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The impact of minimum wage increases on unemployment in the V4 countries: Assessing the recommendations of the European Commission

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Abstract. The European Commission has recently implemented legislative measures to improve worker protection through an adequate minimum wage set by national laws or collective agreements. A recommended benchmark for minimum wage calculation is 60% of the gross median wage or 50% of the mean wage. However, the Kaitz index, a ratio indicator, shows lower values in most EU countries, raising concerns about potential negative impact on the labour market. This study aims to identify the impact of the Kaitz index and several other selected variables on unemployment in the V4 countries. Using multiple linear regression, we concluded that the Kaitz index's growth does not uniformly impact unemployment in the V4 countries. Specifically, in Slovakia and the Czechia, the Kaitz index growth appeared to increase unemployment, in line with neoclassical economic theory. In contrast, Hungary and Poland did not register significant effects. Gender differences were also noted, with the Kaitz index affecting female unemployment in the Czechia and Hungary, and male unemployment in Slovakia. The research results suggest that increasing the minimum wage in the V4

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countries is feasible if its growth rate is higher than that of unemployment benefits and the living minimum, but lower than the average wage growth, and if it is supported by economic growth.

Keywords: unemployment, minimum wage, average wage, Kaitz index, V4 countries.

JEL Classification: A13, C32, C51, E24, J38, J64

1. INTRODUCTION

The minimum wage (MW) is central to labour market policy as a tool used to reduce income inequality and poverty (Detragiache et al., 2020). It is on the current agenda at European Union (EU) level. In 2020, the European Commission (EC) issued a proposal for a directive on adequate MW in the EU, which aligns with the principles of the European Social Pillar and is included in the Strategic Agenda for 2019-2024.

The MW is considered the minimum remuneration, set by law or collective agreement that an employer must pay for work during a given period (The European Parliament and the Council of the European Union, 2022). The aim of the EC is to ensure adequate MWs by adopting stable and clear criteria designed to guide the setting and updating of statutory standards in line with national procedures and to support collective bargaining on wage setting. Article 5(4) of the Directive (The European Parliament and the Council of the European Union, 2022) stipulates that Member States 'shall use indicative reference values to guide their assessment of the adequacy of statutory MWs. To that end, they may use indicative reference values commonly used at the international level, such as 60% of the gross median wage and 50% of the gross average wage (AW), and/or indicative reference values used at the national level'. Thus, the Directive de facto establishes a double 'decency threshold' below which no MW should be set. Although this threshold is not legally binding, it represents a strong normative benchmark for national MW setting. Member States have until 15 November 2024 to transpose the Directive into national law, but recent developments in various EU countries indicate that even before its transposition the Directive is already influencing national MW setting and political debates on national reforms to ensure compliance with the Directive's objectives. However, the setting of the MW remains fully within the competence of EU member states.

Differences in the setting of MW levels across EU countries may have different labour market implications. Economists have been studying this issue for almost a century, but the results remain inconsistent. MW systems are globally heterogeneous, with many different policy approaches to achieve their effective application. Some countries have implemented simple systems that apply a single MW to all employees, while others have more complex systems with multiple rates according to the sector of activity, occupation, or geographic region (Jiménez Martínez & Jiménez Martínez, 2021). If the MW is set inadequately, it is possible to observe effects contrary to the purpose for which it was created. If the setting level is too low, the MW will have little impact on worker protection, but if it is too high, the MW will be insufficiently respected or have adverse effects on labour demand and the quality of employment (ILO, 2016). An increase in the MW can affect the general distribution of wages and, due to spillover effects, may affect more people than just those who receive it (Redmond et al., 2021). The role of MW in stimulating firm productivity has also been identified. Higher wage costs may force companies to use more capital-intensive forms of production, implement organizational changes, or invest more in training (Riley & Bondibene, 2017; Habánik et al., 2021; Samoliuk et al., 2021).

In economic theory, three main theories describe the relationship between the MW and the labour market (Gavroglou, 2013; Karamanis et al., 2018; Karamanis & Naxakis, 2014). First, neoclassical economic theory suggests that by mandating a price floor above the equilibrium wage, the MW law should cause unemployment (Gouider, 2022), in other words, the price of labour and the quantity of labour have an

inverse relationship. Second, variations of the neoclassical theory under the alternative concession of monopsony in the labour market suggest that the introduction of a MW rate contributes to the proper functioning of the market and economy, thus increasing total employment. Third, the Keynesian approach suggests that the introduction of a MW rate tends to increase the prices of products while the effect on the level of employment is ex ante undefined. The neoclassical economic theory predicts unemployment from MW laws. They argue that setting a MW (price floor) above the market equilibrium wage disrupts the balance between supply and demand for labour. In simpler terms, a higher "price" for labour leads to a lower "quantity" of labour demanded (fewer jobs). However, some neoclassical theory variations acknowledge monopsony power in some labour markets. In such cases, a MW can improve market efficiency by curbing exploitation, potentially leading to higher overall employment. Keynesian economics takes a different stance. They suggest that a MW might raise product prices, but the effect on employment is uncertain beforehand (ex-ante). The overall impact depends on various factors within the economy.

