UNDERSTANDING EMPLOYMENT DYNAMICS ACROSS THE BUSINESS CYCLE: IS EDUCATION IMPORTANT IN REDUCING THE RISK OF LOSING A JOB DURING AN ECONOMIC DOWNTURN?

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Abstract

Purpose: This paper aims to assess the impact of output changes on gender-, age- and educational attainment level-specific employment considering two business cycle phases. It also aims to answer whether education is essential in reducing the risk of losing a job during an economic downturn.

Methodology: We employ the first differences approach to evaluate the asymmetric response of different employment types to output changes in 27 EU countries from 2000 to 2020. The Eurostat database provides the data for this analysis, and we use the Pooled OLS estimation technique for our calculations, ensuring the robustness of our findings.

Findings: The results of this study are significant, indicating that during periods of economic upturn, the reaction of employment to output changes is weaker than during

economic downturn. This is a crucial insight, as it suggests that the negative impact on employment is more severe, particularly for young and less educated individuals, with men generally facing sharper declines in employment compared to women. However, older and more educated workers exhibit greater job stability during economic downturns, highlighting the protective role of higher education and experience. These findings underscore the importance of education in reducing the risk of job loss during economic downturns, a key point of this research.

Originality: This research stands out for its comprehensive examination of how employment reacts to output changes in the EU, considering the asymmetric output-employment relationship and the various employment types segmented by age, gender, and educational attainment levels. The findings underscore the necessity for targeted measures to uphold employment stability across diverse economic circumstances and demographic groups.

Keywords: output-employment elasticity; business cycle; education, European Union

JEL index*: C33, E24, E32

Introduction

A high level of employment in a country indicates the efficient utilisation of labour resources and a country's potential for production. Conversely, a low employment rate or a high unemployment rate indicates the underutilisation of labour and other resources and the resulting economic and social problems, such as rising poverty, income inequality, emigration, and budget deficits. Employment dynamics in response to economic fluctuations have long been a subject of interest in labour economics.

The analysis of the relationship between output and employment is based on Okun's law (1962). This law describes the inverse relationship between output and unemployment, suggesting that the effect on employment should be positive (Mihajlović and Marjanović, 2021). Unlike the unemployment version, the employment version of Okun`s law (IMF, 2010) does not suggest the effect size. Thus, it should ideally vary between 0 and 1 (Ghazali and Mouelhi, 2018) in a country where the output growth is determined by increased employment and labour productivity. However, the effect is heterogeneous and can be determined by various factors.

Most of the research focuses on the analysis of the linear relationship between economic growth and employment, leaving behind the potential asymmetric behaviour of employment to output changes and specifically assessing the impact of various *economic* (Slimane, 2015; Guisan and Exposito, 2017; Mkhize, 2019; Zaki et al., 2020; Ben-Salha and Zmami, 2021;), *institutional* (Richter and Witkowski, 2014; Ali et al., 2017; Ben-Salha and Zmami, 2021) and *demographic factors* (Anderson and Braunstein, 2013; Slimane, 2015;

Anderson, 2016; Ben-Salha and Zmami, 2021) on heterogeneous employment response to economic growth.

Empirical studies rarely emphasise that the impact of economic growth on employment can be heterogeneous concerning the age, gender, or educational attainment levels of the employed. In those studies where this aspect is evaluated (Anderson and Braunstein, 2013; Askenazy et al., 2015; Anderson, 2016; Adegboye et al., 2019; Butkus et al., 2022, 2023), not all three demographic characteristics (age, gender, and education) are considered together. Additionally, considering all the demographic characteristics combined, these studies do not assess how this impact manifests during economic downturns and upturns.

Notably, employment tends to respond more vigorously during downturns than upturns, with negative employment changes often persisting longer. The conventional wisdom posits that economic growth stimulates job creation and reduces unemployment rates (Kreishan, 2011; Boga, 2020). However, this relationship is more nuanced across different business cycle phases. During downturns, labour hoarding suggests that firms are more likely to retain workers despite reduced output, anticipating a recovery. Conversely, firms might prioritise increasing worker productivity over hiring new employees during an economic upturn. This phenomenon results in a weaker employment response during economic upturn as firms can maximise output with existing labour resources.

While several studies have explored the heterogeneous impacts of economic growth on employment across different stages of the business cycle, research in this area remains limited. Burggraeve et al. (2015) and Coşar and Yavuz (2019) have examined the differential impacts of output changes on employment during downturns versus upturns, with findings indicating a more pronounced employment response during downturns. However, these studies did not establish significant deviations in output-employment elasticity between these two business cycle phases (Butkus et al., 2022). Anderson and Braunstein (2013) further confirmed that higher output–employment elasticities are associated with more substantial employment losses during periods of negative output changes and more significant gains during positive. Butkus et al. (2024) highlighted that output–employment elasticity is not constant within each business cycle phase and may vary with the phase's maturity. Additionally, some authors emphasised education (Askenazy et al., 2015) and gender (Anderson and Braunstein, 2013) as the sources of heterogeneous employment reaction to output changes, and others highlighted the connection between asymmetric employment behaviours to education differences (Marelli et al., 2013; Vuolo et al., 2016; Ball et al., 2019; Aaronson et al., 2019). However, the abovementioned studies did not consider the reaction of the gender-, age- and educational attainment level-specific employment reaction to negative (downturns) and positive (upturn) output changes.

To fill this gap, this paper aims to assess the response of different types of employment disaggregated by gender, different age groups and levels of education during economic downturns and upturns (a total of 48 different employment options) using data from 27 EU countries. This research provides valuable insights for policymakers about which demographic groups are most vulnerable in the context of economic instability and which

groups require specific labour markets or economic stimulus tools to preserve employment. This study also aims to answer whether education is essential in reducing the risk of losing a job during an economic downturn.

The rest of the paper is organised as follows: Section 2 presents a literature review; Section 3 presents the research model, data, and estimation strategy; Section 4 presents and discusses estimation results; and the last Section concludes the paper.

