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Heterogeneity and spatial dependence in Okun's law: a global view

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Abstract

This study analyses the relationship between unemployment and economic growth at the international level, addressing the nature and decomposition of the Okun coefficient. Using World Bank data from 173 countries between 1991 and 2019, econometric techniques including decompositions and spatial dependence analysis are applied. First, the validity of Okun's law is confirmed, noting the heterogeneity of the coefficient across countries, suggesting the need for context-specific approaches to improve labour dynamics. Second, the evidence underlines the importance of labour productivity over labour supply as a key determinant of the unemployment-output relationship. Finally, the identification of spatial patterns highlights the interdependence between neighbouring economies, justifying coordinated strategies at the regional level to boost employment. These results provide valuable guidelines for the design of more effective public policies, adapted to the productive and labour realities of each country and capable of exploiting of the synergies arising from economic integration.

Keywords: Okun's Law; Economic growth; Unemployment; Labour productivity; Labour supply; Spatial dependence; Economic integration.

JEL Codes: C21; C32; E32; J21; R23

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1. Introduction

Since its formulation in 1962, Okun's law has served as a guide to understanding the macroeconomic dynamics of countries by establishing a negative relationship between output growth and unemployment (Okun, 1962). Although initially studied in the context of the United States, this law has served as a key tool for measuring the short-term responsiveness of labour markets to business cycle fluctuations.

However, the literature warns that this relationship is not uniform across countries or regions. According to Perry et al. (1971) and Gordon & Clark (1984), factors such as labour force participation, hours worked per employee, labour productivity and the geographical environment can significantly affect the variability of the Okun coefficient. These discrepancies raise questions about the effectiveness of economic policies based on general assumptions and highlight the need for a deeper understanding of the factors influencing this relationship. Its relevance becomes even more pronounced in economic recession scenarios, as highlighted by Porras-Arena et al. (2024).

In this context, the main objective of this research is to contribute to the economic literature by providing a detailed analysis of the relationship between economic growth and unemployment. To this end, we identify both the direct effects of output on the unemployment rate and the indirect mechanisms that operate through other variables, in order to identify the factors other than economic growth that affect the level of unemployment. We will use World Bank data for the period 1991-2019 and a sample of 173 countries, classified by income level and region. The approach is carried out in three stages.

The first will focus on reaffirming the validity of Okun's law at the global level by extending the analysis of Ball et al. (2019), which considers 71 countries, with the aim of identifying regional differences in the magnitude of the Okun coefficient. The second will establish a formal comparative scheme with the approach of Ismihan (2016), which consists in decomposing the Okun coefficient by identifying the direct and indirect effects of economic growth on unemployment, which will allow a better understanding of the determinants of unemployment. The third will apply spatial econometric techniques to identify patterns of global interdependence around the decomposition of each country's Okun coefficient.

Therefore, this study represents a significant contribution with a triple impact, as there is no previous research that estimates and decomposes the Okun coefficient for such a large sample of countries, and also addresses spatial dependence by differentiating countries by income level. This will allow policymakers to understand how to improve the effectiveness of policies aimed at reducing unemployment by adjusting policies to regional dynamics and the different determinants of unemployment, thus providing a more detailed understanding of the observed differences across countries.

In order to achieve the stated objectives, the document is divided into five sections. Section 2 presents the literature review on the topic. Section 3 explains the basis of the theoretical framework that supports the aims of the research as well as the methodology to be used to test the proposed hypotheses. Section 4 explains the composition of the data to be used, the countries selected for the period of analysis and

the characteristics of the series used for modelling. Section 5 presents the results of the estimation of the Okun coefficient at the global level, as well as its decomposition and spatial dependence analysis. Finally, section 6 presents the conclusions and economic policy recommendations based on the results obtained.

2. Literature review

Okun (1962) established an empirical relationship whereby for every 1% increase in the growth rate of output, the unemployment rate in the United States fell by about 0.3 percentage points (p.p.). Although this relationship has remained stable for several decades in different economies, as pointed out by Gordon & Clark (1984), Knotek (2007) warns that analyses based on long time series may hide changing relationships. As a result, heterogeneous Okun coefficients are generated across countries, as shown by Cazes et al. (2013).

Hamada & Kurosaka (1984) analyse how unemployment can condition output. From this perspective, they emphasise that the magnitude of the Okun coefficient depends on structural factors, including working time flexibility, changes in labour force participation, and fluctuations in productivity.¹ For example, a reducing in working hours prior to lay-offs helps to mitigate the rise in unemployment and hence its impact on output. Similarly, the effects of the discouraged worker (Long, 1953, 1958) and the added worker (Woytinsky, 1940) modify the participation rate, altering the relationship between unemployment and output growth. In turn, fluctuation in productivity affect the ability of firms to retain their staff even in periods of economic contraction, as pointed out by Kaufman (1988) and Sögner & Stiassny (2002).

Other studies have examined variations in Okun's law across countries. For example, Moosa (1997) analyses its applicability in the G7 countries and finds that the Okun coefficient varies significantly across countries. According to the author, these differences could be explained by the differences in the degree of rigidity of national labour markets. In addition, Lee (2000) finds that many countries have experienced a structural break in Okun's law since the 1970s. His results show that coefficient estimates can vary considerably depending on the methodological approach and the economic context analysed, which underlines the need to interpret this relationship with caution.

Silvapulle et al. (2004) extend this perspective by pointing out that the relationship between output and unemployment exhibits asymmetries depending on the phases of the business cycle, thus highlighting the dynamic complexity of Okun's law, in line with what was suggested by Knotek (2007). Nevertheless, Ball et al. (2017) reaffirm that Okun's law retains its robustness and stability, despite the fact that more than half a century has passed since its implementation. However, with differentiated effects across countries, as suggested by Porras-Arena & Martín-Román (2023b), probably due to the idiosyncratic characteristics of their labour markets and their heterogeneous phases of the business cycle, according to Chamberlin (2011).

¹ Reaffirming what Okun (1962) called the underlying factors (hours worked, labor participation and hourly productivity) behind the relationship between unemployment and economic activity.

To delve deeper into these dynamics, Ball et al. (2019) examined Okun's law in 71 developed and developing countries. They found considerable heterogeneity across the economies studied, with the average Okun coefficient in developed countries being -0.4, while in developing countries it was around -0.2. Such a norm is consistent with that found by Porras-Arena & Martín-Román (2023a) for Latin American economies, whose Okun coefficient turned out to be lower than that reported by Ball et al. (2019) for developed countries.

These results raise questions about the factors that explain such differences. Some authors argue that rigidities in labour markets, stemming from strict hiring and firing rules, make it difficult for employment to adjust to fluctuations in economic activity, resulting in relatively low Okun coefficients. Although most studies addressing this issue focus on analysing differences between countries, Villaverde & Maza (2009) and Porras-Arena & Martín-Román (2019) provide evidence suggesting regional differences for Okun's law within the same country, which implies that other factors besides labour legislation (which is assumed to apply to all regions of the same country) influence these disparities.

In this sense, Villaverde & Maza (2021) stress the importance of taking into account the spillover effects of Okun's law, especially with regard to the geographical environment within countries. Their findings recommend the implementation of differentiated policies for each region, but taking into account the interdependence between neighbouring regions, in order to improve labour market performance, in line with Duran (2022). This position is also supported by Elhorst & Emili (2022), who emphasise that the economic growth required to reduce unemployment by one p.p. is highly dependent on the consideration of spillovers to surrounding regions and output multipliers. This approach highlights the need to adopt more comprehensive and territorial perspectives in the design of economic policies.

The economic literature has developed various theoretical and empirical approaches to understanding the changes that the Okun coefficient may undergo, as highlighted by Porras-Arena & Martín-Román (2023b). These efforts aim to establish a conceptual framework linking the dynamics of the labour market and the goods market, providing a theoretical basis for decomposing and interpreting the factors that affect the relationship between unemployment and economic growth. The accumulated evidence suggests that the Okun coefficient can be affected by structural changes, labour policies, and the behaviour of economic agents.

Following this perspective, Sögner & Stiassny (2002) analysed the behaviour of the Okun coefficient across 15 countries in the Organization for Economic Co-operation and Development (OECD), attributing its variations to both labour supply and demand factors. On the one hand, economic growth influences labour demand, as firms adjust their production levels and employment structures. On the other hand, labour supply is shaped by migration policies and wage trends. Their study concludes that, in most countries, employment sensitivity to output fluctuations increases, thereby amplifying the Okun coefficient, though this effect is partially mitigated by labour force elasticity. Additionally, labour policies and employment protection regulations impact on market responses, such that economies with greater labour rigidity exhibit a weaker employment

reaction to economic growth. This phenomenon is linked to so-called "*labour hoarding*", whereby firms retain workers during recessions, thereby dampening the impact of economic growth on unemployment.

Similarly, Cazes et al. (2013) reinforce the argument regarding the instability of the Okun coefficient by examining a sample of 31 OECD countries. Their key findings indicate that economies experiencing increases in productivity, hours worked per employee, and labour force participation exhibit a significant rise in the Okun coefficient during recessions. In contrast, countries where these variables show moderate or sustained declines during downturns display the opposite behaviour, with a weaker relationship between unemployment and economic growth.

Ismihan (2016) introduces an analytical framework linking labour and goods markets in six G7 economies, offering a theoretical perspective that decomposes the Okun coefficient into two components: a direct effect of economic growth on unemployment and an indirect effect related to labour productivity, hours worked and labour force growth. The results indicate that cross-country variations in the Okun coefficient are primarily driven by differences in the indirect effect, with labour productivity emerging as the key determinant of the coefficient's heterogeneity. This approach provides further evidence of the variability of Okun's law over time, suggesting that observed differences across contexts may be due to structural changes and more complex dynamics than the simple interaction between labour laws and unemployment (Cuaresma, 2003; Freeman, 2001; Owyang & Sekhposyan, 2012; Zanin, 2014).

Collectively, these studies underscore that the Okun coefficient should not be understood as a fixed relationship between output and unemployment but rather as the outcome interactions between labour supply and demand factors. Table 1 presents a synthesis of the key contributions to the literature on Okun's law, highlighting the number of countries analysed in each study. This compilation illustrates the diversity of contexts and methodological approaches characterised previous research on the subject, ranging from more limited samples - such as Kaufman (1988), which focused on developed economies- to broader analyses, such as Ball et al. (2019), which examined 71 economies.

Table 1: Main studies on Okun's Law, with a focus on multiple economies

Authors	Countries analysed	Types of countries
Kaufman (1988)	6	Developed
Moosa (1997)	7	G7
Lee (2000)	16	OECD
Freeman (2001)	10	Developed
Sögner & Stiassny (2002)	15	OECD
Cazes et al. (2013)	31	OECD
Ismihan (2016)	6	G7
Ball et al. (2017).	20	Developed
Ball et al. (2019).	71	42 developing and 29 developed
Porras-Arena & Martín-Román (2023a)	15	Latin America

In this context, our research makes a novel contribution by substantially expanding the coverage of countries analysed to a total of 173 economies, of which 58

are high-income, 94 are middle-income and 21 are low-income according to the World Bank classification². This approach allows us to examine how economic shocks can affect the labour market in economies with different income levels. By incorporating this diversity, we aim to enrich the understanding of Okun's law from a truly global perspective, adding new dimensions to the existing literature. Moreover, it emphasises the need to approach the relationship between output and unemployment in a flexible and contextualised manner, recognising the temporal and spatial influences across countries.

3. Conceptual framework and methodology

3.1. Okun's Law and its decomposition

Okun (1962) proposed three formulations to examine the relationship between unemployment and output: the difference version, the gap-based version, and the trend-and elasticity-adjusted version. It should be noted that Okun looked at this relationship in both directions: he estimated the impact of output on the unemployment rate and, in turn, posited the inverse relationship with unemployment as the explanatory variable. Although both relationships have been studied, the present analysis focuses on the former, in the context of assessing the impact of economic fluctuations on the labour market. This study uses the first-differences version, which directly models changes in the unemployment rate as a function of changes in output. In addition to being widely used in the literature, this formulation allows us to capture the contemporaneous effects of changes in economic activity on the labour market, as shown in equation (1).

$$u_t - u_{t-1} = \beta_0 + \beta_1 g_{yt} \quad (1)$$

Where u_t is the unemployment rate and g_{yt} is the rate of change of output at time t . β_1 represents Okun coefficient, which is assumed to have a negative sign, thus indicating a negative relationship between the variables. On the other hand, β_0 is the change in the unemployment rate u_t when the change in output remains unchanged. Years later, Blanchard (1997) reformulated equation (1) by adding the normal growth rate of output (g_y^*) to this expression, as shown below:

$$\Delta u_t = \beta(g_{yt} - g_y^*) \quad (2)$$

Expression (2) suggests that in order for the unemployment rate to fall when economic activity increases, this growth must be higher than the "normal" growth of the economy. This normal rate (g_y^*) would be defined by the variation of the product that keeps the unemployment rate constant, reflecting the normal dynamics of the labour supply (g_{LF}) and labour productivity (g_{PT}).

² This will be detailed in section 4.1 (see Table 3).

$$g_y^* = g_{LF} + g_{PT} \quad (3)$$

The parameter β in equation (2) will eventually capture the effect of Okun's law. However, since g_y^* is not observable, the following model is estimated in this study to estimate Okun's law for each country:

$$\Delta u_t = \alpha + \beta g_{yt} + \varepsilon_t \quad (4)$$

Where ε_t is a random variable containing the estimation error of the model (4) and α is a constant equal to $-\beta g_y^*$, which captures the linear trend of the unemployment rate. Ismihan (2016) notes that the Okun coefficient can be affected by both direct and indirect effects of GDP on unemployment. From a demand perspective (direct effect), increases in output lead to higher job creation, which reduces unemployment. However, this relationship is also conditioned by supply factors (indirect effects), such as changes in hourly labour productivity, hours worked, or the evolution of the economically active population.

Consequently, equation (2) could be reformulated as follows:

$$\Delta u_t = \theta + \varphi(g_{yt} - g_{LFt} - g_{PTt}) + \mu_t \quad (5)$$

The variation in the unemployment rate (Δu_t) would then be explained by the variation in output (g_{yt}) after discounting the effective change in labour supply and productivity per worker, a relationship that we will refer to from here on as the net effect. θ is a constant that is expected to be non-significant or to have values close to zero, since a constant was not included in equation (2). On the other hand, φ is expected to have a negative sign, since if output grows above labour supply and productivity per worker, the unemployment rate would fall.

Hamada & Kurosaka (1984) point out that fluctuations in the labour participation rate are usually influenced by labour discouragement³, which becomes more pronounced during business cycles. In the same vein, Sögner & Stiassny (2002) point out that economic growth influences labour demand as firms adjust their production and employment according to their needs. It is therefore plausible to assume that changes in labour supply and productivity per worker can be explained as a function of the rate of change in output, as suggested by Ismihan (2016).

$$g_{LFt} = \gamma_1 + \delta_1 g_{yt} \quad (6)$$

$$g_{PTt} = \gamma_2 + \delta_2 g_{yt} \quad (7)$$

³ This is confirmed by more recent studies such as that of (Martín-Román, 2022) and (Maridueña-Larrea & Martín-Román, 2024b).

From equation 6 we can see that with $\delta_1 > 0$ there would be an encouraged worker effect⁴ (or discouraged⁵ if the phase of the business cycle were recessionary), which would consequently make labour participation procyclical (Maridueña-Larrea & Martín-Roman, 2025). However, if $\delta_1 < 0$, labour participation would be countercyclical, since there would be a subtracted (or added⁶ if the variation in GDP is negative) worker effect⁷.

As for equation (7), with $\delta_2 > 0$, labour productivity adjusts procyclically, i.e., it increases during economic expansions and decreases during recessions, as found by Nickell (1986). However, with $\delta_2 < 0$, productivity can behave countercyclically, decreasing during expansions (for example, when firms hire more workers than necessary or use less efficient resources) and improving during recessions (when only the most productive workers remain and inefficiencies are eliminated).

Substituting equations (6) and (7) into equation (5), we arrive at equation (8):

$$\Delta u_t = \rho + (\varphi - \varphi\delta_1 - \varphi\delta_2)g_{yt} + \mu_t \quad (8)$$

Where ρ is a constant equal to: $\theta - \varphi\gamma_1 - \varphi\gamma_2$. If we associate α from equation (4) with the value of ρ , and β with the expression: $\varphi - \varphi\delta_1 - \varphi\delta_2$, we obtain the version of Okun's law in differences. This suggests that the Okun coefficient, estimated from the parameter β of equation (4), summarises what we have called in this research as direct and indirect effects. Equation (8) allows for an approximate quantification of these effects, as discussed below in equation (9):

$$\beta_{Okun} = \underbrace{\varphi}_{\substack{\text{Direct} \\ \text{effect} \\ \text{of the output}}} + \underbrace{-\varphi\delta_1}_{\substack{\text{Indirect effect} \\ \text{of the labour} \\ \text{supply}}} + \underbrace{-\varphi\delta_2}_{\substack{\text{Indirect effect} \\ \text{of productivity} \\ \text{per employee}}} \quad (9)$$

Finally, the parameter φ will measure the direct effect of output on the unemployment rate and its sign is expected to be negative.⁸ This parameter is estimated from equation (5). The term $-\varphi\delta$ will capture the indirect effects, its sign is not predetermined and will depend on whether labour supply and productivity per worker are procyclical or countercyclical. The indirect effect of labour supply will be obtained by estimating the auxiliary equation (6), weighting δ_1 by φ . The indirect effect of labour productivity will be obtained by estimating the auxiliary equation (7), weighting δ_2 by φ . The net effect between these three components ($\varphi - \varphi(\delta_1 + \delta_2)$) will finally allow us to approximate the Okun coefficient.

From the theoretical framework presented on Okun's law and its decomposition, two hypotheses are formulated and compared using econometric estimations based on

⁴ Following the definition of Congregado et al. (2014).

⁵ See Long (1953, 1958).

⁶ This is how Woytinsky (1940) defines it.

⁷ As suggested by Evans (2018).