Most empirical studies suggest a small, albeit negative, impact on employment. Jiménez Martínez & Jiménez Martínez (2021), authors of a meta-analysis covering more than 588 studies over the last 120 years, report a possible negative publication bias in developed countries. In high-income countries, most studies find that employment effects are too small to be observed in aggregate employment statistics. A 2018 EU panel study covering 18 countries found an elasticity of around -0.05 for the impact of the MW on the overall employment rate of the working-age population (European Commission, 2018). Other studies that have confirmed the negative impact of the MW on employment in a broad sample of countries include, for example, Kim & Lim (2018) and Paun et al. (2021). Nolla Sabaret (2022) examined the issue using the case of Spain, where OLS estimates show that MW increases have a negative impact on employment when they are not accompanied by a proportional increase in the AW. Conversely, when the MW is increased at the same rate as the AW, the employment effects turn out to be positive. For women, OLS estimates show that the effects are indeed different for the female population but not negative.

There are also studies that report positive employment effects of MW increases (Holtemöller & Pohle, 2020). MW growth reduces job creation and the demand for unskilled labour (Chu, Kou, and Wang, 2021), but at the same time, over time, it can reduce the selectivity of firms, promote increased job search (Gavrel, Lebon & Rebière, 2010), or increase worker productivity (Owens and Kagel, 2010; Mishchuk et al., 2021). Jiménez Martínez & Jiménez Martínez (2021) have shown that the outcomes of MW impacts depend mainly on the selection of the sample surveyed. For developing countries, Neumark and Corella (2021) find that heterogeneity is systematic, with the estimated employment effects of MW being more consistently negative in studies with relatively more features for which institutional factors and the competitive model more strongly predict negative effects. They can be strengthened by the labour market fluctuations caused by migration and demand for labour (Kersan-Škabić & Blažević Burić, 2022; Urbański, 2021). Karamanis et al. (2018) use the case of Greece to show the lack of a clear link between the evolution of the MW and unemployment and attribute a significant impact on the labour market to other factors in the Greek economy.

Existing theories as well as scholarly studies suggest that the impacts of MW on the labour market can vary significantly depending on the country under study. The question is therefore whether the European Commission's mandatory adjustment of the MW to 60% of the AW will negatively affect the EU labour market, given the heterogeneity of the Member States' labour markets. Applying the neoclassical view, this would mean that there may be countries in the EU where an increase in MW will cause an increase in the unemployment rate under ceteris paribus conditions. For this reason, the present study aims to identify the effects of MWs on unemployment in the V4 countries, which form a long-standing economically cooperative grouping, although their approach to MW formation is different. For a more in-depth analysis, the gender factor has also been taken into account for the selected countries.

2. LITERATURE REVIEW

There are now enough studies available that address the issue at the level of some of the V4 countries (Majchrowska & Zółkiewski, 2012; Soukup et al., 2018; Chytil & Frejlich, 2020; Sikora, 2021). These studies either focus on individual countries or include these countries in groups of EU or OECD countries analyzed (Kim & Lim, 2018; Sturm, 2018; Paun et al., 2021). However, there is a dearth of studies examining the impact of MW on unemployment at the V4 countries level (Nedomlelová et al., 2017; Jašová & Kadeřábková, 2021; Fialová & Mysíková, 2021; Gonos et al., 2023; Farkačová et al., 2023). To a greater extent, studies focus on the relationship between MW and employment.

In their paper, Kim & Lim (2018) examined the correlation between MW and employment in a sample of 25 OECD countries (including all V4 countries) over the period 2000 to 2014. Based on their analysis, the authors found that a 10 percent increase in the MW reduces labour demand by 0.7 percent and increases the unemployment rate by 0.64 percent. Thus, if the minimum hourly wage increases from $10 to $15, their model predicts an approximately 3 percent increase in the unemployment rate. Paun et al. (2021) examined the relationship between the MW and employment dynamics, focusing particularly on the most vulnerable groups of workers (young people, women, and the elderly). The authors conducted the analysis on panel data from 22 countries (selected EU countries including V4 countries, Australia, and Turkey) for the period 1999 to 2016. The authors' results confirmed the expected negative impact of the MW on total employment, youth employment, and female employment. However, they did not confirm a negative impact on older people aged 55-64. Sturm (2018) examined the impact of MW rates on the employment of low-skilled women and young people in OECD countries over the period 1997-2013. The findings provide little evidence of substantial impacts on unemployment for the groups studied. The estimated employment elasticities are small and statistically insignificant.

In the case of the Czechia, one notable study is the research by Soukup et al. (2018). The authors conducted a panel regression using annual data and individual sectors of the economy as cross-sectional variables. They examined the impact of the MW on three aspects - value added, productivity, and employment—which acted as explanatory variables in their models and chose real MW and lagged aggregate gross value added as explanatory variables. Their economy-wide results show that an increase in the MW does not have a statistically significant effect on value-added growth but has a negative effect on employment and a positive effect on labour productivity. Other authors have also investigated the impact of MW on the Czech economy, but their findings do not show a statistically significant impact of MW increases on unemployment, e.g., Pavelka et al. (2014), Pícl & Richter (2014). The same conclusions were reached by Chytilová & Frejlich (2020), who examined the effect of MW along with other exogenous variables on the unemployment rate for the period 2006 to 2018. Over a more narrowly defined period, the effect on female unemployment was positive, while the effect on male unemployment was not statistically significant. The authors, therefore, conclude that it is appropriate for the real MW to grow more slowly than real wages.

