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Does economic growth deliver jobs? Revisiting Okun's Law

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▶ Does economic growth deliver jobs? Revisiting Okun's Law

Authors / Sangheon Lee, Dorothea Schmidt-Klau, Johannes Weiss,
Juan Chacaltana





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▶ Abstract

This paper revisits the relationship between economic growth and employment creation as expressed in Okun's law by using the latest updated global ILO dataset for new and more detailed estimates. The analysis confirms that there are important variations across regions of the world and income levels in both magnitude and significance of this relationship: In developing and emerging countries, the Okun's coefficient is lower than in developed countries. Moreover, there are important differences depending on the labour market structures as given by the level of informality or the relative presence of SMEs in the labour markets. Furthermore, the paper examines the extent to which the sectoral composition of growth is associated with the responsiveness of unemployment to business cycles: In developed economies, there are large variations in sectoral elasticities while in developing and emerging countries, the role of sectoral composition is limited. While further research is needed to better understand the relationship between economic growth and employment, especially in the presence of high informality (and SMEs), the analysis in this paper calls for greater caution in using Okun's coefficients to inform policy decisions.

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▶ Introduction

Economic growth, typically expressed in changes in GDP, is commonly understood as a necessary condition for creating jobs and reducing unemployment. This understanding is well reflected in the current debate on how to overcome the economic crisis caused by the COVID-19 pandemic. It is also to a large extent reflected in SDG 8, which aims to “promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all”. The standard explanatory note on SDG 8 adds that “Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs that stimulate the economy while not harming the environment.”¹

While this understanding allows policymakers (including those dealing with monetary and fiscal policies) to focus on economic growth especially in times of high unemployment (such as the current crisis), the relationship between economic growth and employment is far from straightforward and indeed subject to intense debates.

The debate has a long history. In the 1960s, Okun’s law established a stable negative relationship between changes in output (GDP) and unemployment. The original article (1962) began with the overarching question of how much output the economy could produce under conditions of full employment, and estimated that, in the US economy, every one percentage point reduction in unemployment was associated with output growth of three percentage points. Since then, Okun’s law has found its place in the standard economic textbook as an empirical regularity, for example in Blanchard (1999).

However, the existence and stability of Okun’s law has been the subject of empirical scrutiny, with the results being often sensitive to data and estimation methods. For instance, the macroeconomic text of Blanchard, mentioned above, offered the observation that the stability of the Okun coefficients varied across countries and had declined over time for various reasons. At the same time, the concept/definition of employment is another salient aspect of debates on Okun’s law. While Arthur Okun accepted unemployment of 4 % as “full employment”, following the dominant view at that time, the concept of full employment has been evolving along with economic policy approaches relating to Okun’s law. Full employment for Keynes and Beveridge, which originally inspired Okun’s work, was close to a situation where only “frictional unemployment” exists (Dubina, 2017)². Later, the scope of unemployment was gradually expanded, including structural unemployment. A more critical step was to link full employment to inflation, which paved the way for the concept of the Non-Accelerating Inflation Rate of Unemployment (NAIRU). Through this evolution, macroeconomic policies have de facto shifted away from the mandate of full employment.

A renewed interest in Okun’s law grew particularly strong since the Great Recession when effective policy interventions were required to mitigate the job impacts of economic downturns and for that, estimates of the magnitude of expansionary measures needed for job recovery were essential. Not surprisingly, Okun’s law has been extensively used for employment projections (Dubina, 2017). The same is happening in the debate on the current COVID-19 induced crisis.³

Yet again, using Okun’s law for these purposes needs to be carefully evaluated as recent empirical studies, notably those from international organizations, such as the IMF and the World Bank, raise questions about the existence, strength and stability of Okun’s law. As reviewed later in this paper, there is evidence that Okun’s coefficients have been weakened in advanced countries, while they have been very low or even close to zero in developing and emerging countries.⁴ Some suggest that Okun’s law is not symmetric, showing significant differences across the business cycle. Others, especially Blanchflower (2019), took a step further to suggest that the conventional Okun’s coefficient, even if empirically significant, may not be a good indicator to guide policy decisions, as the assumed wage/inflation behaviors

¹ <https://www.un.org/sustainabledevelopment/economic-growth>. It should be noted that SDG 8 offers a more nuanced view on the growth-job linkage by placing emphasis on *types* of economic growth: sustained, inclusive, and sustainable. As discussed in this paper, this aspect is crucial in better understanding the employment outcome of economic growth.

² The Beveridge curve combines job vacancies and job seekers.

³ See for example OECD (2020).

⁴ In this paper, the term “developing” corresponds to “low income”, “emerging” to “lower-middle income” as well as “upper-middle income”, and “developed” to “high income”.

fail to come out. For instance, higher employment (and lower unemployment) is expected to raise wages, but this has not happened in many advanced countries in the recovery process.

Using ILO's global data sets, this paper estimates Okun's coefficients in various specifications. It shows significant variations between income groups and between regions. There are also significant differences in estimates for the time periods before and after the Great Recession. In explaining these variations, previous studies point to the importance of labour market institutions (e.g. employment protection laws) and, most recently, to employment structure and informality. This paper examines these crucial issues by analyzing the impacts of sectoral composition on the growth-employment linkage. Taking advantage of such global data, which combines information on sectors, firms and informality, we also investigate the role of SMEs and informal employment in Okun's law. Our results suggest that these factors are all significant in determining the growth-employment linkage, and therefore that the quality and structure of employment should be considered in interpreting Okun's coefficient. Aggregate estimates, as conventionally done for Okun's coefficients, may not be reliable guides for policies, particularly in developing and emerging countries and, increasingly, in advanced countries.

The rest of the paper is structured as follows: It first reviews recent literature on both estimation methods and major findings and then proceeds to propose data and estimation strategies. The paper presents estimates by both income groups and regions, and identifies general patterns and variations. The role of sectoral composition is analyzed in a variety of specifications. The paper concludes with a short summary of key findings and policy implications as well as possible areas for future research.

► 1 Recent empirical estimates of the Okun coefficient

► Estimation methods

Empirically, Okun (1962) estimated two versions of the relation between unemployment and production⁵: The first 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). The second 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.