⁸ Ismihan (2016) estimates it through the average employment rate, which is calculated as the ratio of the number of employed to the Economically Active Population (EAP). In our study, however, it is estimated using equation (5).

the Ordinary Least Squares (OLS) method. The estimation of equation (4) gives rise to the following hypothesis to be tested:

- **Hypothesis 1:** From the literature review discussed, is expected that Okun's law will hold in most of the countries analysed, with high heterogeneity in the response of unemployment to economic growth by income level; being more intense in high-income economies than in middle- and low-income ones.

The estimation of equation (9) allows us to test the following hypothesis:

- **Hypothesis 2:** The variability in the Okun coefficient across countries is mainly explained by differences in the responsiveness of labour productivity to changes in economic activity and, to a lesser extent, by differences in the responsiveness of labour supply.

3.2. Global scale spillover effects on the Okun coefficient decomposition

Once the effects described in equation (9) have been estimated, spatial econometric techniques are applied to look for patterns of global interdependence around the Okun coefficient and its decomposition for each country. A neighbourhood criterion will be defined using spatial weighting matrices to detect the effect of geographical space on these relationships by estimating a Moran's I, defined by Moran (1948), as follows:

$$I_{\text{Moran}} = \frac{n}{S_0} \times \frac{\sum_{i,j}^n SW_{i,j} (X_i - \bar{X})(X_j - \bar{X})}{\sum_{i=1}^n (X_i - \bar{X})^2} \quad (10)$$

where n is the sample size or, in this case, the number of estimated effects (direct or indirect). $SW_{i,j}$ will contain the components of the spatial weight matrix, X_i represents the value of each effect in country i , X_j the value of each effect in country j . S_0 is equal to $\sum_i \sum_j SW_{i,j}$ while $\bar{X}$ corresponds to the sample mean of the estimated effect for each country. Values of I_{Moran} greater than 0 indicate positive spatial dependence, while those less than 0 indicate negative spatial dependence. In the case of a Moran's I close to 0 indicate the absence of spatial autocorrelation, suggesting a random distribution of values in space (Maridueña-Larrea & Martín-Román, 2024a). These results will allow us to look more closely at the possible interdependencies that exist in the effects calculated on a global scale.

Elhorst & Emili (2022) point out that economies influence each other through spatial interaction effects, so that productive growth in one area can boost activity in other areas through the input-output relationships that link their firms. This intensification of trade also favours the diffusion of knowledge and investment in research and development, which is consistent with the growing global integration described by Baskaran et al. (2011). According to these authors, differences in factor endowments explain why countries exchange certain goods (especially in "dispersed" trade networks), thereby reinforcing specialization and fostering the cross-border learning suggested by Elhorst & Emili (2022). Consequently, positive interactions can be generated not only in terms of output, but also in terms of unemployment. As explained by Elhorst & Emili

(2022), labour mobility crosses borders and allows households to reorient their labour supply according to the conditions they find in different regions. When Okun's law is estimated at the regional level, these flows can manifest direct and indirect effects that are transmitted globally; i.e. the dynamics between economic growth and unemployment in one country end up influencing neighbouring countries. Therefore, the following hypothesis is tested by estimating equation 10:

- **Hypothesis 3:** The direct and indirect effects derived from the decomposition of the Okun coefficient show a global spatial dependence, so that the dynamics between growth and unemployment in one country are influenced by those of its neighbours.

4. Data

4.1. Series to be used

This research employs time series data with an annual frequency, covering the period from 1991 to 2019, which corresponds to the range of years for which the World Bank provides complete information for the sample of 173 selected countries.⁹ The calculation of the Okun coefficient and its decomposition by country will require the use of four fundamental macroeconomic indicators: **i)** Gross Domestic Product (GDP), **ii)** Economically Active Population (EAP), **iii)** Unemployment Rate (UR), and **iv)** Labour Productivity (LP). The units of measurement, specifications, and calculation strategies associated with these indicators are detailed in Table 2.

Table 2. Variables to be used for estimating Okun's law and its decomposition

Indicator	Unit of measure Calculation
GDP	Gross Domestic Product (GDP) at constant 2015 prices.
EAP	Economically Active Population (EAP) also defined as Labour Supply, consist of people aged 15 and over who offer their labour force to the labour markets.
UR	The Unemployment Rate (UR) refers to the share of the EAP that is not in work but is available and looking for work.
LP	Labour Productivity (LP) is defined as: $LP = \frac{GDP}{EMP}$ where EMP corresponds to the number of employees. Previous operations were carried out for its calculation: 1. Unemployed (UNEMP) = UR × EAP 2. Employees (EMP) = EAP – UNEMP

Source: World Bank.

Table 3 presents the distribution of countries by income category (high, middle, and low) across different world regions, according to the World Bank classification. Most

⁹ The last year of the analysis period is 2019, in order to isolate the effects of the Covid-19 pandemic so as not to bias the research results. The World Bank reports time series data for 217 countries worldwide. However, 44 countries were excluded from the analysis because they did not provide data for the selected period.

countries fall within the middle-income category (94 countries), followed by high-income countries (58 countries) and, finally, low-income countries (21 countries).¹⁰

Europe and Central Asia are dominated by high-income countries (31 out of 46), while Sub-Saharan Africa has a different distribution, with most of its countries in the low-income (20 countries) and middle-income (25 countries) categories, and none in the high-income category. The Middle East and North Africa has a concentration of countries in the middle and high-income range, with 8 high-income countries, 9 middle-income countries and only 1 low-income. Latin America and the Caribbean are dominated by the middle-income category, with 21 of the 29 countries in this category and 8 countries in high-income category. East Asia and the Pacific has a similar dynamic, with 17 middle-income countries and 9 high-income countries. South Asia has only middle-income countries, with a total of 7. Finally, North America has only 2 countries, both in the high-income category.

Looking at the totals by world region, the highest concentrations of countries are found in Europe and Central Asia (46 countries) and Sub-Saharan Africa (45 countries). On the other hand, regions such as South Asia (7 countries) and North America (2 countries) have a smaller number of countries included in the analysis. The distribution shows how some regions have a predominance of countries in certain income categories, while others have greater diversity in their rankings.

Table 3. Ranking of selected countries by region and income level

Region \ Income classification	Income classification			Totals
	High	Middle	low	
Europe and Central Asia	31	15	0	46
Sub-Saharan Africa	0	25	20	45
Middle East and North Africa	8	9	1	18
Latin America and the Caribbean	8	21	0	29
East Asia and the Pacific	9	17	0	26
South Asia	0	7	0	7
North America	2	0	0	2
Totals	58	94	21	173

Source: World Bank. Own elaboration.

Note: The World Bank classifies countries into four income categories according to their Gross National Income (GNI) per capita as adjusted by the Atlas methodology: high income (more than US\$14,005 per year), upper middle income (between US\$4,516 and US\$14,005), lower middle income (between US\$1,146 and US\$4,515), and low income (less than US\$1,145 per year). In this analysis, upper-middle-income and lower-middle-income countries are grouped together as middle-income countries.

¹⁰ The World Bank classifies countries into four income categories according to their Gross National Income (GNI) per capita as adjusted by the Atlas methodology: high income (more than US\$14,005 per year), upper middle income (between US\$4,516 and US\$14,005), lower middle income (between US\$1,146 and US\$4,515), and low income (less than US\$1,145 per year). In this analysis, upper-middle-income and lower-middle-income countries are grouped together as middle-income countries.

4.2. Stationarity of time series

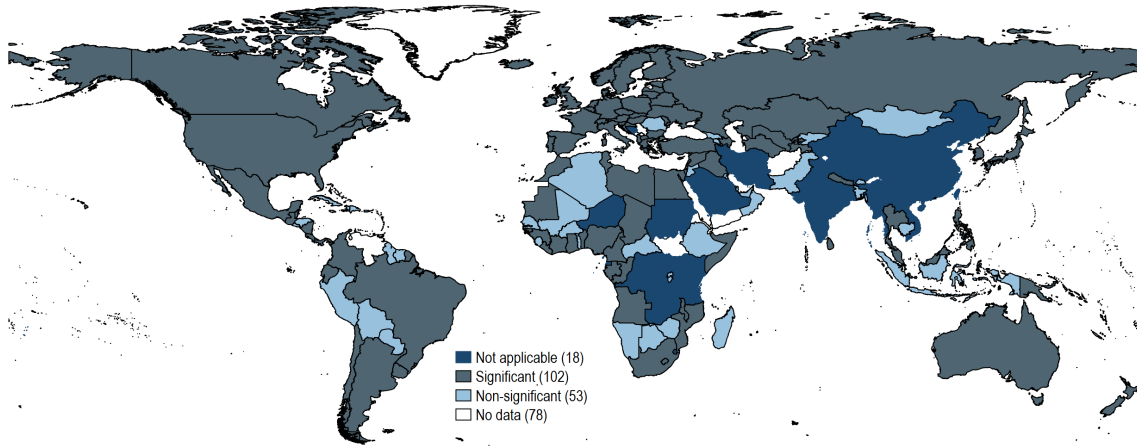
In order to ensure the degree of stationarity of the stochastic processes and thus to avoid possible spurious correlations, the Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests were applied to the series described in Table 2. As indicated in the conceptual framework of the research, these series were used in the estimations in their first different version. In this sense, the variation in the unemployment rate (Δu_t), economic growth or GDP variation (g_{yt}), the variation in productivity per worker (g_{PTt}) and the variation in labour supply (g_{Lft}) were found to be stationary.¹¹

5. Results

5.1. Estimation of Okun coefficients

Okun coefficients were estimated for each of the 173 countries in the sample analysed.¹² In 18 countries a parameter $\beta > 0$ was found, which is contrary to the expected sign of the Okun relation, while in 155 countries a negative relation between output dynamics and unemployment was found (i.e. $\beta < 0$). Within the latter group, the Okun coefficient was not significant in all countries, but it was significant in the majority of countries (102 countries). Figure 1 shows a global geo-referencing based on these estimates.¹³

Figure 1. Okun Coefficients at the world level (selected countries)



Source: World Bank. Own elaboration.

Note: Not applicable is considered a $\beta > 0$. Significant includes the category of $\beta < 0$ with a p-value of less than 10%. Non-significant is considered a p-value of at least 10%

¹¹ For a reduced sample of countries, the tests carried out did not lead to an absolute consensus on the stationarity of the series. Nevertheless, it was decided to continue with the modeling, supported by the fact that at least one of the three criteria applied allows the series to be considered stationary. The results are presented in Appendix A of this study.

¹² For further details, see Appendix B of this study.

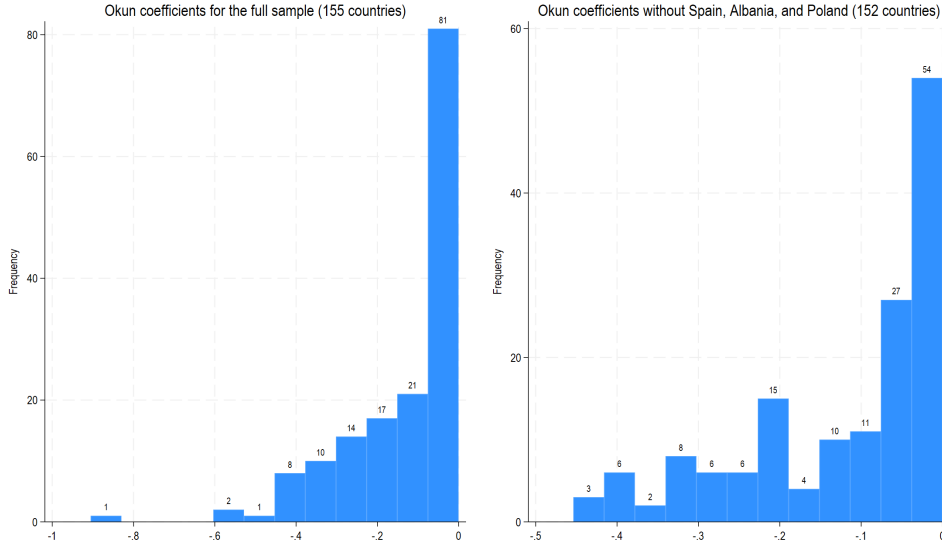
¹³ Coordinates for georeferencing were taken from the World Bank, for further reference see: <https://datacatalog.worldbank.org/search/dataset/0038272/World-Bank-Official-Boundaries>

To further explore the decomposition of Okun coefficients, the analysis is conducted on the 155 countries where the sign of the coefficient was as expected ($\beta < 0$). Beyond the significance of the parameter, we believe that covering this complete sample will allow us to capture both the statistical robustness of the coefficient in the 102 significant cases and the practical relevance in the remaining 53, thus broadening the understanding of the different economic realities. This will make it possible to identify regional or structural patterns that might be missed if non-significant countries are excluded, thereby strengthening the global character and validity of the study.

The left panel of Figure 2 shows the distribution of Okun coefficients for the 155 countries that showed a negative relationship between economic growth and unemployment. Spain, Albania, and Poland, with coefficients of 0.91, 0.55, and 0.53 respectively, are identified as outliers that could disproportionately influence the analysis. After their exclusion, the right panel shows a more representative distribution, on the basis of which we have classified Okun coefficients into the following categories (in absolute values).

- High: for $\beta > 0.30$
- Middle: for the range $0.17 < \beta \leq 0.30$
- Low: for range $0 < \beta \leq 0.17$

Figure 2. Distribution of Okun coefficients (selected countries with $\beta < 0$)



The definition of thresholds to characterise Okun coefficients can be justified primarily on the basis of the distribution observed in the right-hand histogram in Figure 2. It shows that most of the values are concentrated in a narrow range around zero, while only a few cases have remarkably high magnitudes. This concentration confirms the importance of establishing cut-off points that adequately differentiate the magnitude of the coefficients.

Second, the choice of intervals is based on the intention to capture different intensities in the response of unemployment to economic growth assigning them labels consistent with the income classification described in Table 3, which allows a more intuitive interpretation of the results. Table 4 shows the rankings of the Okun coefficient using

the previously defined thresholds and distinguishing them according to the income level of each country.

Table 4. Ranking of countries by level of Okun coefficient and income level

Type of Effect in OL Income classification	High	Middle	Low	Not applicable
High	Barbados, United Kingdom, Finland, France, Cyprus, New Zealand, Canada, Sweden, Australia, Greece, Bahamas, Portugal, Denmark, United States, Poland, and Spain.	Slovenia, Switzerland, Slovak Republic, Germany, Estonia, Uruguay, Ireland, Chile, Bulgaria, Republic of Korea, Hong Kong - Special Administrative Region, Hungary, Iceland, Israel, Latvia, Czech Republic, Belgium, Lithuania, Italy, Netherlands.	Kuwait, Qatar, Guyana, Oman, United Arab Emirates, Bahrain, Romania, Malta, Macao Special Administrative Region - China, French Polynesia, Luxembourg, Puerto Rico, Trinidad and Tobago, Brunei Darussalam, Panama, Singapore, Russian Federation, Japan, Croatia, Norway, and Austria.	Saudi Arabia
Middle	Tunisia, Costa Rica, Algeria, Colombia, the Arab Republic of Egypt, and Albania.	Kazakhstan, Mexico, Nicaragua, St. Lucia, Argentina, Ghana, North Macedonia, Brazil, and Belarus.	Zimbabwe, Kyrgyzstan, Cape Verde, Cambodia, Timor-Leste, Fiji, Libya, Nepal, Bhutan, Namibia, Iraq, Papua New Guinea, Maldives, Angola, Comoros, Solomon Islands, Mauritania, Armenia, Nigeria, Cuba, Botswana, Peru, Republic of Congo, Bangladesh, Sao Tome and Principe, Guinea, Indonesia, Bolivia, Haiti, Vanuatu, Georgia, Cameroon, Lesotho, Azerbaijan, El Salvador, Gabon, Philippines, Suriname, Lebanon, Mauritius, Mongolia, Dominican Republic, Malaysia, Senegal, Jamaica, Pakistan, Turkmenistan, St. Vincent and the Grenadines, Benin, Morocco, Guatemala, Samoa, Ecuador, Côte d'Ivoire, Republic of Moldova, Ukraine, Tajikistan, Belize, Honduras, Thailand, Jordan, Sri Lanka, South Africa, Uzbekistan, Paraguay, and Turkey.	Bosnia and Herzegovina, China, Equatorial Guinea, Equatorial Guinea, India, Islamic Republic of Iran, Kenya, Lao People's Democratic Republic, Myanmar, Tanzania, Tonga, Viet Nam, and Zambia.

Type of Effect in OL Income classification	High	Middle	Low	Not applicable
Low	-	-	Central African Republic, Liberia, Chad, Sierra Leone, Rwanda, Burundi, Ethiopia, Mozambique, Burkina Faso, Guinea-Bissau, Mali, Somalia, Togo, Malawi, Madagascar, Gambia, and the Syrian Arab Republic.	Democratic Republic of Congo, Sudan, Niger, and Uganda.

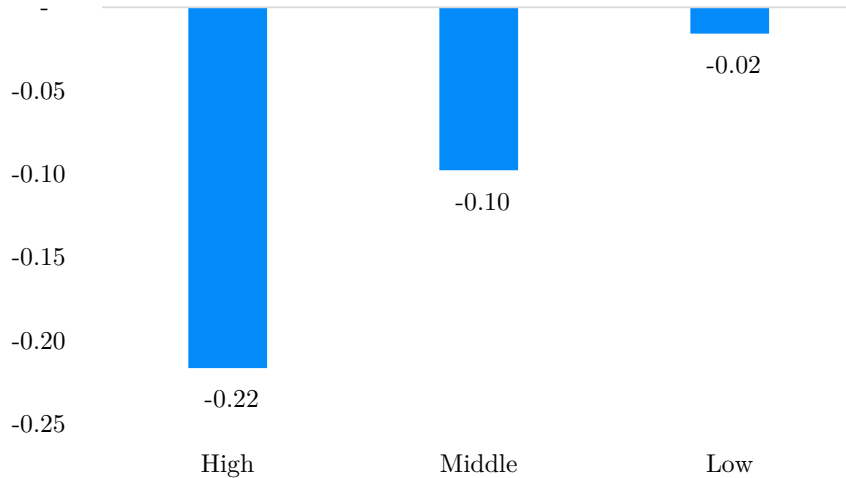
Notes: OL = Okun's Law. The World Bank classifies countries into four categories according to their Gross National Income (GNI) per capita, as adjusted by the Atlas methodology: high-income (over US\$14,005), upper middle-income (US\$4,516-US\$14,005), lower middle-income (US\$1,146-US\$4,515) and low-income (less than US\$1,145). In this analysis, upper-middle-income and lower middle-income countries are grouped as middle-income countries. The thresholds (in absolute value) of the Okun coefficient are defined as High ($\beta > 0.30$), Middle ($0.17 < \beta \leq 0.30$), and Low ($0 < \beta \leq 0.17$) in absolute values. The category Not applicable applies to countries with a positive Okun coefficient.