In Slovakia, this issue is addressed in a study by Hidas and Žúdel (2016) from the Institute of Financial Policy. Using a cross-sectional analysis of year-on-year data over the period 2008-2014, the authors confirm that while MW increases are statistically significant, they have little year-on-year impact on employment in Slovakia. They also conclude that the MW may have a greater impact on younger workers relative to older workers, and its impact is greater in poorer counties relative to Bratislava. Ondruš et al. (2017) argue that in Slovakia's context, MW increases, combined with tax instruments that increase net income, lead to a reduction of social disparities in the country, and the government should take such steps during times of boom and labour productivity growth. Zeman (2018) analyzed unemployment in Slovakia in the period 1998-2016 and discusses the negative impact of MW increases on the labour market. He concludes that in

regions where the ratio between the MW and the AW is higher, the MW restricts job creation more significantly than in more economically advanced regions.

The labour market in Hungary was tracked in a study by Harasztosi and Lindner (2019). The authors provide a comprehensive assessment of how firms have absorbed the large and persistent MW increase in Hungary. The results showed that about 75 percent of the MW increase was paid by consumers and 25 percent by firm owners. The authors found that firms responded to the MW by substituting capital for labour and that the effects on unemployment were larger in sectors where the pass-through of wage costs to consumers is more complex. To explain these findings, they estimate a model with monopolistic competition. Hungary is one of the countries with a high MW share of AWs.

In Poland, MW gained great importance at the end of 2019, when the government declared a relatively rapid increase in MW for the following years (Cieślak-Wróblewska & Roguski, 2019). The impacts of MW in Poland are tracked by Siroka (2021). Using the Toda-Yamamoto approach and quarterly data covering 2002-2019, Granger causality between the Kaitz index and selected labour market indicators is examined. The results suggest the presence of unidirectional Granger causality between the Kaitz index and the general unemployment rate. For the other indicators examined, including the employment rate and youth unemployment, similar relationships are not reported.

For the V4 countries, a study by Nedomlelová et al. (2017), who investigated the issue using regression analysis, is also available. The results of their study confirm that an increase in the MW causes an increase in employment and unemployment rates, but only in Poland. The hypothesis that an increase in the MW causes GDP growth was refuted for all V4 countries.

Jašová & Kadeřábková (2021) are among a group of economists who have provided evidence of a positive impact of the MW on selected labour market indicators. In their study, they analyzed the effect of MW changes on unemployment duration, average hours worked, temporary unemployment by education, and employment by occupation and education. They conducted their research on the V4 countries for the period 2000 to 2016. Only low sensitivity was found when examining the overall magnitude of MW effects on selected labour market indicators in the Czechia and Hungary. In Slovakia and Poland, MW effects were very weak. Positive effects of the MW on selected labour market indicators were somewhat more often confirmed than negative ones. Similar findings regarding the links between unemployment and average wages are obtained by Remeikiene, & Gaspareniene (2021).

Fialová & Mysíková (2021) focus on the impact of MWs on youth employment in the V4 countries. Their analyses are based on a regional panel dataset for the period 2003-2016. The results suggest that changes in MWs, measured as a ratio of regional AWs, have not negatively affected youth employment rates in the Visegrad Four countries at the national level. However, detailed analyses suggest that changes in the ratio of minimum to AWs may have dampened regional youth employment in Hungary in 2008-2011, in the Czechia in 2003-2007, and in several regions in Poland and Slovakia over the entire sample period.

3. METHODOLOGY

The aim of the present study is to identify the impact of MW on unemployment in the V4 countries using multiple linear regression models. Annual data from the Visegrad Group countries - Slovakia, Czechia, Hungary, and Poland - covering the period 2000-2022 are analysed. The data sources are Eurostat, OECD, and the statistical offices of the V4 countries. The study also investigates the impact of gender on unemployment trends in the selected countries, leading to the construction of 12 separate models for each country that track the impact of selected variables on the unemployment rate (UR) (total, female, male). Multiple linear regression models and testing were conducted in R.

The choice of explanatory variables is based on previously published studies that use a more recent perspective to track the impact of MW on unemployment. Thus, the model does not directly incorporate the value of MW, but rather uses ratio variables expressing the relationship of MW to AW and the living minimum (LM). Table 1 presents an overview of the variables with anticipated impact on unemployment.

Table 1

Key variables in the models and their expected impact

Explained variable	**Abbreviation**	
Unemployment rate (total)	UR_t	
Unemployment rate (women)	UR_w	
Unemployment rate (men)	UR_m	
Explanatory variables	**Abbreviation / Relation**	**Anticipated impact**
Kaitz index (total)	Kaitz_t = MW_t/AW_t	+
Kaitz index (women)	Kaitz_w = MW_w/AW_w	+
Kaitz index (men)	Kaitz_m = MW_m/AW_m	+
Share of the living minimum in MW	LI = LM/MW	+
GDP growth rate	GDP	-
Inflation	I	-
Social transfers in unemployment	ST	+
Unemployment rate with primary education	ER	+

Source: own elaboration.

