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Heterogeneity of Non-linear Growth-unemployment Relationship Across Economic Sectors. Does Gender and Age Matter?

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ABSTRACT

The growth-unemployment relationship is widely discussed in scientific literature. However, there is a lack of research analysing the variation of Okun's coefficient across economic sectors, especially considering gender and age characteristics. The aim of this article is to investigate the non-linear impact of sectoral output growth on age- and gender-specific unemployment over the business cycle. We apply the first-differenced specification of Okun's Law to estimate heterogeneous coefficients across economic sectors: agriculture, manufacturing, services and construction, over the business cycle, also accounting the sector's size which depends on the share of the sector's output. The research results indicate varying unemployment sensitivity across the main economic sectors. We have found that unemployment is affected the most by the output changes in the service sector. Measuring the response of gender specific unemployment, we found that the changes in construction sector has more significant impact on male than female. Youth unemployment sensitivity is higher to the output changes in service, industry and construction sectors. Our findings imply that policies targeting specific sectors can be more efficient in reducing unemployment and highlight the importance for fiscal and monetary policymakers to know how sensitive is unemployment rate to output changes of various sectors.

INTRODUCTION

The low unemployment level is one of the fundamental concerns of macroeconomic policy. Due to the Great Recession, the unemployment level soared up in some European Union (EU) countries, while in

others, it barely increased. The labour markets in some countries have not recovered from this economic downturn when faced with the new challenges posed by Coronavirus.

The output elasticity of the unemployment rate, known as Okun's coefficient, has received a lot of attention in the literature. Extensive empirical research investigates the size of Okun's coefficient, its variation over time and across countries. Increasingly, more detailed questions are being raised, whether unemployment sensitivity to output changes is age- and gender-specific? Another particularly new branch of research estimates how the response of unemployment rates to growth varies across economic sectors. The literature review revealed that the research scarcely discusses how the unemployment rate responds to the output growth in different sectors (Goto and Bürgi, 2021). Loría and Salas (2014) and Sánchez López (2019) estimate the response of overall unemployment to output growth covering one country and one sector, the construction sector in Spain and the tourism sector in Mexico, respectively. Apap and Gravino (2017) and Goto and Bürgi (2021), using data on individual countries, estimate and compare Okun's coefficients for various sectors.

The abovementioned sector-specific studies do not take the age or gender of the unemployed into account. Contributing to limited evidence on this issue, our paper aims to measure the response of overall, age- and gender-specific unemployment to growth in the main economic sectors, namely manufacturing, services, construction, and agriculture.

Our research provides several contributions to the limited literature on unemployment sensitivity to sectoral output growth. First, we investigate the effect of sectoral output growth on age- and gender-specific unemployment rate. We distinguished youth unemployment, as Boeri and Jimeno (2015) point to it as the primary driver of the differences in unemployment across the EU. As Casado et al. (2015) show, the growth in the probability of transition from employment to unemployment over 2007-2009 was more significant for youth. The research on unemployment rate sensitivity to GDP growth confirms that age and gender impact the magnitude of Okun's coefficient (see for review Butkus et al. 2020). However, as far as we know, previous studies on Okun's law at the sectoral level do not take demographic characteristics into account.

The second contribution – contrary to earlier studies on sectoral Okun's Law, our paper examines the non-linear impact of sectoral growth on unemployment. Empirical evidence shows that overall unemployment is more sensitive to economic decline than to growth (see Novák and Darmo (2019) for the literature review). Still, there is little if no empirical evidence on how this conclusion holds when age- and gender-specific unemployment rates are regressed on GDP growth (Ahn et al. 2019, Butkus and Seputiene, 2019) or sectoral value-added growth.

We find that the output of all four sectors is significantly and negatively related to the changes in total unemployment. Our research confirms previous findings that unemployment is most affected by the changes in the service sector output and that after accounting for the sector's size, construction has the most significant impact on unemployment. Also, by using a specification to evaluate the reaction of unemployment over expansion and recession periods separately, we find that youth unemployment is the most sensitive during periods of economic downturn.

