WP/21/270

IMF Working Paper

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INTERNATIONAL MONETARY FUND

IMF Working Paper

Research Department

Okun's Law, Development, and Demographics: Differences in the Cyclical Sensitivities of Unemployment Across Economy and Worker Groups

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Authorized for distribution by Romain Duval

November 2021

Abstract

The negative and stable relationship between an economy's aggregate demand conditions and overall unemployment is well-documented. We show that there is a large degree of heterogeneity in the cyclical sensitivities of unemployment across worker and economy groups. First, unemployment is more than twice as sensitive to aggregate demand in advanced as in emerging market and developing economies. Second, youth's unemployment is twice as sensitive as that of adults'. Third, women's unemployment is significantly less sensitive to demand than men's in advanced economies. These findings point to the highly unequal impacts of the business cycle across worker and economy groups.

JEL Classification Numbers: E24, E26, J20, J21, J40, J46

Keywords: unemployment, business cycles, Okun's Law, demographics

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[†] This paper is an outgrowth of research undertaken for an IMF staff discussion note on youth employment prospects in emerging market and developing economies (Ahn and others 2019). We thank all our team members on that project and Romain Duval for their comments and helpful discussions. The paper has also benefited from the feedback received from numerous seminar participants. This paper was supported in part through a research project on macroeconomic policy in low-income countries with the United Kingdom's Department for International Development (DFID). The views expressed here are our own and do not represent the views of the IMF or DFID.

1. Introduction

Starting with Okun's 1963 study of the United States, a rich empirical literature has documented the existence of a negative and stable relationship between an economy's aggregate demand conditions and its overall unemployment. This empirical regularity, known as Okun's Law, is typically expressed as a negative linear association between the cyclical component of the unemployment rate (the difference between the actual and natural unemployment rates – the unemployment gap) and the output gap (the difference between the log level of real output and log potential output). Okun saw the relationship as a natural consequence of employers adjusting the level of employment in response to fluctuations in aggregate demand. These generate movements in output, to which employers respond by adjusting the employment level.[1] If labor force participation were relatively stable, the change in employment would, in turn, result in a similar movement in the unemployment rate. Okun's Law has been found to hold across a broad set of economies, but more strongly in advanced economies (AEs) than in emerging market and developing economies (EMDEs; see Ball, Leigh, and Loungani 2017; An et al. 2019; Ball, Furceri, et al. 2019).

But does this negative relationship between unemployment and demand conditions vary across demographic groups (age and gender) within a country? Are some groups more sensitive to demand conditions than others? Motivated by the spikes in youth unemployment seen in many European countries in the wake of the Great Recession, Hutengs and Stadtmann (2013a), Banerji, Saksonovs, et al. (2014), and Banerji, Lin, and Saksonovs (2015) examined the cyclical sensitivity of youth unemployment for samples of advanced European countries, finding it to be about twice as large as that of adults, reflecting youth's relatively more fragile attachment to employment.[2] Hutengs and Stadtmann (2013b) looked at the relationship for a small sample consisting mostly of emerging European economies and similarly found that younger cohorts' cyclical unemployment is much more sensitive than that of older cohorts'.

Recently, there has been work done to further unpack the Okun relationship, by both age and gender. Dixon, Lim, and van Ours (2017) estimated Okun coefficients (coefficients from a linear regression of the unemployment gap on the output gap) for a sample of OECD economies by age and gender, replicating earlier findings for age but also finding that women's Okun coefficients tended to be lower than men's. Evans (2018) investigated Okun coefficients by age and gender

[1] Others see Okun's Law as resulting from the production function, in which it is the level of employment that determines the level of output (see Daly et al. 2012 for example). Empirically, it may well be possible that causation runs both ways. We do not take a stance in this debate and rather see the relationship between deviations from potential output and the natural rate as a pure stylized fact.

[2] Youth are defined as individuals between the ages of 15-24 years-old, while adults are 25-64 years-old.

in Australia using an unobserved components model, finding similar results to Dixon, Lim, and van Ours (2017). In the wake of the outbreak of the COVID-19 in 2020 and the subsequent labor market disruptions observed across most countries in the world, heterogeneity in the strength of Okun's relationship has gained new attention. In this paper, we expand upon earlier analyses, looking at the relationship between demand conditions and cyclical unemployment by demographic group (age and gender) for a large sample of 38 AEs and 58 EMDEs.[3]

Our baseline results confirm that there is a large degree of heterogeneity in the cyclical sensitivities of unemployment across demographic groups and reveal further heterogeneity across economy groups. Our first key finding is that the sensitivity of the overall working age population's unemployment gap to demand conditions is about twice as high in AEs as in EMDEs. The unemployment gap for the working age population in EMDEs rises less than 0.2 percentage points for a 1 percentage point decline in the output gap, while in AEs, the same gap rises more than 0.3 percentage points. In general, the pattern of unemployment's cyclical sensitivity in AEs being twice that in EMDEs holds across different demographic groups. This finding, which is robust to alternative regression specifications and estimation procedures, is consistent with the view that labor markets display a much stronger link to demand conditions in AEs than in EMDEs.