The Kaitz index represents the relationship between the MW and the gross AW at the country level and provides detailed information on the redistributive policies that countries are implementing. It can also be expressed in terms of the relationship between MW and the median wage, as suggested by the European Commission's Directive on adequate MW. Modifications with the level of the wage net of contributions or the level of inflation are also known. In the case of tracing the effects of MW on unemployment, it has been shown that using the AW in the denominator does not change the direction of the Kaitz index. On the other hand, median values are not affected by outliers, as is the case with average values, so they may provide a better indicator for empirical analysis (Chytilová & Frejlich, 2020). For the purposes of this study, the Kaitz index was calculated uniformly as a proportion of MW to the mean wage. The study expects a positive impact of the growth of the Kaitz index on unemployment, as reported by the neoclassical approach to the MW, confirmed by Aaronson and Frenche (2007) and Sikora (2021).

The variable LI represents the share of the living minimum and MW. The further the value of the MW is from the living minimum in the positive direction, the more motivated people are to work (Pollin, 2007). Fabo and Belli (2017) share this view, although they add that in the V4 countries the level of the living minimum relative to the MW is too low. The model assumes that as the share of the MW in the living minimum, unemployment decreases.

In the case of GDP growth, there should be a negative correlation between the unemployment rate and the GDP growth rate, as expressed by Okun's law. This is confirmed by the results of Pavelka et al. (2014), Pícl & Richter (2014), and Chytilová & Frejlich (2020). The model assumes that unemployment decreases as the GDP growth rate increases.

The inflation rate I is expressed using the Harmonised Index of Consumer Prices. Unemployment support (ST) is expressed as annual government expenditure on unemployment benefits. The unemployment rate with primary education (ER) has already been shown to be a significant variable in the studies of Herr et al. (2009) and Neumark et al. (2014). The unemployment rate with primary education ER represents the share of people with primary education in the total number of unemployed.

Pícl and Richter (2014) argue that the more people with only primary education, the harder it will be for them to find employment, worsening the unemployment problem.

The final model is specified as follows:

$$UR_{t,i,j} = \beta_0 + \beta_1 Kaitz_{t,i,j} + \beta_2 LI_{t,i,j} + \beta_3 GDP_{t,i,j} + \beta_4 I_{t,i,j} + \beta_5 ST_{t,i,j} + \beta_6 ER_{t,i,j} + \varepsilon_t \quad (1)$$

Where t – time, i – country, j – sex.

The initial step of the model involved verifying stationarity using the KPSS test, supplemented by the Dickey-Fuller test with a constant term. The test results indicated the presence of a unit root in all-time series. Consequently, the first differences of the series were employed for subsequent analysis. The final model has the following shape:

$$\Delta UR_{t,i,j} = \beta_0 + \beta_1 \Delta Kaitz_{t,i,j} + \beta_2 \Delta LI_{t,i,j} + \beta_3 \Delta GDP_{t,i,j} + \beta_4 \Delta I_{t,i,j} + \beta_5 \Delta ST_{t,i,j} + \beta_6 \Delta ER_{t,i,j} + \varepsilon_t \quad (2)$$

Where t – time, i – country, j – sex.

In the final models, the Breusch-Pagan test was employed to assess for heteroskedasticity. Additionally, the Jarque-Bera test was utilized to evaluate the normality of residuals, and the Durbin-Watson test was conducted to examine autocorrelation within the random components.

4. EMPIRICAL RESULTS

This study investigates the influence of the MW on unemployment across various categories. Firstly, four distinct models are constructed to analyse the impact of chosen variables on overall unemployment. Subsequently, the effect of gender-adjusted variables on unemployment rates specific to females and males within these countries is examined.

4.1. Development of the Kaitz index in the V4 countries

The Kaitz index exhibits sensitivity to the way of its calculation. As illustrated in Figure 1, the index value is primarily determined by the form of the input data. Two common formulations are presented: the ratio of the MW to the average (mean) wage and the ratio of MW to the median wage.

The 2020 EU Directive on Adequate MWs establishes benchmarks for the Kaitz index, recommending a minimum of 60% of the gross median wage and 50% of the gross AW. During the review period, none of the V4 countries achieved these recommendations on both indicators.