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

1. LITERATURE REVIEW ON THE OKUN'S COEFFICIENT AT THE SECTORAL LEVEL

Sectoral differences in responsiveness of the unemployment rate to output growth have received relatively limited academic attention. The lack of data on unemployment at the sectoral level is the main obstacle for the research on sector-specific Okun's Law. Arias-Vazquez et al. (2012), Loría and Salas (2014), Apap and Gravino (2017), Sánchez López (2019), Goto and Bürgi (2021) are among few who investigated how total unemployment responds to the output growth of a specific sector.

Arias-Vazquez et al.'s (2012) cross-country analysis provided little evidence that besides mining and utilities, growth in separate sectors significantly impacted changes in unemployment. Growth in the mining and utilities sector appears to harm labour markets by reducing employment and increasing unemployment. Analysis at a more aggregated level showed that the growth of high-productivity sectors is associated with an increase in the unemployment rate. In contrast, the development of low-productivity sectors significantly reduces unemployment.

Loría and Salas (2014) and Sánchez López (2019) applied the first-difference Okun's Law model to estimate the response of overall unemployment to output growth in the construction sector in Spain and tourism sector in Mexico, respectively. Loría and Salas (2014) included squared growth term in the model specification and found that growth rates above 7.38 % have a negative marginal impact on unemployment. Apap and Gravino (2017) showed that in Malta, output growth in the services sector has a more significant effect on both the total and youth unemployment rate than the growth in the manufacturing industry.

Goto and Bürgi (2021) applied the reported data on the previous occupation of the unemployed to allocate them to specific sectors and calculated sector-specific unemployment rates. With data for the US, the UK, Switzerland, and Japan, they estimated Okun's coefficients for various sectors. Point estimates for the manufacturing industry were higher than those for services across all countries, except Japan. Results showed that unemployment reacts strongly to output fluctuation in cyclical sectors, such as manufacturing, construction, wholesale and retail trade.

In the academic literature, the focus on age- and gender-specific unemployment sensitivity to economic growth has increased since the Great Recession. Empirical research (for the review see Butkus et al. 2020) clearly shows higher youth unemployment sensitivity to economic growth than that for adult, while the comparison of Okun's coefficient for males and females gives no consensus.

As far as we know, studies on age- and gender-specific unemployment elasticity to output do not consider assessments at the sectoral level. Apap and Gravino's (2017) research is one of the first attempts to investigate Okun's coefficient for youth in different sectors. The findings show that youth unemployment in Malta is more sensitive to output growth in services than in the manufacturing sector.

2. MODEL AND THE DATA

We generate estimates of the strength of the relationship between output growth and changes in the unemployment rate, using the difference version of Okun's Law (Okun, 1962) for a panel of countries:

$$\Delta U_{i,t} = \alpha + \beta \Delta Y_{i,t} + \theta_t + \Delta \varepsilon_{i,t}, (1)$$

where $\Delta U_{i,t}$ is the percentage point change of the unemployment rate in country *i* between period *t* and *t-1*. $\Delta Y_{i,t}$ is the percentage change of the real output between period *t* and *t-1*. β (usually referred to as the Okun's coefficient) shows the elasticity of the unemployment with respect to output. α shows the change in unemployment when there is no change in output. θ_t represents unobserved time-varying effects common to all countries which are modelled using time dummies, and $\Delta\varepsilon_{i,t}$ is the idiosyncratic error that changes over time and varies across countries. Since Eq. (1) is a first-differenced equation of an unobserved effects model, the unobserved country-fixed effects do not appear in Eq. (1) because they have been "differenced away".