Our second key finding is that the sensitivity of young men's unemployment gap is about twice as high as that of the overall working age population, both in AEs and EMDEs. In both country groups, this demographic displays the highest cyclical sensitivity of the unemployment gap. However, our results suggest that there are marked differences in the cyclical sensitivity of unemployment by gender between AEs and EMDEs. Women's unemployment gap is significantly less sensitive to demand conditions than that of men in AEs, at only about 80 percent the magnitude for both youth and adults. By contrast, our results suggest that gender does not play a role in labor market sensitivity in EMDEs–there are no significant differences in the Okun's relationship among men and women in EMDEs, neither for adults nor youth.

We also consider several extensions to these core results, enabling us to elaborate upon the possible channels by which demand conditions influence aggregate labor outcomes by demographic group. First, we decompose the cyclical unemployment rate response into employment and participation margins. The results indicate that, for all groups, procyclicality of labor force participation leads to an unemployment rate gap response that is smaller, in absolute value, than that of the employment gap (defined as the cyclical component of the employment level). Second, we study whether

[3] Heterogeneity in Okun's Law has also been studied from other angles. For example, Hartwig (2014) and Palombi, Perman, and Tavera (2015) consider the relationship between employment and activity in industry-level data, focusing on single countries.

the cyclical sensitivity of unemployment depends on the stage of the business cycle-—are there differences in responsiveness across periods of positive and negative output gaps? Our estimates suggest that cyclical unemployment is more sensitive to demand conditions in downturns than in upturns. This asymmetry is driven by men and, consistent with our earlier findings, particularly young men.

The rest of the paper is structured as follows: Sections 2 and 3 respectively discuss the econometric methodology and the data; Section 4 presents the baseline empirical results on Okun's Law and some robustness checks; Section 5 discusses the different extensions; and Section 6 concludes.

2. Econometric Methodology

2.1. Baseline Specification

Defining the deviations of output from its potential level and those of unemployment from the natural rate as, respectively, the output gap and the unemployment gap, we estimate Okun's Law through the following gaps specification (similar to Ball, Leigh, and Loungani 2017, among others):

$$u_{i,t} - u^*_{i,t} = \mu_i + \beta[ln(y_{i,t}) - ln(y_{i,t})^*] + \epsilon_{i,t} \tag{1}$$

where $u_{i,t}$ indicates the unemployment rate of country i in year t, $y_{i,t}$ is real GDP, and * indicates their long-run levels. μ_i are country fixed effects which account for potential cross-country differences in time-invariant characteristics. $\epsilon_{i,t}$ is an error term with zero mean that is assumed to be uncorrelated with the output gap. The coefficient β measures the short-run responsiveness of the unemployment gap to the output gap.

Unlike Ball, Leigh, and Loungani (2017), who estimate country-specific Okun's coefficients, our focus is on the pooled coefficient estimate by country group in the above specification. Pooling within country group allows us to overcome the limited availability of output and unemployment data in some EMDEs.[4] Estimation is by least squares regression for panel data, with heteroskedasticity and autocorrelation-robust standard errors clustered at the country level.

Reflecting an inverse relationship between economic activity and labor market slack, Okun's

[4] A similar strategy has been followed in Huang and Yeh (2013) and Ibragimova and Ibragimov (2017) who examine the validity of Okun's Law based on panel data sets.

coefficient is expected to be negative. However, its magnitude is difficult to pin down, as it is likely to depend on several factors. For example, if employers are able to adjust labor employed freely, the Okun's coefficient should depend on the (inverse) elasticity of output to employment and the sensitivity of labor force participation to output fluctuations. Ball, Leigh, and Loungani (2017) argue that, in frictionless labor markets with a constant labor force participation, the Okun's coefficient would be around -1.5. Their estimates are much higher (around -0.4 on average for the AEs they consider), reflecting the presence of labor adjustment costs and and that participation moves procyclically with output, thereby dampening the response of the unemployment rate. Since these features are likely to also apply in our sample, we expect the Okun's coefficient to always be above -1.5.

As mentioned above, our analysis distinguishes between AEs and EMDEs. The typically greater degree of labor market informality in EMDEs than in AEs motivates this choice. By making the outside option of self-employment more readily available, greater informality is likely to dampen the sensitivity of unemployment rates to overall business conditions. This weakens the link between employers' labor demand and the level of employment which lies at the heart of Okun's Law. Consequently, we expect the Okun's coefficient for the group of EMDEs to be smaller in absolute value than that for AEs.

Additional drivers of cross-country heterogeneity in Okun's Law could be considered, but are not investigated further in this paper. Our main aim is rather to explore whether the Okun's coefficient differs across demographic groups within the broad country groups of AEs and EMDEs. Differences in cyclical unemployment sensitivities by demographic groups could indicate segmentations in the labor market, either on the demand for or supply of labor (or both). They could also arise as a result of policy and/or institutional factors.