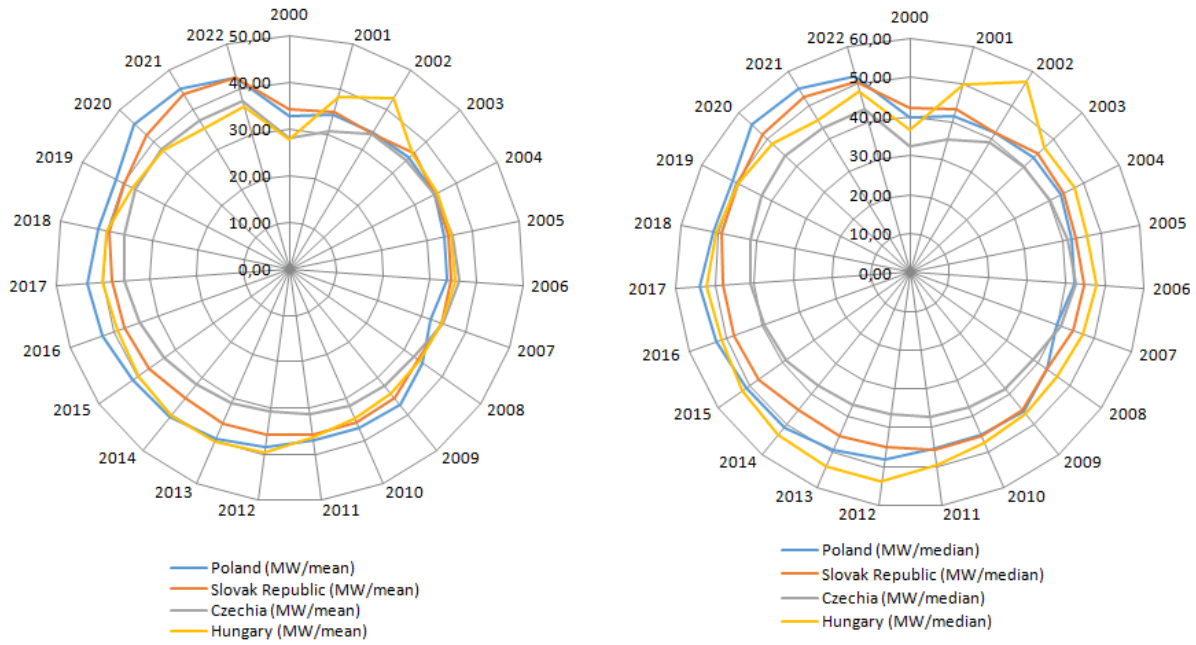

Figure 1. Development of the Kaitz index mean and Kaitz index median for the V4 countries in 2000-2022 (%)

Source: own elaboration based on Eurostat data

Particularly concerning is the stagnant growth rate of the Kaitz index in both formulations. Over the 2001-2022 period, the average growth rate is a meagre 0.013 with minimal variation across countries (Appendix Table A). To comply with the recommendations of the EU Directive, a substantial increase in MWs is necessary in each V4 country. This increase should be implemented gradually over time to mitigate potential negative impacts on the labour market. Table 2 presents the recalculated MWs based on the 2022 EU criteria, alongside the actual MWs approved for 2024.

Table 2

Real and estimated MW in the V4 countries

Indicator	Poland	Slovakia	Czechia	Hungary
Kaitz (mean) 2022	42.60%	42.60%	37.30%	36.30%
Kaitz (median) 2022	52.10%	50.10%	43.30%	48%
Real MW 2022	655.00 €	646.00 €	652.00 €	542.00 €
MW (50% mean) estimate 2022	768.00 €	757.00 €	873.00 €	746.00 €
MW (60% median) estimate 2022	754.00 €	763.00 €	903.00 €	677.00 €
MW 2024	978.00 €	750.00 €	764.00 €	697.00 €
Annual growth MW (2023/2024)	21.50 p.p.	7.10 p.p.	9.20 p.p.	15p.p.

Source: own elaboration based on Eurostat data

Table 2 highlights the shortfall in MW levels in all V4 countries in 2022 compared to the recommended levels outlined in the adopted Directive. Significant increases in MWs are already visible in 2024 compared to the previous year, particularly in Poland (21.5 p.p.). Here, the recommended value of the Kaitz index is expected to be met by 2024. Hungary has also seen an annual increase of 15 p.p., and its MW in 2024 surpasses the estimated level for 2022. The Czechia, with a 9.2 p.p. annual increase in 2024, has not yet reached the MW level calculated for 2022. This indicates that the growth of the MW will likely approach the recommended threshold gradually. Slovakia has increased its MW by 7.1 p.p. and has committed to a

further increase to reach 60% of the relevant wage level from two years ago. All V4 countries have demonstrably taken steps towards achieving significant MW growth, aligning themselves with the EC Directive.

The measurement of the Kaitz index and the fulfilment of the limits in practice remains questionable. Real progress towards the recommended limit can only be determined retrospectively, at a time when median or mean wage values are known. Governments or the tripartite can work with the previous year's data, which means that the real setting and approval of the MW, which happens at time t (e.g. 2024), for year t+1 (e.g. 2025), is thus based on the median or mean wage data for the last known period t-1 (e.g. 2023). If states want to get as close as possible to the recommended threshold they would have to base their predictions on the input variables.

It is crucial to consider regional disparities when evaluating the Kaitz index. Lower Kaitz index values tend to be observed in wealthier regions, where the centrally set MW represents a smaller proportion of the AW and unemployment rates are lower. Conversely, poorer regions already exhibit a high Kaitz index, often accompanied by higher unemployment compared to richer regions. Consequently, vulnerable populations such as women, young people, and older workers may potentially face greater challenges in the labour market due to the impact of MW growth. For this reason, the rate of MW increase should be contingent upon a sufficient rate of growth in the AW and should also account for developments in regions with high unemployment.

4.2. Impact of variables on total unemployment in the V4 countries

Multiple linear regression models were estimated for each V4 country. Diagnostic tests revealed the presence of autocorrelation in the models. To address this issue, robust estimators were employed, ensuring the validity of the results presented in Table 3.