We aim to examine how the heterogeneous growth in economic sectors are transmitted to changes in the unemployment rate by estimating a modified specification of Okun's equation. Following Anderton et al.'s (2014) disaggregation method used to disaggregate output growth by its expenditure components, and similar to Apap and Gravino (2017) we disaggregate output growth in terms of various economic sectors using the following approximation:

$$\Delta Y_{i,t} = \Delta \sum_{s=1}^{S} Y_{s,i,t} \approx \sum_{s=1}^{S} \frac{Y_{s,i,t}}{\sum_{s=1}^{S} Y_{s,i,t}} \Delta Y_{s,i,t}, (2)$$

where s represents four economic sectors: agriculture (*agr*), industry (*ind*), construction (*con*) and service (*ser*), $\Delta Y_{s,i,t}$ is the gross value-added growth in sector s.

Allowing for the parameter β to vary across sectors, Eq. (1) can then be rewritten as follows:

$$\Delta U_{i,t} = \alpha + \sum_{s=1}^{S} \beta_s \varphi_{s,i,t} \Delta Y_{s,i,t} + \theta_t + \Delta \varepsilon_{i,t}, (3)$$

where β_s measures the reaction of the unemployment to output growth in sector s. $\varphi_{s,i,t} = \frac{Y_{s,i,t}}{\sum_{s=1}^{S} Y_{s,i,t}}$ represents the time-varying share of sector s in the country's economy. Parameter $\beta_s\varphi_s$ shows the responsiveness of the unemployment with respect to an output change in each of the four sectors. Parameter β_s is the weighted β-coefficient. We get $\beta_s\varphi_s$ estimates by regressing unemployment change on output change in different sectors, i.e. $\Delta Y_{s,i,t}$, while β_s estimates are obtained by regressing on the weighted output change in different sectors, i.e. $\varphi_{s,i,t}\Delta Y_{s,i,t}$. Hereby, we can isolate the specific unemployment responsiveness (Anderton et al. (2014) as "unemployment intensity"), β_s, for the individual sector. Yet, the parameter $\beta_s\varphi_s$ is useful since it represents the individual "component elasticities", i.e. the proportional reaction of unemployment to the output changes in each sector. To put it simply, the parameter $\beta_s\varphi_s$ measures the responsiveness of the unemployment to a 1% change in the output of sector s.

Based on the results of empirical research that unemployment is more sensitive to negative rather than positive output change (see Novák and Darmo (2019) for the review) and to allow for the β to vary not just across sectors but over the business cycle as well we can re-specify Eq. (3):

$$\Delta U_{i,t} = \alpha + \sum_{s=1}^{S} \beta_{1,s} \varphi_{s,i,t} \Delta Y_{s,i,t} + \sum_{s=1}^{S} \beta_{2,s} \varphi_{s,i,t} \Delta Y_{s,i,t} d_{s,i,t} + \sum_{s=1}^{S} \gamma_s d_{s,i,t} + \theta_t + \Delta \varepsilon_{i,t}, (4)$$

where $d_{s,i,t}$ is a binary dummy equal to 1 when output in sector s is decreasing, i.e. $\Delta Y_{s,i,t}<0$, and 0 otherwise. Parameter $\beta_{1,s}$ shows the reaction of the unemployment to positive output growth (expansion) in sector s, whereas $\beta_{1,s}+\beta_{2,s}$ shows the reaction of the unemployment to output decrease (recession) in sector s.

We estimate our equations using ordinary least-squares with Newey-West standard errors to minimise the probability that heteroscedasticity and serial correlation could produce misleading results due to inefficient estimates with biased regular standard errors.

The panel covers 28 EU countries for the period of 1995-2019. The data is collected from Eurostat. Table 1 shows summary statistics of model variables.

Table 1. Summary statistics of variables

Variable		*Mean*	*S.D.*	*Min*	*Max*
UT	Total unemployment, %.	8.7	4.3	2.0	27.5
UM	Male unemployment, %.	8.4	4.3	1.7	25.6
UF	Female unemployment, %.	9.2	4.9	2.4	31.4
UY	Youth (15-24 years old) unemployment, %.	19.6	9.7	4.6	58.3
ΔY	Change in gross value added (all NACE Rev.2 activities) at constant (2010) prices, %	2.6	3.4	-15.2	25.7
ΔY_{agr}	Change in gross value added (agriculture, forestry and fishing NACE Rev.2 activity A) at constant (2010) prices, %	1.3	11.0	-45.9	54.6
ΔY_{ind}	Change in gross value added (industry NACE Rev.2 activities B-E) at constant (2010) prices, %	2.5	6.4	-20.9	80.9
ΔY_{con}	Change in gross value added (construction NACE Rev.2 activity F) at constant (2010) prices, %	2.2	10.0	-45.6	65.9
ΔY_{ser}	Change in gross value added (services NACE Rev.2 activities G-U) at constant (2010) prices, %	2.8	3.3	-27.9	18.2

