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# Chapter 5

# Okun's Law and Demographics: Differences Across Labor Markets

## 5.1 Introduction

Starting with Okun, 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 expressed as a negative linear association between the cyclical component of the unemployment rate (henceforth unemployment gap), and the output gap. This law has been found to hold across a broad set of economies, but more strongly in advanced economies (AEs) than emerging market and developing economies (EMDEs; see Ball, Leigh, and Loungani, 2017, An, Ghazi, and Prieto, 2017, Ball et al., 2016).

But does this negative relationship between unemployment and demand conditions vary across demographic groups within a country? Are some groups more sensitive to demand conditions? Motivated by the spikes in youth unemployment seen in many European countries in the wake of the Great Recession, Hutengs and Stadtmann, 2013a, Banerji et al., 2014, 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. 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 older cohorts'.

Recently, there has been work to further unpack the Okun relationship, by both age and gender. Dixon, Lim, and 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 the 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 in Australia using an unobserved components model, finding similar results to Dixon, Lim, and Ours, 2017. In this paper, we expand upon these analyses, looking at the relationship between demand conditions and cyclical unemployment by demographic group (age and gender) for large samples of 38 AEs and 58 EMDEs.

Our baseline results indicate 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 about 0.14 percentage points for a one percentage point decline in the output gap, while AE adult men's gap rises about 0.30. Women's unemployment gap is significantly less sensitive to demand conditions than men's in AEs, at only about 80 percent the magnitude for both youth and adults. By contrast, EMDE adult women's cyclical sensitivity of unemployment is exactly equal that of EMDE adult men's, while that of young women is about 80 percent the size of young men's, although the two are not statistically different from each other. These findings are robust to alternative regression specifications and estimation procedures.

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). 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. For example, the cyclical sensitivity of employment is about five times larger for young men than for adult women in AEs. Within the sample of EMDEs, young men also exhibit the largest cyclical employment sensitivity, but their sensitivity is still less than half that of young men in AEs. Adult women, by contrast, have roughly the same sensitivity in AEs and EMDEs. Aggregating across demographic groups, the overall population's employment cyclical sensitivities in AEs and EMDEs are not as different. The cyclical component of employment is estimated to be 0.30 and 0.43 percentage points higher for each percentage point increase in the output gap in EMDEs and AEs, respectively. That points to the importance of demographic compositional differences across countries underlying aggregate cyclical sensitivities — despite their generally lower labor market cyclical sensitivity, EMDEs are characterized by larger populations of more sensitive demographic groups (such as young men) than AEs, attenuating the difference in aggregate sensitivities between AEs and EMDEs.

Second, we study whether 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 in upturns than downturns. This finding is again sharper for young men. Focusing again on employment, we find that its cyclical component decreases by 1.03 percentage points for each percentage point decrease in the output gap for young men in EMDEs, while its response during periods of positive output gap is not statistically different from 0. Such large asymmetry is not evident when looking at the unemployment gap sensitivity, as it is masked by a sizeable asymmetric response of the cyclical component of the labor force participation rate. That decreases by 0.53 percentage points for each percentage point reduction in the output gap during bad economic times. Its response is instead not statistically different from 0 during good economic times.

The rest of the paper is structured as follows: Sections 5.2 and 5.3 respectively discuss the econometric methodology and the dataset; Section 5.4 presents the baseline empirical results on Okun's Law and some robustness checks; Section 5.5 discusses the different extensions; and Section 5.6 concludes.

## 5.2 Econometric Methodology

We start by analyzing the validity of Okun's Law across both demographic groups (adult men, adult women, young men, and young women) and country groups (AEs and EMDEs). Next, we explore the channels determining the unemployment response. First, we analyze to what extent the cyclical behavior of the labor force participation reduces or amplifies the strength of Okun's Law. Second, we study what margin drives Okun's Law, whether short- or long-term unemployment rate. We then conclude the analysis by investigating whether Okun's Law is stronger during good or bad economic times. The rest of this section explains the empirical methodology in greater detail.