Table 3

Estimation of the overall model for the V4 countries

Country /Indicator	**Slovakia**		**Czechia**		**Hungary**		**Poland**	
	ß	p-value	ß	p-value	ß	p-value	ß	p-value
Intercept	-0.0148	0.0472	-1.4235	0.0005	-0.9541	0.4027	1.0875	0.3325
ER	**1.0749**	**5.51E-11**	**0.7514**	**0.0247**	**1.0327**	**9.54E-16**	**1.0604**	**7.01E-15**
GDP	**-0.0292**	**0.0385**	**-0.0105**	**0.03069**	**-0.0261**	**0.0188**	**-0.072**	**0.0362**
ST	0.006	0.4482	**0.0006**	**4.82E-05**	**0.0012**	**0.0084**	-0.0009	0.0942
I	0.0015	0.8244	**0.0393**	**0.0171**	0.0173	0.5333	**0.0612**	**0.0431**
Kaitz_t	**2.0910**	**0.0082**	**0.0439**	**4.33E-06**	0.0209	0.4220	-0.0150	0.5081
LI	-0.0702	0.2478	**1.8595**	**8.84E-06**	0.0542	0.9488	3.7590	0.0946
R2	**0.9926**		**0.9969**		**0.9955**		**0.9926**	

Source: own elaboration.

Table 3 reveals several statistically significant variables at the 5% significance level. Notably, the effects of the MW on unemployment in the V4 countries are evident in Czechia and Slovakia, where a positive correlation between the Kaitz index and unemployment is observed. The ratio of the minimum subsistence wage to the AW was not statistically significant only in the Czechia. The model demonstrates that economic downturns, as indicated by falling GDP, lead to rising unemployment in all V4 countries. Furthermore, primary education level was found to be statistically significant for unemployment across the Visegrad region, suggesting that lower educational attainment contributes to unemployment growth. Interestingly, social transfers were found to contribute to higher unemployment rates in Czechia, Hungary, and Poland, suggesting that an increase in these benefits may lead to an increase in unemployment.

4.3. Impact of variables on unemployment in the V4 countries by gender

The impact of the selected variables was further assessed by estimating separate models for the unemployment rates of females and males (Table 4 and 5). The gender-specific models necessitated the use of distinct input variables. Specifically, both the dependent variable (UR-w or UR_m) and the independent variables (Kaitz_w or Kaitz_m]) were differentiated. This distinction is crucial due to existing gender disparities in AWs, which disadvantage females. Mathematically, this translates to a consistently higher Kaitz index for women compared to men, as the MW represents a larger proportion of their AW.

Table 4

Overall model estimation for V4 countries for women

Country /Indicator	Slovakia W		Czechia W		Hungary W		Poland W	
	ß	p-value	ß	p-value	ß	p-value	ß	p-value
Intercept	0.0087	0.6426	-1.6892	0.0007	-4.3762	0.0126	1.4069	0.2907
ER	**0.4528**	**1.31E-12**	**0.7655**	**6.358E-13**	**0.5058**	**1.095E-17**	**0.5510**	**1.86E-10**
GDP	**-0.0025**	**0.0265**	-0.0060	0.6788	00162	0.1060	**-0.0977**	**0.0218**
ST	-0.2227	0.2839	**-0.0008**	**0.0004**	**0.0015**	**0.0022**	**-0.0014**	**0.0151**
I	-0.9624	0.0653	0.0348	0.2909	-0.0350	0.1037	**0.1021**	**0.0019**
Kaitz_w	-0.0476	0.5059	**0.0600**	**0.0003**	**0.1026**	**0.0064**	-0.0143	0.5298
LI	-0.1284	0.7820	**2.1681**	**0.0005**	-1.5224	0.0529	4.0108	0.0865
R2	**0.9160**		**0.9976**		**0.9942**		**0.09973**	

Source: own elaboration.

Table 5

Overall model estimation for V4 countries for men

Country /Indicator	Slovakia M		Czechia M		Hungary M		Poland M	
	ß	p-value	ß	p-value	ß	p-value	ß	p-value
Intercept	-0.0378	0.0734	-0.6185	0.2260	5.8162	0.042E-18	0.4225	0.6334
ER	**0.4499**	**8.43E-08**	**0.7338**	**1.547E-11**	**0.6900**	**1.447E-18**	**0.6262**	**3.027E-11**
GDP	**-0.0044**	**0.0026**	-0.0129	0.4266	**-0.0467**	**0.0009**	-0.0603	0.0835
ST	0.0104	0.6949	-0.0002	0.1636	**-0.0016**	**0.0069**	-0.0011	0.1007
I	-0.4899	0.4167	0.0426	0.1773	0.0112	0.4476	-0.0101	0.7392
Kaitz_m	**1.0872**	**0.0024**	0.0147	0.2309	-0.1026	0.0773	0.0082	0.6193
LI	-0.0411	0.5011	**1.2239**	**0.0348**	0.5886	0.1251	4.605	0.1209
R2	**0.8957**		**0.9911**		**0.9942**		**0.9980**	

Source: own elaboration.

Gender-based disparities were identified when comparing the effects of selected variables on unemployment. Across all V4 countries, both models confirmed a positive correlation between the number of individuals with primary education and unemployment rates for both men and women. The impact of the Kaitz index on female unemployment was statistically significant and positive in Czechia and Hungary. In these two countries, an increase in the Kaitz index (indicating a rise in the MW while holding the AW constant) is associated with an increase in unemployment for females. For males, a positive effect on unemployment was only observed in Slovakia, while the effect on female unemployment in Slovakia was positive but not statistically significant. The ratio of the minimum subsistence level to the MW had a positive and statistically significant effect on unemployment growth for both women and men in Czechia. This effect was not statistically significant in the other V4 countries.