3. ESTIMATES

Table 2 represents the estimates based on Eq. (3). On the left side of the table, $\beta_s\varphi_s$ show the change in the unemployment associated with a 1% increase of output in sector s. The results show that the output of all four sectors is significantly and negatively related to changes in total unemployment. In line with Apap and Gravino (2017), we find that unemployment is most affected by the output change in the service sector. Its increase by 1% reduces the total unemployment rate by 0.12 p. p. In part, this is related to the largest share of the service sector in the economy. A minor decrease in unemployment is associated with an output increase in the agriculture sector, resulting from the smallest share in the country's economy.

Table 2. Estimates of Eq. (3)

	$\Delta UT_{i,t}$	$\Delta UMi,t$	$\Delta UFi,t$	$\Delta UYi,t$	φ_s	$\Delta UT_{i,t}$	$\Delta UMi,t$	$\Delta UFi,t$	$\Delta UYi,t$
	$\beta_s\varphi_s$					β_s			
α	-0.05	0.06	-0.14	-0.03		-0.07	0.03	-0.15	-0.06
	(0.22)	(0.25)	(0.21)	(0.50)		(0.22)	(0.25)	(0.21)	(0.50)
$\Delta Y_{agr,i,t}$	-0.01**	-0.01**	-0.01*	-0.01	0.03	-0.19	-0.19	-0.17	-0.38
	(<0.01)	(<0.01)	(<0.01)	(0.01)		(0.12)	(0.14)	(0.12)	(0.28)
$\Delta Y_{ind,i,t}$	-0.03***	-0.03***	-0.03***	-0.07***	0.20	-0.08***	-0.10***	-0.07**	-0.18***
	(0.01)	(0.01)	(0.01)	(0.02)		(0.03)	(0.03)	(0.03)	(0.07)
$\Delta Y_{con,i,t}$	-0.04***	-0.05***	-0.03***	-0.07***	0.06	-0.59***	-0.70***	-0.49***	-1.15***
	(0.01)	(0.01)	(0.01)	(0.01)		(0.08)	(0.09)	(0.08)	(0.18)
$\Delta Y_{ser,i,t}$	-0.12***	-0.13***	-0.11***	-0.20***	0.71	-0.19***	-0.22***	-0.17***	-0.34***
	(0.02)	(0.02)	(0.02)	(0.05)		(0.03)	(0.03)	(0.03)	(0.06)
n	622	622	622	622		622	622	622	622
R^2	0.49	0.50	0.43	0.45		0.48	0.49	0.43	0.45

*, ** and *** represent the 90%, 95% and 99% levels of significance, respectively.

The value in the bracket represents Newey-West standard error.

All estimates include time dummies.

Comparing the impact of sectoral output on male and female unemployment, it can be seen that the output change in the agriculture sector reduces male unemployment. Still, its effect on female unemployment is statistically insignificant. It is mainly due to a higher share of male labour than female labour in this sector. The output of the industry and service sectors has a similar impact on unemployment for both men and women. The construction sector's output affects male unemployment much stronger than female unemployment since the construction sector usually employs more male than female. Output changes in the agricultural sector do not have a significant impact on youth unemployment. It could be related to the fact that only a small share of the young labour force works in this sector. Kharaishvili et al. (2017) show that young people are less involved in agricultural activities due to low wages in this sector and lack of motivation to study in this area since it is not prestigious among young people. The output changes in other sectors affect youth unemployment approximately twice as much as total unemployment. As Junankar (2016) states, most young people are employed in casual work or work on temporary contracts in the service or construction sectors. Also, it could be related to the lower level of education and skills of young people. As many employers are looking for skilled and experienced workers, young people are usually at the end of the employment queue. Görlich et al. (2013) state that the protection of young workers is generally lower. Besides, they are likely to have less experience; companies have invested less in their training, so the losses laying off young workers are smaller than an experienced adult worker.