Although most countries would be expected to be concentrated along the main diagonal of Table 4 (i.e., high-income countries with high-Okun coefficient, middle-income countries with middle-Okun coefficient, and low-income countries with low-Okun coefficient), based on the fact that the more consolidated labour markets of high-income countries tend to make unemployment more sensitive to fluctuation in economic growth, while the high informality and lower productive diversification of lower-income countries dampen this effect, some divergences deviate from this pattern. This highlights the influence of specific institutional and structural elements that can modify the relationship between economic activity and unemployment.

For example, of the 57 high-income countries, only 16 had a high unemployment-output sensitivity. In the remaining cases, 20 were classified as having medium Okun coefficients and 21 having low coefficients. On the other hand, middle-income countries have mostly low Okun coefficients (66 out of 81 countries), only 9 cases had an Okun coefficient in line with their income level, while 6 countries had a high effect. Finally, all low-income countries reported Okun coefficients classified as low.

In this sense, the marked variability of the Okun coefficient at the global level is confirmed, supporting the evidence of its heterogeneity discussed in section 2. In particular, for the United States we estimate a coefficient close to -0.44, which is higher, in absolute values, than the -0.30 originally reported by Okun (1962). While this value could be taken as a benchmark for all high-income economies, the evidence (see Figure 3) shows that the average sensitivity of unemployment to changes in output is lower in other countries that are also belong to this group. This suggests that while the United States is one of the advanced economies with the greatest weight in global growth (Valli, 2018), its Okun coefficient is not necessarily a “benchmark” for the remaining high-income economies, where very different realities coexist.

Figure 3. The average value of the Okun coefficient classified by the income level of the countries ($\beta_{Okun} < 0$ (155 countries)).¹⁴



Our results are generally consistent with the conclusions of Ball et al. (2019), who highlight that despite the heterogeneity of the Okun coefficient across countries, the value corresponding to developing economies (approximating middle-income economies) remains around half that of developed economies. In the context of our study, the latter would correspond to high-income economies. However, there are specific differences that we consider relevant to highlight.

When comparing our results with those of these authors, it is necessary to qualify how the economies are grouped in each study. Of the 57 countries that we consider high-income according to the World Bank criteria and whose Okun coefficient was negative (see Table 4), 28 coincide with those used by Ball et al. (2019) as "developed" according to the International Monetary Fund (IMF) metric. However, countries such as Bulgaria, Chile, Croatia, Hungary, Panama, Poland, Romania, or Uruguay (listed here as high-income) are included in the "developing" category by Ball et al. (2019). In addition, our study identifies 21 high-income countries that are not included in the Ball et al. (2019) study.

These differences in the classification criteria have led to the average coefficient for high-income countries in our study (around -0.22) being lower, than that estimated by Ball et al. (2019) (-0.40). As we include a broader set of countries in the high-income category, we end up including economies that are considered "developing" by the IMF due to certain structural characteristics. This reduces the average Okun coefficient of the high-income group by including countries whose unemployment dynamics would be closer to those of developing countries.

By identifying these contrasts, it becomes clear that the differences in the values of the Okun coefficient are not only due to the idiosyncratic factors of each country, but also to the methodologies used to classify them. Intuitively, our "beta" for high-income

¹⁴ If we take into account only those countries that reported a negative coefficient and with a significance level of less than 10% (102 countries), the coefficient in the high-income category would be -0.26. The coefficient for middle-income countries would be -0.13 and for low-income countries it would remain at -0.02.

countries coincides with what Ball et al. (2019) define as developing countries, precisely because the two classifications are not equivalent: on the one hand, the World Bank considers GNI per capita to classify certain countries as "high", while the IMF includes additional criteria to distinguish them as "developed" or "developing".

The broader classification strategy used in this study, compared to that used in Ball et al. (2016), allows us to capture the heterogeneity that exists in lower-income economies and to avoid excluding relevant cases that can provide valuable information on the relationship between economic growth and unemployment.

In this sense, the present study complements previous evidence by providing a more disaggregated and representative perspective on the global variability of the Okun coefficient. This can serve as a basis for future research and more robust international comparisons.

5.2. Decomposition of Okun's law

As can be seen from equation (9), the Okun coefficient of each country can be obtained from the sum of columns B and C of Table 5. This calculation gives what we have called in this study the "net effect", which shows a remarkable coincidence with Okun coefficient estimated using equation (4), the results of which are shown in the first column of Table 5.. This relationship allows us to validate the robustness of the methodology applied and the relevance of the decomposition used.

Table 5. Okun coefficients and their decomposition by type of income among countries

Income classification	(1) Okun coefficient (β_{Okun})	Net effect (A=B+C)	(2) Direct effect(φ) (B)	Indirect effects		
				Total (C=D+E)	(3) Labour force ($-\varphi\delta_1$) (D)	(4) Productivity ($-\varphi\delta_2$) (E)
High	-0.22	-0.22	-0.81	0.59	0.07	0.52
Middle	-0.10	-0.11	-0.77	0.67	0.01	0.66
Low	-0.02	-0.02	-0.51	0.49	0.04	0.45

Notes: Okun coefficients and their decomposition correspond to the average of the individual estimates by income category for each country. Only countries with negative a Okun coefficient (155 countries) are included.

(1) Estimated from equation (4)

(2) Estimated from equation (5)

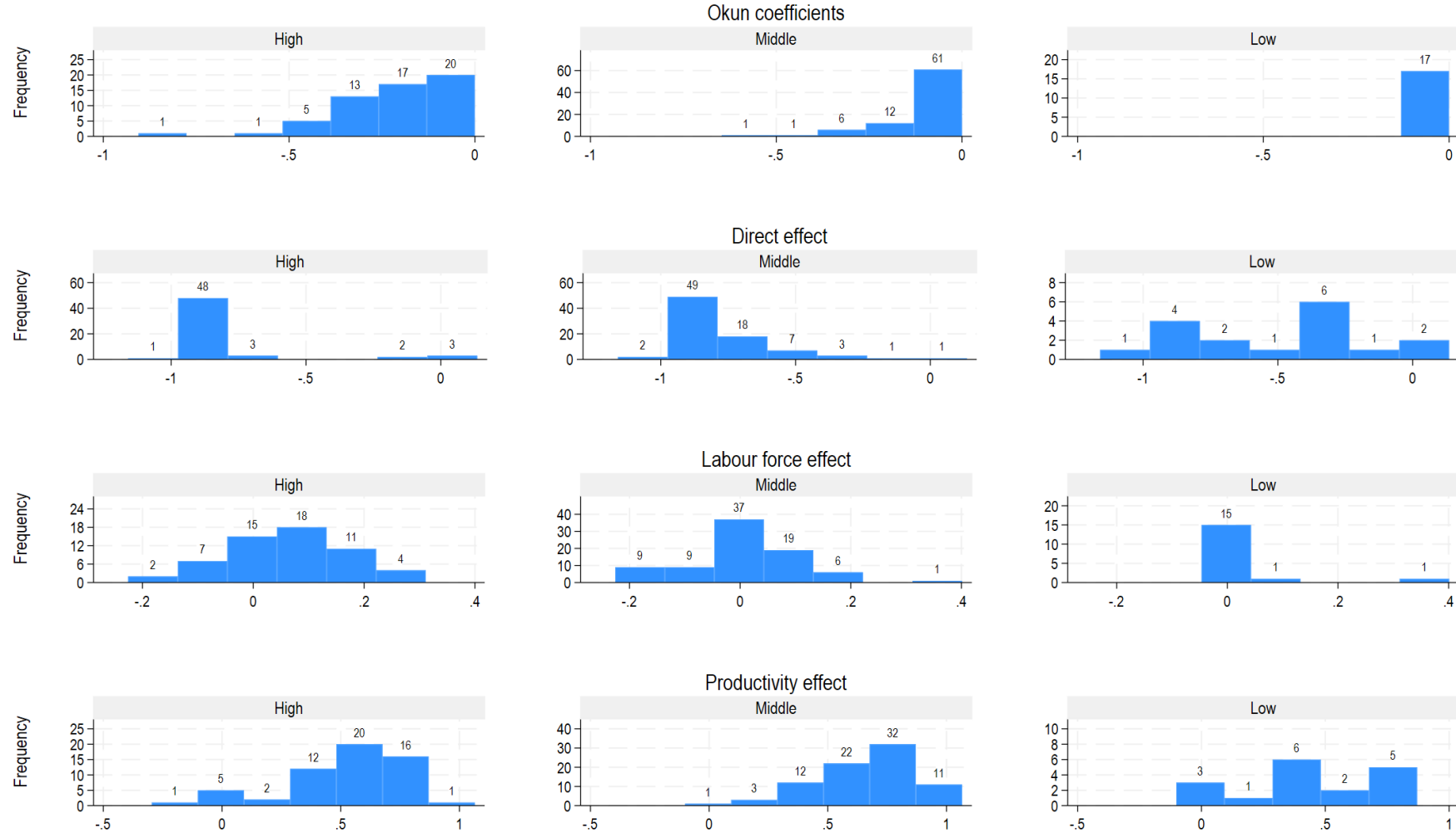
(3) Estimated from equation (6) and weighted by $-\varphi$ from equation (5).

(4) Estimated from equation (7) and weighted by $-\varphi$ from equation (5).

The countries show a differentiated dynamic according to the type of income, since as income decreases, the Okun coefficient becomes less sensitive, showing a lower response of unemployment to changes in output. On the other hand, a significant direct effect of economic growth (φ) on the reduction of the unemployment rate is observed in all income categories. However, this effect is attenuated to a lesser extent by the behaviour of labour supply ($-\varphi\delta_1$) and, more fundamentally, by the dynamics of labour productivity ($-\varphi\delta_2$), which is, in aggregate, procyclical. The underlying logic of this

relationship suggests that increases in productivity allow higher levels of output to be achieved with the same number of workers, reducing the need to hire additional labour. As a result, the ability of economic growth to reduce unemployment is weakened.

Complementarily, but to a lesser extent, labour supply has also been procyclical in aggregate terms, exerting an upward effect on unemployment at the same time that GDP growth. In other words, if the production structure is not able to absorb this excess supply, the unemployment rate tends to rise. This mechanism would thus counteract the direct effect of output growth on job creation. This dual dynamic, characterised by dispersed effects, reinforces the hypothesis that, behind the heterogeneity of the Okun coefficient across countries, there is heterogeneity in the dynamics of labour supply and labour productivity across countries. A more detailed analysis of this finding is presented in Figure 4.

Figure 4. Okun coefficients and their decomposition by type of income among countries ($\beta_{Okun} < 0$ (155 countries)).

Notes: The Okun coefficient was estimated from equation (4), and the direct effect (φ) was obtained from equation (5). The labour supply effect (δ_1) was estimated from equation (6) and weighted by $-\varphi$ from equation (5). Finally, the labour productivity effect (δ_2) was estimated from equation (7) and weighted by $-\varphi$ from equation (5).

Figure 4 shows the distribution of the Okun coefficients and their decomposition for the different groups of countries.¹⁵ It can be seen that most of the values of the Okun coefficient in high-income economies reach a maximum of 0.5 in absolute value, with a marked heterogeneity that includes countries with more intense values such as Spain (-0.91) and Poland (-0.54).

For middle-income economies, the values tend to cluster around 0, with less variability than for high-income economies. Although there is a significant number of negative values, this applies to only a few countries, indicating a relatively weak impact of growth on unemployment reduction. In these economies, Okun coefficient values mostly fluctuate between -0.28 (Belarus) and -0.01 (Libya), with Albania (-0.55), Egypt (-0.45), Colombia (-0.38), Costa Rica (-0.35) and Tunisia (-0.33) outside this range.

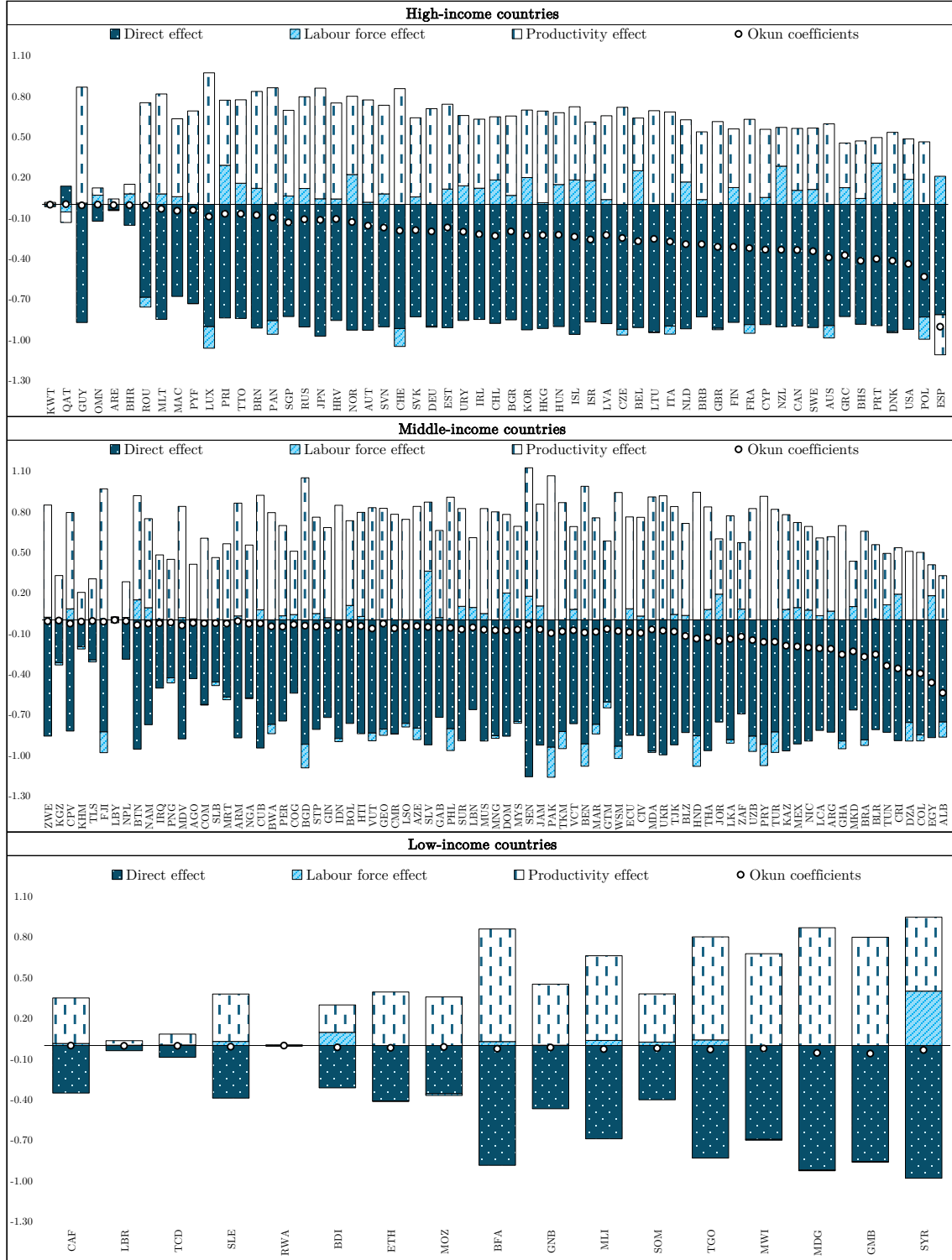
For low-income countries, the relationship between growth and unemployment is in most cases close to 0. This situation indicates that the increase in output would have a limited or no impact on reducing unemployment, a situation that could be related to structural constraints in the labour market or in the production process of these economies.

As regards the direct effect, in high-income economies this contribution is concentrated very close to -1. Within this range, countries such as Japan (-0.97), Iceland (-0.96), and Lithuania (-0.94) stand out. This dynamic is in line with the middle and low-income economies, which also show strong direct effects located in a range between -1 and -0.5. In the former group, Ukraine (-1) and the Republic of Moldova (-0.97) stand out, and among of low-income countries, the Syrian Arab Republic (-0.98) and Madagascar (-0.92). The low level of the overall Okun coefficient is therefore explained by the fact that these direct contributions are offset by productivity and labour supply effects, which tend to dampen the ability of economic growth to reduce unemployment.

Most of the productivity contributions are positive, suggesting a procyclical behaviour, with the exception of Spain, whose contribution was negative, which could explain why its Okun coefficient is the highest in absolute terms. However, labour supply does not show a uniform pattern, with positive contributions in some countries and negative in others. To examine this heterogeneity further, Figure 5 shows the Okun coefficients and their decomposition at the level of each economy, classifying by type of income. Each bar in the graph represents the sum of different contributions to the relationship between economic growth and unemployment: the direct effect of output change on unemployment and the indirect effects of output change through changes in productivity and labour supply. The dot (or mark) above each bar indicates the sum of the different effects, which approximates the Okun coefficient for each country.

¹⁵ If only Okun coefficients that were statistically significant up to a level of less than 10% are taken into account, a record of 102 countries is reached. However, the effects still exhibit the same distribution.

Figure 5. Okun coefficients and their decomposition: countries classified by income according to the World Bank criteria ($\beta_{Okun} < 0$ (155 countries)).