The gap version can be written as

$$u_t - u_t^n = \beta(y_t - y_t^n) + \epsilon_t$$

where u_t is the rate of unemployment at time t , and y_t is the log of real GDP and u_t^n and y_t^n stand for the “natural” rate of unemployment and output of a given country, which are unobserved and need to be estimated.

By taking differences, this equation can be rewritten as

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

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 is also constant ($\Delta y_t^n = g$), the equation becomes

$$\Delta u_t = \alpha + \beta \Delta y_t + e_t$$

where $\alpha = -\beta g$ and $\Delta \epsilon_t = e_t$. This is the “difference version” which can then be interpreted as a special case of the gap version. In particular, the “natural” rate of growth of GDP can be estimated using the intercept of the equation.

Okun’s original estimation, using quarterly data for the US from 1947 to 1960, found a value for the coefficient of $\beta = -0.3$: an increase in output of one percentage point decreased the change in the unemployment rate by around 0.3 percentage points.

► Recent evidence

These estimation methods, although with some modifications, have guided a growing body of empirical work for decades. The empirical evidence on Okun’s law has been mixed. Given that the Great Recession has seen a renewed interest in estimating Okun’s coefficients using a larger global dataset, let us focus on some notable panel studies:

⁵ See Pizzo (2019) for further details.

Early empirical work since the Great Recession tended to analyze advanced countries where the crisis hit most (IMF, 2010; Cazes, Verick, & Hussami, 2013). These studies observed heterogeneity in the magnitude of Okun’s coefficient and then attempted to explain the underlying reasons. Employment protection and related protection institutions were the particular focus of such analysis, especially in explaining why unemployment in Germany was relatively unresponsive to downward economic cycles.

Since then, empirical analysis has been extended to cover developing and emerging countries. Following Huang and Yeh (2013), the IMF (Ball et al., 2016; An et al., 2017) estimated Okun’s coefficients with global panel data. The World Bank has also revisited the subject (Farole et al., 2017). Other empirical studies (e.g. Bartolucci et al., 2018) followed. Typically, these studies produced different estimates by region and by income groups and broadly confirmed the findings that unemployment seems to be more responsive to GDP in rich economies.

A recent review of studies (Pizzo, 2019) provides snapshots of estimated Okun’s coefficients. Figure 1 shows that such estimates are higher (in absolute value) in rich/developed economies and that they are more precisely estimated for developed economies. In contrast, the coefficients tend to be very low in developing and emerging countries and, in many cases, are not significant. An et al (2017) showed that cross-country heterogeneity was quite strong so that Okun’s law held only in 25 or approximately half of the countries in the sample.

► **Figure 1: Cross country estimates of Okun’s coefficients**

Advanced vs. developing and emerging			
Authors	Sample	Okun’s law version	Okun’s coefficient
Ball, Furceri, Leigh, Loungani	Adv=29	DIFF	-0.29
		GAPS	-0.39
	Developing and emerging=42	DIFF	-0.18
		GAPS	-0.2
Huang, Yeh	OECD	ARDL (ECM)	-0.27
	OECDNOT	ARDL (ECM)	-0.15



Income levels			
Authors	Sample	Okun’s law version	Okun’s coefficient
Bartolucci, Choudhry, Marelli, Signorelli	High income	DIFF	-0.174
	Low income	DIFF	-0.131
Farole, Ferro, Michel Gutierrez	High income	DIFF	-0.21
	Upper middle income	DIFF	-0.08
	Lower middle income	DIFF	-0.03
	Low income	DIFF	-0.005

Source: Based on Pizzo (2019). Note: ARDL refers to the “Auto Regressive Distributed Lag” model used by Huang & Yeh (2013). ECM means “Error Correction Model”.

▶ Explaining factors

Market institutions and quality of employment

Answering the question of how this cross-country heterogeneity can be explained is not a purely academic exercise, but has important policy implications. For instance, the strong and significant presence of Okun's law is often seen as justifying the importance of aggregate demand management for full employment (see Ball et al., 2016). At the same time, it is occasionally suggested that lower magnitude of Okun's coefficients in countries with similar income levels indicate the presence of bottlenecks in market adjustments and, in particular, labour market rigidity (e.g. employment protection and wages). This leads to a structural reform agenda (e.g., IMF, 2010).⁶

The heterogeneity of Okun's coefficients has also much to do with the concept of employment. In the typical setting of estimation, the term employment follows the standard definition of employment and unemployment (i.e. using the threshold of one-hour at work per week). Duration of working hours and level of labour earnings, or more broadly quality of employment, are not considered. This may not raise a serious problem in advanced countries (an assumption, which is increasingly being challenged: see Blanchflower (2019)) but can be highly questionable in developing and emerging countries where many workers do not have any alternative income source in case of job loss and thus cannot afford being unemployed. For this reason, when workers lose their jobs during economic downturn, they tend to move to alternative inferior employment, typically informal employment. In short, in the massive presence of informal employment, "the adjustment to business cycles is likely to be observed through earnings, working hours, and/or shifts in employment within the informal sector" rather than quantitative changes in employment per se (Farole et al., 2017). In this case, typical estimates of Okun's law could render low or flat coefficients. A corollary of this would be that Okun's law makes sense and can thus guide policy-making *only* if the quality dimension of employment is explicitly considered as part of the employment indicator for Okun's law (e.g. formal employment rather than aggregate employment).

Given that both factors (labour market institutions and quality of employment) may matter in determining Okun's law in developing and emerging countries, the question is then to what extent each factor can explain the cross-country heterogeneity. Overall, the empirical studies to date seem to give more weight to the job quality, while observing a relatively small role of labour market institutions. A World Bank study (Farole et al., 2017) examined the role of employment "rigidity", but concluded that "surprisingly our results show that the ease to hire and fire workers does not appear to influence the employment outcomes (...) We find little association between the Okun's coefficient and aggregate measures of labour market flexibility". Similar conclusions were reported in the studies on advanced countries (Ball et al., 2013) on employment protection laws). In addition, some studies indicated the possible potential roles of social protection (e.g. "affordability" of unemployment, but no systematic analysis of such potential roles has been undertaken to date".