We estimate Equation 1 separately for the overall working age population (defined as individuals between 15 to 64 years-old), youth (ages 15-24 years-old), and adults (ages 25-64 years-old), with each age group further broken down by gender (women and men). A priori, we expect output fluctuations to generate larger variations in unemployment for the youth than adults, due to their typically more fragile employment conditions. This reflects the more limited work experience of the youth on average and that labor adjustment costs for employers (such as employment protection regulations) are typically lower for those with shorter job tenure and less experience. Indeed, greater cyclical sensitivity of youth unemployment was found by Banerji, Lin, and Saksonovs (2015) for AEs.

Regarding gender differences, women may be more likely to have weaker labor force attachment

than men, reflecting differences in personal circumstances and social norms. For example, some research suggests that lack of access to childcare options has a marked negative effect on the labor force participation of women with children (Compton and Pollak 2014). Gender discrimination has also been found to play a role in contributing to more fragile employment conditions for women (Altonji and Blank 1999). Weaker labor force attachment at the individual-level for women is likely to manifest in the behavior of aggregate labor quantities for women. However, the impact on the cyclical sensitivity of women's unemployment depends on the relative magnitudes of the aggregate sensitivities of women's participation and employment. For example, the importance of flows from employment directly to nonparticipation during bad economic times and the other way around during good economic times (Elsby, Hobijn, and Şahin 2015) might be such that the estimated Okun's coefficient on unemployment is smaller in absolute value than for men.

2.2. Extensions

To unpack the cyclical unemployment response, we decompose it into an employment and participation margin. Verifying how much (cyclical) participation responds to the output gap is important to understand how much of the Okun's coefficient is driven by the employment margin. To see this formally, we can write the unemployment rate as 1 minus the ratio of employment to the labor force: $U_{i,t}/L_{i,t} = 1 - E_{i,t}/L_{i,t}$ where $E_{i,t}$ and $L_{i,t}$ respectively indicate the levels of employment and the labor force (participation). Rearranging and taking logs, we obtain the following:

$$ln(E_{i,t}) - ln(L_{i,t}) = ln(1 - u_{i,t}) \approx -u_{i,t}$$

In other words, the unemployment rate can be approximated by the difference between the log-levels of labor force participation and employment. We then estimate the sensitivity of both cyclical employment and participation by replacing $u_{i,t}$ with either $ln(E_{i,t})$ or $ln(L_{i,t})$ in Equation 1:

$$ln(E_{i,t}) - ln(E_{i,t})^* = \mu_i^E + \delta[ln(y_{i,t}) - ln(y_{i,t})^*] + \epsilon_{i,t}^E \tag{2}$$

$$ln(L_{i,t}) - ln(L_{i,t})^* = \mu_i^L + \theta[ln(y_{i,t}) - ln(y_{i,t})^*] + \epsilon_{i,t}^L \tag{3}$$

where we define $ln(E_{i,t}) - ln(E_{i,t})^*$ and $ln(L_{i,t}) - ln(L_{i,t})^*$ as the employment and the labor force participation gap respectively, δ and θ are the parameters of interest (cyclical sensitivities), μ_i is a country fixed effect for the indicated equation, and $\epsilon_{i,t}$ is an error term for the indicated equation with conditional mean zero.

We also extend the baseline model to allow for the cyclical sensitivity to vary according to the phase of the business cycle. In other words, we analyze whether Okun's Law is stronger during good or bad economic times. We create a dummy variable ($d_{i,t}$) taking value 1 for periods in which the output gap is positive and 0 otherwise and estimate the following extended specification:

$$\begin{aligned} z_{i,t} - z^*_{i,t} = d_{i,t} \cdot \mu^z_i + \mu^z_i + \rho^z\{d_{i,t} \cdot [ln(y_{i,t}) - ln(y_{i,t})^*]\} + \\ + \sigma^z\{(1 - d_{i,t})[ln(y_{i,t}) - ln(y_{i,t})^*]\} + \epsilon^z_{i,t} \end{aligned} \tag{4}$$

where $z_{i,t}$ is, in turn, the unemployment rate, the log-level of employment, or the log-level of labor force participation, ρ^z and σ^z are the parameters of interest, and the remaining elements are defined similar to Equations 2 and 3.

3. Dataset

The sample spans the years from 1990 to 2015 and covers 38 AEs and 58 EMDEs, classified according to the definition contained in the IMF World Economic Outlook (WEO). We provide a list of the countries covered in the Appendix. Due to data availability issues, the panel is unbalanced.