Table 6 summarizes the key findings of the analysis, including a comparison of the anticipated and calculated impacts of the variables on unemployment in the V4 countries.

Table 6

Anticipated and calculated impact of variables on the unemployment rate in V4 countries

Indicator	Anticipated impact	Calculated impact											
		Slovakia			Czechia			Hungary			Poland		
		T	W	M	T	W	M	T	W	M	T	W	M
ER	+	+	+	+	+	+	+	+	+	+	+	+	+
GDP	-	-	-	-	-	x	x	-	x	-	-	-	x
ST	+	x	x	x	+	-	x	+	+	-	x	-	x
I	-	x	x	x	+	x	x	x	x	x	+	+	x
Kaitz_w	+	+	x	+	+	+	x	x	+	x	x	-	x
LI	+	x	x	x	+	+	+	x	x	x	x	x	x

Source: own elaboration.

5. DISCUSSION

The panel regression models revealed variations in the impact of MW changes on unemployment rate changes within the sample of four EU countries. Statistically significant positive effects were identified for both Czechia and Slovakia in the full sample. For females, a significant positive effect was observed in the Czechia and Hungary, while for males, it was only significant in Slovakia. In all statistically significant cases, a rise in the Kaitz index was associated with a rise in unemployment. This finding is particularly relevant considering the European Commission's recommendations and the sluggish growth rate of the Kaitz index in the V4 countries. It can inform national-level decisions regarding the optimal growth rate for MWs to minimize negative labour market impacts. As previously noted, the choice between average or median wages in the Kaitz index calculation should not influence the direction of the effect on unemployment. Table 7 compares our findings with selected studies on V4 countries but does not yield definitive conclusions for all V4 countries. This, along with existing literature and our findings, suggests that MW growth may have heterogeneous effects on unemployment across member states. This reinforces the rationale for a recommendatory approach to MW levels in the EU Directive.

For Slovakia, a positive association between MW growth and unemployment was confirmed, holding other factors constant. The Czechia shows a small but statistically significant positive effect of the Kaitz index on unemployment, aligning with Soukup (2018). In contrast, Poland and Hungary did not exhibit statistically significant impacts, which deviates from comparative studies reporting a negative MW-unemployment relationship.

The EU Directive's advantage lies in not mandating specific MW values, but rather establishing a recommended reference ratio. This flexibility allows countries like Slovakia and the Czechia, where the Kaitz index positively affects unemployment, to determine optimal timing for MW increases without jeopardizing labour market outcomes.

The Kaitz index can be influenced by various scenarios. First, if a country maintains a constant MW while the AW increases, the Kaitz index will decrease. Based on our results, this decrease should lead to lower unemployment in Slovakia and the Czechia.

Second, a more realistic scenario for V4 countries involves simultaneous growth in both minimum and AWs. Here, the relative growth rates become crucial. To achieve a decline in unemployment, the AW should increase faster than the MW. This incentivizes a portion of the population to seek higher-paying jobs beyond the MW threshold, as argued by Nolla Sabaret (2022).

Table 7

Comparison of results of selected scientific studies and own results

Country	Scientific study	Results of the scientific study: The impact of MW on the labour market	Our results: The impact of the KI on unemployment
Slovakia	Hidas & Žúdel, (2016)	Significant but a small year-on-year impact on employment. Higher impact on younger workers.	The growth of KI causes unemployment to rise. In terms of gender, there was a positive effect for men.
	Zeman (2018)	The negative impact on the labour market.	
	Jašová & Kadeřábková (2021)	Weak positive effects on selected market indicators.	
Czechia	Soukup et al. (2018)	Negative impact of MW on employment.	KI growth causes unemployment to rise. In terms of gender, there was a positive effect for women.
	Pavelka et al. (2014), Pícl a Richter (2014)	Statistically insignificant impact of MW growth on unemployment.	
	Chytilová & Frejlich (2020)	The impact on female unemployment is positive. Not statistically significant in case of man.	
Poland	Siroka (2021)	Negative impact of MW on employment.	It does not have a statistical impact.
	Nedomlelová et al. (2017)	An increase in MW causes an increase in employment and unemployment rates.	
	Jašová & Kadeřábková (2021)	Weak positive effects of MW on selected market indicators.	
Hungary	Harasztosi & Lindner (2019)	Negative effect of MW on unemployment in sectors where the pass-through of wage costs to consumers is more complex.	There is no statistical impact, a positive effect for women.

Source: own elaboration.

The Kaitz index must also be viewed through a gender lens. Persistent gender and income gaps exist in the EU (European Commission, 2023; Iwasaki & Satogami, 2023; Lauzadyte-Tutliene & Mikuciauskaite, 2022). These disparities manifest in both AW levels and their growth rates. In the V4 countries, a rising Kaitz index is associated with increased female unemployment in the Czechia and Hungary. MW hikes could potentially exclude some women from the labour market due to higher employer costs. Low-educated women are particularly vulnerable to job losses under MW pressure.

Statistically significant findings were also observed for other variables. Notably, changes in unemployment benefits in the Czechia and Hungary exhibit a positive association with unemployment growth. The MW to living wage ratio effect is demonstrated in the Czechia case, where the results confirm a negative impact of a rising ratio on unemployment. In such scenarios, individuals may opt for social benefits over MW employment. This suggests that the state can potentially increase both the MW and the minimum subsistence wage without harming unemployment, but the MW increase rate must exceed that of the minimum subsistence wage.