Literature review

The researchers have observed that labour market indicators exhibit distinct responses to employment during economic upturn and downturn periods. The asymmetric reaction of employment to output fluctuations indicates that employment responds more strongly during negative output changes than during positive periods. Additionally, adverse changes in employment persist for a longer duration. The prevailing view is that economic growth will lead to job creation and a decline in the unemployment rate (Kreishan, 2011; Pavelka and Löster, 2013; Boga, 2020). However, it is also anticipated that the labour market will exhibit differential responses during periods of growth. Regarding labour hoarding during economic downturns, it is assumed that the impact of economic growth on employment in an upturn will be weaker than in downturns. This is because firms will be able to increase output by increasing workers' productivity rather than the number of workers.

A limited number of studies have examined the heterogeneous impact of economic growth on employment over different business cycle stages (Burggraeve et al., 2015; Coşar and Yavuz, 2019). Coşar and Yavuz (2019) examined the relationship between economic growth, employment and the unemployment rate in Turkey from 1989 to 2018. The findings indicated a more pronounced response of employment and unemployment rates to changes in output during the downturns. Similarly, Burggraeve et al. (2015) compared the response of employment in developed countries to output changes in recessionary periods versus expansion periods. The findings indicated that the impact of economic growth on employment was asymmetric. Still, results did not confirm any statistically significant deviations of output-employment elasticity over recession compared to non-recession periods. This is similar to the results by Butkus et al. (2022), analysing the impact of sectoral economic structure on employment elasticities. The research also found no significant differences between recession and expansion periods. Anderson and Braunstein (2013) confirm that higher elasticities imply more employment losses when growth turns negative and more employment gains when growth is positive. Butkus et al. (2024) found that the employment elasticity concerning output is not constant within each phase of the business cycle and might depend on the maturity of that phase.

Very few empirical studies have delved into the relationship between employment and economic growth within the business cycle framework while considering variables like

gender, age, and education. A review of existing literature, such as those of Butkus et al. (2023, 2022), indicates that young individuals and those employed in agriculture tend to be most impacted by jobless growth. Furthermore, research conducted by Anderson and Braunstein (2013) suggests that differences in how employment responds to growth between genders are primarily influenced by the composition of the service sector in the economy and the ratio of female to male participation in the labour force, leading to higher responsiveness among women compared to men.

The weaker employment response is also related to the educational attainment level of employees. A weaker response of the employment of people with higher education to the changes in output can occur in upturn periods and downturns. During the post-recession recovery, output growth is driven by labour productivity growth, which implies that employers may be tempted to lay off lower-performing workers during downturns. Employers during downturns tend to retain more educated, experienced workers who will not only be able to adapt more quickly to changes in production during the recovery but will also be able to train new employees later. Vuolo et al. (2016), Ball et al. (2019), and Aaronson et al. (2019) note that educated and highly skilled workers are more likely to be employed, especially in times of recession. Marelli et al. (2013) point out that the effects of economic recession tend to be greater for low-skilled young people.

As Devereux (2002) concludes, during expansion, low unemployment and labour shortages lead to less skilled workers taking up positions they would not usually get. In recessions, low-skilled workers become more vulnerable for reasons other than changes in labour productivity: (1) the cost of recruiting lower-skilled people is lower, making it easier to lay them off; and (2) in recessions, when unemployment is higher, the supply of workers increases, so that employers can recruit better educated and more qualified workers at the same wage. It can also be noted that low-skilled workers are employed in sectors that are sensitive to the business cycle and are, therefore, more likely to remain unemployed in the long run (Garrouste et al., 2010). Askenazy et al. (2015) analysed how the impact of economic growth on employment in the US and the EU depends on the educational attainment level of the employed. The results confirmed that the employment response to changes in output is weaker for employees with tertiary education than for employees with less than tertiary education. Based on the literature analysis, we hypothesise that the role of education is crucial in reducing the risk of losing a job during an economic downturn.

Data and the model

Empirical research uses real gross domestic product data and gender-, age- and educational attainment-level specific employment from 27 EU countries. Statistical data is collected from the Eurostat database and covers the period from 2000 to 2020. The dependent variable under examination encompasses various employment types. Regarding gender, employment is divided into total, male and female groups. By age, employment is divided

into four groups: 15-64 years, 15-24 years, 25-39 years and 40-64 years. In terms of education, employment is divided into four groups based on the International Standard Classification of Education (ISCED). ISCED0–8 encompasses all education levels, with ISCED0–2 indicating less than primary, primary, and less than secondary education (further – the least educated); ISCED3–4 representing secondary and other non-higher education; and ISCED5–8 denoting higher education (further – highly educated). Summary statistics of variables are presented in Appendix A (Table 1).

Based on the summary statistics of indicators used in the analysis, it can be stated that during the analysed period, the average output growth in the EU was 2.1%. However, changes ranged from the most significant negative (-14.8%) to the most significant positive change (25.2%). During the same period, employment grew by only 0.7%, indicating that economic growth was three times faster than employment growth in the EU. Employment changes also varied among employed people of different ages, genders, and educational attainment levels. When assessing employment changes without considering educational attainment levels, it was found that women's employment grew faster than men's, while the employment of young people, both men and women, decreased during the study period.

When analysing employment changes by educational attainment level, it was observed that the employment of least educated individuals of any age, both men and women, decreased. In contrast, the employment of highly educated people increased. The most significant variation among all analysed demographic groups in EU countries was seen in the employment of the least educated and youth. The results also indicate that the demand for women and highly educated workers is increasing in the labour market, which may be related to structural changes in the countries. When assessing employment changes among people with ISCED3–4 level of education, it was noted that only the employment of individuals over 40 years old with this level of education increased. In contrast, the employment of those under 40 years old with the same education level decreased during the study period from 2000 to 2020.

This paper aims to evaluate the impact of output changes on gender-, age- and educational attainment level-specific employment considering two business cycle phases, i.e. economic downturn and upturn. Evaluation of economic growth impact on employment (Slimane, 2015; Ali et al., 2017; Thuku et al., 2019; Mkhize, 2019) often rely on translog regression, i. e. the method presented in the study of Kapsos (2006). According to this methodology, the most basic definition of output-employment elasticity is the percentage change in the number of employed persons in an economy or region associated with a percentage change in economic output, measured by gross domestic product.

