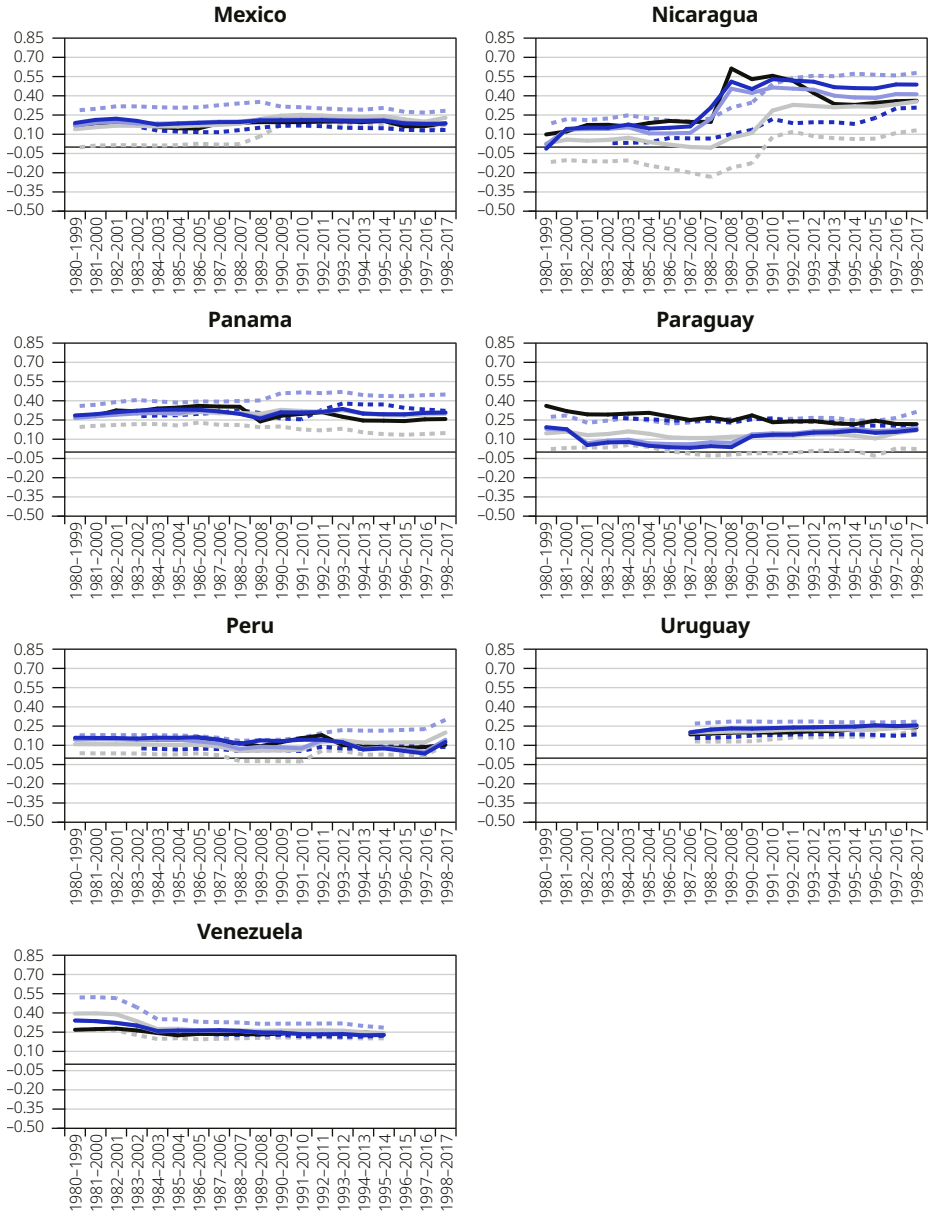


Figure 1. Sequential estimates of Okun's coefficient for Latin American countries *(cont'd)*



Notes: Gap_HP_6.65: gap model using the HP filter and a multiplier (λ) of 6.65; Gap_HP_10: gap model using the HP filter and a multiplier (λ) of 10; Gap_HP_100: gap model using the HP filter and a multiplier (λ) of 100; Differences: differences model; Gap_HF: gap model using the Hamilton filter. The dotted grey line corresponds to the confidence interval at 95 per cent of the model with HP filter and λ=100.

Source: Compiled by the authors.

As regards the sequential estimates (in absolute values), we observed, first, that the choice of the estimation method does not yield statistically different results (figure 1). With the exception of a few cases, the estimates for each country are within the confidence interval.[13] Secondly, it was once again confirmed that Okun's ratio apparently does not hold true in Bolivia, Ecuador, Honduras and Nicaragua. Indeed, the graphs for those countries show that zero lies within the confidence interval (the interval occurring between the two dotted light blue and grey lines) throughout almost the entire period. In addition, the estimates for some periods present values close to zero or take the opposite sign to that expected.