The values of $\beta_s\varphi_s$ estimates depend on the share of the sector's output in total gross value-added. The higher weight of value-added in a sector is related to the more significant impact of that sector on the unemployment rate. Services account, on average, for the largest share of value-added (71%). The average weight of industry is 20%, while agriculture and construction is 3% and 6%, respectively. After

accounting for the sector's size, we found that output change in construction has the most significant impact on unemployment what is in line with Goto and Bürgi (2021), considering construction as a more cyclical sector which could lead to disproportionate job losses during recessions. It can be explained that this sector reacts strongly to output fluctuation. Thus, the unemployed can quickly enter this sector with minimal barriers. Besides, the construction sector is a labour-intensive industry. This sector has an almost three-times higher impact on overall unemployment than services and nearly six times bigger than the industry sector.

The change in construction output has a more significant impact on male than female unemployment. It can be explained by the fact that the construction sector is one of the most gender-segregated sectors where males constitute the most significant workers' share. We found that the construction output change effect on youth unemployment is particularly substantial. The output change in manufacturing and services affects youth unemployment almost twice as much as the overall unemployment. This could be related to the assumption that companies tend to lay off part-time young workers with less experience in the first place. Also, this sector is labour intensive and attracts an unskilled young labour force who dropped out of schools to enter the labour market. This is consistent with the previous research by O'Reilly et al. (2019) and Junankar (2016). We also estimated (see Table 3) the impact of sectors' output changes on unemployment separately for economic growth and downturn periods based on Eq. (4).

Table 3. Estimates of Eq. (4)