Consequently, the β coefficients of the regression equation calculated in this way are interpreted as elasticity coefficients showing how much the employment changes (in per cent) when output changes by one per cent.

The primary model for estimating output–employment elasticities is defined in Equation 1.

$$\Delta lnEMP_{i,t} = \alpha + \beta \cdot \Delta lnGDP_{i,t} + \theta_t + \Delta \varepsilon_{i,t} \tag{1}$$

where:

$\Delta lnEMP_{i,t}$ represents the changes in employment, measured as a thousand persons employed,

$\Delta lnGDP_{i,t}$ represents the changes in real output, measured as GDP at constant 2015 prices, million euro, in country i at the year t.

The coefficient β is the output–employment elasticity.

α is the intercept, θ_t represents time dummies, $\varepsilon_{i,t}$ is the idiosyncratic error.

Since the analysis of economic growth impacts on employment is called the employment version of Okun`s law (IMF, 2010), for estimations we use one of the primary methods proposed in the seminal Okun (1962) paper, i.e. the first differences approach. Using the dependent and independent variables in their first differences, we expect to eliminate the unobserved time-invariant country-fixed effects from the model and deal with autocorrelation issues. Expressing variables in a logarithmical form helps to deal with the heteroscedasticity issues and, as was noted by Šetikienė (2022), also helps to transform the nonlinear economic phenomena dependencies into linear ones.

To evaluate the impact of output changes on gender-, age—and educational attainment level-specific employment during the different business cycle phases, we use the methodology applied in studies by Bartolucci et al. (2018) and Butkus et al. (2022). These studies define a downturn period as when real GDP decreases, and an upturn is when real GDP increases.

To estimate the effect during the economic downturn, we modify Equation 1 by including a multiplicative term between output change and the dummy variable, which reflects the time when real GDP decreases.

$$\Delta lnEMP_{i,t} = \alpha + \beta_1 \cdot \Delta lnGDP_{i,t} + \beta_2 \cdot D_{i,t,n} + \delta_1 \cdot \Delta lnGDP_{i,t} \cdot D_{i,t,n} + \theta_t + \Delta \varepsilon_{i,t}, \tag{2}$$

where $D_{i,t,n}$ is a dummy variable, which is equal to 1, when $\Delta lnGDP_{i,t} < 0$, β_1 – output–employment elasticity during economic upturn, $\beta_1 + \delta_1$ – output–employment elasticity during economic downturn, δ_1 – coefficient, which shows how much the effect of GDP change differs during the period of economic downturn compared to the period of economic upturn. Other parameters are the same as in Equation 1.

The pooled OLS method was used to estimate gender-, age-, and educational attainment level-specific output–employment elasticities in the EU. Despite its simplicity, this method is widely used to estimate the impact of economic growth on employment by other researchers (Kapsos, 2006; Furceri et al.; 2012; Richter and Witkowski, 2014; Slimane, 2015) with several transformations used to eliminate the drawbacks of this method (i.e. using first differences, logs, including heteroscedasticity and autocorrelation consistent

robust standard errors or standard errors which deal with the crossectional dependence). For testing autocorrelation, we use the Wooldridge autocorrelation test; for the heteroscedasticity testing – Breusch Pagan (LM) test; and for crossectional dependence, we use the Pesaran CD test. In models, autocorrelation, heteroscedasticity, or both are detected. The heteroscedasticity and autocorrelation consistent (HAC) Arellano standard errors are included. All regression models that detect crossectional dependence are corrected by including the Driscoll-Kraay standard errors.

Results and discussion

The results are presented in Tables 1 and 2, representing different age groups. The tables provide the estimates of the coefficients β_1, δ_1, $\beta_1 + \delta_1$ using equation 2.

Table 1. The employment response to changes in output during periods of economic upturn and downturn, taking into account the age of the employed (groups aged 15–64 and 15–24), gender, and educational attainment level

Educational attainment level	Gender	The effect during the economic upturn		The effect during the economic downturn		Difference in the effect between the two phases	
		β_1		$\beta_1 + \delta_1$		δ_1	
		Age					
		15–64	15–24	15–64	15–24	15–64	15–24
ISCED0–8	Both	0.1958*** [0.0338]	0.2160 [0.1735]	0.5234*** [0.1713]	1.3090*** [0.4361]	0.3276* [0.1654]	1.0931** [0.4178]
	Pesaran (CD) test	0.0093	0.0144	0.0093	0.0144	0.0093	0.0144
	n	538	538	538	538	538	538
	Adj. R²	0.43	0.29	0.43	0.29	0.43	0.29
	Males	0.2543*** [0.0440]	0.2767 [0.1903]	0.6776*** [0.2167]	1.4572** [0.6046]	0.4233* [0.2121]	1.1805* [0.5762]
	Pesaran (CD) test	0.0191	0.0176	0.0191	0.0176	0.0191	0.0176
	n	538	538	538	538	538	538
	Adj. R²	0.48	0.29	0.48	0.29	0.48	0.29
	Females	0.1350*** [0.0388]	0.1431 [0.1874]	0.3775** [0.1046]	1.1581*** [0.2847]	0.2425* [0.1357]	1.0150*** [0.3022]
	Pesaran (CD) test	0.0043	0.0114	0.0043	0.0114	0.0043	0.0114
	n	538	538	538	538	538	538
	Adj. R²	0.27	0.29	0.27	0.29	0.27	0.29