Notes: The net effect was estimated from equation (9) and the direct effect (φ) was obtained from equation (5). The labour supply effect (δ_1) was estimated from equation (6) and weighted by $-\varphi$ from equation (5). Finally, the labour productivity effect (δ_2) was estimated from equation (7) and weighted by $-\varphi$ from equation (5). For further reference to the acronyms for each country, see Appendix A or B.

The direct effect in most countries is the one that contributes most to the reduction of unemployment and, as suggested by Ismihan (2016), in each case it is close

to the average employment rate of the economies, with values very close to unity in absolute value. However, the indirect contributions corresponding to productivity ($-\varphi\delta_2$; indirect factor of greater significance in the decomposition) and labour supply ($-\varphi\delta_1$) tend to offset part of this direct effect, shifting the net coefficient towards values close to zero.

The sign of the contribution of indirect effects ($-\varphi\delta$) allows us to infer the direction of δ_2 and δ_1 to define the behaviour of productivity and labour supply, respectively. Provided that $-\varphi$ is positive (i.e., if economic growth succeeds in reducing unemployment through the direct effect) a positive contribution of the indirect effect, for example, implies that δ_2 or δ_1 was also positive, while a negative contribution would indicate a value of δ_2 or δ_1 below zero.

In this respect, the contribution of productivity per worker to the Okun coefficient was positive in most countries. Productivity therefore behaved procyclically in this respect. As can be seen in Figure 5, the less procyclical labour productivity is, the higher Okun coefficient (in absolute value) is. A notable exception is Spain, where the indirect effect of output through productivity changes was negative (-0.30). This reflects a counter-cyclical behaviour of this indicator in this economy, which reinforces the direction of the direct effect and causes the Okun coefficient to take a relatively high value (in absolute value). As regards the indirect effect of labour supply, different patterns are observed, with positive values in some countries and negative values in others. These results suggest that in the first case the encouraged/discouraged worker effect dominates (procyclical labour supply; 105 countries), while in the second case the subtracted/added worker effect dominates (countercyclical labour supply; 68 countries).

On the other hand, in some countries the contribution of productivity and labour supply exceeds the magnitude of the direct effect, resulting in a net coefficient close to zero, as in Libya, Qatar, and Rwanda. This suggests that the relationship between economic growth and unemployment depends not only on the level of output,¹⁶ but also on its interaction with productivity improvements and fluctuation in labour participation. The differences observed across regions and income levels underline the importance of taking into account the structural conditions and specificities of each country when assessing the impact of economic growth on unemployment.

As part of the robustness analysis of our results, Appendix B presents the replication of the methodology proposed by Ismihan (2016) for the calculation and decomposition of the Okun coefficient. Although the said author includes hours worked as an indirect effect affecting the coefficient and hourly labour productivity, in our approach these two dimensions are considered to be captured by productivity per worker. As for the direct effect, we follow the author's suggestion and estimate it from the average employment rate for the period for each country. However, the two studies are consistent in the way they estimate the contribution of labour supply. The results obtained using this methodology show a high degree of consistency with ours, which reinforces the

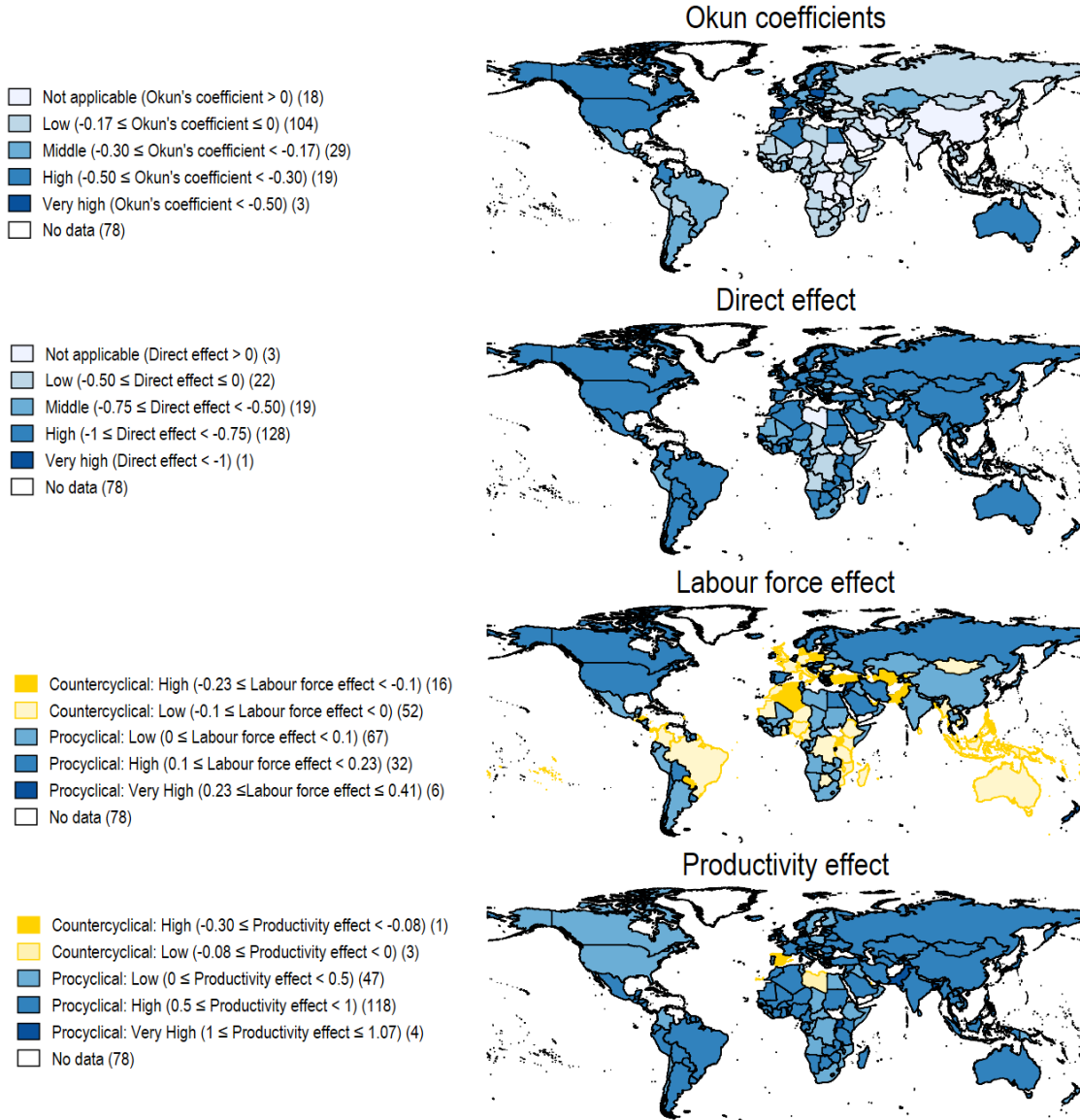
¹⁶ For example, Dal Bianco et al. (2015) point out that both institutions and policies and the impact of past and recent economic and financial crises are determinants of unemployment.

robustness of the treatment of the series and of the methodological approach used to decompose the Okun coefficient. This strengthens the validity of our results.

5.3. Global spatial dependence analysis

Figure 6 presents the results of the Okun coefficient estimates and their decomposition into direct and indirect effects in a geo-referenced manner at the global level. This approach allows us to visualize the relationship between production and unemployment, considering the specific interactions that occur in each region.

Figure 6. Okun coefficients and their decomposition at the world level (173 countries)



Source: World Bank. Own elaboration.

The spatial patterns identified in the maps show a geographical concentration of similar values for each of the components of the Okun coefficient. This distribution does not appear to be random, suggesting a possible spatial dependence between countries and regions. This would imply that economic shocks and labour market dynamics in one

country or region may be influenced by the behaviour of its geographical neighbours. This finding highlights the need to adopt a spatial perspective when analysing the relationship between output and unemployment. It is therefore proposed to move towards estimating models that allow us to capture these effects and to investigate the role of geography in the effectiveness of policies aimed at reducing unemployment.

In this regard, spatial econometric techniques were used to estimate a Moran's I following the recommendations of Moran (1948)(see section 3.2 for more details on its composition). This approach allows us to determine whether there is a significant geographical influence on the observed relationships on a global scale. The analysis is based on the use of spatial nearest neighbour weighting matrices (Knn), where K represents the number of nearest neighbours (nn) considered for each country. The value of K varies between 1 and 10 and provides a continuous measure of spatial interdependence.

The logic behind this method is clear: for a given country, the spatial influence is determined by the behavior of its neighbours. For example, if $K=1$, only the relationship with the closest neighbouring country is taken into account. On the other hand, if $K=10$, the interaction with the ten nearest neighbours is included, capturing a wider network of geographical interdependence. The specification of the spatial weights matrix (W) follows the classical principles of spatial econometrics and is presented below:

$$W_{ij} = \begin{cases} 1, & \text{if the centroid of country } j \text{ is one of the } k \text{ closest centroids to that country } i. \\ 0, & \text{otherwise.} \end{cases}$$

Figure 7 shows the results of the spatial dependence analysis for the Okun coefficients of each country analysed. Figures 8 and 9 present these results for the direct and indirect effects. Using the overall Moran index and its associated probability value for the different numbers of nearest neighbours (Knn), a strong and significant positive spatial dependence is observed for each of the variables analysed, which holds with 99% confidence from the nearest neighbour 1 (Knn=1), 5 (Knn=5) and up to 10 (Knn=10).

It should be noted that the degree of spatial dependence differs between these three components: the Okun coefficient shows the highest Moran's I values, followed by the direct effects, while the indirect effects show the most moderate spatial correlation. Thus, the spatial transmission of the unemployment-growth relationship is mainly concentrated in the direct component captured by Okun's law, while the indirect contribution shows less intensity in its spatial dependence.

Figure 7. Moran's I for Okun's Law

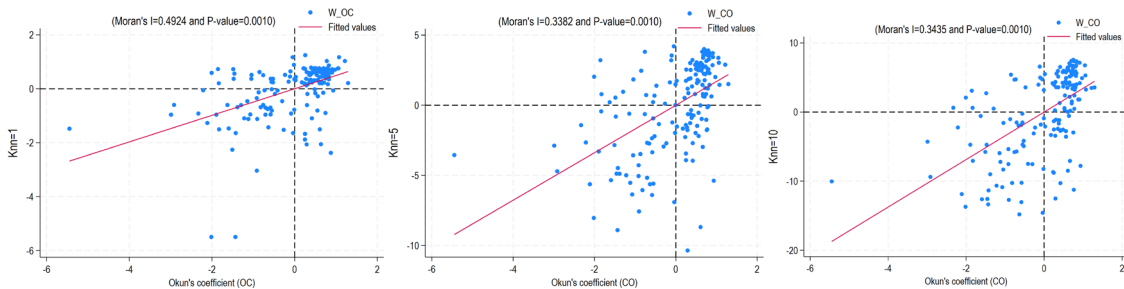


Figure 8. Moran's I for direct effect

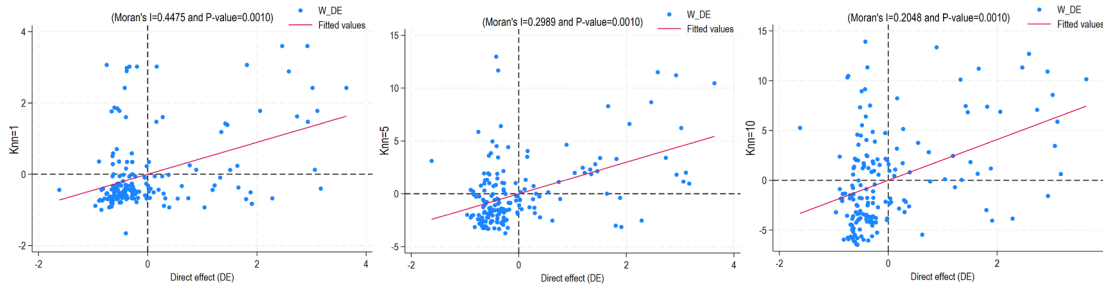
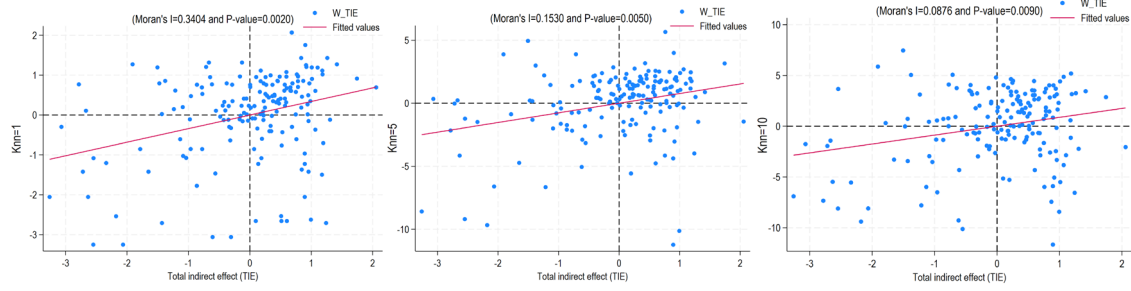


Figure 9. Moran's I for indirect effect



These results confirm the existence of geographical patterns that affect the relationship between output and unemployment, as represented by the Okun coefficient. The finding of a positive and statistically significant spatial dependence, both in the coefficient itself and in its direct and indirect components, suggests that countries do not operate in isolation. The way in which productive dynamics affect the labour market is to a large extent determined by the characteristics and performance of neighbouring economies.

From a macroeconomic perspective, this means that structural conditions, such as labour market flexibility or productive diversification, and economic policies in one country can spill over and affect the labour environment in neighbouring countries. Moreover, many of the geographically close countries share the same level of income (high as in Europe or North America, medium as in Latin America, or low as in Africa), suggesting that structural similarities may enhance the spillover of economic and labour effects. As a result, geographical proximity and income similarity overlap, reinforcing patterns of spatial dependence and jointly influencing the dynamics of the relationship between unemployment and economic growth.

Improvements in productivity, the availability of labour or fluctuations in output are therefore not confined to the national territory, but spread through regional networks, as these variables affect the competitiveness, export capacity and the attraction of foreign investment in each economy. This phenomenon points to the need to design economic policy strategies with a broader vision, taking into account the interaction with the immediate geographical environment, in order to formulate coordinated policies aimed at improving working conditions and growth at the regional level.

6. Conclusions and policy recommendations

This paper makes a novel contribution to the study of macroeconomics and labour economics in an international context by testing three hypotheses on the nature and decomposition of the Okun coefficient, based on a little-explored methodological approach on a large sample of countries. Their results highlight not only the heterogeneity in the behaviour of this output-unemployment relationship at the international level, but also the relevance of the behaviour of labour productivity and the spatial interaction between neighbouring economies.

First, it is confirmed that the Okun coefficient exhibits a high degree of heterogeneity across countries. This variability implies that "normal" output growth cannot be considered constant across countries, which in turn suggests that each economy responds in a particular way to its structural and regulatory conditions and to the external shocks it faces. This finding calls for more disaggregated and contextualised assessments so that the formulation of public policies can be better adapted to the productive and labour realities of each nation.

Second, we have found that differences in the Okun coefficient are mainly explained by variations in labour productivity rather than labour supply. In countries where labour productivity is highly procyclical, economic growth is less effective in reducing unemployment as improvements in the efficiency of productive processes may be accompanied by adjustments in labour demand that limit the capacity to create jobs. Nevertheless, the promotion of technological innovation, the training of human talent and the continuous improvement of production processes lay the foundations for more solid economic growth, which, in contexts where productivity is not an obstacle, can have a positive impact on job creation. The relationship between productivity and employment is thus becoming a central element in the design of effective public policies.

Finally, the analysis confirms the existence of spatial dependence at the global level, i.e., that the dynamics between economic growth and unemployment in one country are influenced by conditions in its neighbours. This pattern highlights the interdependence of regional economies and the importance of taking geographical location and the immediate environment into account when evaluating economic policies. The identification of these interactions provides an empirical basis that justifies the coordination of policies at the regional level and the strengthening of cooperation between countries in order to boost growth and reduce unemployment in a context of greater economic integration.

These findings provide a substantial basis for policymakers to design interventions that are appropriate to the specific circumstances of each nation, without losing sight of the synergies that can be generated at the regional level. At the same time, they provide a solid foundation for the formulation of policies that promote greater equity, efficiency and sustainability in the functioning of the international labour market.