In the case of Paraguay, although the occasional estimate for the period as a whole does not allow us to rule out that Okun's law applies for that country, the figure for the sequential estimates indicates that the lower limit of the confidence interval in some sections is very close to zero or has the opposite sign to that expected. Furthermore, some estimates of the ratio also yield results indicating a very weak unemployment–output ratio (below 0.1). Something similar can be seen in the graph for Peru, with the difference that, in this case, all the estimates are highly concentrated and remain below 0.1 for almost the entire period. As for Mexico, although the validity of Okun's law is not ruled out throughout the period, the sensitivity of unemployment may be very low, especially in the first half of the estimates, given that the lower limit of the confidence interval is very close to zero throughout that stretch.

The cases of Argentina, Panama and Uruguay are noteworthy because of the ratio's stability throughout the entire period under analysis and because all the estimates are highly concentrated (around 0.25). The same holds true for the estimates for Venezuela during the period 1984–2003 and for Brazil from the beginning to the 1991–2010 window. The estimates for Chile, Costa Rica and the second half of the period in Brazil are somewhat more disperse and variable, but the values are at levels close to 0.25 in most cases. Thus, for this group of countries, it can be anticipated that growth in economic activity at 1 per cent above its natural or potential level will reduce the unemployment rate by about 0.25 percentage points. On the other hand, in the case of Colombia, whose point-specific estimates for the entire period showed the highest absolute values of Okun's coefficient, the sequential estimates reveal a fairly wide confidence interval, meaning that we cannot rule out that the coefficients end up being situated in each period even below 0.25.

In conclusion, we can distinguish between two groups of countries. The first group consists of the countries that have a relatively stable Okun's ratio that holds true throughout the period and whose estimated coefficients do not differ too much from the sequential estimates. This group is made up of Argentina, Brazil, Chile, Colombia, Costa Rica, Panama, Uruguay and Venezuela. In addition, the coefficients for these countries denote an unemployment rate that is more sensitive to variations in output (estimates between –0.2 and –0.4).

[13] The figure indicates the margins of significance at 95 per cent of the occasional estimate using the Hodrick–Prescott filter and at a multiplier (λ) of 100 (dotted light grey lines).

Table 3. Division into groups according to Okun's law results

Group 1 (estimates between –0.2 and –0.4)	Group 2 (estimates between –0.1 and –0.19 or of dubious validity)
Argentina	Bolivia
Brazil	Ecuador
Chile	Honduras
Colombia	Nicaragua
Costa Rica	Mexico
Panama	Paraguay
Uruguay	Peru
Venezuela	

Source: Compiled by the authors

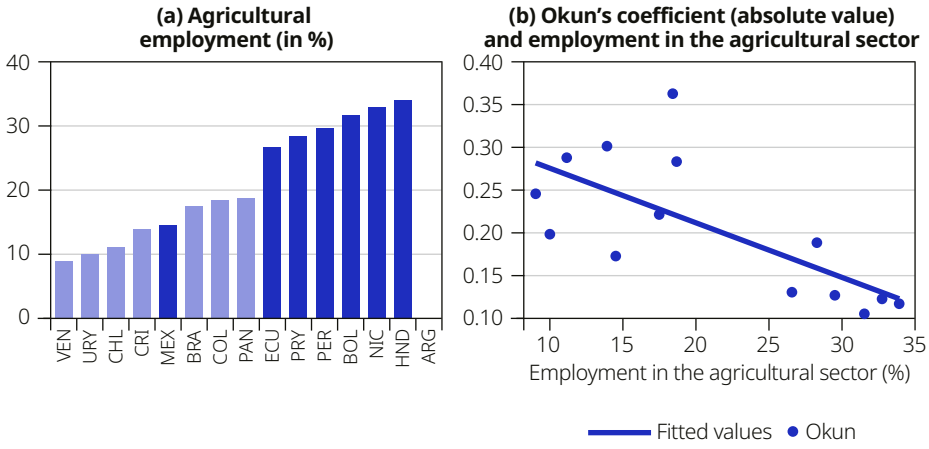
The second group is made up of countries that do not obey Okun's law, as was already ascertained when their coefficients were estimated for the entire period and when the results of the sequential estimates were analysed. Bolivia, Ecuador, Honduras and Nicaragua are in this group. Furthermore, although the results cast doubt on the validity of the law in these countries, the coefficients resulting from the point-specific estimates are the lowest in absolute value (between 0.1 and 0.13), which indicates that, if the law holds true, the unemployment rate would be very insensitive to changes in output. Mexico, Paraguay and Peru are also in this group and in their case, despite the fact that the estimates for the entire period corroborate the law's validity, in some cases with an absolute value quite close to – albeit lower than – those of the first group, the analysis of the sequential estimates provides information that to some extent calls into question some of these results and, in line with the earlier findings, brings them closer to the second group (table 3).