ISCED0–2	Both	0.0830 (0.1571)	0.2608 (0.2983)	0.8551*** (0.2416)	2.1506*** (0.4572)	0.7721*** (0.2259)	1.8898*** (0.5374)
	Pesaran (CD) test	0.1520	0.0921	0.1520	0.0921	0.1520	0.0921
	n	538	538	538	538	538	538
	Adj. R^2	0.17	0.15	0.17	0.15	0.17	0.15
	Males	0.2431 (0.2010)	0.3017 (0.3187)	1.0317*** (0.2862)	1.8346*** (0.4315)	0.7886*** (0.2546)	1.5329*** (0.4965)
	Pesaran (CD) test	0.1540	0.0762	0.1540	0.0762	0.1540	0.0762
	n	538	536	538	536	538	536
	Adj. R^2	0.17	0.13	0.17	0.13	0.17	0.13
	Females	−0.1479 (0.1590)	0.0324 (0.3849)	0.5313** (0.2545)	2.2363*** (0.4833)	0.6792** (0.3021)	2.2038*** (0.5414)
	Pesaran (CD) test	0.0689	0.1320	0.0689	0.1320	0.0689	0.1320
	n	538	504	538	504	538	504
	Adj. R^2	0.11	0.10	0.11	0.10	0.11	0.10
ISCED3–4	Both	0.1837** [0.0811]	0.1519 [0.1879]	0.6178*** [0.2977]	1.4259*** [0.3857]	0.4341 [0.2996]	1.2740*** [0.3729]
	Pesaran (CD) test	0.0230	0.0064	0.0230	0.0064	0.0230	0.0064
	n	538	538	538	538	538	538
	Adj. R^2	0.16	0.21	0.16	0.21	0.16	0.21
	Males	0.2345** (0.1041)	0.2165 [0.1313]	0.6907*** (0.1347)	1.5450** [0.5803]	0.4562** (0.1768)	1.3285** [0.5628]
	Pesaran (CD) test	0.1040	0.0160	0.1040	0.0160	0.1040	0.0160
	n	538	538	538	538	538	538
	Adj. R^2	0.18	0.17	0.18	0.17	0.18	0.17
	Females	0.1198 [0.0944]	0.0569 [0.1803]	0.5230* [0.2877]	1.2829*** [0.4180]	0.4032 [0.2812]	1.2259*** [0.4115]
	Pesaran (CD) test	0.024	0.0104	0.024	0.0104	0.024	0.0104
	n	538	538	538	538	538	538
	Adj. R^2	0.10	0.13	0.10	0.13	0.10	0.13

ISCED5–8	Both	0.0885 (0.1315)	−0.0370 [0.3833]	0.3917*** (0.1066)	0.8656 [0.7882]	0.3032 (0.1498)	0.9026 [0.8060]
	Pesaran (CD) test	0.7250	0.0189	0.7250	0.0189	0.7250	0.0189
	n	538	533	538	533	538	533
	Adj. R^2	0.02	0.01	0.02	0.01	0.02	0.01
	Males	0.1497 (0.1213)	−0.1681 [0.4223]	0.4956*** (0.1078)	0.7827 [0.9351]	0.3459 (0.1782)	0.9508 [0.9254]
	Pesaran (CD) test	0.9380	0.0275	0.9380	0.0275	0.9380	0.0275
	n	538	485	538	485	538	485
	Adj. R^2	0.03	0.004	0.03	0.004	0.03	0.004
	Females	0.0270 (0.1546)	−0.3135* [0.1845]	0.3603** (0.1325)	1.0279 [0.6791]	0.3333** (0.1547)	1.3414** [0.6687]
	Pesaran (CD) test*	0.1460	0.0080	0.1460	0.0080	0.1460	0.0080
	n	538	519	538	519	538	519
	Adj. R^2	0.01	-0.003	0.01	-0.003	0.01	-0.003

Note: *,**, *** denotes statistical significance at 10 %, 5 % and 1 % levels, respectively. We present just the p-value of the Pesaran (CD) test since the selection of the covariance matrix estimator hinges on its results. Values in parentheses represent the Arellano HAC robust standard errors, and values in brackets are Driscoll-Kraay standard errors.

Source: own elaboration based on Eurostat data.

The results indicate (Table 1) that during periods of economic upturn, a 1% increase in output leads to a 0.20% increase in employment. The coefficients of employment to output growth also suggest that during economic upturns, there is a statistically significant increase in employment among men, particularly those over 25 years old, and women aged 25–39 (Table 2). The analysis of impact based on educational attainment level showed that during output growth periods, production increase promotes employment growth among men over 40 years old with ISCED3–4 level of education. No statistically significant impact of output growth on employment was found among the least educated individuals and those with higher education, regardless of gender. It can also be concluded that during periods of output growth, production increase does not have a statistically significant impact on the employment of young people, regardless of their gender or education. These results indicate that during economic upturns, production growth does not enhance employment opportunities for young people. The different reactions of women, men, and young people to output growth may also be related to variations in their concentration in economic sectors and differences in labour productivity.

Table 2. The employment response to changes in output during periods of economic upturn and downturn, taking into account the age of the employed (groups aged 25–39 and 40–64), gender, and educational attainment level

Educational attainment level	Gender	The effect during the economic upturn		The effect during the economic downturn		Difference in the effect between the two phases	
		β_1		$\beta_1 + \delta_1$		δ_1	
		Age					
		25–39	40–64	25–39	40–64	25–39	40–64
ISCED0–8	Both	0.2159*** [0.0450]	0.1690** [0.0662]	0.5239*** [0.1039]	0.4231*** [0.1614]	0.3080** [0.1045]	0.2542 [0.1725]
	Pesaran (CD) test	0.0196	0.0158	0.0196	0.0158	0.0196	0.0158
	n	538	538	538	538	538	538
	Adj. R^2	0.29	0.24	0.29	0.24	0.29	0.24
	Males	0.2823*** [0.0649]	0.2237*** [0.0539]	0.6423*** [0.1063]	0.5755*** [0.2066]	0.3600*** [0.1173]	0.3519* (0.2097)
	Pesaran (CD) test	0.0105	0.0118	0.0105	0.0118	0.0105	0.0118
	n	538	538	538	538	538	538
	Adj. R^2	0.35	0.30	0.35	0.30	0.35	0.30
	Females	0.1317*** [0.0370]	0.1383 [0.1336]	0.3965*** [0.1081]	0.2995** [0.1384]	0.2648** [0.1044]	0.1612 [0.1604]
	Pesaran (CD) test	0.0183	0.0130	0.0183	0.0130	0.0183	0.0130
	n	538	538	538	538	538	538
	Adj. R^2	0.16	0.12	0.16	0.12	0.16	0.12