Appendix A

Table 1A. Unit root test (1992-2019)

Country	Type of income	Δu_t			g_{yt}			g_{Lft}			g_{Prt}		
		ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
Spain (ESP)	High	-2.48**	-2.47**	0.11	-1.52	-1.49	0.2	-1.78*	-1.52	0.42	-2.57**	-2.46**	0.12
Poland (POL)	High	-2.18**	-2.46**	0.14	-0.84	-0.65	0.12	-4.34***	-4.35***	0.22	-1.33	-1.03	0.45
United States (USA)	High	-3.00***	-3.11***	0.1	-1.48	-1.34	0.35	-1.36	-1.28	0.54	-1.80*	-1.69*	0.44
Denmark (DNK)	High	-4.43***	-4.42***	0.14	-2.52**	-2.44**	0.2	-4.08***	-4.09***	0.25	-2.84***	-2.73***	0.44
Portugal (PRT)	High	-2.56**	-2.61**	0.18	-2.13**	-2.04**	0.19	-3.25***	-3.22***	0.30	-3.65***	-3.62***	0.27
Bahamas (BHS)	High	-5.91***	-5.86***	0.08	-3.05***	-3.09***	0.26	-1.75*	-2.23**	0.89***	-5.09***	-5.09***	0.2
Greece (GRC)	High	-1.81*	-2.13**	0.09	-1.68*	-1.80*	0.31	-3.07***	-3.03***	0.83***	-2.40**	-2.37**	0.3
Australia (AUS)	High	-4.14***	-4.16***	0.2	-0.77	-0.61	0.42	-0.68	-0.41	0.33	-2.28**	-2.08**	0.45
Sweden (SWE)	High	-3.53***	-3.47***	0.16	-2.59**	-2.45**	0.09	-2.42**	-2.31**	0.76***	-2.82***	-2.68***	0.58
Canada (CAN)	High	-4.10***	-4.10***	0.08	-1.70*	-1.44	0.31	-0.52	-0.35	0.15	-2.52**	-2.39**	0.42
New Zealand (NZL)	High	-2.98***	-3.02***	0.18	-1.30	-1.14	0.19	-1.21	-1.21	0.12	-3.28***	-3.20***	0.39
Cyprus (CYP)	High	-2.54**	-2.65**	0.11	-2.38**	-2.35**	0.26	-1.34	-1.06	0.43	-4.41***	-4.41***	0.29
France (FRA)	High	-4.01***	-3.96***	0.13	-2.11**	-1.92*	0.21	-2.36**	-2.13**	0.47	-3.39***	-3.36***	0.19
Finland (FIN)	High	-4.21***	-4.36***	0.2	-2.75***	-2.69***	0.25	-3.36***	-3.34***	0.15	-3.06***	-2.88***	0.73
United Kingdom (GBR)	High	-3.21***	-3.21***	0.11	-1.90*	-1.65*	0.27	-1.41	-1.04	0.55	-2.29**	-2.04**	0.69
Barbados (BRB)	High	-3.16***	-3.17***	0.22	-3.49***	-3.59***	0.14	-5.52***	-5.52***	0.48	-5.90***	-5.91***	0.18
Austria (AUT)	High	-6.08***	-6.06***	0.15	-2.20**	-2.05**	0.24	-3.31***	-3.22***	0.09	-3.57***	-3.56***	0.23
Norway (NOR)	High	-4.71***	-4.72***	0.09	-1.70*	-1.54	0.61	-2.16**	-2.09**	0.08	-2.59**	-2.53**	0.46
Croatia (HRV)	High	-1.70*	-2.06**	0.16	-3.13***	-3.20***	0.1	-4.63***	-4.63***	0.15	-2.81***	-2.84***	0.14
Japan (JPN)	High	-2.99***	-2.92***	0.53	-4.50***	-4.50***	0.07	-2.26**	-2.33**	0.22	-4.41***	-4.43***	0.25
Russian Federation (RUS)	High	-3.22***	-3.22***	0.23	-3.05***	-3.01***	0.34	-4.25***	-4.20***	0.18	-3.70***	-3.71***	0.35
Singapore (GSP)	High	-5.96***	-6.25***	0.25	-2.19**	-1.90*	0.31	-1.46	-1.39	0.23	-3.59***	-3.50***	0.15
Panama (PAN)	High	-4.05***	-4.08***	0.17	-1.49	-1.46	0.17	-1.73*	-1.55	0.30	-2.18**	-2.15**	0.27

Country	Type of income	Δu_t			g_{yt}			g_{Lft}			g_{ptt}		
		ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
Brunei Darussalam (BRN)	High	-0.21	-1.81*	0.09	-3.22***	-3.23***	0.38	-1.74*	-1.48	0.73	-4.60***	-4.61***	0.06
Trinidad and Tobago (TTO)	High	-3.26***	-3.28***	0.35	-2.44**	-2.42**	0.51	-2.26**	-2.14**	0.66	-3.58***	-3.63***	0.35
Puerto Rico (PRI)	High	-3.72***	-3.71***	0.13	-2.86***	-2.69***	0.83***	-2.72***	-2.64**	0.57	-3.83***	-3.82***	0.42
Luxembourg (LUX)	High	-5.60***	-5.59***	0.07	-1.89*	-1.67*	0.25	-2.31**	-2.21**	0.43	-3.68***	-3.67***	0.53
French Polynesia (PYF)	High	-3.15***	-3.17***	0.15	-2.13**	-2.15**	0.17	-1.32*	-1.43	0.89***	-2.12**	-2.04**	0.37
Macao Special Administrative Region, China (MAC)	High	-3.79***	-3.77***	0.2	-2.74***	-2.70***	0.12	-1.18	-1.10	0.27	-3.30***	-3.31***	0.1
Malta (MLT)	High	-4.27***	-4.29***	0.45	-2.58**	-2.38**	0.16	-0.26*	0.21	0.76***	-4.29***	-4.32***	0.4
Romania (ROU)	High	-5.28***	-5.29***	0.12	-3.06***	-3.14***	0.21	-3.80***	-3.81***	0.13	-2.99***	-3.00***	0.17
Bahrain (BHR)	High	-4.72***	-4.72***	0.07	-1.93*	-1.68*	0.25	-0.94	-1.04	0.18	-4.10***	-4.05***	0.16
United Arab Emirates (ARE)	High	-5.03***	-5.04***	0.21	-2.42**	-2.22**	0.2	-1.02	-1.28	0.22	-2.34**	-2.40**	0.12
Oman (OMN)	High	-3.19***	-3.17***	0.52	-2.43**	-2.33**	0.15	-1.32	-1.53	0.20	-2.38**	-2.40**	0.33
Guyana (GUY)	High	-1.87*	-1.94*	0.34	-2.09**	-1.86*	0.19	-5.93***	-6.17***	0.11	-1.78*	-1.38	0.18
Qatar (QAT)	High	-3.11***	-3.18***	0.12	-2.26**	-2.15**	0.18	-1.09	-1.36	0.18	-4.48***	-4.50***	0.21
Kuwait (KWT)	High	-5.03***	-5.03***	0.11	-11.08***	-10.22***	0.4	-3.90***	-3.60***	0.12	-7.19***	-7.21***	0.46
Netherlands (NLD)	High	-3.30***	-3.48***	0.1	-1.78*	-1.64*	0.29	-1.93*	-1.80*	0.31	-3.39***	-3.41***	0.11
Italy (ITA)	High	-2.90***	-2.98***	0.1	-3.39***	-3.32***	0.33	-4.65***	-4.63***	0.29	-3.77***	-3.72***	0.55
Lithuania (LTU)	High	-4.19***	-4.21***	0.2	-3.26***	-3.26***	0.25	-4.17***	-4.19***	0.44	-4.12***	-4.12***	0.19
Belgium (BEL)	High	-3.98***	-3.95***	0.17	-2.30**	-2.05**	0.19	-3.24***	-3.18***	0.06	-2.84***	-2.74***	0.39
Czech Republic (CZE)	High	-3.25***	-3.24***	0.39	-2.06**	-2.03**	0.07	-3.10***	-2.98***	0.14	-2.19**	-2.09**	0.14
Latvia (LVA)	High	-3.65***	-3.57***	0.2	-4.99***	-4.64***	0.17	-3.27***	-3.31***	0.06	-6.50***	-5.77***	0.17
Israel (ISR)	High	-3.48***	-3.53***	0.1	-1.88*	-1.72*	0.24	-1.80*	-1.73*	0.48	-4.41***	-4.51***	0.07
Iceland (ISL)	High	-3.99***	-3.97***	0.07	-2.18**	-2.19**	0.07	-2.48**	-2.42**	0.06	-3.55***	-3.56***	0.13
Hungary (HUN)	High	-3.38***	-3.35***	0.16	-2.00**	-1.86*	0.13	-2.70***	-2.73***	0.49	-2.64**	-2.63**	0.24
Hong Kong, Special Administrative Region (HKG)	High	-4.64***	-4.61***	0.25	-2.73***	-2.56**	0.18	-2.60**	-2.54**	0.35	-3.68***	-3.63***	0.16
Republic of Korea (KOR)	High	-4.67***	-4.64***	0.05	-2.24**	-1.98**	0.65	-2.40**	-2.21**	0.21	-1.86*	-1.51	0.86***
Bulgaria (BGR)	High	-3.64***	-3.69***	0.13	-4.37***	-4.45***	0.25	-4.64***	-4.70***	0.41	-4.76***	-4.82***	0.13

Country	Type of income	Δu_t			g_{yt}			g_{Lft}			g_{ptt}		
		ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
Chile (CHL)	High	-6.18***	-6.18***	0.2	-2.35**	-2.35**	0.56	-1.71*	-1.61*	0.16	-2.27**	-2.21**	0.86***
Ireland (IRL)	High	-2.32**	-2.34**	0.15	-2.24**	-2.07**	0.12	-1.41	-1.57	0.26	-3.69***	-3.67***	0.16
Uruguay (URY)	High	-3.10***	-3.13***	0.12	-2.57**	-2.54**	0.09	-3.82***	-3.82***	0.15	-3.90***	-3.89***	0.11
Estonia (EST)	High	-3.67***	-3.61***	0.22	-3.66***	-3.67***	0.14	-3.81***	-3.85***	0.65	-3.54***	-3.61***	0.16
Germany (DEU)	High	-2.75***	-2.76***	0.42	-3.82***	-3.80***	0.05	-3.65***	-3.66***	0.34	-4.99***	-5.00***	0.5
Slovak Republic (SVK)	High	-3.24***	-3.26***	0.23	-2.50**	-2.53**	0.1	-3.65***	-3.61***	0.19	-2.92***	-2.90***	0.3
Switzerland (CHE)	High	-3.86***	-3.76***	0.12	-2.34**	-2.19**	0.17	-3.32***	-3.26***	0.05	-5.19***	-5.19***	0.11
Slovenia (SVN)	High	-2.86***	-2.91***	0.12	-2.60**	-2.63**	0.12	-5.02***	-5.03***	0.17	-3.83***	-3.86***	0.13
Saudi Arabia (SAU)	High	-2.94***	-2.94***	0.2	-3.32***	-3.28***	0.25	-0.76	-0.47	0.18	-4.04***	-4.00***	0.17
Syrian Arab Republic (SYR)	Low	-4.99***	-4.99***	0.05	-2.47**	-2.54**	0.44	-1.68*	-1.86*	0.28	-3.08***	-3.07***	0.53
Gambia (GMB)	Low	-2.18**	-2.27**	0.46	-3.32***	-3.26***	0.07	-1.43	-1.17	0.22	-5.23***	-5.24***	0.08
Madagascar (MDG)	Low	-3.47***	-3.45***	0.08	-4.09***	-4.14***	0.09	-1.19	-0.90	0.24	-6.15***	-6.16***	0.1
Malawi (MWI)	Low	-7.65***	-7.48***	0.05	-3.97***	-4.08***	0.17	-0.66	-0.72	0.16	-5.22***	-5.24***	0.13
Togo (TGO)	Low	-2.71***	-2.76***	0.08	-3.55***	-3.54***	0.13	-1.09	-0.95	0.08	-5.04***	-5.05***	0.16
Somalia (SOM)	Low	-4.79***	-4.80***	0.06	-3.03***	-2.94***	0.38	-1.07	-1.20	0.11	-4.27***	-4.26***	0.4
Mali (MLI)	Low	-1.01	-1.24	0.33	-2.51**	-2.39**	0.13	-0.09	-0.09	0.25	-4.84***	-4.92***	0.12
Guinea-Bissau (GNB)	Low	-4.66***	-4.63***	0.07	-5.61***	-5.60***	0.1	-0.69	-0.61	0.21	-7.99***	-9.21***	0.09
Burkina Faso (BFA)	Low	-3.84***	-3.77***	0.11	-1.13	-0.77	0.13	0.70	0.60	0.28	-1.88*	-1.66*	0.09
Mozambique (MOZ)	Low	-5.01***	-5.02***	0.31	-1.96**	-1.81*	0.21	-0.15	-0.28	0.18	-2.91***	-2.91***	0.23
Ethiopia (ETH)	Low	-2.57**	-2.71***	0.21	-1.98**	-1.83*	0.57	-0.67	-0.71	0.08	-3.35***	-3.42***	0.58
Burundi (BDI)	Low	-2.96***	-2.95***	0.15	-2.66***	-2.64**	0.44	-2.99***	-2.88***	0.41	-3.68***	-3.67***	0.19
Rwanda (RWA)	Low	-6.24***	-6.27***	0.07	-4.63***	-4.65***	0.15	-3.59***	-3.54***	0.07	-7.24***	-7.48***	0.1
Sierra Leone (SLE)	Low	-3.72***	-3.77***	0.21	-4.42***	-4.43***	0.34	-1.29	-1.31	0.18	-5.19***	-5.19***	0.33
Chad (TCD)	Low	-3.25***	-3.34***	0.1	-3.16***	-3.16***	0.15	-1.37	-1.28	0.06	-3.83***	-3.85***	0.15
Liberia (LBR)	Low	-2.83***	-2.91***	0.27	-3.29***	-3.27***	0.08	-1.69*	-1.79*	0.20	-3.66***	-3.63***	0.08
Central African Republic (CAF)	Low	-3.53***	-3.55***	0.23	-5.16***	-5.16***	0.06	-0.91	-1.00	0.59	-5.97***	-6.09***	0.06

Country	Type of income	Δu_t			g_{yt}			g_{Lft}			g_{ptt}		
		ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
Democratic Republic of the Congo (COD)	Low	-1.77*	-2.04**	0.23	-1.89*	-1.86*	0.78***	-0.90	-0.85	0.09	-2.36**	-2.36**	0.74***
Sudan (SDN)	Low	-4.04***	-3.99***	0.17	-3.00***	-2.92***	0.55	0.07	-0.11	0.07	-3.92***	-3.89***	0.68
Niger (NER)	Low	-5.21***	-5.23***	0.1	-2.33**	-2.06**	0.78***	-0.40	-0.39	0.07	-4.95***	-4.97***	0.62
Uganda (UGA)	Low	-4.68***	-4.66***	0.04	-0.94	-0.57	0.22	0.45	0.37	0.74	-1.97**	-1.76*	0.37
Albania (ALB)	Middle	-10.44***	-8.63***	0.12	-3.00***	-3.03***	0.24	-4.43***	-4.40***	0.33	-3.93***	-3.93***	0.6
Arab Republic of Egypt (EGY)	Middle	-3.62***	-3.70***	0.12	-0.52	-0.57	0.08	-2.35**	-2.20**	0.37	-2.68***	-2.57**	0.21
Colombia (COL)	Middle	-3.99***	-3.97***	0.1	-1.59	-1.38	0.09	-1.90*	-1.65*	0.24	-3.51***	-3.55***	0.07
Algeria (DZA)	Middle	-4.03***	-4.01***	0.19	-1.59	-1.36	0.17	-2.64**	-2.42**	0.72	-6.68***	-6.91***	0.2
Costa Rica (CRI)	Middle	-5.20***	-5.20***	0.13	-2.01**	-1.98**	0.33	-2.65**	-2.54**	0.20	-3.92***	-3.92***	0.07
Tunisia (TUN)	Middle	-5.06***	-5.05***	0.13	-2.22**	-2.16**	0.58	-1.40	-1.40	0.64	-2.59**	-2.58**	0.13
Turkey (TUR)	Middle	-4.10***	-4.02***	0.1	-3.05***	-3.00***	0.07	-3.54***	-3.54***	0.40	-4.65***	-4.68***	0.07
Paraguay (PRY)	Middle	-8.42***	-9.10***	0.08	-2.60**	-2.41**	0.18	-3.03***	-2.88***	0.10	-5.05***	-5.05***	0.21
Uzbekistan (UZB)	Middle	-2.92***	-2.83***	0.36	-1.58	-1.60	0.66	-2.29**	-2.37**	0.71	-3.05***	-2.99***	0.68
South Africa (ZAF)	Middle	-5.37***	-5.37***	0.45	-1.64*	-1.60*	0.21	-3.45***	-3.43***	0.08	-5.13***	-5.15***	0.17
Sri Lanka (LKA)	Middle	-3.35***	-3.33***	0.43	-1.38	-1.16	0.12	-5.44***	-5.44***	0.06	-2.68***	-2.54**	0.16
Jordan (JOR)	Middle	-2.96***	-2.97***	0.38	-2.94***	-2.89***	0.38	-1.86*	-1.85*	0.10	-3.13***	-3.25***	0.22
Thailand (THA)	Middle	-6.67***	-6.83***	0.07	-2.46**	-2.35**	0.12	-2.86***	-2.67***	0.77***	-2.92***	-2.80***	0.08
Honduras (HND)	Middle	-5.72***	-5.75***	0.08	-2.25**	-2.04**	0.1	-2.25**	-2.08**	0.11	-4.71***	-4.69***	0.11
Belize (BLZ)	Middle	-3.90***	-3.91***	0.1	-2.74***	-2.76***	0.36	-0.62	-0.59	0.34	-3.72***	-3.74***	0.29
Tajikistan (TJK)	Middle	-2.90***	-2.84***	0.58	-2.90***	-2.91***	0.57	-0.61	-0.64	0.15	-3.82***	-3.90***	0.59
Ukraine (UKR)	Middle	-3.43***	-3.42***	0.22	-2.49**	-2.38**	0.28	-1.38	-1.17	0.07	-2.63**	-2.50**	0.27
Republic of Moldova (MDA)	Middle	-4.71***	-4.73***	0.32	-5.26***	-5.22***	0.58	-3.53***	-3.50***	0.10	-5.18***	-5.17***	0.53
Côte d'Ivoire (CIV)	Middle	-3.77***	-3.77***	0.13	-2.02**	-1.93*	0.32	-1.30	-1.10	0.44	-3.37***	-3.36***	0.45
Ecuador (ECU)	Middle	-4.65***	-4.62***	0.05	-2.32**	-2.12**	0.15	-2.07**	-1.93*	0.06	-3.17***	-3.12***	0.16
Samoa (WSM)	Middle	-4.59***	-4.59***	0.07	-2.83***	-2.71***	0.14	-0.99	-0.78	0.36	-3.18***	-3.12***	0.17
Guatemala (GTM)	Middle	-4.62***	-4.59***	0.28	-1.06	-0.90	0.17	-3.06***	-2.94***	0.21	-5.38***	-5.38***	0.06