5.2. Explanation of the differences

What factors explain the differences between these two groups of countries, namely that in one of them changes in GDP have an impact of dubious validity or of little importance on the unemployment rate, while in the other the impact is greater? As already noted in the introduction, the impact depends on how changes in economic activity affect labour supply and demand, which in turn is conditioned by the characteristics of each county's labour market.

As we saw in the introduction, the demand factors that can influence the unemployment–output ratio are the following: productive specialization and labour market legislation/institutions. On the supply side, decisions may depend on the following factors: the workers' social security coverage, the proportion of informal employment and the weight of own-account employment and unpaid family work. First, we use a graphic visualization to analyse the correlation between these factors and Okun's law. In the bar charts designated with the letter (a) in figures 2 to 7, the aim is to observe whether the variable in question discriminates between the two groups of countries. This information is complemented with the corresponding scatter diagrams, designated with the letter (b),

Figure 2. Relationship between Okun's coefficient and employment in the agricultural sector



Notes: Correlation coefficient: –0.70. The light blue bars indicate countries in the first group; the dark blue bars indicate countries in the second group.

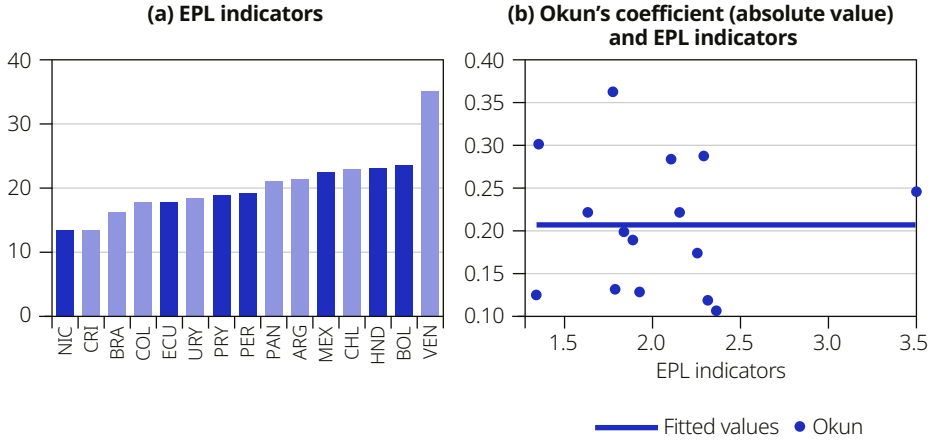
Source: Compiled by the authors using CEPALSTAT data.

in order to see if there is any kind of correlation or linear relationship between the variable and the estimated Okun's coefficient for the countries. Second, we present the results of the explanatory models with due caution, given the paucity of information.

As an approximation to productive specialization, we examine agricultural employment as a share of total employment, a variable that, except in the case of Mexico, discriminates between the two groups of countries (figure 2(a)). The countries with the highest percentage of agricultural employment are those in the second group, which confirms the theory that Herwartz and Niebuhr (2011) set out in their study on European economies. This is due to the fact that some productive activities are more labour-intensive than others and the demand for labour will respond to a lesser extent to variations in economic activity in less labour-intensive (agricultural) activities. In addition, in the case of the countries of Latin America, where agricultural employment accounts for a significant share of the economy, the productive structure is of the "smallholder" type, with the characteristics already described, and employment behaves anti-cyclically (Weller 2016, 64). On the other hand, when studying the correspondence between the data on agricultural employment and the point values of the estimates of Okun's law for the countries in the sample (figure 2(b)), a negative linear correlation is observed between both variables, that is, the higher the proportion of agricultural employment, the less the unemployment rate reacts to output, and vice versa.

The EPL indicators, which is the variable that is usually used to measure the degree of employment protection provided by legislation and labour market institutions, do not present a pattern that discriminates between the two groups of countries (figure 3 (a)) and therefore do not explain the differences identified

Figure 3. Relationship between Okun's coefficient and EPL indicators



Note: Correlation coefficient: –0.0045275. The light blue bars indicate countries in group 1; the dark blue bars indicate countries in group 2.