Data on the working age and youth unemployment and labor force participation rates (for all genders) come from ILOSTAT of the ILO. Population data by age and gender come from the United Nations population statistics. To calculate the adult unemployment rate, we proceed in the following manner. We first calculate the unemployment level of the youth and the working age population, according to the following expression:

$$U^{a,g}_{i,t} = u^{a,g}_{i,t} \cdot l^{a,g}_{i,t} \cdot P^{a,g}_{i,t} \tag{5}$$

where U indicates the level of unemployment and P indicates that of the working-age population; the superscript index a indicates the age cohort (either Y for the youth or WAP for the working age population), the superscript index g indicate gender (either W for women, M for men and B for both), and the subscript indices i and t denote country and time. Upper and lower case letters indicate levels and rates respectively. Similarly, we calculate the level of the youth and the adult labor force participation as:

$$L^{a,g}_{i,t} = l^{a,g}_{i,t} \cdot P^{a,g}_{i,t} \tag{6}$$

Finally, we compute the adult unemployment rate by gender groups g as:

$$u_{i,t}^{a,g} = \frac{(U_{i,t}^{WAP,g} - U_{i,t}^{Y,g})}{(L_{i,t}^{WAP,g} - L_{i,t}^{Y,g})}$$

We then obtain the employment level by age and gender group as the difference between the labor force and unemployment levels: $E_{i,t}^{a,g} = L_{i,t}^{a,g} - U_{i,t}^{a,g}$.

Analyses of the sensitivity of the unemployment rate and employment and participation are constrained to the sample for which both the working age and the youth unemployment and participation rates data are available to ensure a constant composition sample for all the estimations.

To calculate the gaps formulation for the unemployment rate, participation, and employment, we estimate potential levels for these variables according to the following algorithm. First, we linearly interpolate the underlying original series where a country's data exhibits gaps. Second, we apply the Hodrick-Prescott filter to the interpolated series recovering its trend component, which is used as the potential level of the variable. The smoothing parameter is set to 100 for the yearly data. Finally, potential level observations that are either preceded *and* followed by three or more missing observations, or for which the original data are not available are treated as missing.

Data on real GDP comes from the IMF WEO and are complete over the sample of country-years investigated. To estimate the output gap, we use the log of real GDP and apply the Hodrick-Prescott filter with smoothing parameter 100 and recover the cyclical component. We also collect data on per capita and potential GDP from the IMF WEO for sensitivity analyses.

4. Okun's Law Across Economy and Worker Groups

4.1. Baseline Results

Table 1 shows the estimates from Equation 1. In line with existing empirical evidence, the unemployment gap in AEs for the overall working age population is estimated to be about 0.3 percentage points lower for each 1 percentage point rise in the output gap, while it is about half that amount lower in EMDEs. The lower cyclical sensitivity of unemployment in EMDEs is as we expected. Lower income countries tend to have more informal labor markets, which might dampen the sensitivity of the unemployment gap to the business cycle as workers can easily transition between formal employment and self- (informal) employment, rather than between employment and unemployment (or nonparticipation) in absence of informality. Confirming this intuition is also

the much lower fit of the Okun's Law in EMDEs relative to AEs, with the explanatory power of the regression being more than three times smaller.

Table 1: Okun's Law Across Demographic Groups

	AEs			**EMDEs**		
	β	**s.e.**	R^2	β	**s.e.**	R^2
All working age	-0.31**	0.05	0.47	-0.17**	0.03	0.14
Adult women	-0.22**	0.04	0.35	-0.14**	0.03	0.08
Adult men	-0.30**	0.05	0.43	-0.14**	0.03	0.13
Young women	-0.53**	0.09	0.36	-0.25**	0.06	0.07
Young men	-0.67**	0.11	0.44	-0.32**	0.06	0.13

Notes: the table presents estimates from Equation (1). Standard errors, clustered at the country level, are in parenthesis. *, and ** denote significance at the 90 percent, and 99 percent confidence level, respectively. AEs and EMDEs stand respectively for advanced economies and emerging markets and developing economies. The sample of AEs comprises 38 countries and 908 observations. The sample of EMDEs comprises 57 countries and 751 observations.
Sources: Authors' estimation based on ILO Key Indicators of the Labour Market and IMF World Economic Outlook.

Looking at different demographic groups, we confirm the finding that the responsiveness of the unemployment gap to business conditions is about half in EMDEs relative to AEs to hold across all groups. Furthermore, we observe greater heterogeneity among the different groups. The relationship between the unemployment gap and business conditions is generally stronger for men than women and youth than adult. That is valid in both AEs and EMDEs, although the differences are starker in AEs. There, young men (for which Okun's Law is strongest) display an Okun coefficient that is about three times larger in absolute value relative than that of adult women (the group for which Okun's Law is the least relevant).

Considering both genders, the sensitivity of the youth unemployment gap is about twice as large as that of the adults in EMDEs and more than twice as large in AEs. The estimated coefficient is about -0.7 (-0.5) and -0.3 (-0.3) for young men (women) in AEs and EMDEs respectively, as opposed to just about -0.3 (-0.2) and -0.1 (-0.1) for adult men (women). Distinguishing between men and women, instead, differences in terms of coefficients are smaller than in terms of explanatory power of the regression. This is evident when looking at adults in EMDEs: the Okun coefficient is the same for men and women while the R^2 is almost twice as large for men as for women, indicating that other factors are more important in explaining the cyclical fluctuations of the unemployment gap for women than for men.