Country	Type of income	Δu_t			g_{yt}			g_{Lft}			g_{ptt}		
		ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
Morocco (MAR)	Middle	-5.86***	-5.82***	0.17	-4.01***	-4.14***	0.17	-1.62*	-1.49	0.77***	-6.52***	-6.33***	0.48
Benin (BEN)	Middle	-5.04***	-5.04***	0.12	-0.77	-0.46	0.11	-0.85	-0.71	0.54	-2.12**	-2.06**	0.38
Saint Vincent and the Grenadines (VCT)	Middle	-3.39***	-3.47***	0.08	-2.86***	-2.80***	0.29	-2.26**	-2.96***	0.99***	-3.07***	-3.02***	0.17
Turkmenistan (TKM)	Middle	-1.91*	-2.00**	0.33	-2.81***	-2.67***	0.61	-2.37**	-2.61**	0.74***	-3.59***	-3.55***	0.62
Pakistan (PAK)	Middle	-6.72***	-6.88***	0.36	-1.78*	-1.76*	0.06	-1.08	-0.73	0.32	-2.91***	-2.96***	0.19
Jamaica (JAM)	Middle	-2.73***	-2.69***	0.24	-3.33***	-3.25***	0.18	-2.68***	-2.66***	0.33	-3.74***	-3.72***	0.52
Senegal (SEN)	Middle	-3.93***	-3.95***	0.09	-1.23	-0.91	0.37	-4.05***	-4.12***	0.23	-7.21***	-7.06***	0.21
Malaysia (MYS)	Middle	-4.78***	-4.76***	0.06	-2.24**	-1.97**	0.25	-0.71	-0.67	0.11	-3.72***	-3.64***	0.22
Dominican Republic (DOM)	Middle	-5.47***	-5.47***	0.07	-1.96**	-1.91*	0.11	-2.04**	-1.76*	0.18	-2.83***	-2.80***	0.13
Mongolia (MNG)	Middle	-4.84***	-4.58***	0.24	-1.78*	-1.80*	0.48	-1.12	-0.73	0.10	-2.47**	-2.50**	0.55
Mauritius (MUS)	Middle	-4.83***	-4.83***	0.07	-1.56	-1.39	0.63	-3.92***	-3.89***	0.24	-2.31**	-2.06**	0.23
Lebanon (LBN)	Middle	-2.83***	-2.90***	0.31	-2.70***	-2.71***	0.48	-1.61*	-1.81*	0.09	-3.57***	-3.57***	0.34
Suriname (SUR)	Middle	-4.58***	-4.58***	0.16	-2.48**	-2.36**	0.18	-0.45	-0.48	0.18	-3.53***	-3.56***	0.16
Philippines (PHL)	Middle	-5.02***	-5.02***	0.4	-0.83	-0.39	0.72	-1.47	-1.12	0.43	-2.30**	-2.16**	0.71
Gabon (GAB)	Middle	-3.31***	-3.40***	0.09	-3.31***	-3.34***	0.17	-0.42	-0.36	0.33	-4.42***	-4.44***	0.18
El Salvador (SLV)	Middle	-7.48***	-7.70***	0.08	-2.44**	-2.45**	0.32	-3.29***	-3.16***	0.26	-4.83***	-4.84***	0.19
Azerbaijan (AZE)	Middle	-1.88*	-1.78*	0.47	-1.83*	-1.94*	0.27	-1.21	-0.87	0.24	-1.95*	-2.05**	0.25
Lesotho (LSO)	Middle	-4.74***	-4.78***	0.18	-2.64**	-2.53**	0.42	-0.99	-1.14	0.26	-2.54**	-2.42**	0.35
Cameroon (CMR)	Middle	-1.89*	-2.06**	0.2	-1.43	-1.27	0.34	-0.52	-0.53	0.26	-2.87***	-2.78***	0.49
Georgia (GEO)	Middle	-4.78***	-4.79***	0.43	-5.24***	-4.60***	0.36	-3.28***	-3.35***	0.12	-4.24***	-3.83***	0.24
Vanuatu (VUT)	Middle	-2.41**	-2.51**	0.13	-2.99***	-2.86***	0.07	-0.35	-0.32	0.33	-4.92***	-4.92***	0.12
Haiti (HTI)	Middle	-1.85*	-1.90*	0.19	-4.79***	-4.79***	0.21	-0.24	-0.27	0.28	-5.29***	-5.37***	0.15
Bolivia (BOL)	Middle	-4.98***	-4.99***	0.2	-0.84	-0.70	0.24	-3.27***	-3.19***	0.08	-3.71***	-3.71***	0.27
Indonesia (IDN)	Middle	-4.16***	-4.18***	0.53	-2.10**	-1.94*	0.1	-1.97**	-1.71*	0.26	-2.91***	-2.85***	0.09
Guinea (GIN)	Middle	-3.75***	-3.63***	0.07	-1.30	-0.98	0.37	-1.52	-1.76*	0.38	-1.90*	-1.65*	0.51
Sao Tome and Principe (STP)	Middle	-4.36***	-4.32***	0.15	-1.57	-1.27	0.32	-0.08	-0.14	0.23	-2.92***	-2.84***	0.29

Country	Type of income	Δu_t			g_{yt}			g_{Lft}			g_{ptt}		
		ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
Bangladesh (BGD)	Middle	-5.64***	-5.71***	0.08	0.44	0.61	0.82***	-1.30	-1.05	0.24	-0.77	-0.29	0.7
Republic of Congo (COG)	Middle	-4.55***	-4.56***	0.14	-3.66***	-3.67***	0.16	-0.72	-0.67	0.22	-4.43***	-4.43***	0.13
Peru (PER)	Middle	-5.96***	-6.18***	0.1	-1.75*	-1.56	0.09	-1.74*	-1.42	0.56	-3.83***	-3.86***	0.32
Botswana (BWA)	Middle	-3.23***	-3.25***	0.12	-4.03***	-4.02***	0.08	-1.46	-1.15	0.13	-6.55***	-6.86***	0.1
Cuba (CUB)	Middle	-2.21**	-2.23**	0.17	-2.58**	-2.59**	0.23	-2.72***	-2.58**	0.23	-2.99***	-2.97***	0.26
Nigeria (NGA)	Middle	-2.13**	-2.22**	0.44	-1.62*	-1.58	0.21	-0.46	-0.53	0.68	-2.20**	-2.22**	0.22
Armenia (ARM)	Middle	-4.18***	-4.15***	0.53	-4.87***	-4.54***	0.22	-2.03**	-1.93*	0.47	-4.75***	-4.51***	0.16
Mauritania (MRT)	Middle	-4.20***	-4.24***	0.13	-3.41***	-3.36***	0.11	-1.43	-1.38	0.39	-4.48***	-4.46***	0.18
Solomon Islands (SLB)	Middle	-2.56**	-2.69***	0.19	-2.84***	-2.84***	0.1	-0.33	-0.31	0.50	-3.08***	-3.11***	0.11
Comoros (COM)	Middle	-6.19***	-6.10***	0.36	-3.61***	-3.62***	0.06	-0.48	-0.56	0.34	-5.75***	-5.72***	0.07
Angola (AGO)	Middle	-3.25***	-3.30***	0.04	-2.51**	-2.45**	0.16	0.15	0.12	0.26	-3.13***	-3.03***	0.16
Maldives (MDV)	Middle	-1.45	-1.49	0.38	-3.49***	-3.46***	0.08	0.21	0.30	0.64	-5.75***	-5.78***	0.29
Papua New Guinea (PNG)	Middle	-4.51***	-4.50***	0.09	-3.11***	-3.00***	0.12	-1.28	-1.27	0.26	-3.47***	-3.39***	0.14
Iraq (IRQ)	Middle	-3.46***	-3.43***	0.56	-4.43***	-4.42***	0.31	-1.15	-1.07	0.09	-5.09***	-5.11***	0.27
Namibia (NAM)	Middle	-4.15***	-4.12***	0.09	-2.57**	-2.51**	0.16	-2.13**	-1.86*	0.16	-4.04***	-4.09***	0.09
Bhutan (BTN)	Middle	-5.54***	-5.55***	0.12	-1.49	-1.13	0.18	-1.78*	-1.60*	0.16	-2.61**	-2.47**	0.12
Nepal (NPL)	Middle	-3.66***	-3.66***	0.42	-1.30	-0.80	0.18	-0.97	-0.93	0.43	-2.18**	-1.88*	0.4
Libya (LBY)	Middle	-5.16***	-5.16***	0.12	-8.06***	-8.92***	0.08	-2.14**	-2.07**	0.35	-7.98***	-9.08***	0.13
Fiji (FJI)	Middle	-5.09***	-5.09***	0.07	-3.53***	-3.48***	0.13	-1.97**	-1.95*	0.27	-3.37***	-3.33***	0.17
Timor-Leste (TLS)	Middle	-1.20	-1.55	0.13	-5.30***	-5.31***	0.05	-1.20	-0.85	0.60	-5.82***	-5.95***	0.07
Cambodia (KHM)	Middle	-7.08***	-7.05***	0.19	-3.53***	-3.54***	0.24	-1.20	-1.07	0.34	-4.22***	-4.25***	0.28
Cape Verde (CPV)	Middle	-5.67***	-5.68***	0.07	-1.59	-1.38	0.7	-1.81*	-1.37	0.60	-2.22**	-2.07**	0.57
Kyrgyzstan (KGZ)	Middle	0.97	1.09	0.35	-2.59**	-2.52**	0.41	-2.20**	-2.06**	0.45	-2.85***	-2.79***	0.48
Zimbabwe (ZWE)	Middle	-2.45**	-2.54**	0.18	-3.08***	-3.13***	0.14	-1.00	-1.10	0.20	-3.25***	-3.30***	0.14
Belarus (BLR)	Middle	-3.47***	-3.40***	0.25	-2.07**	-2.06**	0.23	-1.26	-1.51	0.35	-2.94***	-2.86***	0.22
Brazil (BRA)	Middle	-3.55***	-3.58***	0.1	-2.38**	-2.26**	0.25	-1.82*	-1.50	0.51	-3.61***	-3.63***	0.12

Country	Type of income	Δu_t			g_{yt}			g_{Lft}			g_{ptt}		
		ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
North Macedonia (MKD)	Middle	-2.66***	-2.65**	0.53	-2.33**	-2.25**	0.43	-5.90***	-5.95***	0.21	-4.01***	-4.03***	0.12
Ghana (GHA)	Middle	-3.45***	-3.42***	0.25	-0.92	-0.74	0.31	-0.32	-0.32	0.61	-1.58	-1.33	0.29
Argentina (ARG)	Middle	-3.93***	-3.94***	0.19	-3.59***	-3.54***	0.16	-2.33**	-2.07**	0.28	-3.82***	-3.75***	0.25
St. Lucia (LCA)	Middle	-3.33***	-3.31***	0.09	-4.58***	-4.59***	0.14	-1.35	-1.30	0.60	-5.81***	-5.87***	0.07
Nicaragua (NIC)	Middle	-3.95***	-3.92***	0.05	-1.76*	-1.67*	0.1	-1.28	-1.14*	0.75***	-3.18***	-3.14***	0.09
Mexico (MEX)	Middle	-4.33***	-4.31***	0.08	-3.73***	-3.72***	0.15	-1.35	-1.23	0.37	-6.83***	-6.90***	0.1
Kazakhstan (KAZ)	Middle	-2.79***	-2.82***	0.3	-1.32	-1.36	0.35	-1.05	-1.26	0.40	-1.55	-1.58	0.29
Equatorial Guinea (GNQ)	Middle	-3.32***	-3.31***	0.23	-2.77***	-2.70***	0.63	-0.08	-0.18	0.25	-2.95***	-2.90***	0.63
Myanmar (MMR)	Middle	-3.59***	-3.46***	0.09	-0.76	-0.75	0.24	-2.33**	-1.98**	0.72	-0.64	-0.56	0.19
Kenya (KEN)	Middle	-0.54	-0.61	0.41	-1.26	-0.92	0.63	-1.23	-1.02	0.51	-3.24***	-3.17***	0.75***
Eswatini (SWZ)	Middle	-1.06	-1.25	0.12	-1.35	-1.15	0.16	-3.04***	-3.04***	0.31	-1.84*	-1.88*	0.06
China (CHN)	Middle	-2.97***	-2.99***	0.32	-1.65*	-1.67*	0.47	-1.38	-1.40*	0.93***	-1.40	-1.37	0.25
Tanzania (TZA)	Middle	-3.74***	-3.74***	0.04	-0.03	0.26	0.64	-0.38	-0.40	0.28	-0.96	-0.71	0.66
Bosnia and Herzegovina (BIH)	Middle	-2.78***	-2.74***	0.5	-1.92*	-2.08**	0.29	-2.68***	-2.70***	0.11	-1.69*	-1.73*	0.5
India (IND)	Middle	0.20	0.38	0.69	-0.97	-0.77	0.11	-1.03	-1.02	0.68	-1.29	-1.09	0.37
Zambia (ZMB)	Middle	-3.81***	-3.78***	0.05	-2.07**	-1.77*	0.36	1.33	1.32*	0.79***	-4.27***	-4.27***	0.24
Islamic Republic of Iran (IRN)	Middle	-4.41***	-4.37***	0.06	-3.01***	-2.95***	0.21	-2.11**	-1.94*	0.14	-4.90***	-4.88***	0.16
Viet Nam (VNM)	Middle	-7.31***	-7.31***	0.07	-0.64	-0.64	0.36	-1.42	-1.22	0.35	-0.70	-0.43	0.2
Lao People's Democratic Republic (LAO)	Middle	-1.98**	-2.15**	0.25	-0.43	-0.30	0.3	-1.46	-1.34	0.50	-0.61	-0.44	0.44
Tonga (TON)	Middle	-2.41**	-2.59**	0.13	-3.32***	-3.25***	0.19	-3.01***	-3.07***	0.71	-3.46***	-3.44***	0.09

Notes: Null Hypothesis (H_0): In the case of the ADF and PP tests, the null hypothesis states that the series contains a unit root, while in the case of the KPSS test, the null hypothesis assumes stationarity. *** indicates that the null hypothesis is rejected at the 1% level. The ADF and PP tests were run without a constant or trend, while the KPSS includes at least one constant.

Appendix B

Table 1B. Okun coefficients and their decomposition by type of income among countries (1992-2019).

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Spain (ESP)	High	High	The authors	-0.91***	-0.90	-0.82***	-0.09	0.21*	-0.3***
			Ismihan (2016)	-0.91***	-0.92	-0.83	-0.09	0.21*	-0.3***
Poland (POL)	High	High	The authors	-0.54***	-0.53	-0.83***	0.30	-0.16**	0.46**
			Ismihan (2016)	-0.56***	-0.57	-0.88	0.31	-0.18**	0.49**
United States (USA)	High	High	The authors	-0.44***	-0.44	-0.92***	0.48	0.19***	0.3***
			Ismihan (2016)	-0.45***	-0.45	-0.94	0.49	0.19***	0.3***
Denmark (DNK)	High	High	The authors	-0.42***	-0.42	-0.94***	0.52	-0.01	0.53***
			Ismihan (2016)	-0.42***	-0.43	-0.94	0.51	-0.01	0.52***
Portugal (PRT)	High	High	The authors	-0.41***	-0.40	-0.9***	0.49	0.31***	0.19
			Ismihan (2016)	-0.41***	-0.42	-0.92	0.50	0.31***	0.19
Bahamas (BHS)	High	High	The authors	-0.41***	-0.42	-0.89***	0.47	0.04	0.43***
			Ismihan (2016)	-0.42***	-0.42	-0.89	0.47	0.04	0.43***
Greece (GRC)	High	High	The authors	-0.39***	-0.38	-0.83***	0.45	0.12**	0.33***
			Ismihan (2016)	-0.39***	-0.40	-0.86	0.46	0.13**	0.33***
Australia (AUS)	High	High	The authors	-0.39***	-0.39	-0.9***	0.50	-0.09	0.6***
			Ismihan (2016)	-0.4***	-0.40	-0.94	0.53	-0.09	0.63***
Sweden (SWE)	High	High	The authors	-0.35***	-0.35	-0.91***	0.57	0.11	0.45***
			Ismihan (2016)	-0.35***	-0.35	-0.93	0.57	0.12	0.46***
Canada (CAN)	High	High	The authors	-0.33***	-0.34	-0.9***	0.56	0.1	0.46***
			Ismihan (2016)	-0.34***	-0.34	-0.92	0.58	0.11	0.47***
New Zealand (NZL)	High	High	The authors	-0.33***	-0.34	-0.91***	0.57	0.28**	0.29**
			Ismihan (2016)	-0.34***	-0.34	-0.94	0.60	0.3**	0.3**
Cyprus (CYP)	High	High	The authors	-0.33***	-0.33	-0.89***	0.56	0.05	0.5***
			Ismihan (2016)	-0.34***	-0.35	-0.93	0.58	0.06	0.52***
France (FRA)	High	High	The authors	-0.32***	-0.32	-0.89***	0.57	-0.06	0.63***
			Ismihan (2016)	-0.33***	-0.33	-0.90	0.57	-0.07	0.64***
Finland (FIN)	High	High	The authors	-0.32***	-0.31	-0.87***	0.56	0.12***	0.43***
			Ismihan (2016)	-0.32***	-0.32	-0.90	0.58	0.13***	0.45***
United Kingdom (GBR)	High	High	The authors	-0.32***	-0.31	-0.92***	0.60	-0.01	0.61***
			Ismihan (2016)	-0.32***	-0.32	-0.94	0.62	-0.01	0.63***
Barbados (BRB)	High	High	The authors	-0.3***	-0.29	-0.83***	0.54	0.04	0.5***