ISCED0–2	Both	0.6366* (0.3692)	−0.3158* (0.1649)	0.7933*** (0.2208)	0.7528** (0.3032)	0.1566 (0.3684)	1.0686*** (0.3029)
	Pesaran (CD) test	0.0737	0.4640	0.0737	0.4640	0.0737	0.4640
	n	538	538	538	538	538	538
	Adj. R^2	0.11	0.10	0.11	0.10	0.11	0.10
	Males	0.7818* (0.4079)	−0.1849 (0.1572)	0.9649*** (0.2334)	0.9564** (0.4276)	0.1831 (0.3583)	1.1413** (0.4851)
	Pesaran (CD) test	0.0510	0.3770	0.0510	0.3770	0.0510	0.3770
	n	538	538	538	538	538	538
	Adj. R^2	0.12	0.09	0.12	0.09	0.12	0.09
	Females	0.2258 (0.2845)	−0.4108 (0.2612)	0.4430 (0.3441)	0.5181 (0.4467)	0.2171 (0.4451)	0.9289* (0.5266)
	Pesaran (CD) test	0.0885	0.5460	0.0885	0.5460	0.0885	0.5460
	n	533	538	533	538	533	538
	Adj. R^2	0.04	0.07	0.04	0.07	0.04	0.07
ISCED3–4	Both	0.1044 [0.1145]	0.2633* (0.1536)	0.6080*** [0.2326]	0.5302*** (0.1466)	0.5036* [0.2700]	0.2668 (0.2389)
	Pesaran (CD) test	0.0040	0.1530	0.0040	0.1530	0.0040	0.1530
	n	538	538	538	538	538	538
	Adj. R^2	0.13	0.07	0.13	0.07	0.13	0.07
	Males	0.1465 [0.1217]	0.3293** (0.1384)	0.7115*** [0.1831]	0.5315*** (0.1750)	0.5651** [0.2344]	0.2022 (0.2310)
	Pesaran (CD) test	0.0214	0.3920	0.0214	0.3920	0.0214	0.3920
	n	538	538	538	538	538	538
	Adj. R^2	0.15	0.07	0.15	0.07	0.15	0.07
	Females	0.0514 [0.1158]	0.1761 (0.1748)	0.4220 [0.3210]	0.5407*** (0.1620)	0.3706 [0.3423]	0.3646 (0.2865)
	Pesaran (CD) test	0.0074	0.1150	0.0074	0.1150	0.0074	0.1150
	n	538	538	538	538	538	538
	Adj. R^2	0.08	0.03	0.08	0.03	0.08	0.03

ISCED5–8	Both	0.1359 (0.1767)	0.0634 (0.1385)	0.3445** (0.1274)	0.3959** (0.1452)	0.2086 (0.1865)	0.3326* (0.1736)
	Pesaran (CD) test	0.1210	0.5720	0.1210	0.5720	0.1210	0.5720
	n	538	538	538	538	538	538
	Adj. R²	0.02	0.01	0.02	0.01	0.02	0.01
	Males	0.1720 (0.1561)	0.1296 (0.1310)	0.2731 (0.1874)	0.6815*** (0.1589)	0.1011 (0.2165)	0.5519** (0.2157)
	Pesaran (CD) test	0.1240	0.3850	0.1240	0.3850	0.1240	0.3850
	n	538	538	538	538	538	538
	Adj. R²	0.02	0.03	0.02	0.03	0.02	0.03
	Females	0.0980 [0.1743]	0.0166 (0.1841)	0.4143*** [0.1595]	0.1854 (0.1551)	0.3163 [0.2720]	0.1688 (0.2132)
	Pesaran (CD) test	0.0305	0.6520	0.0305	0.6520	0.0305	0.6520
	n	538	537	538	537	538	537
	Adj. R²	0.03	0.01	0.03	0.01	0.03	0.01

Note: *,**, *** denotes statistical significance at 10 %, 5 % and 1 % levels, respectively. We pre-sent just the p-value of the Pesaran (CD) test since the selection of the covariance matrix estimator hinges on its results. Values in parentheses represent the Arellano HAC robust standard errors, and values in brackets are Driscoll-Kraay standard errors.

Source: own elaboration based on Eurostat data.

A different situation is observed during economic downturns. A decrease in production leads to a decline in employment for almost all analysed demographic groups. Additionally, it can be noted that the estimated coefficients of employment to output elasticity in absolute terms are significantly more significant than those estimated for economic upturns. Although, this does not necessarily mean that this effect differs statistically. The results align with the findings of a study conducted by Coşar and Yavuz (2019). During economic downturns, there are also more significant differences in employment reactions to output changes among genders, different age groups, and educational attainment levels of the employed. Based on the results obtained, it can be concluded that during economic downturns, the employment of young people without higher education reacts most strongly to output changes.

When analysing the impact based on educational attainment levels, it can be stated that during economic downturns, the most vulnerable individuals are the least educated. Evaluating how employment reactions to negative output change differ between men and women, it is found that regardless of educational attainment level, men's employment reaction to negative output change is stronger than women's. Additionally, it can be observed that both men's and women's employment reactions to output changes are stronger during

economic downturns compared to upturns. However, upon closer analysis, it is noticeable that the employment reaction of young, less educated women to output changes is stronger than that of men of the same age and educational attainment level.

The obtained results reveal specific trends. During economic downturns, young employees are laid off first, while those over 40 are laid off last. Among young employees, those who are the least educated are the first to lose their jobs, followed by employees with ISCED3–4 educational attainment levels. A similar trend is observed in the 25–39 years age group. Additionally, it is noted that during economic downturns, the decrease in output does not have a statistically significant impact on the employment of least educated over 25 years old women, women aged 25–39 with ISCED3–4 levels of educational attainment, men aged 25–39 with higher education, and women over 40 with higher education. These results indicate that among highly educated individuals, men aged 15–39 and women aged 15–24 and 40–64 have better chances of remaining employed during economic downturns.

The stronger employment reaction of young people to output changes is associated with lower levels of education, lack of experience, and a tendency to work seasonal or temporary contract jobs (World Bank, 2012; Dietrich and Möller, 2016; Dunsch, 2016). During economic downturns, employers have greater flexibility in their choices, so less experienced, lower-educated workers and workers with lower dismissal costs are the first to be laid off. Differences in the employment reactions of men and women to output changes during downturns can be explained by differences in labour market participation (Boda and Považanova, 2015; Bisello and Mascherini, 2017; Lewandowska-Gwarda, 2018; Ahn et al., 2019) and men's employment in business cycle-sensitive sectors (Kim and Park, 2019; Liotti, 2020).