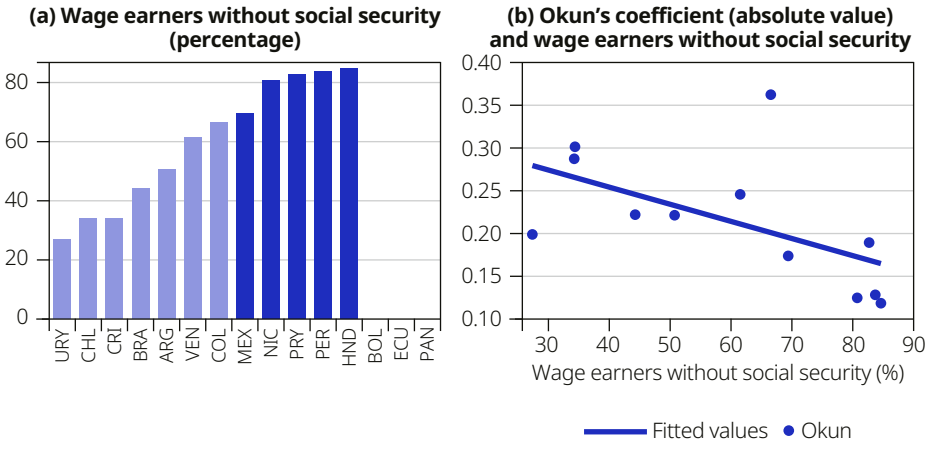
Source: Compiled by the authors using CEPALSTAT data and the EPL indicators produced by the Inter-American Development Bank and the OECD.

between Latin American countries in Okun's coefficient. This is also confirmed in the scatter plot of points (figure 3 (b)), which does not show the existence of a clear linear relationship between the values of Okun's coefficient for each country and the value of the EPL indicators. This result concurs with the conclusions of other studies. For example, Ball, Leigh and Loungani (2017), in an analysis of more advanced economies, and Ball et al. (2019), working with a sample of advanced and developing economies, do not find a clear relationship between both variables. Cazes, Khatiwada and Malo (2012) concur, pointing out that the empirical evidence on the link between the EPL indicators and employment is far from conclusive.

When it comes to labour supply factors, the relative weight of wage earners without social security coverage clearly distinguishes between the two groups, although not enough information is available for Bolivia, Ecuador and Panama (figure 4(a)). The countries with the highest percentage of wage earners without social coverage are in the second group. Figure 4(b) also corroborates the negative relationship between both variables. As we said in the introduction, this is because, in a recession, workers who lose their jobs also lose their wages, a luxury they cannot afford, and are therefore prompted to search for subsistence strategies that have little impact on the unemployment rate. In addition, unemployment also rises because workers have few incentives to look for jobs, employment job opportunities being scarce and there being no unemployment insurance obliging them to remain active. As a result, variations in economic activity have only a slight impact on unemployment.

The variable that indicates the weight of employment in the informal sector partially distinguishes between the two groups of countries (figure 5(a)). No data were available for Nicaragua. The Okun's coefficients for Colombia

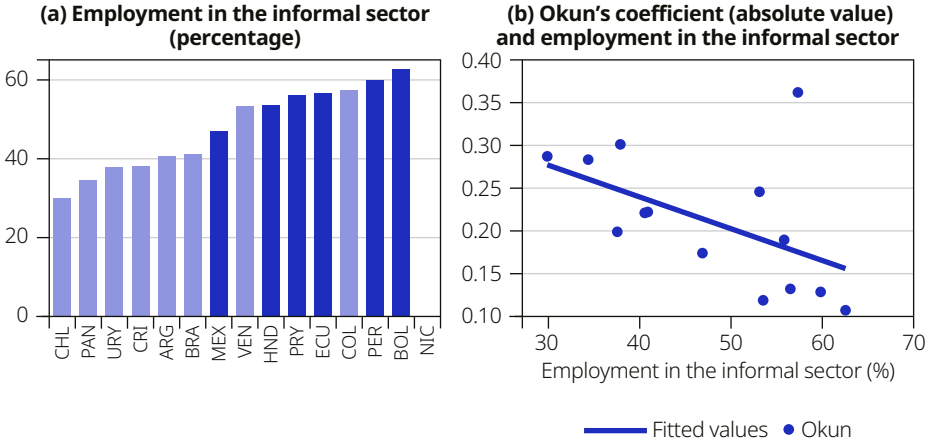
Figure 4. Relationship between Okun's coefficient and salaried employment without social security



Note: Correlation coefficient: –0.5651. The light blue bars indicate countries in group 1; the dark blue bars indicate countries in group 2.

Source: Compiled by the authors using CEPALSTAT data.

Figure 5. Relationship between Okun's coefficient and employment in the informal sector

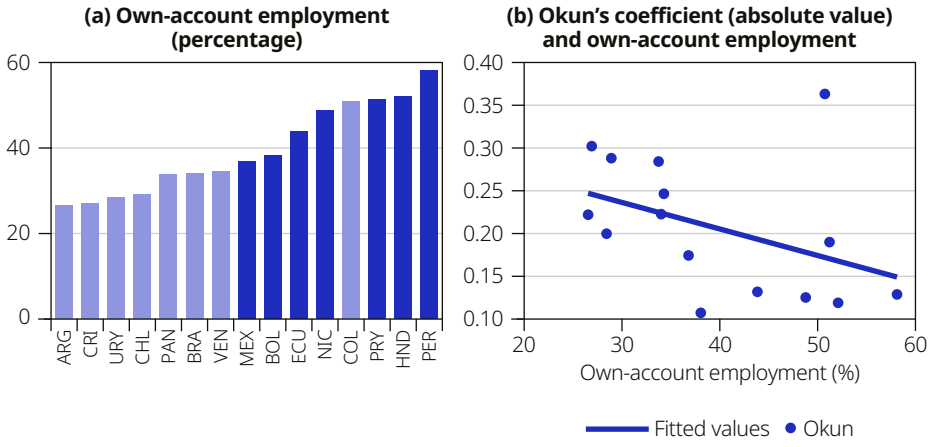


Note: Correlation coefficient: –0.5185. The light blue bars indicate countries in group 1; the dark blue bars indicate countries in group 2.