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Austria (AUT)	High	Low	Ismihan (2016)	-0.3***	-0.31	-0.88	0.57	0.04	0.53***
			The authors	-0.16**	-0.16	-0.93***	0.77	0.02	0.76***
			Ismihan (2016)	-0.16**	-0.16	-0.95	0.79	0.02	0.77***
Norway (NOR)	High	Low	The authors	-0.12*	-0.13	-0.93***	0.80	0.22**	0.58***
			Ismihan (2016)	-0.12*	-0.12	-0.96	0.83	0.23**	0.6***
Croatia (HRV)	High	Low	The authors	-0.12*	-0.11	-0.86***	0.75	0.04	0.71***
			Ismihan (2016)	-0.11*	-0.11	-0.88	0.76	0.04	0.72***
Japan (JPN)	High	Low	The authors	-0.12***	-0.11	-0.97***	0.86	0.04	0.82***
			Ismihan (2016)	-0.12***	-0.12	-0.96	0.84	0.04	0.8***
Russian Federation (RUS)	High	Low	The authors	-0.12***	-0.11	-0.91***	0.80	0.12***	0.68***
			Ismihan (2016)	-0.11***	-0.11	-0.92	0.81	0.12***	0.69***
			The authors	-0.11***	-0.13	-0.83***	0.70	0.06	0.63***
Singapore (GSP)	High	Low	Ismihan (2016)	-0.12***	-0.12	-0.96	0.84	0.07	0.77***
			The authors	-0.08***	-0.10	-0.86***	0.76	-0.1	0.86***
Panama (PAN)	High	Low	Ismihan (2016)	-0.08***	-0.08	-0.94	0.86	-0.12	0.97***
			The authors	-0.06	-0.08	-0.91***	0.84	0.12	0.72***
Brunei Darussalam (BRN)	High	Low	Ismihan (2016)	-0.06	-0.07	-0.94	0.87	0.12	0.75***
			The authors	-0.06**	-0.07	-0.84***	0.77	0.16***	0.62***
Trinidad and Tobago (TTO)	High	Low	Ismihan (2016)	-0.07**	-0.07	-0.91	0.84	0.17***	0.67***
			The authors	-0.06	-0.07	-0.84***	0.77	0.29***	0.48***
Puerto Rico (PRI)	High	Low	Ismihan (2016)	-0.06	-0.06	-0.87	0.81	0.31***	0.5***
			The authors	-0.06	-0.09	-0.9***	0.81	-0.16	0.97***
Luxembourg (LUX)	High	Low	Ismihan (2016)	-0.06	-0.06	-0.96	0.90	-0.17	1.07***
			The authors	-0.04***	-0.04	-0.73***	0.69	0	0.69***
French Polynesia (PYF)	High	Low	Ismihan (2016)	-0.04***	-0.04	-0.88	0.84	0	0.84***
			The authors	-0.04***	-0.05	-0.68***	0.63	0.06**	0.58***
Macao Special Administrative Region, China (MAC)	High	Low	Ismihan (2016)	-0.04***	-0.04	-0.97	0.93	0.08**	0.85***
			The authors	-0.03	-0.03	-0.85***	0.82	0.08	0.74***
Malta (MLT)	High	Low	Ismihan (2016)	-0.03*	-0.03	-0.94	0.91	0.1	0.81***
			The authors	-0.02	-0.01	-0.69***	0.68	-0.07	0.75***
Romania (ROU)	High	Low	Ismihan (2016)	-0.02	-0.02	-0.93	0.91	-0.1	1.02***
			The authors	-0.02***	-0.00	-0.15***	0.15	0.08**	0.07**
Bahrain (BHR)	High	Low	Ismihan (2016)	-0.02***	-0.02	-0.99	0.97	0.51**	0.46**
			The authors	-0.01	-0.01	-0.04	0.03	-0.01	0.04***
United Arab Emirates (ARE)	High	Low	The authors	-0.01	-0.01	-0.04	0.03	-0.01	0.04***

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Oman (OMN)	High	Low	Ismihan (2016)	-0.02	-0.02	-0.98	0.96	-0.12	1.09***
			The authors	-0.01	-0.00	-0.12*	0.12	0.07*	0.05
Guyana (GUY)	High	Low	Ismihan (2016)	-0.01	-0.01	-0.96	0.95	0.52*	0.43
			The authors	-0.01	-0.01	-0.87***	0.87	0.01	0.86***
Qatar (QAT)	High	Low	Ismihan (2016)	-0.01	-0.01	-0.88	0.87	0.01	0.86***
			The authors	0	0.00	0.14***	-0.13	-0.06***	-0.08***
Kuwait (KWT)	High	Low	Ismihan (2016)	0	-0.00	-0.99	0.99	0.41***	0.59***
			The authors	0	-0.00	-0.02	0.01	0***	0.01***
Netherlands (NLD)	High	Middle	Ismihan (2016)	0	-0.00	-0.99	0.98	0.19***	0.79***
			The authors	-0.29***	-0.29	-0.92***	0.63	0.17*	0.46***
Italy (ITA)	High	Middle	Ismihan (2016)	-0.3***	-0.29	-0.95	0.66	0.17*	0.49***
			The authors	-0.28***	-0.28	-0.9***	0.62	-0.06	0.68***
Lithuania (LTU)	High	Middle	Ismihan (2016)	-0.28***	-0.28	-0.90	0.62	-0.06	0.68***
			The authors	-0.27***	-0.25	-0.94***	0.69	0	0.69***
Belgium (BEL)	High	Middle	Ismihan (2016)	-0.26***	-0.25	-0.89	0.64	0	0.64***
			The authors	-0.27**	-0.27	-0.91***	0.64	0.25**	0.39***
Czech Republic (CZE)	High	Middle	Ismihan (2016)	-0.27**	-0.27	-0.92	0.65	0.25**	0.4***
			The authors	-0.25***	-0.25	-0.92***	0.68	-0.04	0.72***
Latvia (LVA)	High	Middle	Ismihan (2016)	-0.25***	-0.25	-0.94	0.69	-0.04	0.73***
			The authors	-0.25***	-0.23	-0.88***	0.66	0.04	0.62***
Israel (ISR)	High	Middle	Ismihan (2016)	-0.21***	-0.21	-0.87	0.67	0.03	0.64***
			The authors	-0.24***	-0.26	-0.87***	0.61	0.18*	0.43***
Iceland (ISL)	High	Middle	Ismihan (2016)	-0.25***	-0.26	-0.91	0.65	0.18*	0.47***
			The authors	-0.24***	-0.24	-0.96***	0.72	0.18**	0.54***
Hungary (HUN)	High	Middle	Ismihan (2016)	-0.24***	-0.24	-0.96	0.72	0.18**	0.54***
			The authors	-0.23***	-0.22	-0.9***	0.68	0.15	0.53***
Hong Kong, Special Administrative Region (HKG)	High	Middle	Ismihan (2016)	-0.23***	-0.23	-0.92	0.69	0.15	0.54***
			The authors	-0.23***	-0.23	-0.92***	0.69	0.01	0.68***
Republic of Korea (KOR)	High	Middle	Ismihan (2016)	-0.23***	-0.23	-0.96	0.73	0.01	0.71***
			The authors	-0.22***	-0.23	-0.93***	0.70	0.2***	0.5***
Bulgaria (BGR)	High	Middle	Ismihan (2016)	-0.23***	-0.24	-0.97	0.73	0.22***	0.51***
			The authors	-0.22***	-0.20	-0.85***	0.65	0.07	0.59***
Chile (CHL)	High	Middle	Ismihan (2016)	-0.21***	-0.21	-0.89	0.67	0.07	0.61***
			The authors	-0.22**	-0.23	-0.88***	0.65	0.18***	0.47***

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Ireland (IRL)	High	Middle	Ismihan (2016)	-0.23***	-0.23	-0.92	0.69	0.19***	0.5***
			The authors	-0.21***	-0.22	-0.85***	0.63	0.12**	0.51***
Uruguay (URY)	High	Middle	Ismihan (2016)	-0.23***	-0.23	-0.91	0.68	0.14**	0.53***
			The authors	-0.2***	-0.20	-0.86***	0.66	0.14**	0.52***
Estonia (EST)	High	Middle	Ismihan (2016)	-0.2***	-0.21	-0.90	0.69	0.15**	0.54***
			The authors	-0.2***	-0.17	-0.91***	0.74	0.11***	0.63***
Germany (DEU)	High	Middle	Ismihan (2016)	-0.19***	-0.19	-0.91	0.72	0.11***	0.61***
			The authors	-0.2**	-0.20	-0.9***	0.70	-0.01	0.71***
Slovak Republic (SVK)	High	Middle	Ismihan (2016)	-0.2**	-0.20	-0.93	0.73	-0.01	0.74***
			The authors	-0.2**	-0.19	-0.83***	0.64	0.06	0.59***
Switzerland (CHE)	High	Middle	Ismihan (2016)	-0.2**	-0.20	-0.87	0.67	0.06	0.61***
			The authors	-0.19***	-0.19	-0.92***	0.73	-0.13	0.86***
Slovenia (SVN)	High	Middle	Ismihan (2016)	-0.2***	-0.19	-0.96	0.77	-0.14	0.9***
			The authors	-0.18***	-0.17	-0.91***	0.73	0.08	0.66***
Saudi Arabia (SAU)	High	Not applicable	Ismihan (2016)	-0.17***	-0.17	-0.93	0.76	0.08	0.68***
			The authors	0.02	-0.01	-0.86***	0.85	0.11	0.74***
Syrian Arab Republic (SYR)	Low	Low	Ismihan (2016)	0.02	0.02	-0.94	0.96	0.12	0.84***
			The authors	-0.08***	-0.03	-0.98***	0.95	0.4***	0.55***
Gambia (GMB)	Low	Low	Ismihan (2016)	-0.07***	-0.07	-0.90	0.83	0.35***	0.47***
			The authors	-0.04	-0.06	-0.86***	0.80	0	0.8***
Madagascar (MDG)	Low	Low	Ismihan (2016)	-0.04	-0.04	-0.91	0.87	0	0.87***
			The authors	-0.03	-0.06	-0.92***	0.86	-0.01	0.87***
Malawi (MWI)	Low	Low	Ismihan (2016)	-0.03	-0.03	-0.96	0.93	-0.01	0.94***
			The authors	-0.02***	-0.02	-0.69***	0.67	-0.01	0.68***
Togo (TGO)	Low	Low	Ismihan (2016)	-0.02***	-0.02	-0.95	0.93	0	0.93***
			The authors	-0.02	-0.03	-0.83***	0.80	0.04*	0.76***
Somalia (SOM)	Low	Low	Ismihan (2016)	-0.02	-0.02	-0.97	0.95	0.05*	0.89***
			The authors	-0.02***	-0.02	-0.4***	0.38	0.02	0.36***
Mali (MLI)	Low	Low	Ismihan (2016)	-0.02***	-0.02	-0.81	0.80	0.05	0.75***
			The authors	-0.01	-0.03	-0.69***	0.66	0.04*	0.63***
Guinea-Bissau (GNB)	Low	Low	Ismihan (2016)	-0.01	-0.01	-0.99	0.97	0.05*	0.92***
			The authors	-0.01***	-0.01	-0.47***	0.45	0	0.45***
Burkina Faso (BFA)	Low	Low	Ismihan (2016)	-0.01***	-0.01	-0.97	0.96	0	0.95***
			The authors	-0.01	-0.02	-0.88***	0.86	0.03	0.83***

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Mozambique (MOZ)	Low	Low	Ismihan (2016)	-0.01	-0.01	-0.97	0.96	0.03	0.92***
			The authors	-0.01***	-0.01	-0.36***	0.35	-0.01	0.36***
			Ismihan (2016)	-0.01***	-0.01	-0.97	0.96	-0.03	0.99***
Ethiopia (ETH)	Low	Low	The authors	-0.01	-0.02	-0.41***	0.39	0	0.4***
			Ismihan (2016)	-0.01	-0.01	-0.97	0.96	-0.01	0.97***
Burundi (BDI)	Low	Low	The authors	-0.01	-0.01	-0.31***	0.30	0.1**	0.2***
			Ismihan (2016)	-0.01	-0.01	-0.98	0.97	0.31**	0.66***
Rwanda (RWA)	Low	Low	The authors	-0.01	-0.00	0	-0.01	0	0***
			Ismihan (2016)	0	-0.00	-0.88	0.88	0.17**	0.71***
Sierra Leone (SLE)	Low	Low	The authors	0	-0.01	-0.39***	0.38	0.03**	0.35***
			Ismihan (2016)	0	-0.00	-0.96	0.95	0.07**	0.88***
Chad (TCD)	Low	Low	The authors	0***	-0.00	-0.09***	0.08	0**	0.08***
			Ismihan (2016)	0***	-0.00	-0.99	0.99	0.04**	0.94***
Liberia (LBR)	Low	Low	The authors	0*	-0.00	-0.04**	0.04	0***	0.03***
			Ismihan (2016)	0*	-0.00	-0.98	0.97	0.05**	0.93***
Central African Republic (CAF)	Low	Low	The authors	0	-0.00	-0.35***	0.35	0.01	0.34***
			Ismihan (2016)	0	-0.00	-0.94	0.94	0.04	0.91***
Democratic Republic of the Congo (COD)	Low	Not applicable	The authors	0	-0.01	-0.25**	0.25	0	0.25***
			Ismihan (2016)	0	0.00	-0.96	0.97	0	0.97***
Sudan (SDN)	Low	Not applicable	The authors	0.01	-0.01	-0.86***	0.85	0.02	0.83***
			Ismihan (2016)	0.01	0.01	-0.85	0.86	0.02	0.84***
Niger (NER)	Low	Not applicable	The authors	0.01	-0.01	-0.9***	0.89	-0.05	0.94***
			Ismihan (2016)	0.01	0.01	-0.99	1.00	-0.05	1.05***
Uganda (UGA)	Low	Not applicable	The authors	0.02	-0.01	-0.95***	0.93	-0.12**	1.05***
			Ismihan (2016)	0.02	0.02	-0.97	0.98	-0.13**	1.11***
Albania (ALB)	Middle	High	The authors	-0.55***	-0.54	-0.76***	0.22	-0.11	0.33*
			Ismihan (2016)	-0.56***	-0.58	-0.83	0.25	-0.12	0.37*
Arab Republic of Egypt (EGY)	Middle	High	The authors	-0.45***	-0.46	-0.87***	0.41	0.18	0.23
			Ismihan (2016)	-0.48***	-0.48	-0.90	0.42	0.19	0.24
Colombia (COL)	Middle	High	The authors	-0.38***	-0.40	-0.85***	0.45	-0.04	0.5***
			Ismihan (2016)	-0.4***	-0.41	-0.88	0.47	-0.04	0.52***
Algeria (DZA)	Middle	High	The authors	-0.38	-0.39	-0.76***	0.37	-0.14	0.51*
			Ismihan (2016)	-0.39	-0.41	-0.82	0.41	-0.15	0.56*
Costa Rica (CRI)	Middle	High	The authors	-0.35***	-0.36	-0.89***	0.53	0.19	0.34

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Tunisia (TUN)	Middle	High	Ismihan (2016)	-0.37***	-0.37	-0.93	0.57	0.21	0.36
			The authors	-0.33***	-0.34	-0.83***	0.49	0.11	0.38***
Turkey (TUR)	Middle	Low	Ismihan (2016)	-0.34***	-0.35	-0.85	0.50	0.11	0.39***
			The authors	-0.15***	-0.16	-0.83***	0.67	-0.15*	0.82***
Paraguay (PRY)	Middle	Low	Ismihan (2016)	-0.16***	-0.16	-0.90	0.74	-0.17*	0.91***
			The authors	-0.15	-0.16	-0.92***	0.76	-0.16	0.91***
Uzbekistan (UZB)	Middle	Low	Ismihan (2016)	-0.16	-0.16	-0.95	0.79	-0.16	0.95***
			The authors	-0.14***	-0.15	-0.86***	0.71	-0.11***	0.82***
South Africa (ZAF)	Middle	Low	Ismihan (2016)	-0.14***	-0.13	-0.93	0.79	-0.12***	0.91***
			The authors	-0.13*	-0.12	-0.7***	0.57	0.08	0.49**
Sri Lanka (LKA)	Middle	Low	Ismihan (2016)	-0.14*	-0.14	-0.79	0.65	0.09	0.56**
			The authors	-0.13***	-0.14	-0.89***	0.74	-0.03	0.77***
Jordan (JOR)	Middle	Low	Ismihan (2016)	-0.14***	-0.13	-0.93	0.79	-0.02	0.82***
			The authors	-0.13	-0.16	-0.76***	0.60	0.19	0.41**
Thailand (THA)	Middle	Low	Ismihan (2016)	-0.14	-0.14	-0.85	0.71	0.22	0.49**
			The authors	-0.12***	-0.13	-0.97***	0.84	0.08	0.76***
Honduras (HND)	Middle	Low	Ismihan (2016)	-0.13***	-0.13	-0.99	0.86	0.08	0.78***
			The authors	-0.11	-0.14	-0.86***	0.72	-0.23	0.94***
Belize (BLZ)	Middle	Low	Ismihan (2016)	-0.11	-0.11	-0.96	0.84	-0.25	1.09***
			The authors	-0.09*	-0.12	-0.83***	0.71	0.03	0.68***
Tajikistan (TJK)	Middle	Low	Ismihan (2016)	-0.1*	-0.10	-0.90	0.80	0.04	0.77***
			The authors	-0.09***	-0.09	-0.92***	0.84	0.04***	0.8***
Ukraine (UKR)	Middle	Low	Ismihan (2016)	-0.08***	-0.07	-0.89	0.82	0.03***	0.78***
			The authors	-0.08***	-0.08	-1***	0.92	0	0.92***
Republic of Moldova (MDA)	Middle	Low	Ismihan (2016)	-0.08***	-0.08	-0.92	0.84	0	0.84***
			The authors	-0.08***	-0.07	-0.97***	0.90	-0.01	0.91***
Côte d'Ivoire (CIV)	Middle	Low	Ismihan (2016)	-0.07***	-0.07	-0.95	0.88	-0.01	0.89***
			The authors	-0.08**	-0.10	-0.86***	0.76	0.03	0.73***
Ecuador (ECU)	Middle	Low	Ismihan (2016)	-0.08**	-0.08	-0.95	0.87	0.03	0.84***
			The authors	-0.08**	-0.09	-0.85***	0.76	0.08	0.68***
Samoa (WSM)	Middle	Low	Ismihan (2016)	-0.08**	-0.08	-0.96	0.88	0.1	0.78***
			The authors	-0.08**	-0.08	-0.93***	0.85	-0.09***	0.94***
Guatemala (GTM)	Middle	Low	Ismihan (2016)	-0.08**	-0.08	-0.94	0.86	-0.09***	0.95***
			The authors	-0.08***	-0.07	-0.61***	0.54	-0.04	0.58**