The results confirm that human capital and associated changes in productivity play a particularly crucial role during economic downturns. The findings indicate that the risk of job loss diminishes even for young individuals if they possess higher education. During economic upturns, weak employment reactions to output changes are linked to the accumulation of a labour force with higher education during economic downturns because precisely those employees with higher education can increase production capacity by enhancing labour productivity during economic upturns and later, when demand significantly increases, they can train new employees. The results show that during economic downturns, in almost all cases, regardless of age and gender, as the level of education increases, the coefficients for employment to output elasticity decrease.

Although the calculated coefficients for employment to output elasticity in absolute terms during the economic downturn are higher than during an upturn, it is essential to note whether the identified impact during downturns significantly differs from that identified during upturns. Based on the conducted calculations (Tables 1 and 2), it can be confirmed that during economic downturns, the identified impact notably differs from that during upturns, particularly in terms of statistical significance for least educated young individuals and those with ISCED3–4 levels educational attainment.

Statistically significant differences are also observed in the employment reaction to

output changes during downturn periods compared to upturns for young women with higher education, men aged 25–39 with ISCED3–4 level of educational attainment, uneducated men aged 40–64, and educated women in the same age group. These results confirm that young individuals are the most vulnerable during downturn periods. The least difference in employment reaction to production changes between downturn and upturn periods is observed in individuals with higher education. It can be concluded that during economic upturns and downturns, the employment of individuals with higher education shows weak responsiveness to output changes, making them less vulnerable in the context of economic instability.

These results suggest that specific labour market measures should be implemented to protect the most vulnerable demographic groups from losing a job during economic downturns and increase abilities to be employed during economic upturns, i.e., to integrate young people into the labour market. Such measures could include state subsidies or tax and other types of incentives that encourage the employment of young people with a commitment to maintaining the job for a specified period. Collaboration between universities and social partners should be encouraged, increasing employers' interest in hiring employees as early as possible and providing opportunities for employees to combine work and studies. Additionally, there should be an opportunity to finance training programs for companies, which are necessary for young persons who lack work experience and education to acquire the knowledge needed for a specific job quickly and to reduce the gap between them and more experienced older employees.

To reduce the disparities between the employment reactions of males and females to output changes determined by working in different economic sectors, thus it is recommended to encourage women's involvement in various fields, especially in sectors traditionally considered "male," while also investing in training and retraining programs tailored for both genders. These programs should include not only the improvement of technical skills but also training on new technologies and innovations. The distribution of men and women across economic sectors is influenced not only by objective reasons, such as physical differences, but also by personal choice. Women often prioritise jobs that allow them to balance work and motherhood. For this reason, it is proposed at the national level to recommend improving working conditions for women not only in the public but also in the private sector by offering more flexible working hours, providing opportunities to work from home, recommending that companies set up separate childcare rooms at work, and ensuring funding for the establishment of these rooms.

Conclusions

From a theoretical point of view, labour market indicators display asymmetrical responses to economic fluctuations, with employment possibly reacting more strongly to negative output changes than to positive ones. This suggests that economic growth generally

leads to job creation and reduced unemployment and does not uniformly impact employment across different business cycle phases. Firms tend to increase output by enhancing worker productivity during upturns rather than hiring more workers, thus weakening the employment response in upturn periods compared to downturns. The studies reviewed highlight that output-employment elasticity varies across different stages of the business cycle and is influenced by factors such as sectoral composition, gender, age, and education of employed people. Educated and highly skilled workers are more productive and thus less likely to lose their jobs during downturns, whereas low-skilled workers are more vulnerable to job losses during downturns.

The study's results highlight that during economic upturns, an increase in output leads to a rise in employment, predominantly benefiting men over 25 and women aged 25–39, particularly those with mid-level education (ISCED3–4). Conversely, the least educated and highly educated individuals and young people do not see significant employment gains from output growth. Economic downturns reveal a more pronounced negative impact on employment, especially among the young and less educated. Males generally experience stronger employment declines than women, regardless of educational attainment level. However, young, least educated females face the highest vulnerability to job loss. Older and more educated workers show greater job stability during downturns, underscoring the protective effect of higher education and experience.

The findings emphasise that human capital and productivity are essential during economic fluctuations. Educated and skilled workers are more resilient to job losses and drive productivity improvements during recoveries. These trends suggest that policies to enhance education and skills training could mitigate the adverse effects of economic downturns on employment, particularly for vulnerable groups. The study underscores the need for targeted interventions to support employment stability across different economic conditions and demographic segments.

Several limitations of the research can be distinguished. The classification of economic phases just into two phases, i.e. downturns and upturns based on GDP changes, may not capture all the nuances of economic cycles since the effect during the start of the economic downturn can differ compared to the effect during the end of this phase. The same holds for periods of economic upturn. Additionally, following the original specification of Okun's law, this paper does not consider other factors that can explain the heterogeneous and asymmetrical behaviour of employment to output changes. Future research should consider the factors determining the asymmetrical responses of gender, age, and educational attainment levels specific to employment and economic fluctuations, such as various regulatory frameworks. This effect should be evaluated by dividing the business cycle into four phases instead of two.

References

1. Adegboye, A. C., Egharevba, M. I., & Edafe, J. (2019). Economic regulation and employment intensity of output growth in Sub-Saharan Africa. In Governance for structural transformation in Africa, Palgrave Macmillan, Cham. 101–143. https://doi.org/10.1007/978-3-030-03964-6_4

2. Ahn, J., An, Z., Bluedorn, J., Ciminelli, G., Koczan, Z., Malacrino, D., Muhaj, D., & Neidlinger, P. (2019). Work in progress: Improving youth labour market outcomes in emerging market and developing economies. International Monetary Fund. Work In Progress. Staff Discussion Notes, 19(02), 1. https://doi.org/10.5089/9781484393901.006

3. Ali, A., Tayeb G., and Yassine M. (2017). Manufacturing Employment Elasticity and Its Drivers in Developing and Emerging Countries: Focus on Sub-Saharan Africa. OCP Policy Center Research Paper 17/03. Available on: https://www.policycenter.ma/sites/default/files/OCPPC-RP1703.pdf.