Recent analyses focusing on AEs had already found the Okun's Law to be more important for the youth than the adult (Banerji, Saksonovs, et al. 2014). Our estimates extend this result to EMDEs. What could explain the larger sensitivity of the youth unemployment gap? Some

potential explanations relate to labor market policies. For starters, the youth are typically more likely to be employed under temporary contracts, which tend to have lower hiring and firing costs. Moreover, employment protection regulations often constrain the freedom of employers to choose which employees to dismiss and tend to protect more senior workers or workers with family responsibilities. Even when legal norms are less stringent – a more likely case for emerging economies – it is more socially acceptable for the employer to first lay-off younger workers during bad economic times.

Perhaps more surprising is the finding that women display a lower unemployment gap sensitivity than men. One potential explanation is that cyclical flows between employment and nonparticipation, which dampen the observed sensitivity of unemployment to the business cycle, are more important for women than for men. Indeed, Elsby, Hobijn, and Şahin (2015) observed that such flows are relevant for women whereas they are much smaller for men in the U.S. Another, somewhat related, possible explanation relates to the behavior of the labor force participation. If women's participation were to be more procyclical than men's, the estimated sensitivity of the women's unemployment gap would be lower (see the discussion in the earlier Subsection 2.2). We will delve deeper on these explanations in the next section.

4.2. Robustness Checks

Before proceeding further, we conduct several robustness checks regarding the variables used, the sample considered, and the assumptions made. As a first robustness check, we supplement Equation 1 with the inclusion of time fixed in effects to account for possible common movements in the unemployment gap that are unrelated to output. We also verify that our results do not depend on the classification of countries between AEs and EMDEs and we estimate Equation 1 excluding from the sample a set of countries that may be classified either as advanced or emerging, depending on the classification rules used, or that have graduated from emerging during the sample period.

Third, we check that our results are robust to different techniques to estimate the output gap: we then estimate Equation 1 using both a measure of the output gap obtained applying the HP filter on per capita GDP and the level of potential output as estimated in the IMF WEO. Finally, we assume that both the natural rate of unemployment and the potential GDP growth rate are constant over time. That allows us to first-difference Equation 1 and derive an alternative, first difference, specification that does not require us to obtain measures of the potential level of output

and the natural rate. In practice, we estimate the following specification:

$$\Delta u_{i,t} = \mu_i + \beta[\Delta ln(y_{i,t})] + \epsilon_{i,t}$$

Results from these robustness checks are reported in Tables A1 to A5 in Appendix. All estimates are similar to those obtained from the baseline regressions, which reassure us about the robustness of our results. In carrying out the rest of the analysis, we will follow the baseline specification.

5. Extensions

5.1. Decomposition Between Employment and Participation Margins

As discussed in Section 2.2, the Okun coefficient is determined by the sensitivities of both the labor force participation and the employment gaps to changes in the business cycle, and it can be approximated as the difference between the two. Here we decompose the unemployment response into its employment and participation channels. The conventional wisdom is that procyclical, but small, movements in the labor force tend to slightly dampen the response of the unemployment rate to the business cycle (that is, the unemployment gap response is below but close that of the employment gap in absolute value). Our results, shown in Table 2 below, suggest that this intuition is indeed valid for the overall working age population and the adults in AEs, but not so much for EMDEs and the youth in AEs. We discuss our results more in detail below.

As expected, both the participation and the employment gaps display positive coefficients across all demographic groups, indicating that these two variables are procyclical. The ratio, in absolute value, of the estimated coefficient for the employment gap (Equation 2) relative to that of the unemployment gap is lowest for adult women in AEs (just about 1.1), reflecting their low and not statistically significant labor force gap response. For both the overall working age population and adult men the same ratio is somewhat higher, but still below 1.4. On the other hand, the employment gap responds almost twice as much as the unemployment gap for young women and young men in AEs (the ratio is about 1.8 and 1.9 respectively). These results are driven by much higher participation sensitivities for the youth relative to adults in AEs, which can be explained by the fact that the youth are more likely to have the option between study and work.

Turning to EMDEs, the ratio between the employment and the unemployment gaps response is comprised between 1.6, for adult women, and 1.8, for young men. The tighter range relative to AEs reflects lower and higher (in relative terms) participation responses for the youth and adults

Table 2: Cyclical sensitivity of employment and labor force participation rates

	AEs			EMDEs		
Panel A. Log employment						
	δ	**s.e.**	R^2	δ	**s.e.**	R^2
All working age	0.43**	0.06	0.28	0.30**	0.07	0.13
Adult women	0.25**	0.04	0.09	0.26**	0.08	0.03
Adult men	0.39**	0.06	0.29	0.23**	0.05	0.05
Young women	0.93**	0.16	0.20	0.44**	0.16	0.04
Young men	1.25**	0.19	0.32	0.57**	0.13	0.07
Panel B. Log labor force participation						
	θ	**s.e.**	R^2	θ	**s.e.**	R^2
All working age	0.09**	0.02	0.06	0.11*	0.06	0.12
Adult women	0.02	0.03	0.01	0.08	0.07	0.02
Adult men	0.07**	0.02	0.03	0.08*	0.04	0.03
Young women	0.23*	0.09	0.02	0.11	0.11	0.03
Young men	0.38**	0.08	0.07	0.17*	0.09	0.03