Structure of employment and sectoral composition

The potential roles of employment quality (not just employment volume) in determining Okun's law point to the importance of the overall structure of employment, as informality is strongly associated with structural shifts in employment, or more generally structural transformation. For instance, it is empirically established that the incidence of informal employment tends to be high in both agriculture and service sectors and is therefore sensitive to changes in sectoral composition of employment (ILO, 2018).

Given the variations in the employment intensity of different sectors (e.g. manufacturing versus services), it can be predicted that sectoral shifts will have significant "composition effects" on the employment intensity of growth. For instance, when the level of economic growth is stable, shifting employment

⁶ Empirical studies differ in the interpretation of the role of labour market institutions, particularly on employment protection laws. For instance, Ball et al. (2013) found no evidence on the impact of 'labour market rigidity' on Okun's coefficients, but concluded that "A notable failure is the OECD's well-known index of employment protection legislation". Yet in the context of the financial crisis, Cazes et al. (2013) argued that the strength of employment protection explained the differences in unemployment behaviors in advanced countries. However, these findings may not necessarily be inconsistent, as they may reflect the asymmetry of Okun's law, i.e. coefficients may differ between positive and negative growth. This issue will be examined later in this paper.

from labour-intensive agriculture to capital-intensive manufacturing would reduce Okun's coefficients, at least in the short-term (i.e. in a longer term, such structural change may have strong spill-over effects to boost the overall productivity and labour demand). Such potential roles of sectoral composition in Okun's law are particularly important in developing and emerging countries where the process of structural transformation tends to be rapid and strong.

If these longer-term determinants (sectoral composition and structural transformation) matter more than short-term cyclical changes, this would have implications for the type of employment policies needed to engineer labour markets to reach full employment (Ball et al., 2013). This also means that, when Okun's law is used to inform macroeconomic policies, notably monetary and fiscal policies, greater attention needs to be given to structure and quality of employment for better-informed decisions. Simply aggregating estimates of Okun's coefficients could be potentially misleading especially in developing and emerging countries.

Unfortunately, studies are rather scant on how the structure and quality of employment affect Okun's coefficients. Even the limited body of research usually focuses on broad sector groups such as industry versus services sector.⁷ This alone makes the findings less relevant for developing and emerging countries with a large agricultural sector.

A study on the EU by Anderton et al. (2014) provides another interesting way of examining the impact of sectoral composition, (e.g. different components of GDP and related employment structure). Their analysis of 17 euro-area countries over the period 1996Q1-2013Q4 shows that unemployment is particularly sensitive to movements in the consumption component of GDP, while movements in foreign trade (exports and imports) have a much lower impact on unemployment developments. According to the authors, this reflects the highly labour-intensive nature of the services that represent the bulk of consumers' expenditure, while the higher productivity manufacturing-related content of exports tends to be less labour intensive. Taking the same approach at the country level for Macedonia (Adonova & Petrovska, 2017) and Lithuania (Pesliakaite, 2015), the authors come to the same conclusion: unemployment rates react to the fluctuations in GDP depending on the compositional characteristics of GDP growth: GDP growth driven by labour-intense private consumption contributes the most to a change in the unemployment rate. The elasticity of the unemployment rate to capital-intense exports is generally much lower as compared to the elasticity to the domestic demand components.

Business cycle

Another important observation from recent studies is the variation of Okun's estimates over the business cycle and, in particular, the existence of asymmetry between positive and negative growth. While estimates vary quite considerably between studies, there is strong indication that the coefficients tend to be relatively large in magnitude during downturns, compared to periods of upward growth (e.g. Farole et al., 2017).

⁷ For instance, Apap & Gravino (2017) use a sectoral specification of Okun's Law to capture the differential sensitivity of the unemployment rate to output developments in the services and manufacturing sectors in Malta. They show that Malta's unemployment rate has been more sensitive to output developments in the services sector than to those in manufacturing. The results show that the impact resulting from developments in the manufacturing sector occurs mainly via lay-offs while developments in the services sector affect the unemployment rate via the hiring of new entrants into the labour market. See also Hartwig (2014) on Switzerland.

► 2 Revisiting Okun’s estimates

Against the backdrop of recent empirical studies, we have estimated Okun’s coefficients in various specifications. First, we estimate the Okun’s coefficient using the latest version of the ILO labour market data set. Then, we introduce a range of factors as discussed above, including those relating to structure and quality of employment.

► Data

For the general estimation, the key variables are: (1) GDP growth from the WESO data set (most of which coming from the IMF) and (2) the change in the unemployment rate as recorded by ILOSTAT in its latest global dataset. The concept of unemployment that the ILO uses is open unemployment, which means that the person in this situation does not have a job, is looking for one and is available for work if he/ she finds one. The descriptive statistics of these variables are provided in Table 1.

► **Table 1: Descriptive statistics**

Variable	Source	Variable Description	Period	Obs	Mean	Std Dev
Dgdp	ILO WESO report	Annual real GDP growth rate (%). Extreme values smoothed	1991-2017	4,775	3.716	5.111
UR	ILOSTAT and SIALC	Unemployment rate based on direct observation by LFS	1991-2017	2,678	8.698	5.680
dUR	ILOSTAT and SIALC	Change in unemployment rate (percentage points), i.e. preceding period subtracted from current period	1992-2017	2,160	-0.541	1.311
UR_est	ILO modelled estimates	The series is harmonized to account for differences in national data and scope of coverage, collection and tabulation methodologies as well as for other country-specific factors.	1991-2017	4,775	8.152	6.298
VA_agriculture	UN national statistics, own calculations	Value-added growth rate (%) in sector of Agriculture, Hunting, Forestry and Fishing (ISIC A-B)	2010-2017	497	1.407	7.620
VA_mmu	UN national statistics, own calculations	Value-added growth rate (%) in sector of Manufacturing, Mining and Utilities (ISIC C- E)	2010-2017	497	1.838	4.762
VA_construction	UN national statistics, own calculations	Value-added growth rate (%) in sector of Construction (ISIC F)	2010-2017	497	2.442	8.629
VA_tradehotel	UN national statistics, own calculations	Value-added growth rate (%) in sector of Wholesale, Retail trade, Restaurants and Hotels (ISIC G-H)	2010-2017	497	2.861	5.554
VA_transport-commu	UN national statistics, own calculations	Value-added growth rate (%) in sector of Transport, Storage and Communication (ISIC I)	2010-2017	497	3.607	4.248
VA_other	UN national statistics, own calculations	Value-added growth rate (%) in sector of Other Activities (ISIC J-P)	2010-2017	497	2.432	2.671