4. Anderson, B. (2016). Do Macroeconomic Structures and Policies Shape the Employment Intensity of Growth Differently for Women and Men? Journal of Economic Issues, 50(4), 940–962. 2. http://dx.doi.org/10.1080/00213624.2016.1249744.

5. Anderson, B., & Braunstein, E. (2013). Economic growth and employment from 1990-2010: explaining elasticities by gender. Review of Radical Political Economics, 45(3), 269–277. http://dx.doi.org/10.1177/0486613413487158.

6. Askenazy, P., Martin C., & Christine E. (2015). Okun's Laws Differentiated by Education. Document de Travail CEPREMAP 1514. Available on: https://www.cepremap.fr/depot/docweb/docweb1514.pdf.

7. Ball, L., Furceri, D., Leigh, D., & Loungani, P. (2019). Does one law fit all? Cross-country evidence on Okun's law. Open Economies Review, 30, 841–874. https://doi.org/10.1007/s11079-019-09549-3.

8. Bartolucci, F., Choudhry, M. T., Marelli, E., & Signorelli, M. (2018). GDP dynamics and unemployment changes in developed and developing countries. Applied Economics, 50(31), 3338–3356. https://doi.org/10.1080/00036846.2017.1420894.

9. Ben-Salha, O., & Zmami, M. (2021). The effect of economic growth on employment in GCC countries. Scientific Annals of Economics and Business, 68(1), 25–41. https://doi.org/10.47743/saeb-2021-0004.

10. Bisello, M., & Mascherini, M. (2017). The gender employment gap: costs and policy responses. Intereconomics, 52(1), 24–27. https://doi.org/10.1007/s10272-017-0638-y.

11. Boda, M., & Považanová, M. (2015). Gender asymmetry in Okun's law in the four PIGS countries. Procedia Economics and Finance, 30, 111–123. https://doi.org/10.1016/s2212-5671(15)01260-5.

12. Boga, S., (2020). Investigating the asymmetry between economic growth and unemployment in Turkey: a hidden cointegration approach. Pressacademia, 7(1), 22–33. https://doi.org/10.17261/pressacademia.2020.1178.

13. Burggraeve, K., de Walque, G., & Zimmer, H. (2015). The relationship between economic growth and employment. Economic Review, (i), 32–52.

14. Butkus, M., Dargenytė-Kacilevičienė, L., Matuzevičiūtė, K., Ruplienė, D., & Šeputienė, J. (2022). Do Gender and Age Matter in Employment – Sectoral Growth Relationship

Over the Recession and Expansion. Ekonomika, 101(2). 38–51. https://doi.org/10.15388/ekon.2022.101.2.3

15. Butkus, M., Dargenytė-Kacilevičienė, L., Matuzevičiūtė, K., Ruplienė, D., & Šeputienė, J. (2024). When and for Whom Does Growth Becomes Jobless? Economies, 12(1), 19. https://doi.org/10.3390/ economies12010019.

16. Butkus, M., Dargenytė-Kacilevičienė, L., Matuzevičiūtė, K., Šeputienė, J., & Ruplienė, D. (2023). Age- and Gender-specific Output-employment Relationship across Economic Sectors. Ekonomický Časopis, 71(1), 3–22. https://doi.org/10.31577/ekoncas.2023.01.01.

17. Choudhry, T.M., Marelli, E., & Signorelli, M. (2012). Youth unemployment rate and impact of financial crises. International Journal of Manpower, 33(1), 76–95. https://doi.org/10.1108/01437721211212538.

18. Coşar, E. E., & Yavuz, A. A. (2021). Okun's law under the demographic dynamics of the Turkish labor market. Central Bank Review, 21(2), 59–69. https://doi.org/10.1016/j.cbrev.2021.03.002.

19. Devereux, Paul J. (2002). Occupational upgrading and the business cycle. Labour 16, 423–52. https://doi.org/10.1111/1467-9914.00202.

20. Dietrich, H., & Möller, J. (2016). Youth unemployment in Europe–business cycle and institutional effects. International Economics and Economic Policy, 13, 5–25. https://doi.org/10.1007/s10368-015-0331-1.

21. Dunsch, S. (2016). Okun's law and youth unemployment in Germany and Poland. International Journal of Management and Economics 49, 34–57. https://doi.org/10.1515/ijme-2016-0003.

22. Furceri, D., Crivelli, E., & Toujas-Bernate, M. J. (2012). Can policies affect employment intensity of growth? A cross-country analysis. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2169762.

23. Garrouste, C. (2010). 100 years of educational reforms in Europe: A contextual database. Luxembourg: Publications Office of the European Union.

24. Ghazali, M., & Mouelhi, R. (2018). The employment intensity of growth: evidence from Tunisia. *Journal of Economic Development*, *43*(3), 85–117. https://doi.org/10.35866/caujed.2018.43.3.004

25. Guisan, M.C., & Exposito, P. (2017). Employment By Sector, Productivity and Wages In 5 European Countries, 1965-2015: Fifty Years of Evolution in Germany, Spain, France, Italy and UK. Applied Econometrics and International Development, 17(2), 33–46.

26. International Monetary Fund (IMF) (2010). Unemployment dynamics during recessions and recoveries: Okun's Law and beyond/Chapter 3 in IMF (2010). World Economic Outlook Rebalancing Growth, April 2010. IMF, Washington, D.C.

27. Kapsos, S. (2006). The Employment Intensity of Growth: Trends and Macroeconomic Determinants. Labor Markets in Asia, 143–201. https://doi.org/10.1057/9780230627383_4.

28. Kim, M. J., & Park, S. Y. (2019). Do gender and age impact the time-varying Okun's law? Evidence from South Korea. Pacific Economic Review, 24(5), 672–685. https://doi.org/10.1111/1468-0106.12288.

29. Kreishan, F. M. (2011). Economic growth and unemployment: An empirical analysis. Journal of Social Sciences, 7(2), 228–231. https://doi.org/10.3844/jssp.2011.228.231.