### 5.2.1 Baseline Methodology

We assume that output hovers around a long-run, potential, level which may or may not grow over time and that it similarly exists a long-run, natural, level of the unemployment rate. Okun's Law is then a short-run relationship between the deviation of output from its potential level and that of unemployment from its natural rate. Okun, 1963 originally interpreted this relationship as the result of 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. 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):

[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. For instance, this is the interpretation of Daly et al., 2012. 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.

$$u_{i,t} - u^*_{i,t} = \mu_i + \beta[ln(y_{i,t}) - ln(y_{i,t})^*] + \epsilon_{i,t} \tag{5.1}$$

In Equation 5.1 above, $u_{i,t}$ indicates the unemployment rate of country $i$ in year $t$, $y_{i,t}$ is real GDP, and * indicates their long-run levels. $\mu_i$ are country fixed effects, included to account for potential cross-country differences in time-invariant characteristics. $\epsilon_{i,t}$ is an error term, capturing shifts in the output-employment relationship, and it is assumed to have zero mean. The $\beta$ coefficient, also defined as the Okun's coefficient, measures the short-run responsiveness of the unemployment gap to the output gap.

Unlike Ball, Leigh, and Loungani, 2017, who estimate the Okun's coefficient on a country-by-country basis, we estimate it through panel regression with country-fixed effects. That allows us to overcome the limited availability of output and unemployment data in some EMDEs, while it restricts us to assume the same coefficient within country groups. The estimation is done through ordinary least squares. Standard errors are clustered at the country level to control for potential correlation in the unobserved components of the unemployment gap within country.

Concerning our priors, we expect the Okun's coefficient to be negative. However, it is difficult to formulate a hypothesis regarding its exact magnitude as this is likely to depend on several factors, which are difficult to quantify. If employers could adjust labor freely (the case of friction-less labor markets), 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 friction-less labor markets and 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) due to the facts that (i) in practice employers do face costs in adjusting the headcount, and (ii) participation might respond to cyclical movements in output in a way that dampens the response of the unemployment rate (i.e. it increases when output increases). For similar reasons, we expect the Okun coefficient to always be above -1.5.

As mentioned above, our analysis distinguishes between AEs and EMDEs. We motivate this choice by noticing that less developed countries tend to have more informal labor markets. In turn, we expect informality to provide some buffer to the impact of overall business conditions on unemployment rates, as it offers individuals the outside option of self- (informal) employment. Hence, this weakens the link between employers' labor demand and the level of employment which lies at the basis of Okun's Law. In this light, we expect the group of EMDEs to display a lower Okun's coefficient than AEs.

Besides differentiating broadly between countries of different income levels, we do not consider further cross-country heterogeneity. Our aim is rather to explore whether the Okun's coefficient differs across demographic groups. Heterogeneities in this respect could indicate segmentations in the labor market in either the demand or the supply of labor (or both), but they could also arise as a result of policy and/or institutional factors.

We estimate Equation 5.1 separately for the overall working age population and then for adult women, adult men, young women, and young men. We generally expect output fluctuations to generate larger variations in unemployment for the youth than the adult, reflecting that the factors increasing labor adjustment costs, such as, for instance, employment protection regulations and social considerations, are typically lower for the youth. Indeed, this is what has been found already by Banerji, Lin, and Saksonovs, 2015 for AEs.

Concerning gender differences, we consider women to generally have a more fragile employment condition than men. Hence, our prior is for women unemployment to respond more to cyclical movements in output than men. However, women might also be less attached to the labor force. Hence, 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 is smaller in absolute value than for men.

### 5.2.2 Channels and Other Extensions

Next, we decompose the unemployment response 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 employment rate: $U_{i,t}/L_{i,t} = 1 - E_{i,t}/L_{i,t}$ where $E_{i,t}$ and $L_{i,t}$ respectively indicate the levels of employment and participation. Re-arranging and taking logs, we obtain the following:

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

The expression above means that, for low levels of the unemployment rate, this can be approximated by the difference between the log-levels of the 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 5.1:

$$ln(E_{i,t}) - ln(E_{i,t})^* = \mu_i + \delta[ln(y_{i,t}) - ln(y_{i,t})^*] + \epsilon_{i,t} \tag{5.2}$$

$$ln(L_{i,t}) - ln(L_{i,t})^* = \mu_i + \theta[ln(y_{i,t}) - ln(y_{i,t})^*] + \epsilon_{i,t} \tag{5.3}$$

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, $\delta$ and $\theta$ are the parameters to be estimated and the rest of the notation is as in Equation 5.1.