Regarding the unemployment time series data, the ILO data set has two separate series: (1) Time series data coming directly from labour force surveys (LFS) are available for 75 countries only, from which 43 are developed countries and 32 are emerging (upper-middle and lower-middle income) countries (called “LFS data set”). (2) ILO estimates for 180 countries, from which 52 are developed and 128 are developing and emerging countries. The modelled estimates method of the ILO uses real data from LFS where available, and completes the missing years using demographic, economic and statistical covariates (called “LFS+ modelled estimates data set”).

► Estimates

As noted above, two types of specification (“gap” and “difference”) are normally used for estimation. We focus on the “difference” version for analytical simplicity. A simple OLS specification⁸ is used for both of the ILO data sets on unemployment.

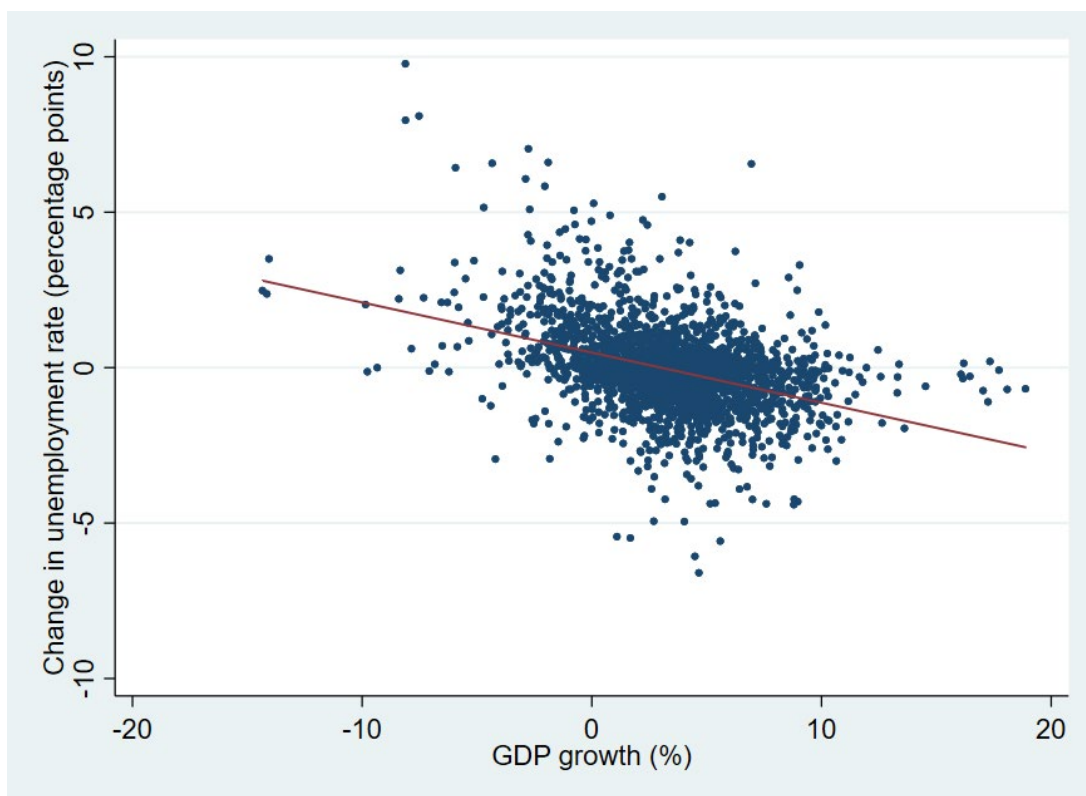
► **Table 2: Okun’s coefficients 1992-2017, pooled regression (OLS)**

	(1)		(2)	
	LFS data set		LFS+ modelled estimates data set	
	Coefficient	# countries	Coefficient	# countries
Change in GDP (smoothed)	-.193***	75	-.048***	180
High income	-.217***	43	-.159***	52
Upper-middle income	-.178***	24	-.035***	49
Lower-middle income	-.144***	8	-.038***	49
Low income	-	-	.000	30
Pre-crisis (1992-2007)	-.189***	75	-.044***	178
Crisis (2008-2009)	-.350***	75	-.158***	178
Post-crisis (2010-2017)	-.137***	75	-.028***	180
Arab States	-	-	-.0017	11
Central and Western Asia	-.224***	3	-.067***	11
Eastern Asia	-.091***	5	-.0661***	7
Eastern Europe	-.178***	8	-.146***	10
Latin America and the Caribbean	-.191***	23	-.111***	29
Northern Africa	-.313**	2	-.007	6
Northern America	-.393***	2	-.397***	2
Northern, Southern and Western Europe	-.289***	25	-.223***	29
South-Eastern Asia and the Pacific	-.109***	6	-.021***	19
Southern Asia	-.080**	1	-.016	9
Sub-Saharan Africa	-	-	-.006	47

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%

⁸ There might be some endogeneity problems at this stage (as contemporary output and unemployment could affect each other), but even in this case, the OLS estimator remains valid as a best linear estimator for predicting changes in unemployment given changes in output.