Notes: Panels A and B respectively present estimates from Equations 2 and 3. Standard errors, clustered at the country level, are in parenthesis. *, and ** denote significance at the 90 percent, and 99 percent confidence level, respectively. AEs and EMDEs stand respectively for advanced economies and emerging markets and developing economies. The sample of AEs comprises 38 countries and 908 observations. The sample of EMDEs comprises 57 countries and 751 observations.
Sources: Authors' estimation based on ILO Key Indicators of the Labour Market and IMF World Economic Outlook.

respectively. The former result can be explained by the fact that the schooling option is less present in EMDEs than in AEs for the youth due to less developed educational systems in EMDEs

Focusing only on employment gap sensitivities, there are few other results that are worth highlighting. For the overall working age population, AEs have a sensitivity that is only about 1.5 times larger than that of EMDEs, rather than about 2 times as it is the case for the unemployment gap. For one specific demographic group, adult women, the sensitivity is about the same in AEs and EMDEs. Moreover, looking at the response of the employment gap reveals even greater heterogeneities among demographic groups in AEs. Young men, with a sensitivity of just below 1.3, have an employment response that is five times as large as that of adult women.

It is worth noticing also the larger participation sensitivities for men relative to women. What could be the reason for this apparently counterintuitive result? The incidence of discouraged workers might display more cyclical variation for men than for women. That might be the case if, for instance, men were employed more in cyclical sectors, such as construction.

The results illustrated here are also useful to interpret the lower unemployment gap sensitivities displayed by women, which were reported in the previous section, particularly for AEs. The two explanations that we put forward, namely the larger importance of flows between employment and nonparticipation and the stronger sensitivity of the labor force participation gap for women, do not seem to have an empirical backing. Indeed, it emerges that the smaller magnitude of the Okun's coefficient is driven by a lower employment gap response for women than for men. We dig deeper on this result in the next section, which looks at differences in the Okun's coefficient across different stages of the business cycle.

5.2. The Stage of the Business Cycle

In this section, we investigate whether the strength of Okun's Law varies according to the stage of the business cycle. A number of empirical studies find that the response of unemployment to output is significantly stronger during a downturn in the economy. Using industry-level data, Harris and Silverstone (2001) finds that the asymmetric responses in different industries are driven by the job creation and destruction facing economic fluctuation. Using region-level data from the UK, Palombi, Perman, and Tavera (2015) finds that the asymmetric responses holds not only in the short-run, but also in the medium-run.

We investigate the potential asymmetric association between labor market and output in different gender and age groups. Specifically, we differentiate through good and bad economic times, defined

as periods of positive and negative output gap respectively (for more details refer to Equation 4 in Section 2.2). Table 3 below shows the estimated coefficients. The negative relationship between unemployment and the output gap is stronger during bad times. That is true in general, although the estimated coefficients are only statistically different from each other in AEs, and just for the overall working age population and both young and adult men.

Table 3: Okun's Law in good and bad states

	AEs				**EMDEs**			
	ρ/σ	**s.e.**	**Wald**	R^2	ρ/σ	**s.e.**	**Wald**	R^2
All working age	-0.25**	0.04	0.01	0.48	-0.15**	0.06	0.50	0.14
	-0.39**	0.07			-0.20**	0.05		
Adult women	-0.20**	0.03	0.17	0.35	-0.13**	0.05	0.57	0.08
	-0.24**	0.05			-0.17**	0.05		
Adult men	-0.23**	0.04	0.02	0.44	-0.11*	0.04	0.25	0.13
	-0.39**	-0.08			-0.18**	-0.04		
Young women	-0.48**	0.09	0.17	0.35	-0.16*	0.09	0.57	0.08
	-0.59**	-0.11			-0.36**	-0.10		
Young men	-0.54**	0.11	0.02	0.45	-0.25**	0.09	0.31	0.13
	-0.86**	0.15			-0.40**	0.09		

Notes: the Table presents estimates from Equation 4, using the unemployment rate gap as dependent variable. In each row the first/second line refers to the sensitivity in the good/bad state. Standard errors, clustered at the country level, are in parenthesis. *, and ** denote significance at the 90 percent, and 99 percent confidence level, respectively. The columns 'Wald' report the p-value from a Wald test for equal coefficients ($H_0 : \rho = \sigma$). AEs and EMDEs stand respectively for advanced economies and emerging markets and developing economies. The sample of AEs comprises 38 countries and 908 observations. The sample of EMDEs comprises 57 countries and 751 observations.
Sources: Authors' estimation based on ILO Key Indicators of the Labour Market and IMF World Economic Outlook.