We also extend the baseline model to allow for non-linearities in the relationship according to the stage 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:

$$\begin{aligned} z_{i,t} - z_{i,t}^* = d_{i,t}\mu_i + (1 - d_{i,t})\mu_i + \rho^z\{d_{i,t}[ln(y_{i,t}) - ln(y_{i,t})^*]\}+ \\ +\sigma^z\{(1 - d_{i,t})[ln(y_{i,t}) - ln(y_{i,t})^*]\} + \epsilon_{i,t} \end{aligned} \tag{5.4}$$

where $z_{i,t}$ is, in turn, the unemployment rate, the log-level of employment and that of the labor force participation, $\rho^z$ and $\sigma^z$ are the parameters to be estimated, and the remaining notation is as in Equation 5.1.

## 5.3 Dataset

Our analysis is carried out both for the overall working age population (including individuals with age ranging from 15 to 64 inclusive) and for four different demographic groups: adult men, adult women, young men, and young women. Adult and youth are defined as to include the population with age ranging from, respectively, 25 to 64 and 15 to 24 (all inclusive). 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. We provide a list of the countries covered in the Appendix D. 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 the ILOSTAT of the International Labour Organization (ILO). We source population data from the United Nations 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:

$$U_{i,t}^{a,g} = \frac{u_{i,t}^{a,g} l_{i,t}^{a,g}}{P_{i,t}^{a,g}}$$

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

$$L_{i,t}^{a,g} = \frac{l_{i,t}^{a,g}}{P_{i,t}^{a,g}}$$

Finally, we compute the adult unemployment rate as:

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

The employment level is computed, for each demographic group, using the labor force and participation level according to $E_{i,t}^{a,g} = L_{i,t}^{a,g} - U_{i,t}^{a,g}$

The analysis of the sensitivity of the unemployment rate and the employment and participation is constrained to the sample for which both the adult and the youth unemployment and participation rates data are available so to have a constant sample for all the estimations.

To estimate the potential level component of our dependent variables in Equations 5.1 to 5.4, we adopt the following algorithm. First, we linearly interpolate the underlying original series when missing observations occur in some country. Second, since the empirical analysis has a time-series dimension, we exclude from the sample all countries with less than five observations. Third, we apply the Hodrick-Prescott filter to the interpolated series and estimate its potential level for each country. The smooth parameter is set to 100 for the yearly data. Finally, we treat all observations that are either — preceded and followed by three or more missing observations — or for which the original data is not available as missing.

Data on real GDP comes from the IMF World Economic Outlook and does not have the issue of missing values. To estimate the output gap $(y_{i,t} - y_{i,t}^*)$ we use the log of real GDP and apply the Hodrick-Prescott filter with smooth parameter 100. We also collect data on per capita and potential GDP from the WEO for sensitivity analyses.

## 5.4 Okun's Law Across Demographic Groups

### 5.4.1 Baseline Results

Table 5.1 shows the estimates from Equation 5.1. In line with existing empirical evidence, the unemployment gap in AEs for the overall working age population is estimated to be 0.31 percentage points lower for each one percentage point rise in the output gap, while it is about half that amount lower in EMDEs (0.17 percentage points). 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 (the $R^2$ is 0.14 for EMDEs and 0.47 for AEs).

**Table 5.1: Okun's Law Across Demographic Groups**

| | AEs | | | EMDEs | | |
|---|---|---|---|---|---|---|
| | $\beta$ | **s.e.** | $R^2$ | $\beta$ | **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 1 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 observe further heterogeneity. 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 to 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 somewhat more than twice in AEs. The estimated coefficient is -0.67 and -0.32 for young men in AEs and EMDEs respectively, as opposed to just -0.30 and -0.14 for adult men. The differences between men and women are smaller in terms of coefficients, but larger for what concerns the explanatory power of the regression. This is evident when looking at adults in EMDEs: the Okun coefficient is the same for men and women, at -0.14, while the $R^2$ is 0.13 for men and only 0.08 for women, indicating that other factors are more important in explaining the cyclical fluctuations of the unemployment gap for women than for men. Finally, the finding that the responsiveness of the unemployment gap to business conditions is about half in EMDEs relative to AEs survives across all different demographic groups.