Source: Compiled by the authors using CEPALSTAT data.

and Venezuela, which are relatively high compared to other countries in Latin America, are mixed with those of the second group. However, the scatter plot in figure 5(b) seems to indicate a negative linear relationship between the two variables. As we explained in the introduction, occupations in the informal sector have low levels of productivity, are poorly paid and require minimal or no qualifications, making it difficult for workers to transition to the formal

Figure 6. Relationship between Okun's coefficient and own-account employment



Note: Correlation coefficient: –0.416. The light blue bars indicate countries in group 1; the dark blue bars indicate countries in group 2.

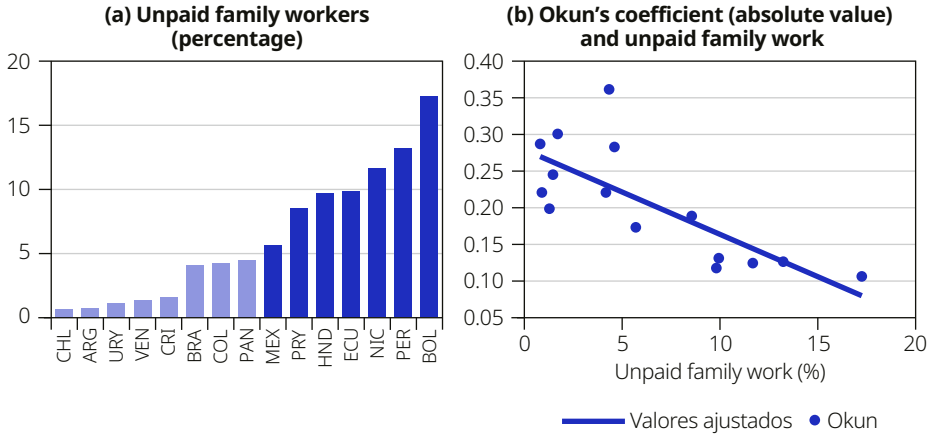
Source: Compiled by the authors using World Bank data.

sector, even when the economy is expanding; changes in informal employment are therefore countercyclical. Consequently, if these occupations account for a significant share of the economy as a whole, variations in output will have slighter effects on unemployment.

On the other hand, the proportion of self-employed persons is a variable that seems to distinguish quite clearly between the two groups of countries, with the exception of Colombia (figure 6(a)). This result agrees with the negative correlation between Okun's coefficient variables and self-employment (figure 6(b)), which means that the countries with the highest proportion of self-employed workers present lower values for Okun's coefficient. This trend also confirms the hypothesis of Porras-Arena and Martín-Román (2019) mentioned earlier: the greater share of self-employed workers causes variations in output to have a weaker effect on unemployment, probably because occupations of this kind are usually a form of "safe haven employment" and act as a buffer against economic fluctuations, especially in economies with high rates of employment without social security coverage, as is the case of several Latin American countries.

Lastly, another notable characteristic of some Latin American labour markets is the high proportion of unpaid family workers, a variable that perfectly distinguishes between the two groups of countries (figure 7(a)). The countries with the highest levels of this type of work are in the second group. Figure 7(b) also indicates a clear negative linear relationship between the two variables. These occupations are characteristic of employment in the informal sector and therefore present features similar to anti-cyclical behaviour. In other words, in economies with a high proportion of family workers, fluctuations in output will have little or no impact on the unemployment rate.

Figure 7. Relationship between Okun's coefficient and unpaid family work



Note: Correlation coefficient: –0.760. The light blue bars indicate countries in group 1; the dark blue bars indicate countries in group 2.
Source: Compiled by the authors using CEPALSTAT data.

So far, our analysis has considered each explanatory variable as independent of the others in its relationship with Okun's coefficient. However, several of the characteristics of the Latin American markets that we analyse here are interrelated. Thus, table A1 in the appendix shows a high positive correlation between the other variables, except for the EPL indicators. This creates problems when estimating the magnitude of the individual impact of each explanatory variable on Okun's coefficient as the dependent variable.[14]

Even though the number of observations is not very high, explanatory models have been estimated as a way of approximating the possible effects that the different variables could generate on Okun's ratio (table 4). As observed in model (1), issues of multicollinearity make it impossible to estimate a model that contains all the variables.[15] Several models have therefore been estimated, each in respect of one explanatory variable, in order to determine which model is most appropriate and which variable best explains the differences.[16] In line with what was observed in figures 2 to 7, the EPL indicators do not explain the differences in Okun's coefficient between Latin American countries (model (2)). We interpret the results obtained in the other models below.