► Figure 2: Change in unemployment rate and GDP growth



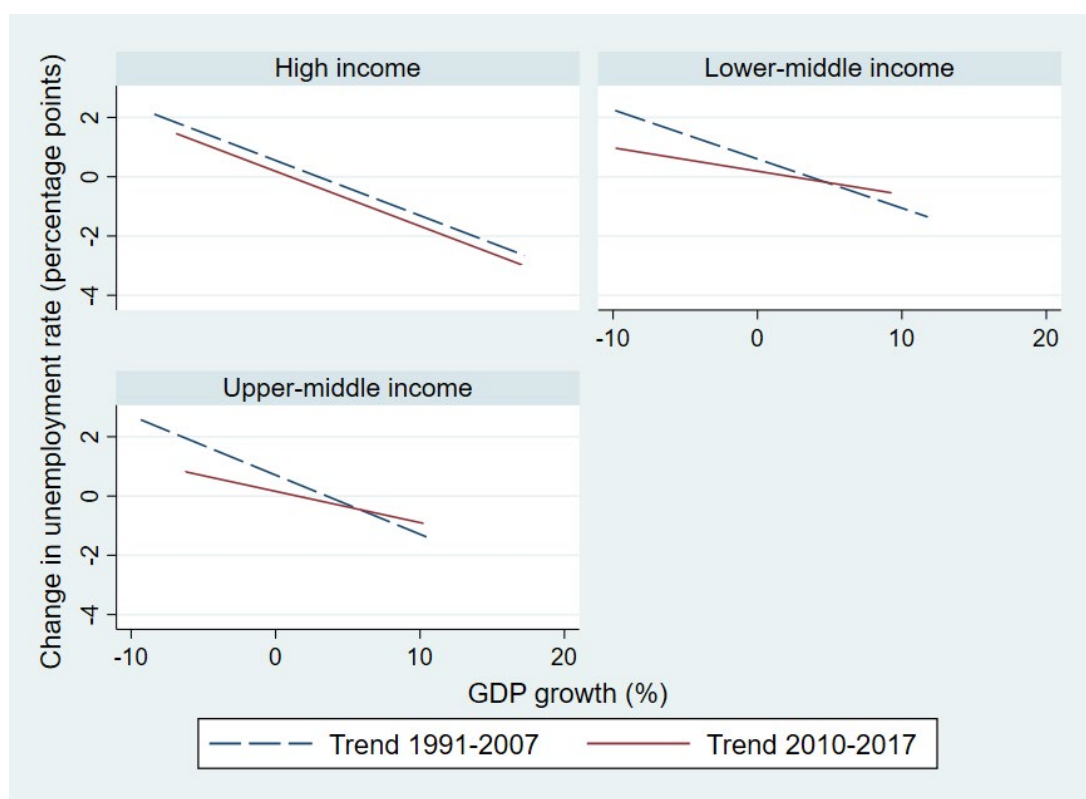
Source: LFS data set

Table 2 presents the main results: First, in both data sets, Okun’s coefficients were estimated to be negative and significant (see also Figure 2). In the case of the LFS data set, the overall Okun’s coefficient is -0.193, meaning that in the period 1992-2017 a one percent increase in GDP decreases the change in the unemployment rate by 0.193 percentage points. In the case of the LFS+ modelled estimates data set, which covers many more countries, the coefficients were much smaller at -0.048. As discussed below, this low estimate has much to do with the composition of countries by income in the samples.

Second, Okun’s coefficients are larger for high-income countries in both data sets. The difference is particularly striking in the LFS+ modelled estimates data: -0.159 for high-income countries, compared to -0.035 for upper-middle income countries. By contrast, the difference between non-high income countries (upper-middle, lower-middle, and low) is relatively small, and in some cases, the coefficients are not significant.

Third, as expected, the estimates are sensitive to business cycles. Overall, employment moves in a larger magnitude to GDP in economic downturn than during recovery or growth periods. The Okun’s coefficient (LFS data set) were estimated at -0.189 before the crisis (1992-2007), which then dropped to -0.350. Afterwards, it recovered close to the pre-crisis level (to -0.137 during 2010-2017). In addition, as Figure 3 shows, there is an indication about shifts in Okun’s law after the crisis (although not in high income countries), but it is not yet clear if this shift is temporary (or cyclical) or reflects deeper structural changes, which may have taken place during the economic recovery.

► **Figure 3: Changes in unemployment rate and GDP growth by income group**



Source: LFS data set

Fourth, as the above results imply, there are large and significant differences between regions. Our estimation suggests that the coefficients are highest for Northern America (-0.393 and -0.397 respectively). The Northern, Southern and Western Europe region shows a coefficient of -0.289 using the LFS data set and -0.223 in the ILO modelled estimates version (of course a difference could also be caused by the different number of countries involved). Not surprisingly, the estimates are low and/or insignificant in Southern Asia and Sub-Saharan Africa where lower-middle and low income countries are strongly represented (see also Figure 4).

► **Figure 4: Changes in unemployment rate and GDP growth by geographical region**



Source: LFS data set; Note: Figure 4 also includes additional data points for countries where only very limited data was available, which were consequently excluded from the selection of 75 countries in the LFS data set. Therefore, data points are also displayed for the “Arab States” and “Sub-Saharan Africa” regions.

As a quick robustness check, we introduce a time lag into the specifications for both data sets. The results are summarized in Table 3. Overall, the estimates are consistent with those in Table 2a in terms of: the existence of Okun’s law; variations by income; asymmetry between positive and negative growth; regional differences. Interestingly, the magnitude of Okun’s coefficients tends to become smaller when the one-period lag is introduced. For example, the overall coefficient using the LFS time series data decreased from -0.193 to -0.121. Moreover, in some regions, such as Central and Western Asia as well as Northern America, the coefficients ceased to be statistically significant.