Recent analyses focusing on AEs had already found the Okun's Law to be more important for the youth than the adult (Banerji 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, being more marginally attached to the labor force than men, 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 5.2.2). We will delve deeper on these explanations in the next section.

### 5.4.2 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 5.1 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 5.1 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 5.1 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 World Economic Outlook. 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 5.1 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 D.1 to D.5 in Appendix D. 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 use the baseline specification.

## 5.5 Channels and Other Extensions

### 5.5.1 Decomposition Between the Employment and Participation Margins

As discussed in Section 5.2.2, 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 5.2 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 5.2) relative to that of the unemployment gap is lowest for adult women in AEs (just 1.13), 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 1.78 and 1.87 respectively). These results are driven by much higher participation sensitivities for the youth relative to adults in AEs, which can be explained by considering that younger agents are more likely to have the option between study and work.

Turning to EMDEs, we note that the ratio between the employment and the unemployment gaps response is comprised between 1.64, for adult women, and 1.78, for young men. The tighter range relative to AEs reflects lower and higher (in relative terms) participation responses for the youth and adults respectively. The former result can be explained by noticing that, due to less developed educational systems in EMDEs, the schooling option is less present in EMDEs than in AEs for the youth.

**Table 5.2: Cyclical sensitivity of employment and labor force participation rates**

| | AEs | | | EMDEs | | |
|---|---|---|---|---|---|---|
| **Panel A. Log employment** | | | | | | |
| | $\delta$ | **s.e.** | $R^2$ | $\delta$ | **s.e.** | $R^2$ |
| All working age | 0.43** | -0.06 | 0.28 | 0.3** | -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 | 0.2 | 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** | | | | | | |
| | $\theta$ | **s.e.** | $R^2$ | $\theta$ | **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 5.2 and 5.3. Standard errors, clustered at the country level, are in parenthesis. *, and ** denote significance at the 90 percent, and 1 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.

Focusing only on employment gap sensitivities, there are few results that are worth highlighting. For the overall working age population, AEs have a sensitivity that is only about 1.5 times larger than EMDEs, rather than about two times as it was the case for the unemployment gap. For one specific demographic group, adult women, the sensitivity is about the same in AEs and EMDEs (0.25 and 0.26 respectively). Moreover, looking at the response of the employment gap reveal even greater heterogeneities among demographic groups in AEs. Young men, with a sensitivity of 1.25, 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 will come back on this result in a later extension when we look at the differences in the Okun's coefficient across the business cycle.

### 5.5.2 The Importance 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. 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 5.4 in Section 5.2.2). Table 5.3 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 youth and adult men.

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 5.4 below, are intriguing. Except in one case, the labor force participation 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 0.32 (0.49) percent higher (lower) for each percentage point increase (decrease) in the output gap. Young men employment displays similar (relative) sensitives, with the cyclical component increasing 1.06 percent during upturns and decreasing 1.52 during downturns. These differences are statistically

**Table 5.3: Okun's Law in good and bad states**

| | AEs | | | | EMDEs | | | |
|---|---|---|---|---|---|---|---|---|
| | $\rho/\sigma$ | **s.e.** | **Wald** | $R^2$ | $\rho/\sigma$ | **s.e.** | **Wald** | $R^2$ |
| All working age | -0.25**<br>-0.39** | -0.04<br>-0.07 | 0.01 | 0.48 | -0.15**<br>-0.20** | -0.06<br>-0.05 | 0.5 | 0.14 |
| Adult women | -0.20**<br>-0.24** | -0.03<br>-0.05 | 0.17 | 0.35 | -0.13**<br>-0.17** | -0.05<br>-0.05 | 0.57 | 0.08 |
| Adult men | -0.23**<br>-0.39** | -0.04<br>-0.08 | 0.02 | 0.44 | -0.11*<br>-0.18** | -0.04<br>-0.04 | 0.25 | 0.13 |
| Young women | -0.48**<br>-0.59** | -0.09<br>-0.11 | 0.17 | 0.35 | -0.16*<br>-0.36** | -0.09<br>-0.1 | 0.57 | 0.08 |
| Young men | -0.54**<br>-0.86** | -0.11<br>-0.15 | 0.02 | 0.45 | -0.25**<br>-0.40** | -0.09<br>-0.09 | 0.31 | 0.13 |

*Notes:* the Table presents estimates from Equation 5.4, 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.

significant at the 95 percent confidence level. Instead, we note that (i) women employment 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.