[14] Table A2 presents evidence of multicollinearity: low tolerance indices and a high variance inflation factor.

[15] Multicollinearity is detected when all the variables are insignificant individually (the value of p in each is above 0.05) but significant when considered as a whole (the value of the variable Prob(F-statistics) is less than 0.05).

[16] The model (2) includes only the LPE index variable. Regarding the other variables, two models were estimated, the first of which includes Colombia, while the second excludes that country. Models (3) and (4) correspond to the variable "employment in the agricultural sector"; models (5) and (6) refer to the variable "salaried workers without social security"; (7) and (8) analyse "employment in the informal sector", (9) and (10) "self-employment" and (11) and (12) correspond to the variable "unpaid family worker".

Table 4. Estimated relationship between Okun's law and the characteristics of Latin American labour markets

Exogenous variables	Models with Okun's coefficient as a dependent variable											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
EPL Indicators		–0.001										
		(0.987)										
Agricultural employment	0.001		–0.006	–0.006								
	(0.893)		(0.005)	(0.001)								
Wage earners without social security					–0.002	–0.002						
					(0.055)	(0.003)						
Employment in the informal sector	–0.002						–0.004	–0.005				
	(0.412)						(0.058)	(0.000)				
Self-employed	–0.001								–0.003	–0.005		
	(0.702)								(0.124)	(0.005)		
Unpaid family work	–0.007										–0.011	–0.011
	(0.385)										(0.001)	(0.000)
ID = Colombia (*)	0.183			0.152		0.177		0.216		0.225		0.144
	(0.003)			(0.008)		(0.002)		(0.000)		(0.002)		(0.003)
Constant	0.374	0.208	0.339	0.320	0.335	0.335	0.393	0.446	0.173	0.377	0.279	0.264
	(0.003)	(0.034)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R^2	0.846	0.000	0.49	0.74	0.32	0.77	0.27	0.79	0.18	0.67	0.58	0.80
Observations	13	15	14	14	12	12	14	14	15	15	15	15
Prob(F-statistics)	(0.00)											

(*) The variable ID = Colombia is a fictitious variable with two possible values: value 1 identifies Colombia and value 0 all other countries. By including this variable in the model, the relationship is estimated without taking account of the information on Colombia.

Notes: The values of *p* are indicated in parentheses. Model (1) includes information on Argentina and Nicaragua; models (3) and (4) do not include data on Argentina; models (5) and (6) have no information on Bolivia, Ecuador and Panama; models (7) and (8) have no information on Nicaragua.

Source: Compiled by the authors.

According to model (4), it would appear that, if Nicaragua were to reduce the share of agricultural employment to the same level as in Brazil (from 32.8 to 17.5 per cent), the sensitivity of unemployment would go up, from a coefficient of 0.125 to 0.22 (in absolute value)[17] – the estimated Okun's coefficient for Brazil. According to model (6), if the number of wage earners in Argentina without social coverage increased to the level of Mexico (from 50.4 to 69.4 per cent), the reaction of unemployment would be reduced and Okun's coefficient would move close to that of Mexico (0.178 in absolute value).[18] If Ecuador reduced employment in the informal sector to the proportion registered in Chile (from 56.5 to 29.9 per cent), variations in output would have a greater impact on unemployment (model (8)), with an Okun's coefficient close to that of Chile (0.27 in absolute value).[19] If self-employment in Peru decreased to match that of Venezuela (from 58 to 34 per cent), according to model (10), its Okun's coefficient would also be similar to that of Venezuela (0.25 in absolute value).[20] Lastly, according to model (12), if the proportion of unpaid family workers in Uruguay increased, approaching that of Honduras (from 1.2 to 9.8 per cent), its Okun's coefficient would fall to the Honduran level (0.11 in absolute value), indicating that the unemployment rate is less responsive to output.[21]

Lastly, as can be seen from the R2, which shows the goodness of fit of the models and how well the dependent variable can be predicted, we find that the variable that indicates the proportion of unpaid family workers in the total number of employed workers seems to be the most explanatory (models (11) and (12)). Indeed, 58 per cent of the variability of Okun's coefficient among Latin American countries is explained by this variable; the percentage is lower for the other models. When Colombia is excluded from the analysis, the model explains 80 per cent of the variability.