► **Table 3: Okun's coefficients 1992-2017, pooled regression (OLS) against 1-period distributed lag of the explanatory variable**

	(1)		(2)	
	LFS data set		LFS+ modelled estimates data set	
	Coefficient	# countries	Coefficient	# countries
Change in GDP (smoothed)	-.121***	75	-.035***	180
High income	-.152***	43	-.114***	52
Upper-middle income	-.095***	24	-.022**	49
Lower-middle income	-.072***	8	-.034***	49
Low income	-	-	-.002	30
Pre-crisis (1992-2007)	-.137***	75	-.039***	178
Crisis (2008-2009)	-.308***	75	-.117***	178
Post-crisis (2010-2017)	-.084***	75	-.019**	180
Arab States	-	-	.001	11
Central and Western Asia	-.156	3	-.060***	11
Eastern Asia	-.044***	5	-.030**	7
Eastern Europe	-.119***	8	-.101**	10
Latin America and the Caribbean	-.074***	23	-.024	29
Northern Africa	-.450	2	-.012	6
Northern America	-.236	2	-.240	2
Northern, Southern and Western Europe	-.218***	25	-.170***	29
South-Eastern Asia and the Pacific	-.054**	6	-.011*	19
Southern Asia	-.042	1	-.021	9
Sub-Saharan Africa	-	-	-.010	47

Source: Own analysis; Notes: * significant at 10%; ** significant at 5%; *** significant at 1%

► Economic structure, employment structure, and quality of employment

Now, we introduce variables relating to the structure of the economy and employment. For the analysis of the economic structure, we follow the methodological strategy used by the existing studies, particularly the decomposition approach of Okun's law by Anderton et al. (2014)⁹. While they decompose GDP (y) into its components by expenditure type, here we use a sectoral decomposition of GDP.

For this decomposition we note that

$$\Delta y_t = \Delta \sum_{st} y_{st} \approx \sum_{yt} \frac{y_{st}}{y_t} \Delta y_{st} \equiv \sum_{st} \lambda_{st} \Delta y_{st}$$

where λ_{st} is the share of GDP in sector s in total GDP in time t for a given country. Following Anderton et al. (2014), this allows rewriting the differences version of Okun's law as

$$\Delta u_t = \alpha + \sum_s \beta_s \lambda_{st} \Delta y_{st} + e_t.$$

⁹ Note that Ravallion and Chen (2007) and Loayza and Raddatz (2006) used a similar approach to link the composition of growth to the evolution of poverty. Arias-Vásquez, Lee and Newhouse (2012) extend this type of analysis to labour market variables.

Note that if all the β_s coefficients are equal, it would be possible to sum up all sectoral changes in value added weighted by its share of regional value added. If this is the case, then the equation becomes an ordinary aggregate regression between the change in the unemployment rate and the change in GDP. Thus, following Ravallion and Chen (2007) and Loayza and Raddatz (2006), we can test the null hypothesis that the coefficients are equal ($\beta_s = B$). If this cannot be rejected, then all that matters is the overall GDP growth and not its composition. Conversely, if the null hypothesis is rejected, the composition of growth is important.

Although we compare with the period before the crisis, here we focus on the post-crisis period (2010-2017). For the sake of simplicity (and, as we have seen above, the overall findings are not sensitive to the choice between the two data sets), we use only the LFS data set. We could match 73 countries only, out of the 75 that we used in our previous estimation. Tables 4 and 5 show the simple correlation matrix between sectoral growth rates and unemployment. Basically, all sectoral correlates of unemployment are negative, but their actual significance needs to be assessed econometrically.

► **Table 4: Correlation matrix of changes in unemployment and sectoral GDP growth. 1992-2007**

	dUR	Agriculture	Manufacturing etc.	Construction	Wholesale etc.	Transport etc.	Other activities
dUR	1.000						
Agriculture	-0.067	1.000					
Manufacturing etc.	-0.231	0.146	1.000				
Construction	-0.393	0.092	0.287	1.000			
Wholesale etc.	-0.365	0.121	0.346	0.425	1.000		
Transport etc.	-0.295	0.119	0.343	0.386	0.465	1.000	
Other activities	-0.288	0.034	0.206	0.290	0.386	0.383	1.000

Source: Own analysis; Notes: “dUR” denotes the change in unemployment rate, while the other variables describe the change in GDP growth in the sectors of (a) agriculture, hunting, forestry and fishing, (b) manufacturing, mining and utilities, (c) construction, (d) wholesale, retail trade, restaurants and hotels, (d) transport, storage and communication, and (e) other activities respectively. Please refer to Table 1 for additional details of these variables.

► **Table 5: Correlation matrix of changes in unemployment and sectoral GDP growth. 2010-2017**

	dUR	dTotal	Agriculture	Manufacturing etc.	Construction	Wholesale etc.	Transport etc.	Other activities
dUR	1.000							
dTotal	-0.370	1.000						
Agriculture	-0.118	0.284	1.000					
Manufacturing etc.	-0.247	0.698	0.166	1.000				
Construction	-0.284	0.620	0.081	0.342	1.000			
Wholesale etc.	-0.262	0.514	-0.095	0.099	0.293	1.000		
Transport etc.	-0.273	0.577	0.084	0.236	0.370	0.401	1.000	
Other activities	-0.164	0.685	0.111	0.276	0.358	0.276	0.331	1.000

Source: Own analysis

Tables 6 and 7 present the main results of this exercise. Table 6 shows the results for the pre-crisis period (1992-2007). In the first column, we present the overall estimator with -0.177. Then, we split the sample by level of development: In the second column the estimator for developed countries is -0.201 and in the third column the estimator is -0.163 for developing and emerging countries. Afterwards, we run the regression of unemployment against $\lambda_{st}\Delta y_{st}$ in each case, in order to estimate β_s that, as Anderton et al. (2014) suggest, can be interpreted as a measure of the unemployment responsiveness (unemployment intensity). Overall, we get significant results for (a) construction, (b) wholesale, retail trade, restaurants and hotels and (c) other activities. For developed countries, we get significant results for the same sectors and manufacturing, mining and utilities. For developing and emerging countries, we get significant results only for (a) construction and (b) wholesale, retail trade, restaurants and hotels.