	$\Delta UT_{i,t}$	$\Delta UMi,t$	$\Delta UFi,t$	$\Delta UYi,t$	φ_s	$\Delta UT_{i,t}$	$\Delta UMi,t$	$\Delta UFi,t$	$\Delta UYi,t$
	Expansion ($\beta_{1,s}\varphi_s$)					*Expansion* ($\beta_{1,s}$)			
α	-0.37*	-0.31	-0.41*	-0.77		-0.47**	-0.43*	-0.48**	-0.90*
	(0.22)	(0.25)	(0.22)	(0.52)		(0.22)	(0.24)	(0.21)	(0.50)
$\Delta Y_{agr,i,t}$	-0.01	-0.01	-0.00	-0.00	0.03	-0.12	-0.15	-0.07	-0.32
	(0.01)	(0.01)	(0.01)	(0.01)		(0.15)	(0.17)	(0.15)	(0.36)
$\Delta Y_{ind,i,t}$	-0.02*	-0.02*	-0.01	-0.04*	0.2	-0.06**	-0.07**	-0.05*	-0.11
	(0.01)	(0.01)	(0.01)	(0.02)		(0.03)	(0.04)	(0.03)	(0.07)
$\Delta Y_{con,i,t}$	-0.02**	-0.02**	-0.02**	-0.03	0.06	-0.28***	-0.27**	-0.31***	-0.47*
	(0.01)	(0.01)	(0.01)	(0.02)		(0.11)	(0.12)	(0.11)	(0.25)
$\Delta Y_{ser,i,t}$	-0.07***	-0.08***	-0.06***	-0.11**	0.71	-0.10***	-0.12***	-0.08**	-0.16**
	(0.02)	(0.03)	(0.02)	(0.05)		(0.03)	(0.04)	(0.032)	(0.08)
	$\beta_{2,s}\varphi_s$					$\beta_{2,s}$			
$\Delta Y_{agr,i,t}$	-0.02	-0.02	-0.02*	-0.03	0.03	-0.13	-0.02	-0.33	0.09
	(0.01)	(0.01)	(0.01)	(0.03)		(0.32)	(0.36)	(0.32)	(0.75)
$\Delta Y_{ind,i,t}$	-0.01	-0.01	-0.02	-0.05	0.2	0.01	-0.04	0.05	-0.13
	(0.02)	(0.03)	(0.02)	(0.06)		(0.12)	(0.13)	(0.12)	(0.27)
$\Delta Y_{con,i,t}$	-0.04***	-0.05***	-0.02	-0.07**	0.06	-0.81***	-1.14***	-0.47**	-1.63***
	(0.01)	(0.02)	(0.01)	(0.03)		(0.22)	(0.25)	(0.22)	(0.51)
$\Delta Y_{ser,i,t}$	-0.24***	-0.32***	-0.17***	-0.52***	0.71	-0.39***	-0.48***	-0.30***	-0.79***
	(0.07)	(0.07)	(0.06)	(0.15)		(0.09)	(0.10)	(0.09)	(0.20)
	Recession ($\beta_{1,s}\varphi_s+\beta_{2,s}\varphi_s$)					*Recession* ($\beta_{1,s}+\beta_{2,s}$)			
$\Delta Y_{agr,i,t}$	-0.02**	-0.02**	-0.02**	-0.03	0.03	-0.25	-0.17	-0.40	-0.23
	(0.01)	(0.01)	(0.01)	(0.02)		(0.28)	(0.32)	(0.28)	(0.65)
$\Delta Y_{ind,i,t}$	-0.03	-0.03	-0.03	-0.10*	0.2	-0.05	-0.11	-0.00	-0.24
	(0.02)	(0.02)	(0.02)	(0.05)		(0.11)	(0.13)	(0.11)	(0.26)
$\Delta Y_{con,i,t}$	-0.06***	-0.07***	-0.04***	-0.10***	0.06	-1.10***	-1.41***	-0.77***	-2.11***
	(0.01)	(0.01)	(0.01)	(0.03)		(0.19)	(0.21)	(0.19)	(0.44)
$\Delta Y_{ser,i,t}$	-0.31***	-0.39***	-0.23***	-0.64***	0.71	-0.49***	-0.60***	-0.38***	-0.96***
	(0.06)	(0.07)	(0.06)	(0.14)		(0.08)	(0.09)	(0.08)	(0.19)
n	622	622	622	622		622	622	622	622
R^2	0.54	0.56	0.47	0.50		0.55	0.57	0.48	0.50

*, ** and *** represent the 90%, 95% and 99% levels of significance, respectively.

The value in brackets represents Newey-West standard error.

All estimates include time and business cycle dummies

During the periods of expansion, the service and construction sectors significantly impact total, male and female unemployment. However, the estimated difference between male and female during expansion periods is insignificant, as the confidence intervals (not presented here) overlap. This was also confirmed in the research of Butkus et al. (2020), who state that the reaction of females and males is the same over the periods of expansion.

After eliminating the influence of the industry size, we found that changes in the agricultural output do not significantly affect unemployment. An increase of output in the service sector reduces unemployment approximately three times more than the increase in the construction output.

Youth unemployment during expansion is reduced only by the growth of output in the service sector what is in line with Apap and Gravino (2017), who also confirm a stronger reaction of youth unemployment to output changes in the service sector. Our findings are consistent with the results of other studies (Marconi et al. 2016; Dixon et al. 2017; Dunsch 2017; Apap and Gravino, 2017; Zanin 2018; Ahn et al. 2019; Butkus and Seputiene 2019) confirming stronger reaction of youth unemployment to output changes compared with other age groups.

After eliminating the influence of the sector size, we found that total unemployment is most strongly affected by the output growth of the construction sector due to high labour intensity in this industry.