6. Analysis and policy recommendations

These findings have implications for public policy. In the first place, they point to a wide variability between the countries of the Latin American region in relation to Okun's law. This is a first sign that it serves little purpose to formulate

[17] The estimated Okun's coefficient for Nicaragua is 0.125. The following calculation is applied: [(17.5 – 32.8)*(–0.006)] + 0.125 = 0.22; the result is compared to the estimated coefficient for Brazil (0.2219).

[18] The estimated Okun's coefficient for Argentina is 0.22. The following calculation is applied: [(69.4 – 50.4)*(–0.0023)] + 0.22 = 0.178; the result is compared to the estimated coefficient for Mexico (0.174).

[19] The estimated Okun's coefficient for Ecuador is 0.132. The following calculation is applied: [(29.9 – 56.5)*(–0.0052)] + 0.132 = 0.27; the result is compared to the estimated coefficient for Chile (0.288).

[20] The estimated Okun's coefficient for Peru is 0.13. The following calculation is applied: [(34 – 58)*(–0.005)] + 0.13 = 0.25; the result is compared to the estimated coefficient for Venezuela (0.245).

[21] The estimated Okun's coefficient for Uruguay is 0.20. The following calculation is applied: [(9.8 – 1.2)*(–0.0107)] + 0.20 = 0.11; the result is compared to the estimated coefficient for Honduras (0.118).

general recommendations without taking into account the characteristics of each country, the institutional structure of which generates different orders of magnitude in the response of the unemployment rate to variations in output; these differences must be kept uppermost in mind when designing public policies. It can be a big mistake to prescribe blanket measures for the entire region, as has been done in the past in other contexts.

Second, the fact that the reaction of unemployment with respect to output is weak in Latin American countries, compared to more developed countries, means that policies that are limited to stimulating economic activity so as to boost job generation and thus solve the problems of unemployment (visible or hidden) will not achieve their objective efficiently. This should not be interpreted as a call to abdicate budgetary policy as a means of stimulating aggregate demand. If budgetary policy is ineffective, that is because the stimulus does not differentiate between the countries' different output sectors.

Thirdly, and in practical terms as a corollary to the above, public spending aimed at increasing aggregate demand must be focused on those sectors able to drive employment. This means that the sectors of economic activity in which unemployment is more sensitive to output must have been identified beforehand, given that elasticity is relatively low at the aggregate level. Once the most sensitive sectors have been selected, public spending should be concentrated on them, with a view to enhancing traditional policies for increasing aggregate demand.

Fourthly, specific policies to stimulate aggregate demand must be supplemented with active labour market policies focused on specific objectives, within the framework of employment promotion programmes such as the following: (i) job search assistance and placement services; (ii) training programmes; (iii) direct creation of public employment; and (iv) subsidies for companies hiring unemployed individuals. Labour market policies of this kind, which have a more definite impact on a range of population groups, should partially remedy the relative ineffectiveness of aggregate demand policies.

Lastly, in accordance with the conclusions of this article, policymakers in countries where Okun's law does not show significant correlations should bear in mind that fluctuations in economic activity, while they may have hardly any impact on unemployment, do have very notable effects on the quality of occupations. In order to correct the adverse effects, specific policy measures such as the following should be adopted: (i) the implementation of unemployment insurance schemes in countries in which workers do not have such coverage; (ii) state supervision of companies, in order to ascertain that workers are registered and thus ensure that they are not excluded from social security coverage and forced to resort to subsistence occupations during economic downturns; (iii) the generation of labour training and retraining programmes that allow workers with few or no skills, or those employed in the informal sector, to acquire the training needed to be able to make the transition to the formal sector when it is expanding; and (iv) the generation of support for the formalization and growth of microenterprises and self-account employment, so that these occupations stop being subsistence alternatives and become interesting options as productive enterprises.

7. Conclusions

Okun's law holds up in several Latin American economies: Argentina, Brazil, Chile, Colombia, Costa Rica, Panama, Uruguay and Venezuela. The estimated values of Okun's coefficient, except in the case of Colombia, are relatively similar and lie on average in the interval between –0.2 and –0.3. In other words, for each percentage point that output grows above its normal or potential level, the unemployment rate falls between 0.2 and 0.3 percentage points. These findings bear out the statement that the response of unemployment to fluctuations in output is, in general, relatively weaker in developing than in more advanced countries. The estimated coefficient for Colombia indicates a stronger unemployment–output ratio, which agrees with the empirical evidence obtained in earlier research.

Bolivia, Ecuador, Honduras and Nicaragua present problems related to the coefficient's significance in all or in several of the estimates made, and the law is therefore of dubious validity in those economies. It remains to be determined in future studies whether this is due to possible shortcomings in the available statistics or to real macroeconomic problems in those countries. Moreover, the estimated coefficients in this case are those with the lowest absolute value of the entire sample analysed (between 0.1 and 0.13), which indicates that, if the law were valid, variations in output would have a very slight impact on the unemployment rate.