► **Table 6: Decomposition of the Okun's coefficient, by sectoral contribution. 1992-2007**

VARIABLES	General regression		Developed		Developing and emerging	
Total GDP	-0.177***		-0.201***		-0.163***	
	(-0.014)		(-0.023)		(-0.019)	
VA_agriculture		-0.013		-0.095		-0.036
		(-0.101)		(-0.159)		(-0.119)
VA_mmu		-0.055		-0.102**		-0.029
		(-0.047)		(-0.041)		(-0.074)
VA_construction		-0.513***		-0.583***		-0.476***
		(-0.071)		(-0.091)		(-0.106)
VA_tradehotel		-0.283***		-0.305***		-0.271**
		(-0.062)		(-0.070)		(-0.106)
VA_transportcommu		-0.156		-0.089		-0.241
		(-0.107)		(-0.129)		(-0.182)
VA_other		-0.122***		-0.141***		-0.087
		(-0.034)		(-0.040)		(-0.064)
Constant	0.466***	0.416***	0.490***	0.428***	0.489***	0.445***
	(-0.063)	(-0.068)	(-0.090)	(-0.083)	(-0.099)	(-0.116)
Observations	1,095	1,095	635	635	460	460
R-squared	0.189	0.223	0.225	0.262	0.168	0.203
Test (all coefficients are equal)		0.000		0.000		0.011

Source: Own analysis; Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 7 shows the results for the post-crisis period (2010-2017), i.e. overall -0.145, which is lower than the pre-crisis period. When we split the sample, we find that the Okun's coefficient increased slightly for developed countries but sharply decreased for developing and emerging countries. Then we perform the sectoral disaggregation and obtain significant negative results only for (a) agriculture, hunting, forestry and fishing, (b) manufacturing, mining and utilities, (c) construction, (d) wholesale, retail trade, restaurants and hotels, and (e) transport, storage and communication. The coefficient for other services is not significantly different from zero. Note that in this post-crisis period, we can reject the hypothesis that all coefficients are equal for developed countries but not for developing and emerging countries.

► **Table 7: Decomposition of the Okun's coefficient, by sectoral contribution. 2010-2017**

VARIABLES	General regression		Developed		Developing and emerging	
Total GDP	-0.145***		-0.240***		-0.083***	
	(0.027)		(0.060)		(0.027)	
VA_agriculture		-.000		-0.580*		-0.007
		(0.079)		(0.315)		(0.072)
VA_mmu		-0.108***		-0.108*		-0.067
		(0.041)		(0.058)		(0.081)
VA_construction		-0.161		-0.478**		-0.083
		(0.113)		(0.237)		(0.104)
VA_tradehotel		-0.221**		-0.591***		-0.119
		(0.104)		(0.198)		(0.084)
VA_transportcommu		-0.304**		-0.305**		-0.253
		(0.118)		(0.139)		(0.159)
VA_other		-0.086		-0.119		-0.026
		(0.063)		(0.076)		(0.076)
Constant		0.111		0.161		0.113
		(0.106)		(0.128)		(0.139)
Observations	497	497	283	283	214	214
R-squared	0.137	0.154	0.295	0.362	0.053	0.069
Test (all coefficients are equal)		0.280		0.005		0.574

Source: Own analysis; Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

The subsequent analysis focuses only on the post-crisis period. The analysis can be divided into the following three steps: (1) We run the same regression separately for developed and developing and emerging countries. In developed countries, where the overall Okun's coefficient is -0.240, when decomposed, relevant sectors are only (a) agriculture, hunting, forestry and fishing, (b) manufacturing, mining and utilities and (c) wholesale, retail trade, restaurants and hotels. In comparison, for developing and emerging countries, the overall coefficient is -0.083 but none of the sectoral coefficients are statistically significant. (2) Afterwards, using the overall sample, we test the hypothesis that all coefficients are equal and find that we cannot reject this possibility. This might be because the sector "other activities", which explains nearly 50% of GDP in this period, for this sample of countries, does not have a significant coefficient (i.e. is irrelevant for unemployment). (3) When we run the same test splitting the sample, we can reject that hypothesis for developed countries although we cannot for developing and emerging countries. One way to interpret these results is that in developing and emerging countries, not even overall GDP growth seems very relevant for unemployment as the estimated Okun's coefficient is rather low. For developed countries, where the Okun's coefficient seems to be more significant, the fact that not all sectors contribute equally to explaining variations in unemployment, is a powerful result.

Now we turn to the structure and quality of employment. In Table 8, we run the same disaggregated regression with more sample break ups in relation to firm structure (large vs SMEs) and informality. First, we run a regression separating the sample countries with a high proportion of SMEs (with more than 60% of the labour force in SMEs) and a low proportion of SMEs. In countries with a high proportion of SMEs, only the sector of wholesale, retail trade, restaurants and hotels seems significant. In the other cases, we identify (a) agriculture, hunting, forestry and fishing, (b) manufacturing, mining and utilities, and (c) wholesale, retail trade, restaurants and hotels, and (d) transport, storage and communications as the significant ones. Similarly, we run a regression separating those countries with high informality rates (with more than 50% of the labour force in informal employment), and those with low informality rates. Again, in countries with high informality rates, only the wholesale, retail trade, restaurants and hotels sector seems to contribute significantly to the Okun's coefficient. In the case of low informality countries, we obtain (a) agriculture, hunting, forestry and fishing, (b) manufacturing, mining and utilities, (c) construction and (d) wholesale, retail trade, restaurants and hotels.

► **Table 8: Decomposition of the Okun's coefficient, by sectoral contribution. 2010-2017**

VARIABLES	(1) General regression	(2) Small Firms	(3) Large Firms	(4) High Informality	(5) Low Informality
VA_agriculture	-0.000 (0.079)	0.024 (0.094)	-1.043*** (0.371)	0.047 (0.065)	-0.452*** (0.167)
VA_mmu	-0.108*** (0.041)	-0.180 (0.136)	-0.091* (0.052)	0.034 (0.100)	-0.108** (0.048)
VA_construction	-0.161 (0.113)	-0.286 (0.212)	0.068 (0.147)	-0.009 (0.116)	-0.610*** (0.184)
VA_tradehotel	-0.221** (0.104)	-0.306* (0.183)	-0.536*** (0.118)	-0.451*** (0.137)	-0.307** (0.129)
VA_transportcommu	-0.304** (0.118)	-0.202 (0.185)	-0.487*** (0.170)	0.107 (0.262)	-0.158 (0.124)
VA_other	-0.086 (0.063)	-0.129 (0.122)	-0.027 (0.103)	-0.050 (0.086)	-0.122 (0.088)
Constant	0.111 (0.106)	0.326 (0.227)	0.096 (0.101)	0.151 (0.157)	0.097 (0.122)
Observations	497	175	144	116	330
R-squared	0.154	0.192	0.357	0.121	0.271
Test (all coefficients are equal)	0.280	0.356	0.001	0.043	0.022

Source: Own analysis; Notes: Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; Regression (2) includes those countries that have more than 70% of the employment in small enterprises (less than 50 employees). Regression (3) includes the countries that have more than 30% of the employment working in large enterprises (at least 50 employees or more). Regression (4) includes countries with informality rates above or equal to 50%. Regression (5) includes countries with informality rates less than 50%.