6. CONCLUSION

The European Commission (EC) has recently prioritized MW levels. A consensus at the EU national level advocates for a "fair MW," recommended by the EC to be set at 60% of the gross median wage or 50% of the gross mean wage. This implies potential MW increases for many EU countries, including all V4 countries (Czechia, Hungary, Poland, and Slovakia). However, existing long-term studies on MW impacts highlight inconsistencies in its effect on labour markets and employment. Consequently, the suitability of a uniform EC recommendation for all member states achieving the desired outcomes is questionable.

This study investigated the impact of MW growth on unemployment in the V4 countries using multiple linear regression models. The analysis revealed mixed results, underlining the issue's complexity. Notably, to provide broader context, the models transformed MW into ratios relative to AWs and subsistence levels (Kaitz index). The findings suggest that a negative effect on unemployment from MW growth only occurs in Slovakia and the Czechia when the MW growth rate surpasses the AW growth rate. This aligns with the neoclassical approach to MW. The results for Hungary and Poland were statistically insignificant.

Similarly, gender-based disparities emerged. The Kaitz index had a statistically significant impact on female unemployment in the Czechia and Hungary, while for men this effect was only significant in Slovakia.

In line with the modelling results, it appears possible to raise the MW in certain countries without exacerbating unemployment growth. However, a specific relationship is crucial: the MW growth rate must exceed the growth rates of the minimum subsistence wage and unemployment benefits, while remaining lower than the AW growth rate. These considerations warrant further scrutiny, particularly given the significant MW increases observed across all V4 countries in 2024.

Economic growth prospects should also be considered a precondition for MW increases. In recessions, an artificially inflated AW can emerge due to job losses concentrated in MW sectors. As long as the MW calculation formula remains insensitive to a country's economic situation (using an inflated AW), implementing a higher MW could lead to unemployment increases. There is also the question of the form of input variables the EC should use to calculate the Kaitz index. To ensure a truly "fair" MW, its calculation should account for country-specific taxes and levies associated with MW payments, reflecting the net wage received by workers.

The results obtained from the V4 countries exemplify the potential for labour market distortions if the EC Directive's recommendations are applied uniformly. In this regard, the recommendatory nature of the Directive is a significant positive feature. However, this study opens doors for further research. Future research could explore the potential benefits and drawbacks of regional MW variations compared to a national MW and utilize the Kaitz index based on net wages to develop tailored MW calculations for each V4 country. Additionally, similar studies conducted at the regional level, or excluding economically developed regions with low unemployment and minimal MW employment, could be insightful. In such regions, the Kaitz index might not be statistically significant, but their high AWs can significantly impact the national AW calculation and, consequently, the centrally set MW.

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APPENDIX

Table A

Kaitz index growth rate in V4 countries in the period 2001-2022

	Kaitz index (MW/Mean)				Kaitz index (MW/ Median)			
	Poland	Slovak Republic	Czechia	Hungary	Poland	Slovak Republic	Czechia	Hungary
2001	0.049	0.028	0.093	0.374	0.050	0.029	0.090	0.371
2002	-0.006	-0.029	0.105	0.116	0.003	-0.033	0.104	0.139
2003	0.025	0.067	0.011	-0.160	0.033	0.071	0.012	-0.180
2004	-0.005	-0.033	0.026	-0.009	0.002	-0.012	0.020	0.011
2005	-0.026	-0.014	0.017	-0.012	-0.025	-0.022	0.021	-0.020
2006	0.000	0.001	0.022	0.013	0.002	0.030	0.029	0.029
2007	-0.053	-0.003	-0.040	-0.035	-0.061	-0.005	-0.038	-0.019
2008	0.086	-0.026	-0.066	-0.006	0.077	-0.034	-0.059	-0.016
2009	0.075	0.056	-0.012	0.001	0.075	0.059	-0.001	0.014
2010	-0.008	0.003	-0.008	0.015	-0.012	0.007	-0.017	0.016
2011	-0.002	0.003	-0.020	0.045	-0.002	0.000	-0.015	0.044
2012	0.038	0.000	-0.019	0.093	0.065	-0.012	-0.021	0.089
2013	0.029	0.005	0.019	0.013	0.029	0.009	0.014	-0.001
2014	0.032	-0.015	0.013	0.001	0.030	-0.010	0.009	-0.006
2015	0.005	0.042	0.043	-0.013	0.005	0.049	0.042	-0.020
2016	0.036	0.016	0.030	-0.016	0.028	0.009	0.022	-0.025
2017	0.024	0.017	0.038	0.028	0.024	0.005	0.034	0.017
2018	-0.037	0.032	0.024	0.000	-0.050	0.028	0.020	-0.028
2019	0.000	0.011	0.025	-0.056	0.000	0.002	0.027	-0.024
2020	0.084	0.053	0.019	-0.016	0.084	0.049	0.025	-0.021
2021	-0.009	0.049	-0.014	-0.057	-0.009	0.012	-0.017	-0.058
2022	-0.055	-0.031	0.001	0.033	-0.055	-0.031	0.002	0.054
Average	0.013	0.011	0.014	0.016	0.013	0.009	0.014	0.017
Average V4	0.013				0.013			

Source: own elaboration based on Eurostat data.