The coefficient estimates for the remaining countries (Mexico, Paraguay and Peru) indicate a somewhat weaker unemployment–output ratio compared to the countries listed in the first paragraph above (less than 0.2 in absolute value). However, from the analysis of sequential estimates, which provides additional information on changes in the ratio over time, it can be deduced that these countries, in some periods, also present problems of significance such as those mentioned in the second paragraph above, which makes them more similar to the latter than to the former.

Consequently, the results have been classified into two groups of countries: a first group that presents a more robust Okun's ratio, and a second group with a weaker ratio or one of dubious validity. Consideration of the factors explaining those differences has led us to draw a number of conclusions. First, the labour markets of the countries in the second group have the highest percentages of employment in the agricultural sector, wage earners without social security, employment in the informal sector, self-employment and unpaid family workers. Second, there is a negative correlation between the Okun's coefficients estimated for each country and the values of each of these variables, from which it can be inferred that the higher the proportion of employment with these characteristics, the lower the response in terms of unemployment to variations in output.

The aforementioned labour market characteristics are correlated. Of all of them, the variable for unpaid family work seems to be the one that has the higher R2 and explains the variability of Okun's coefficient among Latin American countries. This may be because this type of occupation presents almost all the characteristics of the other variables, since it occurs in the informal sector and usually consists of agricultural work without social security coverage. In

short, all the variables analysed refer to occupations that have quality issues: low levels of productivity and qualification of the workers concerned, low pay, precarity, exclusion from social security coverage. In other words, these are occupations that, in many cases, have the characteristics of a subsistence activity. Therefore, the weak unemployment–output ratio in various Latin American countries seems to indicate that cyclical variations in output affect mainly the quality of occupations and only to a lesser extent unemployment. For example, in times of economic downturn, self-account occupations, informal work and unpaid work in family businesses or in family farming constitute "safe haven" alternatives and thus preclude a jump in unemployment. Another factor that influences the weak unemployment–output ratio is the generation of hidden unemployment at times when job opportunities are scarce, given that there is no unemployment insurance and the people who have lost their jobs are therefore not obliged to remain active.

These findings have consequences when it comes to public policy. First, a weak unemployment–output ratio means that policies aimed simply at stimulating economic activity in order to resolve issues of unemployment (visible or hidden) will not be effective, and more targeted active policies will be required in the form of programmes that promote job creation. Second, cyclical variations in output may not have a substantial impact on unemployment, but they do generate adverse effects in terms of the quality of occupations, and those effects will have to be corrected by adopting specific policy measures.

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Appendix

Table A1. Matrix of correlations between variables[1]

Variables[2]	OKUN	EPL	WE_SS	EI	SE	U_FW	AGRO
OKUN	1.00						
EPL	–0.14	1.00					
WE_SS	–0.51	0.24	1.00				
EI	–0.31	0.21	**0.90**	1.00			
SE	–0.40	–0.02	**0.91**	**0.88**	1.00		
U_FW	–0.70	–0.12	**0.85**	**0.73**	**0.89**	1.00	
AGRO	–0.59	–0.21	**0.80**	**0.64**	**0.87**	**0.92**	1.00

Notes: [1] The matrix of correlations corresponds to the relationship between variables using data that are counted for all the countries. [2] OKUN: Okun's coefficient; EPL: EPL indicators; WE_SS: wage earners without social security; EI: employment in the informal sector; SE: self-employed; U_FW: unpaid family worker; AGRO: employment in the agricultural sector.

Source: Compiled by the authors.

Table A2. Indicators of multicollinearity: Tolerance index (IT) and variance inflation factor (FIV)[1]

Variables[2]	$R^2_{Xj/X1, X2 \ldots}$[3]	IT[4] (1-$R^2_{Xj/X1, X2 \ldots}$)	FIV (1/IT)[5]
EI	0.784	0.22	4.6
SE	0.789	0.21	4.7
U_FW	0.898	0.10	9.8
AGRO	0.902	0.10	10.2
WE_SS	0.872	0.13	7.8

Notes: [1] A low IT and a high FIV indicate problems of multicollinearity. [2] EI: employment in the informal sector; SE: self-employed; U_FW: unpaid family worker; AGRO: employment in the agricultural sector; WE_SS: wage earners without social security. [3] Coefficient of determination for the regression between each explanatory variable in respect of the others. The regressions of the first three variables do not include the variable WE_SS, because it is missing information on three countries. [4] IT indicates the scope of the information provided by the explanatory variable that is not contained in the other variables. For example, the share of the AGRO variable that is not explained by the other variables is 10 per cent (and is therefore exclusive to AGRO). [5] FIV indicates the value used to multiply the variation in the parameter estimator of the corresponding explanatory variable when the other variables are incorporated into the model. For example, the variation in the coefficient estimator of the AGRO variable is multiplied by 10.2 when the other variables are included.

Source: Compiled by the authors.