During the recession periods, unemployment is significantly affected only by the output changes in the construction and service sectors, and the impact on the latter is much more significant. Estimates $\beta_{1,s}\varphi_s+\beta_{2,s}\varphi_s$ show that a 1% decrease of output in the service sector increases unemployment by 0.31 p. p. The results are in line with Apap and Gravino (2017). They confirm a more substantial impact of output changes related to the crucial role of the service sector in attracting new entrants to the labour market and the immediate impact when new workers are laid off firstly. Studies, which estimate higher Okun's coefficients for men than women (Brincikova and Darmo 2015; Dunsch 2016) associate this finding with higher male representation in building or construction sectors that are more dependent on the state of the economy compared to the services sector. Our results confirm that changes in the construction sector's output during the downturn affect male unemployment almost twice as strong as female unemployment. The impact is significantly higher than that of services.

The most sensitive to a decrease in the output of the construction and services sectors is youth unemployment. This is in line with previous findings of O'Reilly et al. (2019) and Butkus et al. (2020). O'Reilly et al. (2019) conclude that the steepest falls in youth employment during the Great Recession were associated with young men's exposure to the volatility in the construction sector across European countries. Butkus et al. (2020) estimate higher sensitivity of youth unemployment to a negative output change. This could be explained by the fact that young people were more laid off during the recession as they are usually less skilled and experienced compared with older workers.

After eliminating the influence of the size of the sector, we found that output decrease in the construction sector has the most significant impact on unemployment during the recession. Its decline increases the total, male, female and youth unemployment twice as much as the output decrease in the service sector. The output decrease in the construction sector has a twice more effect on the male unemployment increase than female unemployment but the estimated difference between male and female during recession periods is insignificant, as the confidence intervals (not presented here) overlap. During the recession, this sector has the most significant impact on youth unemployment, which is higher than the impact on total, male and female unemployment and higher compared to expansion periods.

CONCLUSION

Extensive empirical research investigates the output elasticity of the unemployment rate, its variation over time and across countries. However, there is a lack of research analysing the variation of the growth-unemployment relationship across economic sectors, especially considering gender and age characteristics and business cycles. Several studies estimate the response of overall unemployment to output growth covering one country and one sector. Still, they do not take the age or gender of the unemployed into account.

Our research provides several contributions to the limited literature on unemployment sensitivity to sectoral output growth. First, we investigate the effect of output growth on age- and gender-specific unemployment rate in main economic sectors, namely manufacturing, services, construction, and agriculture. The second contribution is related to examining the non-linear impact analysis of the sectoral economic growth on unemployment, including the phase of the business cycle (recession or expansion).

We find that unemployment is most affected by the output change in the service sector. A minor decrease in unemployment is associated with an output increase in the agriculture sector, resulting from the smallest share in the country's economy. The output change in the agriculture sector reduces male unemployment, whereas its effect on female unemployment is statistically insignificant. The output of the industry and service sectors has a similar impact on unemployment for both men and women. The construction sector's output affects male unemployment much stronger than female unemployment.

Measuring the response of age-specific unemployment to the growth of the sectoral output, we found that the output changes in service, industry and construction sectors affect youth unemployment approximately twice as much as total unemployment. Only the output changes in the agricultural sector do not have a significant impact on youth unemployment.

The higher weight of value-added in a sector is related to the more significant impact of that sector on the unemployment rate. After accounting for the sector's size, we found that output change in construction has the most significant impact on unemployment. This sector has an almost three-times higher impact on overall unemployment than services and nearly six times bigger than the industry sector. The change in construction output has a more significant impact on male than female unemployment. We found that construction output change effect on youth unemployment is particularly substantial. The output change in manufacturing and services affects youth unemployment almost twice as much as the overall unemployment.

Estimating the impact of sectors' output changes on unemployment separately for economic growth and downturn periods, we found that during the expansion, the service and construction sectors significantly impact total, male and female unemployment. However, the estimated difference between male and female during expansion periods is insignificant. Youth unemployment during expansion is reduced only by the growth of output in the service sector. During the recession periods, unemployment is significantly affected only by the output changes in the construction and service sectors, and the impact of the latter is much more significant. The most sensitive to a decrease in the output of the construction and services sectors is youth unemployment.

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