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Morocco (MAR)	Middle	Low	Ismihan (2016)	-0.08***	-0.08	-0.97	0.89	-0.07	0.96**
			The authors	-0.07***	-0.09	-0.77***	0.68	-0.07	0.75***
Benin (BEN)	Middle	Low	Ismihan (2016)	-0.08***	-0.08	-0.89	0.81	-0.08	0.89***
			The authors	-0.07*	-0.09	-0.92***	0.82	-0.16	0.99***
Saint Vincent and the Grenadines (VCT)	Middle	Low	Ismihan (2016)	-0.08*	-0.08	-0.99	0.91	-0.18	1.09***
			The authors	-0.07***	-0.08	-0.77***	0.69	0.08***	0.61***
Turkmenistan (TKM)	Middle	Low	Ismihan (2016)	-0.08***	-0.08	-0.80	0.73	0.08***	0.65***
			The authors	-0.07***	-0.09	-0.82***	0.74	-0.13***	0.87***
Pakistan (PAK)	Middle	Low	Ismihan (2016)	-0.07***	-0.07	-0.94	0.86	-0.14***	1***
			The authors	-0.07	-0.10	-0.94***	0.84	-0.22*	1.07***
Jamaica (JAM)	Middle	Low	Ismihan (2016)	-0.07	-0.07	-0.99	0.91	-0.24*	1.15***
			The authors	-0.07	-0.07	-0.92***	0.86	0.1	0.75***
Senegal (SEN)	Middle	Low	Ismihan (2016)	-0.07	-0.07	-0.93	0.86	0.11	0.75***
			The authors	-0.07	-0.03	-1.16***	1.12	0.18	0.95**
Malaysia (MYS)	Middle	Low	Ismihan (2016)	-0.07	-0.07	-0.97	0.90	0.12	0.78**
			The authors	-0.06***	-0.07	-0.75***	0.68	-0.01	0.69***
Dominican Republic (DOM)	Middle	Low	Ismihan (2016)	-0.06***	-0.06	-0.97	0.90	-0.02	0.92***
			The authors	-0.06	-0.08	-0.86***	0.78	0.2**	0.58***
Mongolia (MNG)	Middle	Low	Ismihan (2016)	-0.07	-0.06	-0.94	0.87	0.23**	0.64***
			The authors	-0.06	-0.08	-0.86***	0.78	-0.02	0.8***
Mauritius (MUS)	Middle	Low	Ismihan (2016)	-0.06	-0.06	-0.94	0.88	-0.02	0.91***
			The authors	-0.06	-0.07	-0.9***	0.82	0.05	0.78***
Lebanon (LBN)	Middle	Low	Ismihan (2016)	-0.06	-0.06	-0.92	0.86	0.05	0.81***
			The authors	-0.06***	-0.06	-0.66***	0.61	0.09	0.52***
Suriname (SUR)	Middle	Low	Ismihan (2016)	-0.06***	-0.06	-0.91	0.86	0.14	0.71***
			The authors	-0.05	-0.07	-0.89***	0.82	0.1**	0.72***
Philippines (PHL)	Middle	Low	Ismihan (2016)	-0.05	-0.05	-0.90	0.85	0.1**	0.75***
			The authors	-0.05**	-0.06	-0.8***	0.75	-0.16**	0.91***
Gabon (GAB)	Middle	Low	Ismihan (2016)	-0.05**	-0.05	-0.97	0.92	-0.2**	1.11***
			The authors	-0.05***	-0.06	-0.72***	0.66	0.02	0.64***
El Salvador (SLV)	Middle	Low	Ismihan (2016)	-0.05***	-0.05	-0.81	0.77	0.02	0.75***
			The authors	-0.05	-0.05	-0.92***	0.87	0.36**	0.51***
Azerbaijan (AZE)	Middle	Low	Ismihan (2016)	-0.05	-0.05	-0.94	0.89	0.37**	0.52***
			The authors	-0.05***	-0.05	-0.8***	0.75	-0.09***	0.84***

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Lesotho (LSO)	Middle	Low	Ismihan (2016)	-0.05***	-0.05	-0.93	0.89	-0.1***	0.98***
			The authors	-0.04***	-0.05	-0.77***	0.72	-0.03	0.74***
			Ismihan (2016)	-0.05***	-0.05	-0.84	0.79	-0.03	0.82***
Cameroon (CMR)	Middle	Low	The authors	-0.04*	-0.06	-0.84***	0.78	0	0.78***
			Ismihan (2016)	-0.04*	-0.04	-0.94	0.90	0	0.91***
Georgia (GEO)	Middle	Low	The authors	-0.04	-0.03	-0.81***	0.78	-0.05	0.82***
			Ismihan (2016)	-0.03	-0.03	-0.86	0.83	-0.04	0.87***
Vanuatu (VUT)	Middle	Low	The authors	-0.04	-0.06	-0.84***	0.77	-0.06**	0.83***
			Ismihan (2016)	-0.04	-0.04	-0.93	0.89	-0.06**	0.95***
Haiti (HTI)	Middle	Low	The authors	-0.04	-0.05	-0.84***	0.79	0.03	0.77***
			Ismihan (2016)	-0.03	-0.03	-0.88	0.85	0.03	0.82***
Bolivia (BOL)	Middle	Low	The authors	-0.04	-0.03	-0.77***	0.73	0.11	0.63**
			Ismihan (2016)	-0.04	-0.04	-0.97	0.94	0.13	0.81**
Indonesia (IDN)	Middle	Low	The authors	-0.04	-0.05	-0.88***	0.82	-0.02	0.85***
			Ismihan (2016)	-0.03	-0.03	-0.95	0.91	-0.03	0.94***
			The authors	-0.03***	-0.04	-0.72***	0.68	0.02	0.67***
Guinea (GIN)	Middle	Low	Ismihan (2016)	-0.04***	-0.04	-0.95	0.92	0.02	0.89***
			The authors	-0.03	-0.05	-0.81***	0.76	0.05**	0.71***
Sao Tome and Principe (STP)	Middle	Low	Ismihan (2016)	-0.03	-0.03	-0.85	0.82	0.05**	0.77***
			The authors	-0.03	-0.04	-0.92***	0.88	-0.17	1.05***
Bangladesh (BGD)	Middle	Low	Ismihan (2016)	-0.03	-0.03	-0.96	0.93	-0.19	1.12***
			The authors	-0.03***	-0.03	-0.54***	0.51	0.04**	0.47***
Republic of Congo (COG)	Middle	Low	Ismihan (2016)	-0.03***	-0.03	-0.80	0.77	0.06**	0.71***
			The authors	-0.03	-0.05	-0.75***	0.70	0.03	0.67***
Peru (PER)	Middle	Low	Ismihan (2016)	-0.03	-0.03	-0.96	0.93	0.04	0.89***
			The authors	-0.03	-0.05	-0.77***	0.72	-0.07*	0.79***
Botswana (BWA)	Middle	Low	Ismihan (2016)	-0.02	-0.02	-0.81	0.79	-0.07*	0.85***
			The authors	-0.02	-0.03	-0.95***	0.92	0.08***	0.85***
Cuba (CUB)	Middle	Low	Ismihan (2016)	-0.03	-0.03	-0.96	0.93	0.07***	0.86***
			The authors	-0.02***	-0.03	-0.58***	0.55	0	0.55***
Nigeria (NGA)	Middle	Low	Ismihan (2016)	-0.02***	-0.02	-0.96	0.94	-0.01	0.95***
			The authors	-0.02	-0.01	-0.87***	0.86	0.03*	0.83***
Armenia (ARM)	Middle	Low	Ismihan (2016)	-0.01	-0.01	-0.90	0.88	0.02*	0.86***
			The authors	-0.02***	-0.03	-0.57***	0.54	-0.02	0.56***
Mauritania (MRT)	Middle	Low	The authors	-0.02***	-0.03	-0.57***	0.54	-0.02	0.56***

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Solomon Islands (SLB)	Middle	Low	Ismihan (2016)	-0.02***	-0.02	-0.90	0.88	-0.03	0.91***
			The authors	-0.02***	-0.02	-0.46***	0.43	-0.03***	0.46***
Comoros (COM)	Middle	Low	Ismihan (2016)	-0.02***	-0.02	-0.98	0.96	-0.06***	1.02***
			The authors	-0.02***	-0.03	-0.63***	0.60	0	0.6***
Angola (AGO)	Middle	Low	Ismihan (2016)	-0.02***	-0.02	-0.95	0.93	0	0.94***
			The authors	-0.02***	-0.02	-0.43***	0.41	0.01***	0.4***
Maldives (MDV)	Middle	Low	Ismihan (2016)	-0.02***	-0.02	-0.84	0.82	0.01***	0.8***
			The authors	-0.02	-0.04	-0.88***	0.84	0.02	0.82***
Papua New Guinea (PNG)	Middle	Low	Ismihan (2016)	-0.02	-0.02	-0.95	0.93	0.02	0.9***
			The authors	-0.01***	-0.02	-0.43***	0.41	-0.04	0.45***
Iraq (IRQ)	Middle	Low	Ismihan (2016)	-0.01***	-0.01	-0.97	0.96	-0.09	1.05***
			The authors	-0.01**	-0.02	-0.5***	0.48	0	0.48***
Namibia (NAM)	Middle	Low	Ismihan (2016)	-0.01*	-0.01	-0.91	0.89	0.01	0.89***
			The authors	-0.01	-0.03	-0.77***	0.75	0.09	0.66***
Bhutan (BTN)	Middle	Low	Ismihan (2016)	-0.01	-0.01	-0.79	0.78	0.09	0.68***
			The authors	-0.01	-0.04	-0.96***	0.92	0.15	0.77***
Nepal (NPL)	Middle	Low	Ismihan (2016)	-0.01	-0.01	-0.98	0.96	0.17	0.79***
			The authors	-0.01***	-0.01	-0.29***	0.28	0.02	0.26***
Libya (LBY)	Middle	Low	Ismihan (2016)	-0.01***	-0.01	-0.89	0.89	0.06	0.83***
			The authors	-0.01***	-0.00	0.02	-0.02	0	-0.02***
Fiji (FJI)	Middle	Low	Ismihan (2016)	-0.01***	-0.01	-0.81	0.80	0	0.8***
			The authors	0	-0.01	-0.83***	0.82	-0.15*	0.97***
Timor-Leste (TLS)	Middle	Low	Ismihan (2016)	0	-0.00	-0.96	0.95	-0.18*	1.13***
			The authors	0	-0.01	-0.3***	0.29	-0.01***	0.3***
Cambodia (KHM)	Middle	Low	Ismihan (2016)	0	-0.00	-0.96	0.96	-0.05***	1.01***
			The authors	0	-0.01	-0.2***	0.19	-0.02***	0.2***
Cape Verde (CPV)	Middle	Low	Ismihan (2016)	0	-0.00	-0.99	0.99	-0.07***	1.06***
			The authors	0	-0.03	-0.82***	0.79	0.08*	0.71***
Kyrgyzstan (KGZ)	Middle	Low	Ismihan (2016)	0	-0.00	-0.87	0.87	0.09*	0.78***
			The authors	0	-0.00	-0.32***	0.31	-0.02	0.33***
Zimbabwe (ZWE)	Middle	Low	Ismihan (2016)	0	-0.00	-0.98	0.98	-0.05	1.02***
			The authors	0	-0.01	-0.86***	0.85	0.02	0.83***
Belarus (BLR)	Middle	Middle	Ismihan (2016)	0	0.00	-0.95	0.95	0.03	0.92***
			The authors	-0.28***	-0.25	-0.81***	0.56	0	0.55***

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Brazil (BRA)	Middle	Middle	Ismihan (2016)	-0.28***	-0.29	-0.91	0.62	0.01	0.61***
			The authors	-0.27***	-0.27	-0.89***	0.62	-0.04	0.66***
North Macedonia (MKD)	Middle	Middle	Ismihan (2016)	-0.27***	-0.27	-0.91	0.63	-0.04	0.67***
			The authors	-0.25**	-0.23	-0.67***	0.43	0.1*	0.33**
Ghana (GHA)	Middle	Middle	Ismihan (2016)	-0.25**	-0.24	-0.69	0.45	0.1*	0.35***
			The authors	-0.24***	-0.26	-0.9***	0.64	-0.06**	0.7***
Argentina (ARG)	Middle	Middle	Ismihan (2016)	-0.26***	-0.26	-0.94	0.68	-0.06**	0.75***
			The authors	-0.21***	-0.21	-0.83***	0.62	0.06**	0.55***
St. Lucia (LCA)	Middle	Middle	Ismihan (2016)	-0.21***	-0.22	-0.89	0.66	0.07**	0.59***
			The authors	-0.2	-0.21	-0.82***	0.61	0.03	0.57***
Nicaragua (NIC)	Middle	Middle	Ismihan (2016)	-0.21	-0.20	-0.82	0.62	0.03	0.58***
			The authors	-0.2***	-0.20	-0.9***	0.69	0.07**	0.62***
Mexico (MEX)	Middle	Middle	Ismihan (2016)	-0.2***	-0.20	-0.94	0.74	0.08**	0.66***
			The authors	-0.19***	-0.20	-0.92***	0.72	0.09*	0.63***
Kazakhstan (KAZ)	Middle	Middle	Ismihan (2016)	-0.19***	-0.20	-0.96	0.76	0.09	0.67***
			The authors	-0.19***	-0.19	-0.97***	0.78	0.08***	0.7***
Equatorial Guinea (GNQ)	Middle	Not applicable	Ismihan (2016)	-0.19***	-0.19	-0.92	0.74	0.07***	0.66***
			The authors	0	-0.00	-0.01	0.01	0	0.01***
Myanmar (MMR)	Middle	Not applicable	Ismihan (2016)	0	0.00	-0.92	0.92	0	0.92***
			The authors	0	-0.00	-0.82***	0.82	-0.03	0.85***
Kenya (KEN)	Middle	Not applicable	Ismihan (2016)	0	0.00	-0.99	0.99	-0.04	1.03***
			The authors	0	-0.03	-0.88***	0.85	-0.04	0.89***
Eswatini (SWZ)	Middle	Not applicable	Ismihan (2016)	0	0.00	-0.97	0.97	-0.04	1.02***
			The authors	0	-0.00	-0.73***	0.73	-0.03	0.75***
China (CHN)	Middle	Not applicable	Ismihan (2016)	0	0.01	-0.75	0.76	-0.03	0.79***
			The authors	0	-0.01	-0.9***	0.89	0.1**	0.79***
Tanzania (TZA)	Middle	Not applicable	Ismihan (2016)	0	0.00	-0.96	0.96	0.12**	0.85***
			The authors	0	-0.02	-0.89***	0.86	-0.08*	0.95***
Bosnia and Herzegovina (BIH)	Middle	Not applicable	Ismihan (2016)	0	0.00	-0.97	0.97	-0.09*	1.07***
			The authors	0.02	-0.01	-0.71***	0.70	0.11***	0.59***
India (IND)	Middle	Not applicable	Ismihan (2016)	0.02	0.02	-0.75	0.77	0.15***	0.63***
			The authors	0.02	0.01	-0.91***	0.92	0	0.91***
Zambia (ZMB)	Middle	Not applicable	Ismihan (2016)	0.03	0.03	-0.92	0.95	0	0.94***
			The authors	0.04	0.01	-0.87***	0.88	0.07**	0.81***

Country	Type of income	Type of effect (β_{Okun})	Method	Okun coefficient (β_{Okun})	Ne effect	Direct (φ)	Indirect effect	Source of indirect effects	
								Labour ($-\varphi\delta_1$)	Productivity ($-\varphi\delta_2$)
Islamic Republic of Iran (IRN)	Middle	Not applicable	Ismihan (2016)	0.03	0.04	-0.88	0.92	0.07**	0.85***
			The authors	0.04	0.02	-0.85***	0.87	0.12	0.75***
Viet Nam (VNM)	Middle	Not applicable	Ismihan (2016)	0.04	0.04	-0.89	0.93	0.13	0.8***
			The authors	0.04	0.02	-0.92***	0.94	0	0.94***
Lao People's Democratic Republic (LAO)	Middle	Not applicable	Ismihan (2016)	0.04	0.04	-0.98	1.02	0	1.03***
			The authors	0.06	0.04	-0.93***	0.97	0	0.98***
Tonga (TON)	Middle	Not applicable	Ismihan (2016)	0.06	0.06	-0.98	1.04	-0.01	1.05***
			The authors	0.07**	0.07	-0.98***	1.05	0.03	1.02***
			Ismihan (2016)	0.07**	0.07	-0.98	1.05	0.03	1.02***

Notes: *, **, and *** indicate statistical significance of the parameter at 10%, 5%, and 1% levels, respectively.

a) the income type of the country was obtained from the World Bank's classification. The upper-middle and lower-middle categories were unified to specify the middle-income type; the high and low classifications remained unchanged.

b) The results of Okun coefficient were classified with high, low, and middle thresholds. High: greater than 0.30 (in absolute value), middle: between 0.17 and 0.30, low: between 0 and 0.17. Positive Okun coefficient results were classified as 'not applicable'. In this study, Okun coefficient was obtained by relating the variation of the unemployment rate to economic growth, measured by the variation of real GDP. To replicate the methodology of Ismihan (2016), the variation of the unemployment rate and the log difference of real GDP were used.

c) The direct effect in this study (reference "The authors") was calculated by relating the change in the unemployment rate to the economic growth net of the year-on-year change in the labour force and productivity per employee. Following Ismihan (2016), the direct effect in this case was calculated as the average employment rate for the period analysed.

d) The source of indirect effects was calculated by multiplying the sensitivity of labour supply and productivity per employee to the change in real GDP by the direct effect described in the previous paragraph. In the case of this study, the series were worked in year-on-year variations, while to replicate Ismihan (2016), log differences were used. The significance of these effects corresponds to the p-value of the sensitivities of labour supply and productivity per employee to the variation of real GDP.

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