At this stage, one final point needs to be made: $\beta_s \lambda_{st}$ can be interpreted as the proportional responsiveness of unemployment to changes in each sectoral component of GDP (component elasticities) and the sum of all these elasticities ($\sum \beta_s \lambda_s$) should be roughly equivalent to the Okun's coefficient estimated through an aggregate specification. This implies that different patterns of growth could lead to different responses in unemployment, even if the overall growth rate is the same.

In Table 9, we explore this idea again by splitting the sample between developed and developing and emerging countries. For the total sample, the agriculture, hunting, forestry and fishing sector has a very low unemployment intensity and a low contribution to GDP. Therefore, its contribution to unemployment is significantly close to zero. The manufacturing, mining and utilities sector has low unemployment intensity but a large share of GDP, and its contribution is around -0.022. This means that if GDP in manufacturing, mining and utilities grows by one percent, then unemployment falls by 0.022 percentage points. In the case of construction, the unemployment intensity is higher (-0.161) but its share in GDP in the whole period (post-crisis) is low, making its contribution to unemployment almost negligible. The (a) wholesale, retail trade, restaurants and hotels sector and (b) transport, storage and communication sector have both component elasticities of around -0.030. Finally, the other activities sector, with the largest share of GDP, shows a very low unemployment intensity, thus reducing its component elasticities. The sum of all these sectoral elasticities is -0.134.

► **Table 9: Sectoral component elasticities by income level. 2010-2017**

	Unemployment intensity (β_s)	Average weight (λ_{st})	Component elasticity ($\beta_s \lambda_{st}$)
Total sample			
Agriculture	-0.001	0.023	-0.000
Manufacturing	-0.108	0.203	-0.022
Construction	-0.161	0.052	-0.008
Trade/hotel	-0.221	0.150	-0.033
Transport/communications	-0.304	0.099	-0.030
Other	-0.086	0.473	-0.041
Sum (Overall Okun's coefficient)			-0.134
Developed countries			
Agriculture	-0.580	0.013	-0.008
Manufacturing	-0.108	0.191	-0.021
Construction	-0.478	0.047	-0.023
Trade/hotel	-0.591	0.145	-0.086
Transport/communications	-0.305	0.101	-0.031
Other	-0.119	0.503	-0.060
Sum (Overall Okun's coefficient)			-0.227
Developing and emerging countries			
Agriculture	-0.007	0.070	-0.000
Manufacturing	-0.067	0.264	-0.018
Construction	-0.083	0.072	-0.006
Trade/hotel	-0.119	0.170	-0.020
Transport/communications	-0.253	0.094	-0.024
Other	-0.026	0.331	-0.008
Sum (Overall Okun's coefficient)			-0.076

Source: Own analysis

For developed countries, where the role of sectoral growth is significant, more than one third of the total Okun's coefficient is explained by the wholesale, retail trade, restaurants and hotels sector. In addition, more than half of the responsiveness of unemployment to GDP growth is explained by this sector and the "other activities" sector. For developing and emerging countries, more than half of the small responsiveness of unemployment to GDP growth is explained by (a) the wholesale, retail trade, restaurants and hotels sector and (b) the transport, storage and communications sector. In the case of developing and emerging countries, as countries do not seem to adjust via unemployment, it should be tested whether they adjust via different forms of utilization of the labour force.

► Conclusion

Okun's law has been central for the discussion on full employment policies, as many economists tend to use it for their economic projections and labour market implications. It gained renowned importance during the Great Recession when countries were tackling the negative employment impacts of the crisis and will do so in the coming years when economies are back on recovery paths. At the same time, Okun's law has been subject to different empirical results (some of which challenged its very existence) and also to different (sometimes, conflicting) interpretation for policies. This challenging situation has been compounded by the fact that the very concept of employment as basis for Okun's law has been evolving with new forms of under-employment (in terms of both time and income, e.g., platform economy) along with traditional forms of informal employment. In some cases, economic growth leads to significant employment growth, but mainly in low-paid precarious jobs. This explains in part why job growth has not caused inflation in many countries as often predicted in the conventional macroeconomic thinking.

In this paper, we revisit and estimate the Okun's coefficient with most recent ILO data. This confirms that there are important variations across regions of the world and income levels. In particular, we find that in developing and emerging countries, the Okun's coefficient is lower than in developed countries. We also show that there are important differences depending on the labour market structures as given by the level of informality or the relative presence of SMEs in the labour markets.

Furthermore, considering the potential importance of the composition of output — an element that is sometimes forgotten when assessing Okun's law — we examine the extent to which the composition of growth is associated with the responsiveness of unemployment to business cycles (Okun's coefficient). In developed economies, our main results show large variations in sectoral elasticities. Sectors, such as (a) agriculture, hunting, forestry and fishing, (b) construction, (c) wholesale, retail trade, restaurants and hotels, as well as (d) transport, storage and communication, have large elasticities, while others have rather small and insignificant elasticities. However, in developing and emerging countries, the role of sectoral composition is largely limited.

While further research is needed to better understand the relationship between economic growth and employment, especially in the presence of high informality (and SMEs), our analysis calls for greater caution in using Okun's coefficients to inform policy decisions. For instance, when conventional employment indicators (e.g. total unemployment or employment) are used to evaluate possible job impacts of monetary policies and fiscal stimulus, Okun's coefficients, either at national or sectoral levels, may not provide good guidance and, in some cases, could be misleading. In this case, other policy targets such as formal employment and labour income need to be considered along with aggregate employment figures in order to secure a more accurate understanding of how macro policy decisions, with the aim to boost the economy, would improve the labour market under different circumstances. This is particularly relevant in today's context in which countries are all aspiring to move out of the unprecedented job crisis and achieve job-rich and inclusive recovery.

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