## 5.6 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 about 0.14 percentage points for a one percentage point decline in the output gap, while AE adult men's gap rises about 0.30. 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.

**Table 5.4: Cyclical sensitivity of employment and labor force participation in good and bad states**

| | **AEs** | | | | **EMDEs** | | | |
|---|---|---|---|---|---|---|---|---|
| **Panel A. Log employment** | | | | | | | | |
| | **$\rho/\sigma$** | **s.e.** | **Wald** | **$R\hat{2}$** | **$\rho/\sigma$** | **s.e.** | **Wald** | **$R\hat{2}$** |
| All working age | 0.36**<br>0.52** | -0.07<br>-0.09 | 0.09 | 0.28 | 0.31**<br>0.29* | -0.1<br>-0.13 | 0.91 | 0.13 |
| Adult women | 0.23**<br>0.29** | -0.06<br>-0.08 | 0.6 | 0.1 | 0.29*<br>0.21 | -0.12<br>-0.14 | 0.69 | 0.03 |
| Adult men | 0.32**<br>0.49** | -0.06<br>-0.1 | 0.09 | 0.3 | 0.25**<br>0.21* | -0.09<br>-0.09 | 0.81 | 0.05 |
| Young women | 0.91**<br>0.95** | -0.21<br>-0.22 | 0.6 | 0.1 | 0.26<br>0.67* | -0.25<br>-0.27 | 0.69 | 0.03 |
| Young men | 1.06**<br>1.52** | -0.23<br>-0.19 | 0.04 | 0.32 | 0.22<br>1.03** | -0.2<br>-0.25 | 0.03 | 0.08 |
| **Panel B. Log labor force participation** | | | | | | | | |
| | **$\rho/\sigma$** | **s.e.** | **Wald** | **$R\hat{2}$** | **$\rho/\sigma$** | **s.e.** | **Wald** | **$R\hat{2}$** |
| All working age | 0.09*<br>0.08 | -0.04<br>-0.05 | 0.91 | 0.06 | 0.14*<br>0.06 | -0.07<br>-0.1 | 0.54 | 0.12 |
| Adult women | 0.02<br>0.01 | -0.05<br>-0.07 | 0.92 | 0.01 | 0.15<br>-0.01 | -0.09<br>-0.13 | 0.33 | 0.02 |
| Adult men | 0.08*<br>0.05 | -0.04<br>-0.03 | 0.69 | 0.03 | 0.14*<br>0 | -0.06<br>-0.08 | 0.21 | 0.03 |
| Young women | 0.30*<br>0.14 | -0.14<br>-0.18 | 0.92 | 0.01 | 0.03<br>0.21 | -0.17<br>-0.19 | 0.33 | 0.02 |
| Young men | 0.39*<br>0.37* | -0.16<br>-0.14 | 0.96 | 0.07 | -0.12<br>0.53** | -0.13<br>-0.19 | 0.02 | 0.04 |

*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 1 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.

We also consider several 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 in upturns than downturns. This finding is again sharper for young men. Focusing again on employment, we find that its cyclical component decreases by 1.03 percentage points for each percentage point decrease in the output gap for young men in EMDEs, while its response during periods of positive output gap is not statistically different from 0. Such large asymmetry is not evident when looking at the unemployment gap sensitivity, as it is masked by a large asymmetric response of the cyclical component of the labor force participation rate. Indeed, this decreases by 0.53 percentage points for each percentage point reduction in the output gap during bad economic times, while its response is not statistically different from 0 during good economic times.

The findings provided in this paper argue against the 'one size fits all' rule. Heterogeneities across demographic groups are important. Future work should aim at exploring differences across countries and their determinants.