30. Lewandowska-Gwarda, K. (2018). Female unemployment and its determinants in Poland

in 2016 from the spatial perspective. Oeconomia Copernicana, 9(2), 183–204. https://doi.org/10.24136/10.24136/oc.2018.010.

31. Liotti, G. (2020). Labour market flexibility, economic crisis and youth unemployment in Italy. Structural Change and Economic Dynamics, 54, 150–162. https://doi.org/10.1016/j.strueco.2020.04.011.

32. Mihajlović, V., & Marjanović, G. (2021). Challenges of the Output-Employment Growth Imbalance in Transition Economies. Naše gospodarstvo/Our economy, *67*(2), 1–9. https://doi.org/10.2478/ngoe-2021-0007.

33. Mkhize, N. I. (2019). The sectoral employment intensity of growth in South Africa. Southern African Business Review, 23(1). https://doi.org/10.25159/1998-8125/4343.

34. Okun, A. M. (1962). Potential GNP: its measurement and significance. American Statistical Association, Proceedings of the Business and Economics Section, 98–104.

35. Pavelka, T., & Löster, T. (2013). Changes in regional unemployment rates in the Czech Republic during economic cycle. Intellectual Economics, 7(4), 510–522. https://doi.org/10.13165/ie-13-7-4-06.

36. Richter, K., & Witkowski, B. (2014). Does growth generate jobs in Eastern Europe and Central Asia? World Bank Policy Research Working Paper, (6759). https://doi.org/10.1596/1813-9450-6759.

37. Šetikienė, A. (2022). Heterogeniško finansializacijos poveikio ilgojo laikotarpio ekonomikos augimui vertinimas. Daktaro disertacija: Vilniaus universitetas.

38. Slimane, S. B. (2015). The relationship between growth and employment intensity: evidence for developing countries. Asian economic and financial review, 680–692. https://doi.org/10.18488/journal.aefr/2015.5.4/102.4.680.692.

39. Thuku, G. K., Omolo, J., & Muniu, J. (2019). Employment Intensity of Output Growth in Kenya. Journal of Economics and Finance, 10, 9–21. https://DOI:10.9790/5933-1003040921

40. Vuolo, M., Mortimer, J. T., & Staff, J. (2016). The value of educational degrees in turbulent economic times: Evidence from the Youth Development Study. Social science research, 57, 233–252. https://doi.org/10.1016/j.ssresearch.2015.12.014.

41. Wascher, W. L., Aaronson, S. R., Daly, M. C., & Wilcox, D. W. (2019). Okun revisited: Who benefits most from a strong economy? Finance and Economics Discussion Series, 2019(072), 1–80. https://doi.org/10.17016/feds.2019.072.

42. World Bank, ed. (2012). Gender differences in employment and why they matter. In World Development Report 2012. Washington: The World Bank, 198–253.

43. Zaki, C., Alshyab, N & Seleem, N. (2020). Employment intensity of growth and sectoral output growth: a comparative analysis of Egyptian and Jordanian economies. Mediterranean Journal of Economics, Agriculture and Environment, 19(1), 35–54. https://doi.org/10.30682/nm2001c.

Appendix A

Table 1. Summary statistics

ΔEMP, %						
ISCED Level	**Gender**	**Age Group**	**Mean**	**Min**	**Max**	**Standard Deviation**
ISCED0-8	Both	15-64	0.66	-13.09	11.00	2.42
		15-24	-1.58	-29.28	58.68	7.68
		25-39	-0.05	-10.93	29.23	3.10
		40-64	1.61	-12.13	7.65	2.35
	Males	15-64	0.45	-17.18	13.34	2.69
		15-24	-1.51	-33.33	50.00	8.08
		25-39	-0.16	-14.26	27.71	3.27
		40-64	1.36	-14.71	11.09	2.57
	Females	15-64	0.97	-8.96	10.50	2.58
		15-24	-1.59	-23.83	70.91	8.62
		25-39	0.13	-12.26	31.17	3.50
		40-64	2.15	-12.85	19.17	2.92
ISCED0-2	Both	15-64	-2.67	-27.57	39.47	6.92
		15-24	-2.97	-57.58	83.33	14.89
		25-39	-2.70	-33.76	89.64	10.35
		40-64	-2.26	-37.50	45.61	7.79
	Males	15-64	-2.12	-31.93	48.26	7.55
		15-24	-2.59	-50.00	84.62	15.24
		25-39	-2.04	-32.20	105.92	11.46
		40-64	-1.77	-40.44	58.88	8.94
	Females	15-64	-2.99	-28.02	45.16	7.67
		15-24	-2.39	-51.85	157.14	20.22
		25-39	-3.45	-49.06	66.33	12.73
		40-64	-2.53	-42.05	65.48	9.18
ISCED3-4	Both	15-64	0.68	-20.21	37.56	4.42
		15-24	-0.91	-32.21	53.01	8.84
		25-39	-0.94	-18.36	32.96	4.93
		40-64	2.51	-40.00	57.26	5.58

	Males	15-64	0.77	-22.60	37.08	4.74
		15-24	-0.49	-32.14	60.00	10.33
		25-39	-0.54	-19.92	33.72	5.35
		40-64	2.32	-43.33	41.46	5.80
	Females	15-64	0.59	-17.12	44.72	4.88
		15-24	-1.11	-37.78	55.40	10.75
		25-39	-1.47	-23.02	32.16	5.88
		40-64	2.90	-38.46	78.23	6.97
ISCED5-8	Both	15-64	4.02	−41.42	78.18	6.81
		15-24	3.51	−56.67	310.17	22.04
		25-39	3.72	−36.12	71.43	7.20
		40-64	4.58	−48.81	119.51	8.23
	Males	15-64	3.47	−45.89	82.09	7.24
		15-24	4.89	−57.69	514.93	32.70
		25-39	3.42	−43.69	67.82	7.75
		40-64	3.73	−50.43	117.24	8.77
	Females	15-64	4.65	−38.16	74.34	7.15
		15-24	3.12	−50.00	228.99	21.07
		25-39	4.12	−30.47	76.12	7.91
		40-64	5.47	−47.66	78.05	7.45
ΔGDP, %			2.09	−14.84	25.18	3.84