What could drive this result? To shed more light on this issue, we extend this business cycle analysis to the employment and labor force participation margins. The results, shown in Table 4 below, show that the labor force participation generally does not exhibit significant non-linearities. The employment gap instead does. Again, the non-linearities are driven by men. In AEs, the adult men employment gap is 0.3 (0.5) percent higher (lower) for each percentage point increase (decrease) in the output gap. Young men employment displays similar relative sensitivities, with the cyclical component increasing 1.1 percent during upturns and decreasing 1.5 during downturns. These differences are statistically significant at the 95 percent confidence level. Instead, we note that (i) women employment gap response does not exhibit statistically significant differences during good and bad times and, (ii) the coefficients in good and bad times are just slightly lower than those of men during good times. The bottom line of this analysis is that periods of negative output gap are especially detrimental for men, and particularly young men, in AEs.

Table 4: Cyclical sensitivity of employment and labor force participation in good and bad states

	AEs				EMDEs			
Panel A. Log employment								
	ϱ/σ	**s.e.**	**Wald**	R^2	**ϱ/σ**	**s.e.**	**Wald**	R^2
All working age	0.36**	0.07	0.09	0.28	0.31**	0.1	0.91	0.13
	0.52**	0.09			0.29*	0.13		
Adult women	0.23**	0.06	0.60	0.10	0.29*	0.12	0.69	0.03
	0.29**	0.08			0.21	0.14		
Adult men	0.32**	0.06	0.09	0.30	0.25**	0.09	0.81	0.05
	0.49**	0.10			0.21*	0.09		
Young women	0.91**	0.21	0.60	0.10	0.26	0.25	0.69	0.03
	0.95**	0.22			0.67*	0.27		
Young men	1.06**	0.23	0.04	0.32	0.22	0.20	0.03	0.08
	1.52**	0.19			1.03**	0.25		
Panel B. Log labor force participation								
	ϱ/σ	**s.e.**	**Wald**	R^2	**ϱ/σ**	**s.e.**	**Wald**	R^2
All working age	0.09*	0.04	0.91	0.06	0.14*	0.07	0.54	0.12
	0.08	0.05			0.06	0.10		
Adult women	0.02	0.05	0.92	0.01	0.15	0.09	0.33	0.02
	0.01	0.07			0.01	0.13		
Adult men	0.08*	0.04	0.69	0.03	0.14*	0.06	0.21	0.03
	0.05	0.03			0.00	0.08		
Young women	0.30*	0.14	0.92	0.01	0.03	0.17	0.33	0.02
	0.14	0.18			0.21	0.19		
Young men	0.39*	0.16	0.96	0.07	-0.12	-0.13	0.02	0.04
	0.37*	0.14			0.53**	0.19		

Notes: Panels A and B present estimates from Equation (6), using the log employment gap and the log labor force participation gap, respectively, as dependent variables. In each row, the first/second line refers to the sensitivity in the good/bad state. Standard errors, clustered at the country level, are in parenthesis. *, and ** denote significance at the 90 percent, and 99 percent confidence level, respectively. The columns 'Wald' report the p-value from a Wald test for equal coefficients ($H_0 : \rho = \sigma$). AEs and EMDEs stand respectively for advanced economies and emerging markets and developing economies. The sample of AEs comprises 38 countries and 908 observations. The sample of EMDEs comprises 57 countries and 751 observations.
Sources: Authors' estimation based on ILO Key Indicators of the Labour Market and IMF World Economic Outlook.

6. Conclusions

Starting with Okun (1963), a rich empirical literature has documented the existence of a negative and stable relationship between an economy's aggregate demand conditions and its overall unemployment. We show that there is a large degree of heterogeneity in the cyclical sensitivities of unemployment across demographic and economy groups. EMDE adult men's unemployment gap rises only slightly more than 0.1 percentage points for a 1 percentage point decline in the output gap, while AE adult men's gap rises about 0.3. Women's unemployment gap is significantly less sensitive to demand conditions than men's in AEs. By contrast, EMDE adult women's cyclical sensitivity of unemployment is exactly equal that of EMDE adult men's. The youth unemployment gap is generally twice as sensitive as that of adults. These findings are robust to alternative regression specifications and estimation procedures.

We also consider a few extensions to these core results. First, we decompose the cyclical unemployment rate response into employment and participation margins. The results indicate that, for all groups, procyclicality of labor force participation leads to an unemployment rate gap response that is smaller, in absolute value, than that of the employment gap (defined as the cyclical component of the employment level). Moreover, the magnitudes of labor force participation and employment sensitivities to the cycle differ widely across demographic groups, revealing even greater heterogeneity than the unemployment gap responses across demographics. Second, we study whether the cyclical sensitivity of unemployment depends on the stage of the business cycle. Our estimates suggest that cyclical unemployment is more sensitive to business conditions in downturns than upturns. This finding is again sharper for young men.

The findings provided in this paper argue against a 'one-size-fits-all' approach to the relationship between economic activity and the labor market. There are significant differences in the cyclical sensitivities of unemployment across demographic groups and economies by level of development. Recognizing these differences are a key first step towards better understanding inequalities in labor market prospects across demographic groups and dynamic differences in labor market behavior across levels of development. Future research should aim at further exploring these differences and identifying their deeper determinants.

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Appendix

Countries included in the analysis:

- **Advanced Economies (AEs):** Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Macao SAR, Malta, Netherlands, New Zealand, Norway, Portugal, Puerto Rico, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan Province of China, United Kingdom, United States

- **Emerging Markets and Developing Economies (EMDEs):** Albania, Argentina, Armenia, Azerbaijan, Bangladesh, Barbados, Belize, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Chile, Colombia, Costa Rica, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, FYR Macedonia, Georgia, Guatemala, Honduras, Hungary, Indonesia, Iran, Jamaica, Kyrgyz Republic, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Russian Federation, Saudi Arabia, Serbia, South Africa, Sri Lanka, Suriname, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uruguay, Venezuela, Zimbabwe.

Table A1: Robustness checks on baseline specification – time fixed effects

	AEs			**EMDEs**		
	β	**s.e.**	R^2	β	**s.e.**	R^2
All working age	-0.29**	0.06	0.53	-0.16**	0.03	0.17
Adult women	-0.22**	0.04	0.39	-0.12**	0.04	0.11
Adult men	-0.27**	0.06	0.48	-0.13**	0.03	0.16
Youth women	-0.50**	0.10	0.43	-0.21**	0.07	0.10
Youth men	-0.62**	0.13	0.50	-0.29**	0.06	0.16

Notes: the table presents estimates obtained estimating an alternative specification including time fixed effects. Standard errors, clustered at the country level, are in parenthesis. *, and ** denote significance at the 90 percent, and 99 percent confidence level, respectively. AEs and EMDEs stand respectively for advanced economies and emerging markets and developing economies. The sample of AEs comprises 38 countries and 908 observations. The sample of EMDEs comprises 57 countries and 751 observations.
Sources: Authors' estimation based on ILO Key Indicators of the Labour Market and IMF World Economic Outlook.

Table A2: Robustness checks on baseline specification – per capita output gap

	AEs			EMDEs		
	β	**s.e.**	R^2	β	**s.e.**	R^2
All working age	-0.31**	0.05	0.47	-0.16**	0.03	0.13
Adult women	-0.21**	0.04	0.34	-0.14**	0.03	0.07
Adult men	-0.30**	0.06	0.43	-0.13**	0.03	0.12
Youth women	-0.53**	0.10	0.37	-0.22**	0.07	0.05
Youth men	-0.67**	0.12	0.45	-0.29**	0.06	0.11

Notes: the table presents estimates obtained estimating Equation 1 and using real GDP per capita to compute the output gap. For other notes and sources refer to Table A1.

Table A3: Robustness checks on baseline specification – WEO output gap

	AEs			EMDEs		
	β	**s.e.**	R^2	β	**s.e.**	R^2
All working age	-0.31**	0.04	0.39	-0.25**	0.05	0.21
Adult women	-0.22**	0.03	0.29	-0.2**	0.04	0.11
Adult men	-0.31**	0.04	0.37	-0.2**	0.04	0.17
Youth women	-0.53**	0.07	0.28	-0.33**	0.11	0.08
Youth men	-0.68**	0.09	0.36	-0.47**	0.10	0.17

Notes: the table presents estimates obtained estimating Equation 1 and using the output gap as estimated in the IMF WEO. AEs and EMDEs stand respectively for advanced economies and emerging markets and developing economies. The sample of AEs comprises 38 countries and 908 observations. The sample of EMDEs comprises 36 countries and 493 observations. For other notes and sources refer to Table A1.

Table A4: Robustness checks on baseline specification – sample composition

	AEs			EMDEs		
	β	**s.e.**	R^2	β	**s.e.**	R^2
All working age	-0.27**	0.07	0.39	-0.13**	0.03	0.10
Adult women	-0.20**	0.05	0.27	-0.12**	0.03	0.06
Adult men	-0.25**	0.06	0.36	-0.11**	0.03	0.09
Youth women	-0.45**	0.12	0.28	-0.22**	0.06	0.05
Youth men	-0.59**	0.14	0.37	-0.25**	0.05	0.10

Notes: the table presents estimates obtained estimating Equation 1 excluding from the sample new EU member states, Taiwan and Korea. AEs and EMDEs stand respectively for advanced economies and emerging markets and developing economies. The sample of AEs comprises 30 countries and 728 observations. The sample of EMDEs comprises 52 countries and 650 observations. For other notes and sources refer to Table A1.

Table A5: Robustness checks on baseline specification – first difference specification

	AEs			**EMDEs**		
	β	**s.e.**	R^2	β	**s.e.**	R^2
All working age	-0.24**	0.05	0.35	-0.18**	0.03	0.14
Adult women	-0.16**	0.03	0.21	-0.14**	0.03	0.14
Adult men	-0.23**	0.05	0.33	-0.16**	0.03	0.17
Youth women	-0.41**	0.09	0.23	-0.29**	0.06	0.17
Youth men	-0.55**	0.11	0.32	-0.35**	0.05	0.22

Notes: the table presents estimates obtained estimating an alternative, first difference, Okun's Law specification where the potential levels of GDP growth rate and the unemployment rate are assumed to be constant and for the dependent and explanatory variables the first difference in the unemployment rate and in log output are used. For other notes and sources refer to Table A1.